7 Receiver characteristics

TBD

7.1 General

Unless otherwise stated the receiver characteristics are specified at the antenna connector(s) of the UE. For UE(s) with an integral antenna only, a reference antenna(s) with a gain of 0 dBi is assumed for each antenna port(s). UE with an integral antenna(s) may be taken into account by converting these power levels into field strength requirements, assuming a 0 dBi gain antenna. For UEs with more than one receiver antenna connector, identical interfering signals shall be applied to each receiver antenna port if more than one of these is used (diversity).

The levels of the test signal applied to each of the antenna connectors shall be as defined in the respective clauses below.

Unless otherwise stated, Channel Bandwidth shall be prioritized in the selecting of test points. Subcarrier spacing shall be selected after Test Channel Bandwidth is selected.

The applicability of receiver requirements for Band n90 is in accordance with that for Band n41; a UE supporting Band n90 shall meet the minimum requirements for Band n41.

With the exception of clause 7.3, the requirements shall be verified with the network signalling value NS_01 configured (Table 6.2.3.3-1).

All the parameters in clause 7 are defined using the UL reference measurement channels specified in Annexes A.2.2 and A.2.3, the DL reference measurement channels specified in Annex A.3.2 and using the set-up specified in Annex C.3.1.

The minimum requirements specified in clauses 7.5, 7.6, 7.7 and 7.8 for NR band n48 refer to the minimum requirements for NR bands < 2.7 GHz.

For the additional requirements for intra-band non-contiguous carrier aggregation of two or more sub-blocks, an in-gap test refers to the case when the interfering signal is located at a negative offset with respect to the assigned lowest channel frequency of the highest sub-block and located at a positive offset with respect to the assigned highest channel frequency of the lowest sub-block.

For the additional requirements for intra-band non-contiguous carrier aggregation of two or more sub-blocks, an out-of-gap test refers to the case when the interfering signal(s) is (are) located at a positive offset with respect to the assigned channel frequency of the highest carrier frequency, or located at a negative offset with respect to the assigned channel frequency of the lowest carrier frequency.

For the additional requirements for intra-band non-contiguous carrier aggregation of two or more sub-blocks with channel bandwidth larger than or equal to 5 MHz, the existing adjacent channel selectivity requirements, in-band blocking requirements (for each case), and narrow band blocking requirements apply for in-gap tests only if the corresponding interferer frequency offsets with respect to the two measured carriers satisfy the following condition in relation to the sub-block gap size W_{gap} for at least one of these carriers j = 1,2, so that the interferer frequency position does not change the nature of the core requirement tested:

$$\text{Wgap} \geq 2\cdot|\text{FInterferer (offset)}_{,j}| - \text{BWChannel}(j)$$

where $F_{\text{Interferer (offset)},j}$ for a sub-block with a single component carrier is the interferer frequency offset with respect to carrier j as specified in clause 7.5, clause 7.6.2 and clause 7.6.4 for the respective requirement and $BW_{\text{Channel}(j)}$ the channel bandwidth of carrier j. $F_{\text{Interferer (offset)},j}$ for a sub-block with two or more contiguous component carriers is the interference frequency offset with respect to the carrier adjacent to the gap is specified in clause 7.5A, 7.6A.2 and

7.6A.3. The interferer frequency offsets for adjacent channel selectivity, each in-band blocking case and narrow- band blocking shall be tested separately with a single in-gap interferer at a time.

7.1A General

The minimum requirements for band combinations including Band n41 also apply for the corresponding band combinations with Band n90 replacing Band n41 but with otherwise identical parameters. For brevity the said band combinations with Band n90 are not listed in the tables below but are covered by this specification.

The minimum requirements specified in clauses 7.5A, 7.6A, 7.7A and 7.8A for NR band n48 refer to the minimum requirements for NR bands < 2.7 GHz.

7.2 Diversity characteristics

The UE is required to be equipped with a minimum of two Rx antenna ports in all operating bands except for the bands n7, n38, n41, n77, n78, n79 where the UE is required to be equipped with a minimum of four Rx antenna ports. An exception is allowed for two Rx vehicular UE to be equipped with a minimum of two Rx antenna ports in bands n7, n38, n41, n77, n78, n79. This requirement applies when the band is used as a standalone band or as part of a band combination.

For the single carrier REFSENS requirements in clause 7, the UE shall be verified with two Rx antenna ports in all supported frequency bands, additional requirements for four Rx ports shall be verified in operating bands where the UE is equipped with four Rx antenna ports.

For Rx requirements other than single carrier REFSENS in Clause 7, the UE shall be verified with four Rx antenna ports and skip two Rx antenna ports requirements in operating bands where the UE is equipped with four Rx antenna ports, otherwise, the UE shall be verified with two Rx antenna ports.

The above rules apply for all subclasses with the exception of clause 7.9.

7.3 Reference sensitivity

7.3.1 General

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

In later subclauses of Section 7 where the value of REFSENS is used as a reference to set the corresponding requirement.

For all bands, the UE shall be verified against those requirements by applying the REFSENS value in Table 7.3.2.3-1 with 2 Rx antenna ports tested.

For bands where the UE is required to be equipped with 4 Rx antenna ports, the UE shall additionally be verified against those requirements by applying the resulting REFSENS value derived from the requirement in Table 7.3.2_1.3-1with 4 Rx antenna ports tested.

7.3.2 Reference sensitivity power level

7.3.2.1 Test purpose

The test purpose is to verify the ability of the UE to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

7.3.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward.

7.3.2.3 Minimum conformance requirements

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2.2, A.2.3.2, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.2.3-1 and Table 7.3.2.3-2.

Table 7.3.2.3-1: Two antenna port reference sensitivity QPSK $P_{REFSENS}$

Operating band / SCS / Channel bandwidth / Duplex-mode														
Operating Band	**SCS kHz**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**25 MHz (dBm)**	**30 MHz (dBm)**	**40 MHz (dBm)**	**50 MHz (dBm)**	**60 MHz (dBm)**	**80 MHz (dBm)**	**90 MHz (dBm)**	**100 MHz (dBm)**	**Duplex Mode**
n1	15	-100.0	-96.8	-95.0	-93.8	-92.7	-91.9	-90.6	-89.6					FDD
	30		-97.1	-95.1	-94.0	-92.8	-92.0	-90.7	-89.7					
	60		-97.5	-95.4	-94.2	-93.0	-92.1	-90.9	-89.7					
n2	15	-98.0	-94.8	-93.0	-91.8									FDD
	30		-95.1	-93.1	-92.0									
	60		-95.5	-93.4	-92.2									
n3	15	-97.0	-93.8	-92.0	-90.8	-89.7	-88.9	-87.6						FDD
	30		-94.1	-92.1	-91.0	-89.8	-89.0	-87.7						
	60		-94.5	-92.4	-91.2	-90.0	-89.1	-87.9						
n5	15	-98.0	-94.8	-93.0	-90.8									FDD
	30		-95.1	-93.1	-91.0									
	60													
n7[1]	15	-98.0	-94.8	-93.0	-91.8									FDD
	30		-95.1	-93.1	-92.0									
	60		-95.5	-93.4	-92.2									
n8	15	-97.0	-93.8	-92.0	-90.0									FDD
	30		-94.1	-92.1	-90.2									
	60													
n12	15	-97.0	-93.8	-84.0										FDD
	30		-94.1	-84.1										
	60													
n14	15	-97.0	-93.8											FDD
	30		-94.1											
	60													
n20	15	-97.0	-93.8	-91.0	-89.8									FDD
	30		-94.1	-91.1	-90.0									
	60													
n25	15	-96.5	-93.3	-91.5	-90.3									FDD
	30		-93.6	-91.6	-90.5									
	60		-94.0	-91.9	-90.7									
n26	15	-97.5[6]	-94.5[6]	-92.7[6]	-87.6									FDD
	30		-94.8[6]	-92.7[6]	-87.7									
n28	15	-98.5	-95.5	-93.5	-90.8		-78.5							FDD
	30		-95.6	-93.6	-91.0		-78.6							
	60													
n30	15	-99.0	-95.8											FDD
	30		-96.1											
	60													
n34	15	-100.0	-96.8	-95.0										TDD
	30		-97.1	-95.1										
	60		-97.5	-95.4										
n38[1]	15	-100.0	-96.8	-95.0	-93.8			-90.6						TDD
	30		-97.1	-95.1	-94.0			-90.7						
	60		-97.5	-95.4	-94.2			-90.9						
n39	15	-100.0	-96.8	-95.0	-93.8	-92.7	-91.9	-90.6						TDD
	30		-97.1	-95.1	-94.0	-92.8	-92.0	-90.7						
	60		-97.5	-95.4	-94.2	-93.0	-92.1	-90.9						
n40	15	-100.0	-96.8	-95.0	-93.8	-92.7	-91.9	-90.6	-89.6					TDD
	30		-97.1	-95.1	-94.0	-92.8	-92.0	-90.7	-89.7	-88.9	-87.6			

	60		-97.5	-95.4	-94.2	-93.0	-92.1	-90.9	-89.8	-89.1	-87.6			
n41[1]	15		-94.8	-93.0	-91.8		-89.9	-88.6	-87.6					TDD
	30		-95.1	-93.1	-92.0		-90.0	-88.7	-87.7	-86.9	-85.6	-85.1	-84.7	
	60		-95.5	-93.4	-92.2		-90.1	-88.9	-87.8	-87.1	-85.6	-85.1	-84.7	
n48[1]	15	-99	-95.8	-94.0	-92.7			-89.6	-88.6[5]					TDD
	30		-96.1	-94.1	-92.9			-89.7	-88.7[5]	-87.9[5]	-86.6[5]	-86.1[5]	-85.6[5]	
	60		-96.5	-94.4	-93.1			-89.9	-88.8[5]	-88.0[5]	-86.7[5]	-86.2[5]	-85.7[5]	
n50	15	-100.0	-96.8	-95.0	-93.8		-91.9	-90.6	-89.6					TDD
	30		-97.1	-95.1	-94.0		-92.0	-90.7	-89.7	-88.9	-87.6			
	60		-97.5	-95.4	-94.2		-92.1	-90.9	-89.8	-89.1	-87.6			
n51	15	-100.0												TDD
	30													
	60													
n53	15	-100.0	-96.8											TDD
	30		-97.1											
	60		-97.5											
n65	15	-99.5	-96.3	-94.5	-93.3									FDD
	30		-96.6	-94.6	-93.5									
	60		-97.0	-94.9	-93.7									
n66	15	-99.5	-96.3	-94.5	-93.3			-90.1						FDD
	30		-96.6	-94.6	-93.5			-90.2						
	60		-97.0	-94.9	-93.7			-90.4						
n70	15	-100.0	-96.8	-95.0	-93.8	-92.7								FDD
	30		-97.1	-95.1	-94.0	-92.8								
	60		-97.5	-95.4	-94.2	-93.0								
n71	15	-97.2	-94.0	-91.6	-86.0									FDD
	30		-94.3	-91.9	-87.4									
	60													
n74	15	-99.5[3]	-96.3[3]	-94.5[3]	-93.3[3]									FDD
	30		-96.6[3]	-94.6[3]	-93.5[3]									
	60		-97.0[3]	-94.9[3]	-93.7[3]									
n77[1, 4]	15		-95.3	-93.5	-92.2			-89.1	-88.1					TDD
	30		-95.6	-93.6	-92.4			-89.2	-88.2	-87.4	-86.1	-85.6	-85.1	
	60		-96.0	-93.9	-92.6			-89.4	-88.3	-87.5	-86.2	-85.7	-85.2	
n78[1]	15		-95.8	-94.0	-92.7			-89.6	-88.6					TDD
	30		-96.1	-94.1	-92.9			-89.7	-88.7	-87.9	-86.6	-86.1	-85.6	
	60		-96.5	-94.4	-93.1			-89.9	-88.8	-88.0	-86.7	-86.2	-85.7	
n79[1]	15							-89.6	-88.6					TDD
	30							-89.7	-88.7	-87.9	-86.6		-85.6	
	60							-89.9	-88.8	-88.0	-86.7		-85.7	

NOTE 1: Four Rx antenna ports shall be the baseline for this operating band except for two Rx vehicular UE.
NOTE 2: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4.
NOTE 3: The requirement is modified by -0.5 dB when the assigned NR channel bandwidth is confined within 1475.9-1510.9 MHz.
NOTE 4: The requirement is modified by -0.5 dB when the assigned UE channel bandwidth is confined within 3300 - 3800 MHz.
NOTE 5: For these bandwidths, the minimum requirements are restricted to operation when carrier is configured as a downlink carrier part of CA configuration.
NOTE 6: Values are modified by -0.5dB when carrier channel BW is between 865MHz and 894MHz.

For UE(s) equipped with 4 Rx antenna ports, reference sensitivity for 2Rx antenna ports in Table 7.3.2.3-1 shall be modified by the amount given in $\Delta R_{IB,4R}$ in Table 7.3.2.3-2 for the applicable operating bands.

Table 7.3.2.3-2: Four antenna port reference sensitivity allowance $\Delta R_{IB,4R}$

Operating band	$\Delta R_{IB,4R}$ (dB)
n1, n2, n3, n7, n30, n40, n34, n38, n39, n41, n66, n70	-2.7
n48, n77, n78, n79	-2.2

The reference sensitivity (REFSENS) requirement specified in Table 7.3.2.3-1 and Table 7.3.2.3-2 shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.3-3.

Table 7.3.2.3-3: Uplink configuration for reference sensitivity

Operating Band	SCS kHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz	Duplex Mode
n1	15	25	50[1]	75[1]	100[1]	128[1]	128[1]	128[1]	128[1]					FDD
	30		24	36[1]	50[1]	64[1]	64[1]	64[1]	64[1]					
	60		10[1]	18	24	30[1]	30[1]	30[1]	30[1]					
n2	15	25	50[1]	50[1]	50[1]									FDD
	30	10[1]	24	24[1]	24[1]									
	60		10[1]	10[1]	10[1]									
n3	15	25	50[1]	50[1]	50[1]	50[1]	50[1]	50[1]						FDD
	30		24	24[1]	24[1]	24[1]	24[1]	24[1]						
	60		10[1]	10[1]	10[1]	10[1]	10[1]	10[1]						
n5	15	25	25[1]	25[1]	25[1]									FDD
	30		10[1]	10[1]	10[1]									
	60													
n7	15	25	50[1]	75[1]	75[1]									FDD
	30		24	36[1]	36[1]									
	60		10[1]	18	18[1]									
n8	15	25	25[1]	25[1]	25[1]									FDD
	30		10[1]	10[1]	10[1]									
	60													
n12	15	20[1]	20[1]	20[1]										FDD
	30		10[1]	10[1]										
	60													
n14	15	20[1]	20[1]											FDD
	30		10[1]											
	60													
n20	15	25	20[1]	20[2]	20[2]									FDD
	30		10[1]	10[2]	10[2]									
	60													
n25	15	25	50	50[1]	50[1]									FDD
	30		24	24[1]	24[1]									
	60		10	10[1]	10[1]									
n26	15	25	25[1]	25[1]	25[1]									FDD
	30		12[1]	12[1]	12[1]									
n28	15	25	25[1]	25[1]	25[1]		25[1]							FDD
	30		10[1]	10[1]	10[1]		10[1]							
	60													
n30	15	20[1]	20[1]											FDD
	30		10[1]											
	60													
n34	15	25	50	75										TDD
	30		24	36										
	60		10	18										
n38	15	25	50	75	100			216						TDD
	30		24	36	50			100						
	60		10	18	24			50						
n39	15	25	50	75	100	128	160	216						TDD
	30		24	36	50	64	75	100						
	60		10	18	24	30	36	50						
n40	15	25	50	75	100	128	160	216	270					TDD
	30		24	36	50	64	75	100	128	162	216			
	60		10	18	24	30	36	50	64	75	100			
n41	15		50	75	100		160	216	270					TDD

	30		24	36	50		75	100	128	162	216	243	270	
	60		10	18	24		36	50	64	75	100	120	135	
n48	15	25	50	75	100			216						TDD
	30		24	36	50			100						
	60		10	18	24			50						
n50	15	25	50	75	100		160	216	270					TDD
	30		24	36	50		75	100	128	162	NOTE 3			
	60		10	18	24		36	50	64	75	NOTE 3			
n51	15	25												TDD
	30													
	60													
n53	15	25	50											TDD
	30		24											
	60		10											
n65	15	25	50[1]	75[1]	100[1]									FDD
	30		24	36[1]	50[1]									
	60		10[1]	18	24									
n66	15	25	50[1]	75[1]	100[1]			216						FDD
	30		24	36[1]	50[1]			100[1]						
	60		10[1]	18	24									
n70	15	25	50[1]	75[1]	NOTE 3	NOTE 3								FDD
	30		24	36[1]	NOTE 3	NOTE 3								
	60		10[1]	18	NOTE 3	NOTE 3								
n71	15	25	25[1]	20[1]	20[1]									FDD
	30		12[1]	10[1]	10[1]									
	60													
n74	15	25	25[1]	25[1]	25[1]									FDD
	30		10[1]	10[1]	10[1]									
	60		5[1]	5[1]	5[1]									
n77	15		50	75	100			216	270					TDD
	30		24	36	50			100	128	162	216	243	270	
	60		10	18	24			50	64	75	100	120	135	
n78	15		50	75	100			216	270					TDD
	30		24	36	50			100	128	162	216	243	270	
	60		10	18	24			50	64	75	100	120	135	
n79	15							216	270					TDD
	30							100	128	162	216		270	
	60							50	64	75	100		135	

NOTE 1: UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.3.2-1).

NOTE 2: For Band 20; for 15kHz SCS, in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 16; for 30kHz SCS, in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 6 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 8; for 60kHz SCS, in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 3 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 4.

NOTE 3: For DL channel bandwidths that do not have symmetric UL channel bandwidth, highest valid UL configuration with lowest duplex distance shall be used.

Unless given by Table 7.3.2.3-4, the minimum requirements specified in Tables 7.3.2.3-1 and 7.3.2.3-2 shall be verified with the network signalling value NS_01 (Table 6.2.3.3-1) configured.

Table 7.3.2.3-4: Network signalling value for reference sensitivity

Operating band	Network Signalling value
n2	NS_03
n12	NS_06
n14	NS_06
n25	NS_03
n30	NS_21
n48	NS_27
n53	NS_45
n66	NS_03
n70	NS_03
n71	NS_35

For the UE which supports inter-band carrier aggregation, the minimum requirement for reference sensitivity in Table 7.3.2.3-1 shall be increased by the amount given in $\Delta R_{IB,c}$ defined in subclause 7.3.3 for the applicable operating bands.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.3.2.

7.3.2.4 Test description

7.3.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 7.3.2.4.1-1, Table 7.3.2.4.1-2, and Table 7.3.2.4.1-3 The details of the uplink reference measurement channels (RMCs) are specified in Annexe A2.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.3.2.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1		Low range, Mid range, High range (NOTE 4)		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest (NOTE 4) Lowest UL / Lowest DL, Lowest UL / Highest DL (NOTE 3)		
Test SCS as specified in Table 5.3.5-1		Lowest		
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (NOTE 1)	DFT-s-OFDM QPSK	REFSENS (NOTE 2)

NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2.
NOTE 2: REFSENS refers to Table 7.3.2.4.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band.
NOTE 3: Additional test points selected according to asymmetric channel bandwidths specified in clause 5.3.6. DL channel bandwidth shall be selected first.
NOTE 4: For n70, in addition to default test configurations, additional configurations shall be used to verify reference sensitivity requirements with the UE TX-RX frequency separation of 295MHz (table 5.4.4-1):
5 MHz CH BW with DL @ low range, UL @ mid range
5 MHz CH BW with DL @ mid range, UL @ high range
10 MHz CH BW with DL @ low range, UL @ high range
For NR band n28, 30MHz test channel bandwidth is tested with Low range and High range test frequencies.
NOTE 5: In a band where UE supports 4Rx, the test needs to be repeated with only 2Rx antennas connected and the other antennas terminated.

Table 7.3.2.4.1-2: Downlink Configuration of each RB allocation

Channel Bandwidth	SCS(kHz)	LCRBmax	Outer RB allocation / Normal RB allocation
5MHz	15	25	25@0
	30	11	11@0
	60	N/A	N/A
10MHz	15	52	52@0
	30	24	24@0
	60	11	11@0
15MHz	15	79	79@0
	30	38	38@0
	60	18	18@0
20MHz	15	106	106@0
	30	51	51@0
	60	24	24@0
25MHz	15	133	133@0
	30	65	65@0
	60	31	31@0
30MHz	15	160	160@0
	30	78	78@0
	60	38	38@0
40MHz	15	216	216@0
	30	106	106@0
	60	51	51@0
50MHz	15	270	270@0
	30	133	133@0
	60	65	65@0
60MHz	15	N/A	N/A
	30	162	162@0
	60	79	79@0
80MHz	15	N/A	N/A
	30	217	217@0
	60	107	107@0
90MHz	15	N/A	N/A
	30	245	245@0
	60	121	121@0
100MHz	15	N/A	N/A
	30	273	273@0
	60	135	135@0
NOTE 1: Test Channel Bandwidths are checked separately for each NR band, the applicable channel bandwidths are specified in Table 5.3.5-1.			

Table 7.3.2.4.1-3: Uplink configuration for reference sensitivity, LCRB @ RBstart format

Operating Band	SCS kHz	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz	Duplex Mode
n1	15	25@0	50@2[1]	75@4[1]	100@6[1]	128@5[1]	128@32[1]	128@88[1]	128@142[1]					FDD
	30		24@0	36@2[1]	50@1[1]	64@1[1]	64@14[1]	64@42[1]	64@69[1]					
	60		10@1[1]	18@0	24@0	30@1[1]	30@8[1]	30@21[1]	30@35[1]					
n2	15	25@0	50@2[1]	50@29[1]	50@56[1]									FDD
	30	10@1[1]	24@0	24@14[1]	24@27[1]									
	60		10@1[1]	10@8[1]	10@14[1]									
n3	15	25@0	50@2[1]	50@29[1]	50@56[1]	50@83[1]	50@110[1]	50@166[1]						FDD
	30		24@0	24@14[1]	24@27[1]	24@41[1]	24@54[1]	24@82[1]						
	60		10@1[1]	10@8[1]	10@14[1]	10@21[1]	10@28[1]	10@41[1]						
n5	15	25@0	25@27[1]	25@54[1]	25@81[1]									FDD
	30		10@14[1]	10@28[1]	10@41[1]									
	60													
n7	15	25@0	50@2[1]	75@4[1]	75@31[1]									FDD
	30		24@0	36@2[1]	36@15[1]									
	60		10@1[1]	18@0	18@6[1]									
n8	15	25@0	25@27[1]	25@54[1]	25@81[1]									FDD
	30		10@14[1]	10@28[1]	10@41[1]									
	60													
n12	15	20@5[1]	20@32[1]	20@59[1]										FDD
	30		10@14[1]	10@28[1]										
	60													
n14	15	20@5[1]	20@32[1]											FDD
	30		10@14[1]											
	60													
n20	15	25@0	20@0[1]	20@11[2]	20@16[2]									FDD
	30		10@0[1]	10@6[2]	10@8[2]									
	60													

n25	15	25@0	50@0	50@29[1]	50@56[1]									FDD
	30		24@0	24@14[1]	24@27[1]									
	60		10@0	10@8[1]	10@14[1]									
n26	15	25@0	25@27[1]	25@54[1]	25@81[1]									FDD
	30		12@12[1]	12@26[1]	12@39[1]									
n28	15	25@0	25@27[1]	25@54[1]	25@81[1]		25@135[1]							FDD
	30		10@14[1]	10@28[1]	10@41[1]		10@68[1]							
	60													
n30	15	20@5[1]	20@32[1]											FDD
	30		10@14[1]											
	60													
n34	15	25@0	50@0	75@0										TDD
	30		24@0	36@0										
	60		10@0	18@0										
n38	15	25@0	50@0	75@0	100@0			216@0						TDD
	30		24@0	36@0	50@0			100@0						
	60		10@0	18@0	24@0			50@0						
n39	15	25@0	50@0	75@0	100@0	128@0	160@0	216@0						TDD
	30		24@0	36@0[1]	50@0	64@0	75@0	100@0						
	60		10@0	18@0	24@0	30@0	36@0	50@0						
n40	15	25@0	50@0	75@0	100@0	128@0	160@0	216@0	270@0					TDD
	30		24@0	36@0	50@0	64@0	75@0	100@0	128@0	162@0	216@0			
	60		10@0	18@0	24@0	30@0	36@0	50@0	64@0	75@0	100@0			
n41	15		50@0	75@0	100@0		160@0	216@0	270@0					TDD
	30		24@0	36@0	50@0		75@0	100@0	128@0	162@0	216@0	243@0	270@0	
	60		10@0	18@0	24@0		36@0	50@0	64@0	75@0	100@0	120@0	135@0	
n48	15	25@0	50@0	75@0	100@0			216@0						TDD
	30		24@0	36@0	50@0			100@0						
	60		10@0	18@0	24@0			50@0						
n50	15	25@0	50@0	75@0	100@0[1]			216@0	270@0					TDD
	30		24@0	36@0	50@0			100@0	128@0	162@0	NOTE 3			
	60		10@0	18@0	24@0			50@0	64@0	75@0	NOTE 3			

n51	15	25@0												TDD
	30													
	60													
n53	15	25@0	50@0											TDD
	30		24@0											
	60		10@0											
n65	15	25@0	50@2[1]	75@4[1]	100@6[1]									FDD
	30		24@0	36@2[1]	50@1[1]									
	60		10@1[1]	18@0	24@0									
n66	15	25@0	50@2[1]	75@4[1]	100@6[1]	128@5[1]	160@0	216@0						FDD
	30		24@0	36@2[1]	50@1[1]	64@1[1]	75@3[1]	100@6[1]						
	60		10@1[1]	18@0	24@0	30@1[1]	36@2[1]	50@1[1]						
n70	15	25@0	50@2[1]	75@4[1]	NOTE 3	NOTE 3								FDD
	30		24@0	36@2[1]	NOTE 3	NOTE 3								
	60		10@1[1]	18@0	NOTE 3	NOTE 3								
n71	15	25@0	25@0[1]	20@0[1]	20@0[1]									FDD
	30		12@0[1]	10@0[1]	10@0[1]									
	60													
n74	15	25@0	25@27[1]	25@54[1]	25@81[1]									FDD
	30		10@14[1]	10@28[1]	10@41[1]									
	60		5@6[1]	5@13[1]	5@19[1]									
n77	15		50@0	75@0	100@0			216@0	270@0					TDD
	30		24@0	36@0	50@0			100@0	128@0	162@0	216@0	243@0	270@0	
	60	-	10@0	18@0	24@0			50@0	64@0	75@0	100@0	120@0	135@0	
n78	15		50@0	75@0	100@0[1]			216@0	270@0					TDD
	30		24@0	36@0	50@0			100@0	128@0	162@0	216@0	243@0	270@0	
	60		10@0	18@0	24@0			50@0	64@0	75@0	100@0	120@0	135@0	
n79	15							216@0	270@0					TDD
	30							100@0	128@0	162@0	216@0		270@0	
	60							50@0	64@0	75@0	100@0		135@0	

NOTE 1:	UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth (Table 5.3.2-1).
NOTE 2:	For Band 20; for 15kHz SCS, in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 11 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 16; for 30kHz SCS, in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 6 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 8; for 60kHz SCS, in the case of 15MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 3 and in the case of 20MHz channel bandwidth, the UL resource blocks shall be located at RB_{start} 4.
NOTE 3:	For DL channel bandwidths that do not have symmetric UL channel bandwidth, highest valid UL configuration with lowest duplex distance shall be used.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The UL and Reference Measurement Channel is set according to Table 7.3.2.4.1-1, Table 7.3.2.4.1-2, and Table 7.3.2.4.1-3.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.3.2.4.3.

7.3.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.3.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Tables 7.3.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3. Set the Downlink signal level to the appropriate REFSENS value defined in Table 7.3.2.5-1 if 2Rx antennas connected or Table 7.3.2.5-2 if 4Rx antennas connected. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE to ensure the UE transmits PUMAX level for at least the duration of the Throughput measurement.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2

7.3.2.4.3 Message contents

Message contents are according to TS 38.508-1[5] subclause 4.6 with the following exceptions.

7.3.2.4.3.1 Message contents exceptions (network signalled value "NS_01")

Message contents according to TS 38.508-1 [5] subclause 4.6 can be used without exceptions.

7.3.2.4.3.2 Message contents exceptions (network signalled value "NS_03")

1. Information element additionalSpectrumEmission is set to NS_03. This can be set in *SIB1* as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 7.3.2.4.3.2-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_03" and NR band n2, n25 and n66

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	2 (NS_03)		

Table 7.3.2.4.3.2-2: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_03" and NR band n70

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_03)		

7.3.2.4.3.3 Message contents exceptions (network signalled value "NS_06")

1. Information element additionalSpectrumEmission is set to NS_06. This can be set in *SIB1* as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 7.3.2.4.3.3-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_06" and NR band n12 and n14

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_06)		

7.3.2.4.3.4 Message contents exceptions (network signalled value "NS_35")

1. Information element additionalSpectrumEmission is set to NS_35. This can be set in *SIB1* as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 7.3.2.4.3.4-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_35" and NR band n71

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_35)		

7.3.2.4.3.5 Message contents exceptions (network signalled value "NS_27")

1. Information element additionalSpectrumEmission is set to NS_27. This can be set in *SIB1* as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 7.3.2.4.3.5-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_27" and NR band n48

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_27)		

7.3.2.4.3.6 Message contents exceptions (network signalled value "NS_21")

1. Information element additionalSpectrumEmission is set to NS_21. This can be set in *SIB1* as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 7.3.2.4.3.6-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_21" and NR band n30

Derivation Path: TS 38.508-1 [5] clause 4.6.3, Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_21)		

7.3.2.4.3.7 Message contents exceptions (network signalled value "NS_45")

1. Information element additionalSpectrumEmission is set to NS_45. This can be set in *SIB1* as part of the cell broadcast message. This exception indicates that the UE shall meet the additional spurious emission requirement for a specific deployment scenario.

Table 7.3.2.4.3.7-1: *AdditionalSpectrumEmission*: Additional spurious emissions test requirement for "NS_45" and NR band n53

Derivation Path: TS 38.508-1 [5], Table 4.6.3-1			
Information Element	**Value/remark**	**Comment**	**Condition**
additionalSpectrumEmission	1 (NS_45)		

7.3.2.5 Test requirement

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A3.2 with reference receive power level specified in Tables 7.3.2.5-1 for 2 Rx antenna port, Tables 7.3.2.5-2 for 4 Rx antenna port, and parameters specified Tables 7.3.2.4.1-1, Tables 7.3.2.4.1-2 and Tables 7.3.2.4.1-3.

Table 7.3.2.5-1: Reference sensitivity QPSK $P_{REFSENS}$

Operating band / SCS / Channel bandwidth / Duplex-mode														
Operating Band	**SCS kHz**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**25 MHz (dBm)**	**30 MHz (dBm)**	**40 MHz (dBm)**	**50 MHz (dBm)**	**60 MHz (dBm)**	**80 MHz (dBm)**	**90 MHz (dBm)**	**100 MHz (dBm)**	**Duplex Mode**
n1	15	-100.0 +TT	-96.8 +TT	-95.0 +TT	-93.8 +TT	-92.7 +TT	-91.9 +TT	-90.6 +TT	-89.6 +TT					FDD
	30		-97.1 +TT	-95.1 +TT	-94.0 +TT	-92.8 +TT	-92.0 +TT	-90.7 +TT	-89.7 +TT					
	60		-97.5 +TT	-95.4 +TT	-94.2 +TT	-93.0 +TT	-92.1 +TT	-90.9 +TT	-89.7 +TT					
n2	15	-98.0 +TT	-94.8 +TT	-93.0 +TT	-91.8 +TT									FDD
	30		-95.1 +TT	-93.1 +TT	-92.0 +TT									
	60		-95.5 +TT	-93.4 +TT	-92.2 +TT									
n3	15	-97.0 +TT	-93.8 +TT	-92.0 +TT	-90.8 +TT	-89.7 +TT	-88.9 +TT	-87.6 +TT						FDD
	30		-94.1 +TT	-92.1 +TT	-91.0 +TT	-89.8 +TT	-89.0 +TT	-87.7 +TT						
	60		-94.5 +TT	-92.4 +TT	-91.2 +TT	-90.0 +TT	-89.1 +TT	-87.9 +TT						
n5	15	-98.0 +TT	-94.8 +TT	-93.0 +TT	-90.8 +TT									FDD
	30		-95.1 +TT	-93.1 +TT	-91.0 +TT									
	60													
n7[1]	15	-98.0 +TT	-94.8 +TT	-93.0 +TT	-91.8 +TT									FDD
	30		-95.1 +TT	-93.1 +TT	-92.0 +TT									
	60		-95.5 +TT	-93.4 +TT	-92.2 +TT									
n8	15	-97.0 +TT	-93.8 +TT	-92.0 +TT	-90.0 +TT									FDD
	30		-94.1 +TT	-92.1 +TT	-90.2 +TT									
	60													
n12	15	-97.0 +TT	-93.8 +TT	-84.0 +TT										FDD
	30		-94.1 +TT	-84.1 +TT										
	60													
n14	15	-97.0 +TT	-93.8 +TT											FDD
	30		-94.1 +TT											
	60													
n20	15	-97.0 +TT	-93.8 +TT	-91.0 +TT	-89.8 +TT									FDD
	30		-94.1 +TT	-91.1 +TT	-90.0 +TT									
	60													
n25	15	-96.5 +TT	-93.3 +TT	-91.5 +TT	-90.3 +TT									FDD
	30		-93.6 +TT	-91.6 +TT	-90.5 +TT									

	60		-94.0 +TT	-91.9 +TT	-90.7 +TT									
n26	15	-97.5 +TT	-94.5 +TT	-92.7 +TT	-87.6 +TT									
	30		-94.8 +TT	-92.7 +TT	-87.7 +TT									
n28	15	-98.5 +TT	-95.5 +TT	-93.5 +TT	-90.8 +TT		-78.5 +TT							FDD
	30		-95.6 +TT	-93.6 +TT	-91.0 +TT		-78.6 +TT							
	60													
n30	15	-99.0 +TT	-95.8 +TT											FDD
	30		-96.1 +TT											
	60													
n34	15	-100.0 +TT	-96.8 +TT	-95.0 +TT										TDD
	30		-97.1 +TT	-95.1 +TT										
	60		-97.5 +TT	-95.4 +TT										
n38	15	-100.0 +TT	-96.8 +TT	-95.0 +TT	-93.8 +TT			-90.6 +TT						TDD
	30		-97.1 +TT	-95.1 +TT	-94.0 +TT			-90.7 +TT						
	60		-97.5 +TT	-95.4 +TT	-94.2 +TT			-90.9 +TT						
n39	15	-100.0 +TT	-96.8 +TT	-95.0 +TT	-93.8 +TT	-92.7 +TT	-91.9 +TT	-90.6 +TT						TDD
	30		-97.1 +TT	-95.1 +TT	-94.0 +TT	-92.8 +TT	-92.0 +TT	-90.7 +TT						
	60		-97.5 +TT	-95.4 +TT	-94.2 +TT	-93.0 +TT	-92.1 +TT	-90.9 +TT						
n40	15	-100.0 +TT	-96.8 +TT	-95.0 +TT	-93.8 +TT	-92.7 +TT	-91.9 +TT	-90.6 +TT	-89.6 +TT					TDD
	30		-97.1 +TT	-95.1 +TT	-94.0 +TT	-92.8 +TT	-92.0 +TT	-90.7 +TT	-89.7 +TT	-88.9 +TT	-87.6 +TT			
	60		-97.5 +TT	-95.4 +TT	-94.2 +TT	-93.0 +TT	-92.1 +TT	-90.9 +TT	-89.8 +TT	-89.1 +TT	-87.6 +TT			
n41[1]	15		-94.8 +TT	-93.0 +TT	-91.8 +TT		-89.9 +TT	-88.6 +TT	-87.6 +TT					TDD
	30		-95.1 +TT	-93.1 +TT	-92.0 +TT		-90.0 +TT	-88.7 +TT	-87.7 +TT	-86.9 +TT	-85.6 +TT	-85.1 +TT	-84.7 +TT	
	60		-95.5 +TT	-93.4 +TT	-92.2 +TT		-90.1 +TT	-88.9 +TT	-87.8 +TT	-87.1 +TT	-85.6 +TT	-85.1 +TT	-84.7 +TT	
n48[1]	15	-99.0 +TT	-95.8 +TT	-94.0 +TT	-92.7 +TT			-89.6 +TT	-88.6[5] +TT					TDD
	30		-96.1 +TT	-94.1 +TT	-92.9 +TT			-89.7 +TT	-88.7[5] +TT	-87.9[5] +TT	-86.6[5] +TT	-86.1[5] +TT	-85.6[5] +TT	
	60		-96.5 +TT	-94.4 +TT	-93.1 +TT			-89.9 +TT	-88.8[5] +TT	-88.0[5] +TT	-86.7[5] +TT	-86.2[5] +TT	-85.7[5] +TT	
n50	15	-100.0 +TT	-96.8 +TT	-95.0 +TT	-93.8 +TT		-91.9 +TT	-90.6 +TT	-89.6 +TT					TDD
	30		-97.1 +TT	-95.1 +TT	-94.0 +TT		-92.0 +TT	-90.7 +TT	-89.7 +TT	-88.9 +TT	-87.6 +TT			
	60		-97.5 +TT	-95.4 +TT	-94.2 +TT		-92.1 +TT	-90.9 +TT	-89.8 +TT	-89.1 +TT	-87.6 +TT			
n51	15	-100.0 +TT												TDD
	30													
	60													

n53	15	-100.0 +TT	-96.8 +TT											TDD
	30		-97.1 +TT											
	60		-97.5 +TT											
n65	15	-99.5+TT	-96.3+TT	-94.5+TT	-93.3+TT									FDD
	30		-96.6+TT	-94.6+TT	-93.5+TT									
	60		-97.0+TT	-94.9+TT	-93.7+TT									
n66	15	-99.5 +TT	-96.3 +TT	-94.5 +TT	-93.3 +TT	-92.2 +TT	-91.4 +TT	-90.1 +TT						FDD
	30		-96.6 +TT	-94.6 +TT	-93.5 +TT	-92.3 +TT	-91.5 +TT	-90.2 +TT						
	60		-97.0 +TT	-94.9 +TT	-93.7 +TT	-92.5 +TT	-91.6 +TT	-90.4 +TT						
n70	15	-100.0 +TT	-96.8 +TT	-95.0 +TT	-93.8 +TT	-92.7 +TT								FDD
	30		-97.1 +TT	-95.1 +TT	-94.0 +TT	-92.8 +TT								
	60		-97.5 +TT	-95.4 +TT	-94.2 +TT	-93.0 +TT								
n71	15	-97.2 +TT	-94.0 +TT	-91.6 +TT	-86.0 +TT									FDD
	30		-94.3 +TT	-91.9 +TT	-87.4 +TT									
	60	-												
n74	15	-99.5[3] +TT	-96.3[3] +TT	-94.5[3] +TT	-93.3[3] +TT									FDD
	30		-96.6[3] +TT	-94.6[3] +TT	-93.5[3] +TT									
	60		-97.0[3] +TT	-94.9[3] +TT	-93.7[3] +TT									
n77[1,4]	15		-95.3 +TT	-93.5 +TT	-92.2 +TT			-89.1 +TT	-88.1 +TT					TDD
	30		-95.6 +TT	-93.6 +TT	-92.4 +TT			-89.2 +TT	-88.2 +TT	-87.4 +TT	-86.1 +TT	-85.6 +TT	-85.1 +TT	
	60	-	-96.0 +TT	-93.9 +TT	-92.6 +TT			-89.4 +TT	-88.3 +TT	-87.5 +TT	-86.2 +TT	-85.7 +TT	-85.2 +TT	
n78[1]	15		-95.8 +TT	-94.0 +TT	-92.7 +TT			-89.6 +TT	-88.6 +TT					TDD
	30		-96.1 +TT	-94.1 +TT	-92.9 +TT			-89.7 +TT	-88.7 +TT	-87.9 +TT	-86.6 +TT	-86.1 +TT	-85.6 +TT	
	60		-96.5 +TT	-94.4 +TT	-93.1 +TT			-89.9 +TT	-88.8 +TT	-88.0 +TT	-86.7 +TT	-86.2 +TT	-85.7 +TT	
n79[1]	15							-89.6 +TT	-88.6 +TT					TDD
	30							-89.7 +TT	-88.7 +TT	-87.9 +TT	-86.6 +TT		-85.6 +TT	
	60							-89.9 +TT	-88.8 +TT	-88.0 +TT	-86.7 +TT		-85.7 +TT	

NOTE 1: Four Rx antenna ports shall be the baseline for this operating band except for two Rx vehicular UE.

NOTE 2: The transmitter shall be set to P_{UMAX} as defined in subclause 6.2.4

NOTE 3: [3] indicates that the requirement is modified by -0.5 dB when the assigned NR channel bandwidth is confined within 1475.9-1510.9 MHz.

NOTE 4: The requirement is modified by -0.5 dB when the assigned UE channel bandwidth is confined within 3300 - 3800 MHz.

NOTE 5: For these bandwidths, the minimum requirements are restricted to operation when carrier is configured as a downlink carrier part of CA configuration.

OTE 6: TT for each frequency and channel bandwidth is specified in Table 7.3.2.5-3.

Table 7.3.2.5-2: Reference sensitivity QPSK $P_{REFSENS}$ for Four Rx antenna ports

Operating band / SCS / Channel bandwidth / Duplex-mode														
Operating Band	**SCS kHz**	**5 MHz (dBm)**	**10 MHz (dBm)**	**15 MHz (dBm)**	**20 MHz (dBm)**	**25 MHz (dBm)**	**30 MHz (dBm)**	**40 MHz (dBm)**	**50 MHz (dBm)**	**60 MHz (dBm)**	**80 MHz (dBm)**	**90 MHz (dBm)**	**100 MHz (dBm)**	**Duplex Mode**
n1	15	-102.7 +TT	-99.5 +TT	-97.7 +TT	-96.5 +TT	-95.4 +TT	-94.6 +TT	-93.3 +TT	-92.3 +TT					FDD
	30		-99.8 +TT	-97.8 +TT	-96.7 +TT	-95.5 +TT	-94.7 +TT	-93.4 +TT	-92.4 +TT					
	60		-100.2 +TT	-98.1 +TT	-96.9 +TT	-95.7 +TT	-94.8 +TT	-93.6 +TT	-92.4 +TT					
n2	15	-100.7 +TT	-97.5 +TT	-95.7 +TT	-94.5 +TT									FDD
	30		-97.8 +TT	-95.8 +TT	-94.7 +TT									
	60		-98.2 +TT	-96.1 +TT	-94.9 +TT									
n3	15	-99.7 +TT	-96.5 +TT	-94.7 +TT	-93.5 +TT	-92.4 +TT	-91.6 +TT	-90.3 +TT						FDD
	30		-96.8 +TT	-94.8 +TT	-93.7 +TT	-92.5 +TT	-91.7 +TT	-90.4 +TT						
	60		-97.2 +TT	-95.1 +TT	-93.9 +TT	-92.7 +TT	-91.8 +TT	-90.6 +TT						
n7	15	-100.7 +TT	-97.5 +TT	-95.7 +TT	-94.5 +TT									FDD
	30		-97.8 +TT	-95.8 +TT	-94.7 +TT									
	60		-98.2 +TT	-97.1 +TT	-94.9 +TT									
n30	15	-101.7 +TT	-98.5 +TT											FDD
	30		-98.8 +TT											
	60													
n34	15	-102.7 +TT	-99.5 +TT	-97.7 +TT										TDD
	30		-99.8 +TT	-97.8 +TT										
	60		-100.2 +TT	-98.1 +TT										
n38	15	-102.7 +TT	-99.5 +TT	-97.7 +TT	-96.5 +TT			-93.3 +TT						TDD
	30		-99.8 +TT	-97.8 +TT	-96.7 +TT			-93.4 +TT						
	60		-100.2 +TT	-98.1 +TT	-96.9 +TT			-93.6 +TT						
n39	15	-102.7 +TT	-99.5 +TT	-97.7 +TT	-96.5 +TT	-95.4 +TT	-94.6 +TT	-93.3 +TT						TDD
	30		-99.8 +TT	-97.8 +TT	-96.7 +TT	-95.5 +TT	-94.7 +TT	-93.4 +TT						
	60		-100.2 +TT	-98.1 +TT	-96.9 +TT	-95.7 +TT	-94.8 +TT	-93.6 +TT						
n40	15	-102.7 +TT	-99.5 +TT	-97.7 +TT	-96.5 +TT	-95.4 +TT	-94.6 +TT	-93.3 +TT	-92.3 +TT					TDD
	30		-99.8 +TT	-97.8 +TT	-96.7 +TT	-95.5 +TT	-94.7 +TT	-93.4 +TT	-92.4 +TT	-91.6 +TT	-90.3 +TT			
	60		-100.2 +TT	-98.1 +TT	-96.9 +TT	-95.7 +TT	-94.8 +TT	-93.6 +TT	-92.5 +TT	-91.8 +TT	-90.3 +TT			
n41	15		-97.5 +TT	-95.7 +TT	-94.5 +TT		-92.6 +TT	-91.3 +TT	-90.3 +TT					TDD

	30		-97.8 +TT	-95.8 +TT	-94.7 +TT		-92.7 +TT	-91.4 +TT	-90.4 +TT	-89.6 +TT	-88.3 +TT	-87.8 +TT	-87.4 +TT	
	60		-98.2 +TT	-96.1 +TT	-94.9 +TT		-92.8 +TT	-91.6 +TT	-90.5 +TT	-89.8 +TT	-88.3 +TT	-87.8 +TT	-87.4 +TT	
n48	15	-101.2 +TT	-98.0 +TT	-96.2 +TT	-94.9 +TT			-91.8 +TT	-90.8[3] +TT					TDD
	30		-98.3 +TT	-96.3 +TT	-95.1 +TT			-91.9 +TT	-90.9[3] +TT	-90.1[3] +TT	-88.8[3] +TT	-88.3[3] +TT	-87.8[3] +TT	
	60		-98.7 +TT	-96.6 +TT	-95.3 +TT			-92.1 +TT	-91.0[3] +TT	-90.2[3] +TT	-88.9[3] +TT	-88.4[3] +TT	-87.9[3] +TT	
n66	15	-102.2 +TT	-99.0 +TT	-97.2 +TT	-96.0 +TT	-94.9 +TT	-94.1 +TT	-92.8 +TT						FDD
	30		-99.3 +TT	-97.3 +TT	-96.2 +TT	-95.0 +TT	-94.2 +TT	-92.9 +TT						
	60		-99.7 +TT	-97.6 +TT	-96.4 +TT	-95.2 +TT	-94.3 +TT	-93.1 +TT						
n70	15	-102.7 +TT	-99.5 +TT	-97.7 +TT	-96.5 +TT	-95.4 +TT								FDD
	30		-99.8 +TT	-97.8 +TT	-96.7 +TT	-95.5 +TT								
	60		-100.2 +TT	-98.1 +TT	-96.9 +TT	-95.7 +TT								
n77[4]	15		-97.5 +TT	-95.7 +TT	-94.4 +TT			-91.3 +TT	-90.3 +TT					TDD
	30		-97.8 +TT	-95.8 +TT	-94.6 +TT			-91.4 +TT	-90.4 +TT	-89.6 +TT	-88.3 +TT	-87.8 +TT	-87.3 +TT	
	60	-	-98.2 +TT	-96.1 +TT	-94.8 +TT			-91.6 +TT	-90.5 +TT	-89.7 +TT	-88.4 +TT	-87.9 +TT	-87.4 +TT	
n78	15		-98.0 +TT	-96.2 +TT	-94.9 +TT			-91.8 +TT	-90.8 +TT					TDD
	30		-98.3 +TT	-96.3 +TT	-95.1 +TT			-91.9 +TT	-90.9 +TT	-90.1 +TT	-88.8 +TT	-88.3 +TT	-87.8 +TT	
	60		-98.7 +TT	-96.6 +TT	-95.3 +TT			-92.1 +TT	-91.0 +TT	-90.2 +TT	-88.9 +TT	-88.4 +TT	-87.9 +TT	
n79	15							-91.8 +TT	-90.8 +TT					TDD
	30							-91.9 +TT	-90.9 +TT	-90.1 +TT	-88.8 +TT		-87.8 +TT	
	60							-92.1 +TT	-91.0 +TT	-90.2 +TT	-88.9 +TT		-87.9 +TT	

NOTE 1: Four Rx antenna ports shall be the baseline for above listed operating band except for two Rx vehicular UE.
NOTE 2 The requirement is modified by -0.5 dB when the assigned UE channel bandwidth is confined within 3300 - 3800 MHz.
NOTE 3: For these bandwidths, the minimum requirements are restricted to operation when carrier is configured as a downlink carrier part of CA configuration.
NOTE 4: TT for each frequency and channel bandwidth is specified in Table 7.3.2.5-3.
NOTE 4: The requirement is modified by -0.5 dB when the assigned UE channel bandwidth is confined within 3300 - 3800 MHz.

Table 7.3.2.5-3: Test Tolerance (TT) for RX sensitivity level

f ≤ 3.0GHz	3.0GHz < f ≤ 6.0 GHz
0.7 dB	1.0 dB

For the UE which supports inter-band carrier aggregation, the minimum requirement for reference sensitivity in Table 7.3.2.5-1 shall be increased by the amount given in $\Delta R_{IB,c}$ defined in subclause 7.3.3 for the applicable operating bands.

7.3.3 ΔRIB,c

For a UE supporting CA, SUL or DC band combination, the minimum requirement for reference sensitivity in Table 7.3.2.3-1 shall be increased by the amount given by $\Delta R_{IB,c}$ defined in subclause 7.3A.0.3, 7.3C.0.3, 7.3B in this specification and 7.3A, 7.3B in TS 38.101-3 [4] for the applicable operating bands.

In case the UE supports more than one of band combinations for CA, SUL or DC, and an operating band belongs to more than one band combinations then

- When the operating band frequency range is ≤ 1 GHz, the applicable additional $\Delta R_{IB,c}$ shall be the average value for all band combinations defined in subclause 7.3A.0.3, 7.3C.0.3, 7.3B in this specification and 7.3A, 7.3B in TS 38.101-3 [4], truncated to one decimal place that apply for that operating band among the supported band combinations. In case there is a harmonic relation between low band UL and high band DL, then the maximum $\Delta R_{IB,c}$ among the different supported band combinations involving such band shall be applied

- When the operating band frequency range is > 1 GHz, the applicable additional $\Delta R_{IB,c}$ shall be the maximum value for all band combinations defined in subclause 7.3A.0.3, 7.3C.0.3, 7.3B in this specification and 7.3A, 7.3B in TS 38.101-3 [4] for the applicable operating bands.

7.3A Reference sensitivity for CA

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

Test requirement table for 2DL/2UL is not complete.

- Reference sensitivity power level for 4DL_CA and 5DL_CA are FFS.

- Test description for exceptional cases are incomplete.

7.3A.0 Minimum conformance requirements

7.3A.0.1 General

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

7.3A.0.2 Reference sensitivity power level for CA

7.3A.0.2.1 Reference sensitivity power level for Intra-band contiguous CA

For intra-band contiguous carrier aggregation, the throughput of each component carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2.2.2, A.2.3.2, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.2.3-1, Table 7.3.2.3-2, and Table 7.3.2.3-3.

For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.2.3-3 and the downlink PCC carrier center frequency shall be configured closer to uplink operating band than any of the downlink SCC center frequency.

7.3A.0.2.2 Reference sensitivity power level for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with one uplink carrier and two or more downlink sub-blocks, throughput of each downlink component carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) and parameters specified in Table 7.3.2.3-1, Table

7.3.2.3-2, and Table 7.3A.0.2.2-1 with the reference sensitivity power level increased by ΔR_{IBNC} given in Table 7.3A.0.2.2-1 for the SCC(s). For aggregation of two or more downlink FDD carriers with one uplink carrier the reference sensitivity is defined only for the specific uplink and downlink test points which are specified in Table 7.3A.0.2.2-1. The requirements apply with all downlink carriers active. Unless given by Table 7.3.2.3-4, the reference sensitivity requirements shall be verified with the network signalling value NS_01 (Table 6.2.3.3.1-1) configured.

Table 7.3A.0.2.2-1: Intra-band non-contiguous CA with one uplink configuration for reference sensitivity

CA configuration	SCS (kHz)	Aggregated channel bandwidth (PCC+SCC)	W_{gap} / [MHz]	UL PCC allocation	ΔR_{IBNC} (dB)	Duplex mode
CA_n66(2A)	N/A	NOTE 1	NOTE 2	NOTE 3, NOTE 4	0.0	FDD
CA_n77(2A)		NOTE 1	NOTE 2	NOTE 3	0.0	TDD
CA_n78(2A)		NOTE 1	NOTE 2	NOTE 3	0.0	TDD
NOTE 1: All combinations of channel bandwidths defined in Table 5.5A.2-1. NOTE 2: All applicable sub-block gap sizes. NOTE 3: The PCC allocation is same as Transmission bandwidth configuration N_{RB} as defined in Table 5.3.2-1. NOTE 4: The carrier center frequency of PCC in the DL operating band is configured closer to the UL operating band. NOTE 5: W_{gap} is the sub-block gap between the two sub-blocks.						

7.3A.0.2.3 Reference sensitivity power level for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2.2, A.2.3.2, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 with parameters specified in Table 7.3.2.3-1, Table 7.3.2.3-2 and Table 7.3.2.3-3 modified in accordance with subclause 7.3A.0.3.2. The reference sensitivity is defined to be met with all downlink component carriers active and one of the uplink carriers active. Exceptions to reference sensitivity are allowed in accordance with subclause 7.3A.0.4.

7.3A.0.2.4 Reference sensitivity power level for SDL bands

For band combinations including operating bands without uplink band (as noted in Table 5.2-1), the requirements are specified in Table 7.3A.0.2.4-1 and for any band with uplink the uplink configuration specified in Table 7.3.2.3-3. The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels, as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one-sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal, as described in Annex A.5.1.1/A.5.2.1). The reference sensitivity is defined to be met with all downlink component carriers active and one of the uplink carriers active. Exceptions to reference sensitivity are allowed in accordance with clause 7.3A.0.4.

Table 7.3A.0.2.4-1: Reference sensitivity for SDL bands

NR Band/Channel bandwidth														
NR CA Configuration	**NR band**	**SCS (kHz)**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
			dB	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**
CA_n8A-n75A	n8	15	-97.0	-93.8	-92.0	-90.0								
		30		-94.1	-92.1	-90.2								
		60												
	n75	15	-100	-96.8	-95.0	-93.8								
		30		-97.1	-95.1	-94.0								
		60		-97.5	-95.4	-94.2								
CA_n28A-n75A	n28	15	-98.5	-95.5	-93.5	-90.8								
		30		-95.6	-93.6	-91.0								
		60												
	n75	15	-100	-96.8	-95.0	-93.8								
		30		-97.1	-95.1	-94.0								
		60		-97.5	-95.4	-94.2								
CA_n29A-n66A CA_n29A-n66B CA_n29A-n66(2A)	n29	15	-97.0	-93.8										
		30		-94.1										
		60												
	n66	15	-99.5	-96.3	-94.5	-93.3			-90.1					
		30		-96.6	-94.6	-93.5			-90.2					
		60		-97.0	-94.9	-93.7			-90.4					
CA_n29A-n70A	n29	15	-97.0	-93.8										
		30		-94.1										
		60												
	n70	15	-100	-96.8	-95.0	-93.8	-92.7							
		30		-97.1	-95.1	-94.0	-92.8							
		60		-97.5	-95.4	-94.2	-93.0							
CA_n75A-n78A[1]	n75	15	-100	-96.8	-95.0	-93.8								
		30		-97.1	-95.1	-94.0								
		60		-97.5	-95.4	-94.2								
	n78	15		-95.8	-94.0	-92.7			-89.6	-88.6				
		30		-96.1	-94.1	-92.9			-89.7	-88.7	-87.9	-86.6	-86.1	-85.6
		60		-96.5	-94.4	-93.1			-89.9	-88.8	-88.0	-86.7	-86.2	-85.7
CA_n76A-n78A[1]	n76	15	-100											
		30												
		60												
	n78	15		-95.8	-94.0	-92.7			-89.6	-88.6				
		30		-96.1	-94.1	-92.9			-89.7	-88.7	-87.9	-86.6	-86.1	-85.6
		60		-96.5	-94.4	-93.1			-89.9	-88.8	-88.0	-86.7	-86.2	-85.7
NOTE 1: The transmitter shall be set to P_{UMAX}, as defined in subclause 6.2.4. NOTE 2: Four Rx antenna ports shall be the baseline for this operating band, except for two Rx vehicular UE.														

7.3A.0.3 $\Delta R_{IB,c}$ for CA

7.3A.0.3.1 General

For a UE supporting a CA configuration, the $\Delta R_{IB,c}$ applies for both SC and CA operation.

7.3A.0.3.2 $\Delta R_{IB,c}$ for Inter-band CA

For the UE which supports inter-band carrier aggregation, the minimum requirement for reference sensitivity in subclause 7.3A.0 shall be increased by the amount given by $\Delta R_{IB,c}$ defined in subclause 7.3A.0.3.2 for the applicable operating bands. Unless otherwise stated, $\Delta R_{IB,c}$ is set to zero.

In case the UE supports more than one of band combinations for CA, SUL or DC, and an operating band belongs to more than one band combinations then

- When the operating band frequency range is ≤ 1 GHz, the applicable additional $\Delta R_{IB,c}$ shall be the average value for all band combinations defined in subclause 7.3A, 7.3B, 7.3C in this specification and 7.3A, 7.3B in TS 38.521-3 [14], truncated to one decimal place that apply for that operating band among the supported band combinations. In case there is a harmonic relation between low band UL and high band DL, then the maximum $\Delta R_{IB,c}$ among the different supported band combinations involving such band shall be applied.
- When the operating band frequency range is > 1 GHz, the applicable additional $\Delta R_{IB,c}$ shall be the maximum value for all band combinations defined in subclause 7.3A, 7.3B, 7.3C in this specification and 7.3A, 7.3B in TS 38.521-3 [14] for the applicable operating bands.

7.3A.0.3.2.1 $\Delta R_{IB,c}$ for two bands

Table 7.3A.0.3.2.1-1: $\Delta R_{IB,c}$ due to CA (two bands)

Inter-band CA configuration	NR Band	$\Delta R_{IB,c}$ (dB)
CA_n1-n77	n1	0.2
	n77	0.5
CA_n1-n78	n78	0.5
CA_n3-n77	n3	0.2
	n77	0.5
CA_n3-n78	n3	0.2
	n78	0.5
CA_n3-n79	n79	0.5
CA_n8-n78	n8	0.2
	n78	0.5
CA_n8-n79	n79	0.5
CA n28-n75	n28	0.2
CA_n28-n78	n28	0.2
	n78	0.5
CA_n41-n78[1]	n78	0.5
CA_n41-n79	n41	0.5
	n79	0.5
CA_n75-n78	n78	0.5
CA_n76-n78	n78	0.5
NOTE 1: The requirements only apply when the sub-frame and Tx-Rx timings are synchronized between the component carriers. In the absence of synchronization, the requirements are not within scope of these specifications.		

7.3A.0.3.2.2 Void

7.3A.0.3.2.3 $\Delta R_{IB,c}$ for three bands

Table 7.3A.0.3.2.3-1: $\Delta R_{IB,c}$ due to CA (three bands)

Inter-band CA combination	NR Band	$\Delta R_{IB,c}$ (dB)
CA_n66-n70-n71	n66	0
	n70	0
	n71	0

7.3A.0.4 Reference sensitivity exceptions due to UL harmonic interference for CA

Sensitivity degradation is allowed for a band in frequency range 1 if it is impacted by UL harmonic interference from another band in frequency range 1 of the same CA configuration. Reference sensitivity exceptions are specified in Table 7.3A.0.4-1 with uplink configuration specified in Table 7.3A.0.4-2.

Table 7.3A.0.4-1: Reference sensitivity exceptions due to UL harmonic for NR CA FR1

MSD due to harmonic exception for the DL band													
UL band	**DL band**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
		dB	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**
n1	n77[1,2]		23.9	22.1	20.9			17.9	16.8	16.0	14.8	14.3	13.8
	n77[3]		1.1	0.8	0.3								
n3	n77[1,2]		23.9	22.1	20.9			17.9	16.9	16.1	14.8	14.3	13.8
	n77[3]		1.1	0.8	0.3								
n3	n78[1,2]		23.9	22.1	20.9			17.9	16.9	16.1	14.8	14.3	13.8
	n78[3]		1.1	0.8	0.3								
n8	n78[4,5]		10.8	9.1	8.0			5.1	4.2	3.5	2.3	2.1	1.4
n8	n79[6,7]							[6.8]	6.2	[5.6]	4.9		4.4
n28	n75[1,2]	28.1	25.3	24.0	22.8								
	n78[6,7]		[10.4]	[8.9]	[7.8]			[4.7]	[3.7]	[3]	[1.7]	[1.2]	[0.7]

n71	n70[8,9]	9.9	7.1	6.7	4.9	4.1							

NOTE 1: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band and a range ΔF_{HD} above and below the edge of this downlink transmission bandwidth. The value ΔF_{HD} depends on the band combination: ΔF_{HD} = 10 MHz for CA_n1-n77, CA_n3-n77, CA_n3-n78.

NOTE 2: The requirements should be verified for UL NR-ARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB}/0.2 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 \le f_{UL}^{LB} \le F_{UL\_high}^{LB} - BW_{Channel}^{LB}/2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.

NOTE 3: The requirements are only applicable to channel bandwidths no larger than 20 MHz and with a carrier frequency at $\pm\left(20 + BW_{Channel}^{HB}/2\right)$ MHz offset from $2f_{UL}^{LB}$ in the victim (higher band) with $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 \le f_{UL}^{LB} \le F_{UL\_high}^{LB} - BW_{Channel}^{LB}/2$, where $BW_{Channel}^{LB}$ and $BW_{Channel}^{HB}$ are the channel bandwidths configured in the aggressor (lower) and victim (higher) bands in MHz, respectively.

NOTE 4: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 4[th] transmitter harmonic is within the downlink transmission bandwidth of a high band.

NOTE 5: The requirements should be verified for UL NR-ARFCN of a low band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB}/0.4 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 \le f_{UL}^{LB} \le F_{UL\_high}^{LB} - BW_{Channel}^{LB}/2$ with f_{DL}^{HB} the carrier frequency of a high band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the low band.

NOTE 6: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of a low band for which the 5th transmitter harmonic is within the downlink transmission bandwidth of a high band.

NOTE 7: The requirements should be verified for UL NR-ARFCN of a low band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB}/0.5 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 \le f_{UL}^{LB} \le F_{UL\_high}^{LB} - BW_{Channel}^{LB}/2$ with f_{DL}^{HB} the carrier frequency of a high band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the low band.

NOTE 8: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 3nd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band.

NOTE 9: The requirements should be verified for UL NR-ARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB}/0.3 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 \le f_{UL}^{LB} \le F_{UL\_high}^{LB} - BW_{Channel}^{LB}/2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.

Table 7.3A.0.4-2: Uplink configuration for reference sensitivity exceptions due to UL harmonic interference for NR CA, FR1

NR Band / Channel bandwidth of the high band													
UL band	**DL band**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
n1	n77		25	36	50			100	100	100	100	100	100
n3	n77		25	36	50			50	50	50	50	50	50
n3	n78		25	36	50			50	50	50	50	50	50
n8	n78		16	25	25			25	25	25	25	25	25
n8	n79							25	25	25	25		25
n28	n75	12	25	36	50								
n28	n78		10	15	20			25	25	25	25	25	25
n71	n70	8	16	20	20	20							

NOTE 1: 15kHz SCS is assumed for UL band.
NOTE 2: The UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.2.3-3 for the uplink bandwidth in which case the allocation according to Table 7.3.2.3-3 applies.
NOTE 3: Unless stated otherwise, UL resource blocks shall be centred within the transmission bandwidth configuration for the channel bandwidth.

Table 7.3A.0.4-3: Void

Table 7.3A.0.4-3a: Void

Sensitivity degradation is allowed for a band if it is impacted by receiver harmonic mixing due to another band part of the same CA configuration. Reference sensitivity exceptions are specified in Table 7.3A.0.4-4 with uplink configuration specified in Table 7.3A.0.4-4a.

Table 7.3A.0.4-4: Reference sensitivity exceptions due to harmonic mixing for CA in NR FR1

UL band	**DL band**	**5 MHz (dB)**	**10 MHz (dB)**	**15 MHz (dB)**	**20 MHz (dB)**	**25 MHz (dB)**	**40 MHz (dB)**	**50 MHz (dB)**	**60 MHz (dB)**	**80 MHz (dB)**	**90 MHz (dB)**	**100 MHz (dB)**
n41	n78[1]		8.3	8.0	6.9		3.9	3	2.3	1.2		0.4
n78	n41[2]		10.4	10.4	10.4		7.2	6.2	5.5	4.5		4.5

NOTE 1: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB} / 0.15 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB} / 2 \leq f_{UL}^{LB} \leq F_{UL\_high}^{LB} - BW_{Channel}^{LB} / 2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.
NOTE 2: The requirements should be verified for UL EARFCN of the aggressor (high) band (superscript HB) such that $f_{UL}^{LB} = \lfloor 15 * f_{DL}^{HB} \rfloor 0.1$ in MHz and $F_{UL_{low}}^{HB} + BW_{Channel}^{HB}/2 \leq f_{UL}^{HB} \leq f_{UL_{high}}^{HB} - BW_{Channel}^{HB}/2$ with f_{DL}^{LB} carrier frequency in the victim (lower) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the higher band.

Table 7.3A.0.4-4a: Uplink configuration for reference sensitivity exceptions due to receiver harmonic mixing for CA in NR FR1

UL band	DL band	SCS (kHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
n41	n78	30		24	24	24		24	24	24	24	24	24
n78	n41	30		50	50	50		50	50	50	50	50	50
NOTE 1: The UL configuration applies regardless of the channel bandwidth of the UL band unless the UL resource blocks exceed that specified in Table 7.3.2.3-3 for the uplink bandwidth in which case the allocation according to Table 7.3.2.3-3 applies.													

7.3A.0.5 Reference sensitivity exceptions due to intermodulation interference due to 2UL CA

For inter-band carrier aggregation with uplink assigned to two NR bands given in Table 7.3A.0.5-1 the reference sensitivity is defined only for the specific uplink and downlink test points specified in Table 7.3A.0.5-1. For these test points the reference sensitivity requirement specified in Table 7.3.2.3-1 and Table 7.3.2.3-2 are relaxed by the amount of the corresponding parameter MSD given in Table 7.3A.0.5-1.

Table 7.3A.0.5-1: 2DL/2UL interband Reference sensitivity QPSK $P_{REFSENS}$ and uplink/downlink configurations

Band / Channel bandwidth / N_{RB} / Duplex mode								Source of IMD
NR CA Configuration	NR band	UL F_c (MHz)	UL/DL BW (MHz)	UL C_{LRB}	DL F_c (MHz)	MSD (dB)	Duplex mode	
CA_n1A-n78A	n1	1950	5	25	2140	8.0 10.7[5]	FDD	IMD4
	n78	3710	10	50	3710	N/A	TDD	N/A
CA_n3A-n78A	n3	1740	5	25	1835	[26] [28.7[5]]	FDD	IMD2[4]
	n78	3575	10	25	3575	N/A	TDD	N/A
CA_n3A-n78A	n3	1765	5	25	1860	[8.0] [10.7[5]]	FDD	IMD4[4]
	n78	3435	10	25	3435	N/A	TDD	N/A
CA_n8A-n78A	n8	897.5	5	25	942.5	8.3	FDD	IMD4
	n78	3635	10	50	3635	N/A	TDD	N/A
CA_n66A-n71A CA_n66(2A)-n71A CA_n66B-n71A	n66	1750	5	25	2150	5	FDD	IMD4
	n71	675	5	25	629	N/A	FDD	N/A
CA_n70A-n71A	n70	1697.5	5	25	1997.5	5	FDD	IMD4
	n71	695.5	5	25	649.5	N/A	FDD	N/A
NOTE 1: Both of the transmitters shall be set min(+20 dBm, $P_{CMAX\_L,f,c}$) as defined in subclause 6.2A.4 NOTE 2: RB_{START} = 0, 15kHz SCS is assumed. NOTE 3: No requirements apply when there is at least one individual RE within the intermodulation generated by the dual uplink is within the downlink transmission bandwidth of the FDD band. The reference sensitivity should only be verified when this is not the case (the requirements specified in clause 7.3 apply). NOTE 4: This band is subject to IMD5 also which MSD is not specified. NOTE 5: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.								

7.3A.0.6 Reference sensitivity exceptions due to cross band isolation for CA

Sensitivity degradation is allowed for a band if it is impacted by UL of another band part of the same NR CA configuration due to cross band isolation issues. Reference sensitivity exceptions for the victim band are specified in Table 7.3A.0.6-1 with uplink configuration of the agressor band specified in Table 7.3A.0.6-2.

Table 7.3A.0.6-1: Reference sensitivity exceptions (MSD) due to cross band isolation for NR CA FR1

NR Band / Channel bandwidth of the affected DL band													
UL band	**DL band**	**5 MHz (dB)**	**10 MHz (dB)**	**15 MHz (dB)**	**20 MHz (dB)**	**25 MHz (dB)**	**30 MHz (dB)**	**40 MHz (dB)**	**50 MHz (dB)**	**60 MHz (dB)**	**80 MHz (dB)**	**90 MHz (dB)**	**100 MHz (dB)**
n78	n41[1]		4.5	4.5	4.5			4.5	4.5				
n78	n79							2	2	2	2		2
n79	n78		2.6	2.6	2.6			2.6	2.6	2.6	2.6	2.6	2.6

NOTE 1: Applicable only when harmonic mixing MSD for this combination is not applied.

NOTE 2: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.

Table 7.3A.0.6.2: Uplink configuration for reference sensitivity exceptions due to cross band isolation for NR CA FR1

NR Band / SCS / Channel bandwidth of the affected DL band														
UL band	**DL band**	**SCS of UL band (kHz)**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
n78	n41	30		270	270	270			270	270	270	270	270	270
n78	n79	30							270[2]	270[2]	270[2]	270[2]		270[2]
n79	n78	30		270[2]	270[2]	270[2]			270[2]	270[2]	270[2]	270[2]	270[2]	270[2]

NOTE 1: The UL configuration applies regardless of the channel bandwidth of the UL band unless the UL resource blocks exceed that specified in Table 7.3.2.3-3 for the uplink bandwidth in which case the allocation according to Table 7.3.2.3-3 applies.

NOTE 2: Refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission bandwidth configuration for the channel bandwidth in Table 5.3.2-1.

NOTE 3: The requirements only apply for UEs supporting inter-band carrier aggregation with simultaneous Rx/Tx capability. Simultaneous Rx/Tx capability does not apply for UEs supporting band n78 with a n77 implementation.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.3.A.

7.3A.1 Reference sensitivity power level for 2DL CA without exception

7.3A.1.1 Test purpose

To verify the ability of UE that support CA to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise when no CA exceptions are allowed and single carrier requirements apply.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area.

7.3A.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support NR 2DL CA.

7.3A.1.3 Minimum requirements

The minimum conformance requirements are defined in clause 7.3A.0.

7.3A.1.4 Test description

7.3A.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.2-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 7.3A.1.4.1-1, 7.3A.1.4.1-2 and 7.3A.1.4.1-3. The details of the uplink reference measurement channels (RMCs) are specified in Annexe A2.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.3A.1.4.1-1: Test Configuration Table for intra-band contiguous 2DL CA without exception

<table>
<tr><th colspan="7">Initial Conditions</th></tr>
<tr><td colspan="4">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="3">Normal, TL/VL, TL/VH, TH/VL, TH/VH</td></tr>
<tr><td colspan="4">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="3">Low range, High range</td></tr>
<tr><td colspan="4">Test CC Combination setting (N_{RB_agg}) as specified in subclause Table 5.5A.1-1 for the CA Configuration across bandwidth combination sets supported by the UE.</td><td colspan="3">Lowest N_{RB_agg}, Highest N_{RB_agg}
(NOTE 3)</td></tr>
<tr><td colspan="4">Test SCS as specified in Table 5.3.5-1</td><td colspan="3">Lowest</td></tr>
<tr><td colspan="7">Test Parameters CA Configurations</td></tr>
<tr><th colspan="2">CA Configuration /NRB</th><th colspan="2">DL Allocation</th><th colspan="3">UL Allocation</th></tr>
<tr><th>PCC NRB</th><th>SCC NRB</th><th>CC MOD</th><th>PCC & SCC RB allocation</th><th>CC MOD</th><th colspan="2">PCC & SCC RB allocations (L_{CRB} @ RB_{start})</th></tr>
<tr><td>Lowest N_{RB_agg} (NOTE 4)</td><td>Lowest N_{RB_agg} (NOTE 4)</td><td>CP-OFDM QPSK</td><td>Full RB</td><td>DFT-s-OFDM QPSK</td><td>REFSENS</td><td>-</td></tr>
<tr><td>Highest N_{RB_agg} (NOTE 4)</td><td>Highest N_{RB_agg} (NOTE 4)</td><td>CP-OFDM QPSK</td><td>Full RB</td><td>DFT-s-OFDM QPSK</td><td>REFSENS</td><td>-</td></tr>
<tr><td colspan="7">Note 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2.
Note 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to table 7.3.2.4.1-3.
Note 3: If the UE supports multiple CC Combinations in the CA Configuration with the same N_{RB_agg}, only the combination with the highest NRB_PCC is tested
Note 4: In CA_n66B configuration with the same N_{RB_agg} CC combination, PCC shall be selected as the lower CH BW
Note 5: In a band where UE supports 4Rx, the test needs to be performed only with 4Rx antennas connected.</td></tr>
</table>

Table 7.3A.1.4.1-2: Test Configuration Table for inter-band 2DL CA without exception

Initial Conditions	
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	NC, TL/VL, TL/VH, TH/VL, TH/VH
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range for PCC and SCC with exceptions for CA configurations containing the following band combinations: CA_n1-n77: Mid in band n1 and Low in band n77 CA_n3-n77: TBD in band 3 and TBD in band 77. CA_n8-nX: Low range for PCC in Band 8 CA_n70-n71: High range for PCC in band 71. CA_n3-n78: Mid in band 3 and High in band 78.
Test CC Combination setting (CBW) as specified in subclause Table 5.5A.3.1-1 for the CA Configuration across bandwidth combination sets supported by the UE.	Refer to “PCC N_{RB}”and “SCC N_{RB} ” columns
Test SCS as specified in Table 5.3.5-1	Lowest
Network signalling value	NS_01 Unless given by Table 7.3.2.3-4 for the band with active uplink carrier

Test Parameters for CA Configurations												
ID	CA Configuration / CBW						DL Allocation			UL Allocation (Note 2,3)		
	CA Configuration				PCC N_{RB}	SCC N_{RB}	CC MOD	PCC & SCC RB allocation		CC MOD	PCC & SCC RB allocations (L_{CRB} @ RB_{start})	
	PCC		SCC					PCC	SCC			
	Band	Range	Band	Range								
Default Test Settings for a CA_nXA-nYA Configuration												
1	nX	default	nY	default	Highest (Note 6)	Highest	CP-OFDM QPSK	Full RB		DFT-s-OFDM QPSK	REFSENS	-
2	nY	default	nX	default	Highest (Note 6)	Highest	CP-OFDM QPSK	Full RB		DFT-s-OFDM QPSK	REFSENS	-

Note 1: CA Configuration Test CC Combination test settings are checked separately for each CA Configuration.
Note 2: Use CA Configuration – specific test points if present in the table, otherwise use test points from matching Group Test Settings, if present in the table. Otherwise use the Default Test Settings test points.
Note 3: X,Y correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n3A, X=1, Y=3.
Note 4: REFSENS refers to the PCC bands and PCC N_{RB} 's single carrier Uplink RB allocation for reference sensitivity according to table 7.3.2.4.1-3.
Note 5: For band combinations including operating band without uplink band (as noted in Table 5.2-1), only the CA configuration where PCC band has uplink band shall be tested.
Note 6: For high range in band n66, DL 40 MHz / UL 20 MHz shall be configured (as specified in clause 5.3.6)
For high range in band n70, DL 25 MHz / UL 15 MHz shall be configured (as specified in clause 5.3.6).
Note 7: In a band where UE supports 4Rx, the test needs to be performed only with 4Rx antennas connected.

Table 7.3A.1.4.1-3: Test Configuration Table for intra-band non-contiguous 2DL CA without exception

Initial Conditions	
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	NC, TL/VL, TL/VH, TH/VL, TH/VH
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	For test frequencies refer to “Range” columns.
Test CC Combination setting (CBW) as specified in subclause Table 5.5A.3.1-1 for the CA Configuration across bandwidth combination sets supported by the UE.	Refer to “PCC N_{RB}”and “SCC N_{RB} ” columns
Test SCS as specified in Table 5.3.5-1	Lowest
Network signalling value	NS_01 Unless given by Table 7.3.2.3-4 for the band with active uplink carrier

Test Parameters for CA Configurations													
ID	CA Configuration / CBW							DL Allocation			UL Allocation (Note 2,3)		
	CA Configuration				PCC	W_{gap} / [MHz]	SCC	CC MOD	PCC & SCC RB allocation		CC MOD	PCC & SCC RB allocations (L_{CRB} @ RB_{start})	
	PCC		SCC						PCC	SCC			
	Band	Range	Band	Range									
Default Test Settings for a CA_nX(2A) Configuration													
1	nX	CC1	nX	CC2	Highest	Max (NOTE 4)	Lowest	CP-OFDM QPSK	Full RB		DFT-s-OFDM QPSK	REFSENS	-
2	nX	CC1	nX	CC2	Highest N_{RB_agg} (NOTE 5)	Max (NOTE 4)	Highest N_{RB_agg} (NOTE 5)	CP-OFDM QPSK	Full RB		DFT-s-OFDM QPSK	REFSENS	-

Note 1: CA Configuration Test CC Combination test settings are checked separately for each CA Configuration.
Note 2: Use CA Configuration – specific test points if present in the table, otherwise use test points from matching Group Test Settings, if present in the table. Otherwise use the Default Test Settings test points.
Note 3: REFSENS refers to the PCC bands and PCC N_{RB} ‘s single carrier Uplink RB allocation for reference sensitivity according to table 7.3.2.4.1-3.
Note 4: The Wgap is defined to be widest possible on band based on the PCC and SCC configuration
Note 5: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested
Note 6: In a band where UE supports 4Rx, the test needs to be performed only with 4Rx antennas connected.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The UL and Reference Measurement Channel is set according to Tables 7.3A.1.4.1-1, 7.3A.1.4.1-2 and 7.3A.1.4.1-3.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.3A.1.4.3.

7.3A.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.3A.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1-1 for C_RNTI to transmit the DL RMC according to Tables 7.3A.1.4.1-1, 7.3A.1.4.1-2 and 7.3A.1.4.1-3 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.3A.1.4.1-1, 7.3A.1.4.1-2 and 7.3A.1.4.1-3 on PCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the Downlink signal level to the appropriate REFSENS value defined in Tables 7.3.2.5-1, 7.3.2.5-2. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE to ensure the UE transmits P_{UMAX} level for at least the duration of the throughput measurement. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

7. Measure the average throughput for each component carrier for a duration sufficient to achieve statistical significance according to Annex H.2A.

7.3A.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

7.3A.1.5 Test requirement

For 2DL carrier aggregation, test parameters are specified in table 7.3A.1.4.1-1, 7.3A.1.4.1-2 and 7.3A.1.4.1-3. For the CA configurations listed in table 7.3A.1.5-1 where no REFSENS exceptions applies, the throughput of each component carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with reference power level specified in table 7.3.2.5-1 for non-SDL carrier for 2 Rx antenna port, in table 7.3.2.5-2 for non-SDL carrier for 4 Rx antenna port and in table 7.3A.1.5-2 for SDL carrier with following additional requirements:

For the UE which supports inter-band carrier aggregation, the test requirement for reference sensitivity shall be increased by the amount given by $\Delta R_{IB,c}$ defined in clause 7.3A.0.3 for the applicable operating bands. Unless otherwise stated, $\Delta R_{IB,c}$ is set to zero.

For intra-band non-contiguous 2 DL CA, the test requirement for shall be increased by ΔR_{IBNC} given in Table 7.3A.0.2.2-1 for the SCC. Unless given by Table 7.3.2.3-4, the reference sensitivity requirements shall be verified with the network signalling value NS_01 (Table 6.2.3.1-1) configured.

Table 7.3A.1.5-1: Reference sensitivity requirement for 2DL CA

Carrier aggregation type	DL CA configuration	UL CA configuration
Intra-band contiguous 2DL CA	CA_n40B	-
	CA_n41C	-
	CA_n66B	-
	CA_n78B	-
	CA_n78C	-
Intra-band non-contiguous 2DL CA	CA_n66(2A)	-
	CA_n77(2A)	-
	CA_n78(2A)	-
Inter-band 2DL CA	CA_n1A-n77A	-
	CA_n1A-n78A	-
	CA_n3A-n77A	-
	CA_n3A-n78A	-
	CA_n8A-n78A	-
	CA_n41A-n79A	-
	CA_n66A-n70A	-
	CA_n66A-n71A	-
	CA_n70A-n71A	-
SDL configuration	CA_n29A-n66A	-
	CA_n29A-n70A	-

Table 7.3A.1.5-2: Reference sensitivity for SDL bands

NR band	SCS (kHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
		dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
n29	15	-97.0 +TT	-93.8 +TT										
	30		-94.1 +TT										
Note 1: TT for each frequency and channel bandwidth is specified in Table 7.3.2.5-3.													

For intra-band non-contiguous carrier aggregation with one uplink carrier and two or more downlink sub-blocks, throughput of each downlink component carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) and parameters specified in Table 7.3.2.4.1-1, Table 7.3.2.4.1-2, Table 7.3.2.4.1-3, Table 7.3.2.5-1, Table 7.3.2.5-2 and Table 7.3A.1.4-1 with the reference sensitivity power level increased by ΔR_{IBNC} given in Table 7.3A.0.2.2-1 for the SCC(s). For aggregation of two downlink FDD carriers with one uplink carrier the reference sensitivity is defined only for the specific uplink and downlink test points which are specified in Table 7.3A.0.2.2-1. The requirements apply with all downlink carriers active. Unless given by Table 7.3.2.3-4, the reference sensitivity requirements shall be verified with the network signalling value NS_01 (Table 6.2.3.1-1) configured.

For band combinations including operating bands without uplink band (as noted in Table 5.2-1), the requirements are specified in Table 7.3A.1.5-1 and for any band with uplink the uplink configuration specified in Table 7.3.2.4.1-2. The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels, as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one-sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal, as described in Annex A.5.1.1/A.5.2.1). The reference sensitivity is defined to be met with all downlink component carriers active and one of the uplink carriers active.

7.3A.1_1 Reference sensitivity power level for 2DL CA exceptions

7.3A.1_1.1 Test purpose

To verify the ability of UE that support CA to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise when CA exceptions are allowed.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area.

7.3A.1_1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support NR 2DL CA

7.3A.1_1.3 Minimum requirements

The minimum conformance requirements are defined in clause 7.3A.0.

7.3A.1_1.4 Test description

7.3A.1_1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.2-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 7.3A.1_1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexe A2.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.3A.1_1.4.1-1: Test Configuration Table for inter-band 2DL CA exceptions

<table>
<tr><th colspan="12">Initial Conditions</th></tr>
<tr><td colspan="7">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="5">NC, TL/VL, TL/VH, TH/VL, TH/VH</td></tr>
<tr><td colspan="7">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="5">For test frequencies refer to “Range” columns.</td></tr>
<tr><td colspan="7">Test CC Combination setting (CBW) as specified in subclause Table 5.5A.3.1-1 for the CA Configuration across bandwidth combination sets supported by the UE.</td><td colspan="5">Refer to “PCC N_{RB}”and “SCC N_{RB} ” columns</td></tr>
<tr><td colspan="7">Test SCS as specified in Table 5.3.5-1</td><td colspan="5">Lowest</td></tr>
<tr><td colspan="7">Network signalling value</td><td colspan="5">NS_01
Unless given by Table 7.3.2.3-4 for the band with active uplink carrier</td></tr>
<tr><th colspan="12">Test Parameters for CA Configurations</th></tr>
<tr><th rowspan="4">ID</th><th colspan="6">CA Configuration / CBW</th><th colspan="3">DL Allocation</th><th colspan="2">UL Allocation (Note 2)</th></tr>
<tr><th colspan="4">CA Configuration</th><th rowspan="3">PCC</th><th rowspan="3">SCC</th><th rowspan="3">CC MOD</th><th colspan="2">PCC & SCC RB allocation</th><th rowspan="3">CC MOD</th><th rowspan="3">PCC & SCC RB allocations (L_{CRB} @ RB_{start})</th></tr>
<tr><th colspan="2">PCC</th><th colspan="2">SCC</th><th rowspan="2">PCC</th><th rowspan="2">SCC</th></tr>
<tr><th>Band</th><th>Range</th><th>Band</th><th>Range</th></tr>
</table>

Test Settings for CA_n1A-n77A Configuration											
1	n1	Mid	n77	3900 MHz	20 MHz	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_1	-
2	n1	Mid	n77	3870 MHz	20 MHz	20 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_1	-
Test Settings for CA_n1A-n78A Configuration											
1	n1	1950 MHz (UL)	n78	3710 MHz	5 MHz	10 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_3	REFSENS_CA_3
Test Settings for CA_n3A-n77A Configuration											
1	n3	TBD	n77	TBD	Highest	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_1	-
2	n3	TBD	n77	TBD	Highest	20 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_1	-
3	n70	1697.5 MHz (UL)	n71	695.5 MHz (UL)	5 MHz	5 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_3	REFSENS_CA_3
Test Settings for CA_n70A-n71A Configuration											
1	n71	Low	n70	Low	10 MHz	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_1 with RB start 10	-
2	n71	Low	n70	Low	5 MHz	5 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_1 with RB start 10	-
Test Settings for CA_n3A-n78A Configuration											
1	n3	Mid	n78	3495 MHz	Highest	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_1	-
2	n3	Mid	n78	3465 MHz	20 MHz	20 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_1	-
3	n3	1740 MHz (UL)	n78	3575 ; MHz	5 MHz	10 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_3	REFSENS_CA_3
4	n3	1765 MHz (UL)	n78	3435 MHz	5 MHz	10 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_3	REFSENS_CA_3
Test Settings for CA_n8A-n78A Configuration											
1	n8	Mid	n78	3590 MHz	Highest	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_1	-
2	n8	897.5 MHz (UL)	n78	3635 MHz	5 MHz	10 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_3	REFSENS_CA_3
Test Settings for CA_n66A-n71A Configuration											
2	n66	1750 MHz (UL)	n71	675 MHz (UL)	5 MHz	5 MHz	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	REFSENS_CA_3	REFSENS_CA_3

Note 1: CA Configuration Test CC Combination test settings are checked separately for each CA Configuration.

Note 2: REFSENS refers to the PCC bands and PCC N_{RB} 's single carrier Uplink RB allocation for reference sensitivity according to table 7.3.2.4.1-3.
REFSENS_CA_1 refers to the Uplink RB allocation for reference sensitivity exceptions due to UL harmonic interference according to table 7.3A.0.4-2.
REFSENS_CA_2 refers to the Uplink RB allocation for reference sensitivity exceptions due to receiver harmonic mixing according to table 7.3A.0.4-4a.
REFSENS_CA_3 refers to the Uplink RB allocation for reference sensitivity exceptions due to intermodulation

interference due to 2UL CA according to table 7.3A.0.5-1.
Note 3: In a band where UE supports 4Rx, the test needs to be performed only with 4Rx antennas connected.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.
4. The UL and Reference Measurement Channel is set according to Tables 7.3A.1_1.4.1-1, 7.3A.1_1.4.1-2 and 7.3A.1_1.4.1-3.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.3A.1_1.4.3.

7.3A.1_1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.3A.1_1.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).
4. SS transmits PDSCH via PDCCH DCI format [TBD] for C_RNTI to transmit the DL RMC according to Tables 7.3A.1_1.4.1-1, 7.3A.1_1.4.1-2 and 7.3A.1_1.4.1-3. on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC
5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 6.2A.1.1.4.1-1 on both PCC and SCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
6. Set the Downlink signal level to the appropriate REFSENS value defined in Table 7.3A.1_1.5-1. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE to ensure the UE transmits P_{UMAX} level for at least the duration of the throughput measurement. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.
7. Measure the average throughput for each component carrier for a duration sufficient to achieve statistical significance according to Annex H.2A.

7.3A.1_1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

7.3A.1_1.5 Test requirement

For inter-band carrier aggregation the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2.2 with parameters specified in Table 7.3A.1_1.5-1.

Table 7.3A.1_1.5-1: Reference sensitivity requirement for inter band CA

				Channel bandwidth											
atio	Test ID	NR Band	SCS kHz	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	25 MHz (dBm)	30 MHz (dBm)	50 MHz (dBm)	40 MHz (dBm)	60 MHz (dBm)	80 MHz (dBm)	90 MHz (dBm)	
	all	n1	15	-	-	-	-93.8+TT -93.8 -2.7+TT[4]	-	-	-	-	-	-	-	
77A	1	n77	30	-	-	-	-	-	-	-	-	-	-	-	
	2	n77	30	-	-	-	-92.4 + 0.3 + TT -92.4 - 2.2 + 0.3 + TT[4]								
78A	1	n1	15	-100 +8.0+TT -102.7 +10.7+TT [4]		-	-	-	-	-	-	-	-	-	
	1	n78	30	-	-96.1 + TT -96.1 - 2.2 + TT[4]	-	-	-	-	-	-	-	-	-	
77A	All	n3	15	-	-	-	-	-	-89.0 +TT	-	-	-	-	-	
	1	n77	30		-	-	-	-	-	-	-	-	-	-	
	2	n77	30	-	-	-	-92.4+ 0.3 +TT	-	-	-	-	-	-	-	
	1	n70	15	-	-	-	-	-92.7 +4.1 +TT -95.4[4]+ 5.0+TT	-	-	-	-	-	-	
	2	n70	15	-100.0 +9.9 +TT -102.7[4]+ 5.0+TT	-	-	-	-	-	-	-	-	-	-	
	3	n70	15	-100.0 +5.0 +TT -102.7[4]+ 5.0+TT	-	-	-	-	-	-	-	-	-	-	
	All	n71	15	-97.2 +TT	-94.0 +TT	-	-	-	-	-	-	-	-	-	
78A	1, 2	n3	15	-	-	-	-90.8+TT		-88.9+TT	-	-	-	-	-	
	1	n78	30	-		-	-	-	-		-	-	-	-	

	2	n78	30		-	-	-92.9+0.3+TT	-	-		-	-	-	-
	3	n3	15	-97.0+ [26] +TT	-	-	-	-	-	-	-	-	-	-
				-97.0+ [28.7][4] +TT					-		-			
	4	n3	15	-97.0+ [8.0] +TT	-	-	-	-	-	-	-	-	-	-
				-97.0+ [10.7][4] +TT					-		-			
	3, 4	n78	30	-	-96.1 + TT	-	-	-	-	-	-	-	-	-
78A	1	n8	15	-	-	-	-85.8+TT		-	-	-	-	-	-
	2	n8	15	-97.0+8.3+TT	-	-	-		-	-	-	-	-	-
	1	n78	30	-		-	-	-	-		-	-	-	-
	2	n78	30		-	-	-92+TT	-	-		-	-	-	-
	1	n66	15	-99.5+5.0+TT- -102.2[4]+ 5.0+TT	-	-	-		-	-	-	-	-	-
	1	n71	15	-97.2+TT	-	-	-		-	-	-	-	-	-

ote 1: The transmitter shall be set to maximum output power level (Table 7.3A.3.5-2)

ote 2: The reference measurement channel is specified in Annexe A2.2. Configurations of PDSCH and PDCCH before measurement are specified i C.2.

ote 3: TT for each frequency and channel bandwidth is specified in Table 7.3.2.5-3**.**

ote 4: Applicable only if operation with 4 antenna ports is supported in the band with carrier aggregation configured.

7.3A.2 Reference sensitivity power level for 3DL CA

7.3A.2.1 Test purpose

To verify the ability of UE that support CA to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the effective coverage area.

7.3A.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR 3DL CA.

7.3A.2.3 Minimum requirements

The minimum conformance requirements are defined in clause 7.3A.0.

7.3A.2.4 Test description

7.3A.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.2-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 7.2A.2.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexe A2.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.3A.2.4.1-1: Test Configuration Table for 3DL CA

Initial conditions	
nt as specified in TS 38.508-1 [5] subclause 4.1	NC, TL/VL, TL/VH, TH/VL, TH/VH
s as specified in TS 38.508-1 [5] subclause 4.3.1	For test frequencies refer to “Range” columns. For Inter-band CA: CA_nXA-nYA-nZA: Mid range for PCC and SCC with exceptions: CA_nXC-nYA and CA_nXB-nYA :Low range, High Range for nXC and nXB, nYA for PCC and SCC with exceptions : CA configurations containing the following band combinations: CA_n1-n77: Mid in band n1 and Low in band n77 CA_n3-n77: TBD in band 3 and TBD in band 77. CA_n3-n78: Mid in band 3 and High in band 78. CA_n8-nX: Low range for PCC in Band 8 CA_n70-n71: High range for PCC in band 71
iation setting (CBW) as specified in subclause Table 5.5A.3.1-1 for the n across bandwidth combination sets supported by the UE.	Refer to “PCC N_{RB}”and “SCC N_{RB} ” columns
ecified in Table 5.3.5-1	Lowest
ng value	NS_01 Unless given by Table 7.3.2.3-4 for the band with active uplink carrier

Test Parameters for CA Configurations

CA Configuration / channel BW											DL Allocation			UL allocati NO	
CA configuration								PCC	SCC1	SCC2	CC Mod	PCC & SCC RB allocation		CC Mod	P
C	Wgap1	SCC1		Wgap2	SCC2							PC C	SC C		
Range		Band	Range		Band	Range									

Default Test Settings for a CA_nXD Configuration (Intra-band contiguous)													
Low CC1	N/A	nX	Low CC2	N/A	nX	Low CC3	Highest N_{RB_agg}	Highest N_{RB_agg}	Highest N_{RB_agg}	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	RE
High CC1	N/A	nX	High CC2	N/A	nX	High CC3	Highest N_{RB_agg}	Highest N_{RB_agg}	Highest N_{RB_agg}	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	RE
Default Test Settings for a CA_nXA-nYA-nZA Configuration (Inter-band)													
default	N/A	nY	default	NA	nZ	default	Highest	Highest	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	RE
default	N/A	nZ	default	NA	nX	default	Highest	Highest	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	RE
default	N/A	nY	default	NA	nX	default	Highest	Highest	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	RE
Default Test Settings for a CA_XC-YA and CA_XB-YA Configurations (Intra-band contiguous + Inter-band)													
default	N/A	nX	default	NA	nY	default	Highest NRB_agg	Highest NRB_agg	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	RE
default	N/A	nX	default	NA	nX	default	Highest	Highest NRB_agg	Highest NRB_agg	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	RE
Default Test Settings for a CA_nX(2A)-nYA Configuration (Intra-band non-contiguous + Inter-band)													
CC1	Max (NOTE 7)	nX	CC2	N/A	nY	Mid	Highest NRB_agg (NOTE 6)	Highest NRB_agg (NOTE 6)	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	RE
Mid	NA	nX	CC1	Max (NOTE 7)	nX	CC2	Highest	Highest NRB_agg	Highest NRB_agg	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	RE

onfiguration Test CC Combination test settings are checked separately for each CA Configuration.
SENS refers to the single carrier Uplink RB allocation for reference sensitivity according to table 7.3.2.4.1-3.
CA Configuration – specific test points if present in the table, otherwise use test points from matching Group Test Settings, if present in the table. Other
ult Test Settings test points.
band: X,Y,Z correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n3A-n8A, X=1, Y=3, Z=8.
band contiguous + Inter-band: X,Y correspond to the different bands in the CA Configuration, e.g. for CA_1C-3A, X=1,Y=3
band non-contiguous + Inter-band: X and Y correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n1A-n8A, X=1, Y =8.
UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested
Vgap is defined to be widest possible on band based on the PCC and SCC configuration for Intra-band non-contiguous
and combinations including operating bands without uplink band (as noted in Table 5.2-1), only the CA configurations where PCC band has uplink ban
allback configuration CA_XA-YA for 3CA configurations XC-YA and XB-YA does not need to be tested even if the test frequency differs
and where UE supports 4Rx, the test needs to be performed only with 4Rx antennas connected.

Table 7.3A.2.4.1-2: Void

Table 7.3A.2.4.1-3: Void

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The UL and Reference Measurement Channel is set according to Tables 7.3A.2.1.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.3A.2.1.4.3.

7.3A.2.4.2 Test procedure

1. Configure SCCs according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.3A.2.1.4.3.

3. SS activates SCCs by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1-1 for C_RNTI to transmit the DL RMC according to Tables 7.3A.1.4.1-1 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table Table 7.3A.2.4.1-1 on PCC. Since the UE has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. Set the Downlink signal level to the appropriate REFSENS value defined in Tables 7.3.2.5-1 and 7.3.2.5-2 as appropriate. Send continuously uplink power control "up" commands in every uplink scheduling information to the UE to ensure the UE transmits P_{UMAX} level for at least the duration of the throughput measurement. Allow at least 200ms starting from the first TPC command in this step for the UE to reach P_{UMAX} level.

7. Measure the average throughput for each component carrier for a duration sufficient to achieve statistical significance according to Annex H.2A.

7.3A.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

7.3A.2.5 Test requirement

For 3DL carrier aggregation, test parameters are specified in table 7.3A.2.4.1-1. For the CA configurations listed in table 7.3A.2.5-1 where no REFSENS exceptions applies, the throughput of each component carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with reference power level specified in table 7.3.2.5-1 for each non-SDL carrier for 2 Rx antenna port, in table 7.3.2.5-2 for each non-SDL carrier for 4 Rx antenna port and in table 7.3A.1.5-2 for SDL carrier with following additional requirements:

For the UE which supports inter-band carrier aggregation, the test requirement for reference sensitivity shall be increased by the amount given by $\Delta R_{IB,c}$ defined in clause 7.3A.0.3.2 for the applicable operating bands. Unless otherwise stated, $\Delta R_{IB,c}$ is set to zero.

For intra-band non-contiguous CA with one uplink carrier and two or more downlink sub-blocks, the test requirement for SCC(s) shall be increased by ΔR_{IBNC} given in Table 7.3A.0.2.2-1. Unless given by Table 7.3.2.3-4, the reference sensitivity requirements shall be verified with the network signalling value NS_01 (Table 6.2.3.1-1) configured.

Table 7.3A.2.5-1: Reference sensitivity requirement for 3DL CA

Carrier aggregation type	DL CA configuration	UL CA configuration
Intra-band contiguous 3DL CA	CA_n77D	-
	CA_n78D	-
Intra-band non-contiguous 3DL CA	CA_n48(3A)	-
Inter-band 3DL CA	CA_n66A-n70A-n71A	-
	CA_n66(2A)-n70A	-
	CA_n66(2A)-n71A	-
	CA_n66B-n70A	-
	CA_n66B-n71A	-
SDL configuration	CA_n29A-n66A-n70A	-
	CA_n29A-n66B	-
	CA_n29A-n66(2A)	-

7.3A.3 Reference sensitivity power level for 4DL CA

FFS

7.3A.4 Reference sensitivity power level for 5DL CA

FFS

7.3B Void

7.3C Reference sensitivity for SUL

7.3C.0 Minimum conformance requirements

7.3C.0.1 General

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

7.3C.0.2 Minimum conformance requirements for Reference sensitivity power level

For SUL operation, the reference receive sensitivity (REFSENS) requirement for downlink bands specified in Table 7.3.2.3-1 and 7.3.2.3-2 shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.3-1 or supplementary uplink transmission bandwidth less than or equal to that specified in Table 7.3C.0.2-1 with reference measurement channels as specified in Annexes A.2.2.2, A.2.3.2, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1), unless sensitivity degradation is allowed in this section of this specification. These exceptions also apply to any higher order CA or DC combination containing one of the exception combinations in this section as subset.

Table 7.3C.0.2-1: Supplementary uplink configuration for reference sensitivity

DL band	UL band	SCS of UL band (kHz)	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
n78	n80	15	25	50	75	100			100	100				
n78	n81	15	25	50	75	100			100	100				
n78	n82	15	25	50	75	100			100	100				
n78	n83	15	25	50	75	100			100	100				
n78	n84	15	25	50	75	100			100	100				
n78	n86	15	25	50	75	100			100	100				
n79	n80	15	25	50	75	100			100	100				
n79	n81	15	25	50	75	100			100	100				

For the UE that supports any of the SUL operation given in Table 7.3C.0.2-2, exceptions to the requirements specified in Table7.3.2.3-1 are allowed when the uplink is active in a lower frequency band and is within a specified frequency range such that transmitter harmonics fall within the downlink transmission bandwidth assigned in a higher band as noted in Table 7.3C.0.2-2. For these exceptions, the UE shall meet the requirements specified in Table 7.3C.0.2-2 and Supplementary Uplink configuration (exceptions due to harmonic issue given in Table 7.3C.0.2-3.

Table 7.3C.0.2-2: Reference sensitivity for SUL operation (exceptions due to harmonic issue)

NR Band / Channel bandwidth of the high band													
UL band	**DL band**	**5 MHz**	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
		dB	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**	**dB**
n80	n78[1,2]		23.9	22.1	20.9			17.9	16.8	16.0	14.8	14.3	13.8
	n78[3]		1.1	0.8	0.3			0	0	0	0	0	0
n82	n78[4,5]		10.8	9.1	8			6	4.0	3.2	2.0	1.5	1.0
n81	n78[4,5]		10.8	9.1	8			5.1	4.2	3.5	2.3	1.5	1.4
n83	n78[6,7]		10.4	8.9	7.8			4.7	3.7	3	1.7	1.2	0.7
n86	n78[1,2]		23.9	22.1	20.9			17.9	16.8	16.0	14.8	14.3	13.8
	n78[3]		1.1	0.8	0.3				0	0	0	0	0
n81	n79[6,7]							[6.8]	6.2	[5.6]	4.9		4.4

NOTE 1: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 2nd transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band and a range ΔF_{HD} above and below the edge of this downlink transmission bandwidth. The value ΔF_{HD} depends on the band combination: ΔF_{HD} = 10 MHz for SUL_n78-n80, SUL_n78-n86.

NOTE 2: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB}/0.2 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 \le f_{UL}^{LB} \le F_{UL\_high}^{LB} - BW_{Channel}^{LB}/2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.

NOTE 3: The requirements are only applicable to channel bandwidths no larger than 20 MHz and with a carrier frequency at $\pm(20 + BW_{Channel}^{HB}/2)$ MHz offset from $2 f_{UL}^{LB}$ in the victim (higher band) with $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 \le f_{UL}^{LB} \le F_{UL\_high}^{LB} - BW_{Channel}^{LB}/2$, where $BW_{Channel}^{LB}$ and $BW_{Channel}^{HB}$ are the channel bandwidths configured in the aggressor (lower) and victim (higher) bands in MHz, respectively.

NOTE 4: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 4th transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band.

NOTE 5: The requirements should be verified for UL EARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB}/0.4 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 \le f_{UL}^{LB} \le F_{UL\_high}^{LB} - BW_{Channel}^{LB}/2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.

NOTE 6: These requirements apply when there is at least one individual RE within the uplink transmission bandwidth of the aggressor (lower) band for which the 5th transmitter harmonic is within the downlink transmission bandwidth of a victim (higher) band.

NOTE 7: The requirements should be verified for UL NR-ARFCN of the aggressor (lower) band (superscript LB) such that $f_{UL}^{LB} = \lfloor f_{DL}^{HB}/0.5 \rfloor 0.1$ in MHz and $F_{UL\_low}^{LB} + BW_{Channel}^{LB}/2 \le f_{UL}^{LB} \le F_{UL\_high}^{LB} - BW_{Channel}^{LB}/2$ with f_{DL}^{HB} carrier frequency in the victim (higher) band in MHz and $BW_{Channel}^{LB}$ the channel bandwidth configured in the lower band.

Table 7.3C.0.2-3: Supplementary uplink configuration (exceptions due to harmonic issue)

NR Band / Channel bandwidth of the high band													
UL band	DL band	5 MHz (N_{RB})	10 MHz (N_{RB})	15 MHz (N_{RB})	20 MHz (N_{RB})	25 MHz (N_{RB})	30 MHz (N_{RB})	40 MHz (N_{RB})	50 MHz (N_{RB})	60 MHz (N_{RB})	80 MHz (N_{RB})	90 MHz (N_{RB})	100 MHz (N_{RB})
n80	n78		25	36	50			50	50	50	50	50	50
n81	n78		16	25	25			25	25	25	25	25	25
n81	n79							25	25	25	25		25
n82	n78		16	20	20			20	20	20	20	20	20
n83	n78		10	15	20			25	25	25	25	25	25
n86	n78		25	36	50			100	100	100	100	100	100
NOTE 1: 15kHz SCS is assumed for UL band. NOTE 2: The UL configuration applies regardless of the channel bandwidth of the low band unless the UL resource blocks exceed that specified in Table 7.3.2.3-3 for the uplink bandwidth in which case the allocation according to Table 7.3.2.3-3 applies. NOTE 3: Unless stated otherwise, UL resource blocks shall be centred within the transmission bandwidth configuration for the channel bandwidth.													

7.3C.0.3 ΔRIB,c for SUL

7.3C.0.3.1 General

For a UE supporting a SUL configuration, the $\Delta R_{IB,c}$ applies for both SC and SUL operation.

7.3C.0.3.2 SUL band combination

For the UE which supports SUL band combination, the minimum requirement for reference sensitivity in subclause 7.3C.0 shall be increased by the amount given in $\Delta R_{IB,c}$ defined in subclause 7.3C.0.3 for the applicable operating bands. Unless otherwise stated, $\Delta R_{IB,c}$ is set to zero.

In case the UE supports more than one of band combinations for CA, SUL or DC, and an operating band belongs to more than one band combinations then

- When the operating band frequency range is ≤ 1 GHz, the applicable additional $\Delta R_{IB,c}$ shall be the average value for all band combinations defined in subclause 7.3A, 7.3B, 7.3C in this specification and 7.3A, 7.3B in TS 38.521-3 [14], truncated to one decimal place that apply for that operating band among the supported band combinations. In case there is a harmonic relation between low band UL and high band DL, then the maximum $\Delta R_{IB,c}$ among the different supported band combinations involving such band shall be applied

- When the operating band frequency range is > 1 GHz, the applicable additional $\Delta R_{IB,c}$ shall be the maximum value for all band combinations defined in subclause 7.3A, 7.3B, 7.3C in this specification and 7.3A, 7.3B in TS 38.521-3 [14] for the applicable operating bands.

7.3C.0.3.2.1 ΔRIB,c for two bands

Table 7.3C.0.3.2.1-1: $\Delta R_{IB,c}$ due to SUL (two bands)

Band combination for SUL	NR Band	$\Delta R_{IB,c}$ [dB]
SUL_n78-n80	n78	0.5
SUL_n78-n81	n78	0.5
SUL_n78-n82	n78	0.5
SUL_n78-n83	n78	0.5
SUL_n78-n84	n78	0.5
SUL_n78-n86	n78	0.5

The normative reference for this requirement is TS 38.101-1 [2] clause 7.3C.2 and 7.3C.3.

7.3C.1 General

The reference sensitivity power level REFSENS is the minimum mean power applied to each one of the UE antenna ports for all UE categories, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

7.3C.2 Reference sensitivity power level for SUL

Editor's Note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Test point analysis and selection are FFS.
- Test configuration for exceptional test points is FFS

7.3C.2.1 Test purpose

The test purpose is to verify the ability of the UE to receive data with a given average throughput for a specified reference measurement channel, under SUL operation and conditions of low signal level, ideal propagation and no added noise.

7.3C.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports SUL operation on the SUL bands.

7.3C.2.3 Minimum conformance requirement

The minimum conformance requirements are defined in clause 7.3C.0.

7.3C.2.4 Test description

7.3C.2.4.1 Initial conditions

Same test description as specified in clause 7.3.2.4.1 with following exceptions:

- Instead of table 5.3.5-1 → use Table 5.5C-1
- Instead of table 7.3.2.4.1-1 → use Table 7.3C.2.4.1-1

Table 7.3C.2.4.1-1: Test Configuration Table

Initial Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal, TL/VL, TL/VH, TH/VL, TH/VH			
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1			Mid range for both SUL carrier and Non-SUL carrier			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Mid, Highest for both SUL carrier and Non-SUL carrier			
Test SCS as specified in Table 5.3.5-1			Lowest			
Test Parameters						
Test ID	**Downlink Configuration**		**Uplink Configuration**		**SUL Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (NOTE 1)	DFT-s-OFDM QPSK	REFSENS (NOTE 2)	DFT-s-OFDM QPSK	REFSENS (NOTE 2)
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to Table 7.3.2.4.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band. NOTE 3: In a band where UE supports 4Rx, the test needs to be repeated with only 2Rx antennas connected and the other antennas terminated.						

Table 7.3C.2.4.1-2: Test configurations table for SUL operation exceptions due to UL harmonic issue for n78 with SUL 80

FFS

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C0, C.1, C.2, C3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.0 with consideration of supplementary uplink physical channels.

4. The UL and DL Reference Measurement Channel shall be set according to Table 7.3.2.4.1-1, Table 7.3.2.4.1-2, Table 7.3.2.4.1-3 and Table 7.3C.2.4.1-1.

5. The UL Reference Measurement Channel shall be set according to Table 7.3C.2.3-2 and 7.3C.2.3-3 when testing is performed with UL/DL band combination listed in Table 7.3C.2.3-2 for exceptions due to harmonic issue.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause *4.5*. Message contents are defined in clause 7.3C.2.4.3

7.3C.2.4.2 Test procedure

1 SS transmits PDSCH via PDCCH DCI format [1_1] for C_RNTI to transmit the DL RMC according to Table 7.3.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Tables 7.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3. Set the Downlink signal level to the appropriate REFSENS value defined in Table 7.3.3.1. Send continuously uplink power control "up" commands in the uplink scheduling information to the UE to ensure the UE transmits P_{UMAX} level for at least the duration of the Throughput measurement.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.

7.3C.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Tables 4.6.3-13, 4.6.3-97, and 4.6.3-129A with conditions SUL, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL.

7.3C.2.5 Test requirement

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A3.2 with parameters specified in Tables 7.3.2.3-1 and Tables 7.3.2.3-2.

For SUL operation, the reference receive sensitivity (REFSENS) requirement for downlink bands n78 and n79 specified in Table 7.3.2.5-1 and 7.3.2.5-2 (for 4 Rx ports) shall be met for an uplink transmission bandwidth less than or equal to that specified in Table 7.3.2.4.1-3 and 7.3.2.5-2 (for 4 Rx ports) with exceptions listed in clause 7.3C.2.5.1.

7.3C.2.5.1 Reference sensitivity exceptions due to harmonic issue

For SUL operation with DL band listed in Table 7.3C.2.3-2 with supplementary uplink transmission bandwidth less than or equal to that specified in Table 7.3C.2.3-1, the reference receive sensitivity (REFSENS) requirement for downlink bands specified in Table 7.3C.2.5.1-1 due to harmonic exceptions.

Table 7.3C.2.5.1-1: Reference sensitivity for SUL operation (exceptions due to harmonic issue)

SUL band	DL band	SCS	5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
		kHz	dBm	dBm	dBm	dBm	dBm	dBm	dBm	dBm	dBm	dBm	dBm	dBm
n80	n78[1,2]	15		-70.9 +TT	-70.9 +TT	-70.8 +TT			-70.7 +TT					
		30		-71.2 +TT	-71.0 +TT	-70.9 +TT			-70.8 +TT					
		60		-71.6 +TT	-71.3 +TT	-71.2 +TT			-71.0 +TT					
n80	n78[3]	15		-93.7 +TT	-92.2 +TT	-91.4 +TT								
		30		-94.0 +TT	-92.3 +TT	-91.5 +TT								
		60		-94.4 +TT	-92.6 +TT	-91.8								

		15		-85.0 +TT	-84.9 +TT	-84.7 +TT			-83.6 +TT					
n82	n78[3]	30		-85.3 +TT	-85.0 +TT	-84.9 +TT			-83.7 +TT					
		60		-85.7 +TT	-85.3 +TT	-85.1 +TT			-83.9 +TT					
		15		-85.0 +TT	-84.9 +TT	-84.7 +TT			-84.5 +TT	-84.4 +TT				
n81	n78[4]	30		-85.3 +TT	-85.0 +TT	-84.9 +TT			-84.6 +TT	-84.5 +TT	-84.4 +TT	-84.3 +TT		-84.2 +TT
		60		-85.7 +TT	-85.3 +TT	-85.1 +TT			-84.8 +TT	-84.6 +TT	-84.5 +TT	-84.4 +TT		-84.3 +TT
		15		-85.4 +TT	-85.1 +TT	-84.9 +TT			-84.9 +TT	-84.9 +TT				
n81	n78[5]	30		-85.7 +TT	-85.2 +TT	-85.1 +TT			-85.0 +TT	-85.0 +TT	-84.9 +TT	-84.9 +TT	-84.9 +TT	-84.9 +TT
		60		-86.1 +TT	-85.5 +TT	-85.3 +TT			-85.2 +TT	-85.1 +TT	-85.0 +TT	-85.0 +TT	-85.0 +TT	-85.0 +TT
		15		-71.9 +TT	-71.9 +TT	-71.8 +TT			-71.7 +TT					
n86	n78[6]	30		-72.2 +TT	-72.0 +TT	-72.0 +TT			-71.8 +TT					
		60		-72.6 +TT	-72.3 +TT	-72.2 +TT			-72.0 +TT					
		15		-94.7 +TT	-93.2 +TT	-92.4 +TT								
n86	n78[7]	30		-95.0 +TT	-93.3 +TT	-92.6 +TT								
		60		-95.4 +TT	-93.6 +TT	-92.8 +TT								
		15							-82.8 +TT	-82.4 +TT				
n81	n79[8]	30							-85.0 +TT	-85.0 +TT	-84.9 +TT	-84.9 +TT		-84.9 +TT
		60							-85.2 +TT	-85.1 +TT	-85.0 +TT	-85.0 +TT		-85.0 +TT

NOTE 1: [1] indicates requirement for test configuration specified by Table [TBD] NOTE 2: [2] indicates requirement for test configuration specified by Table [TBD] NOTE 3: [3] indicates requirement for test configuration specified by Table [TBD] NOTE 4: [4] indicates requirement for test configuration specified by Table [TBD] NOTE 5: [5] indicates requirement for test configuration specified by Table [TBD] NOTE 6: [6] indicates requirement for test configuration specified by Table [TBD] NOTE 7: [7] indicates requirement for test configuration specified by Table [TBD] NOTE 8: [8] indicates requirement for test configuration specified by Table [TBD] NOTE 9: TT for each frequency and channel bandwidth is specified in Table 7.3C.2.5.1-2.

Table 7.3C.2.5.1-2: Test Tolerance (TT) for RX sensitivity level

f ≤ 3.0GHz	3.0GHz < f ≤ 6.0 GHz
0.7 dB	1.0 dB

For the UE which supports SUL band combination, the minimum requirement for reference sensitivity in Table 7.3C.2.3-1 shall be increased by the amount given in $\Delta R_{IB,c}$ defined in subclause 7.3C.0.3.

7.3D Reference sensitivity for UL MIMO

7.3D.1 General

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements specified in subclause 7.3 shall be met with the UL MIMO configurations described in clause 6.2D.1. For UL MIMO, the parameter P_{UMAX} is the total transmitter power over the two transmits power over the two transmit antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clauses 7.3D

7.3D.2 Reference sensitivity power level for UL MIMO

7.3D.2.1 Test purpose

The test purpose is to verify the ability of the UE to receive data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

7.3D.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO

7.3D.2.3 Minimum conformance requirements

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements specified in subclause 7.3 shall be met with the UL MIMO configurations described in clause 6.2D.1. For UL MIMO, the parameter P_{UMAX} is the total transmitter power over the two transmits power over the two transmit antenna connectors

The normative reference for this requirement is TS 38.101-1 [2] clauses 7.3D and 7.3.

7.3D.2.4 Test description

7.3D.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.2-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 7.3D.2.4.1-1, Table 7.3D.2.4.1-2, and Table 7.3D.2.4.1-3. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexe A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.3D.2.4.1-1: Test Configuration Table

Initial Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal, TL/VL, TL/VH, TH/VL, TH/VH		
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1		Low range, Mid range, High range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest		
Test SCS as specified in Table 5.3.5-1		Lowest		
Test Parameters				
Test ID	**Downlink Configuration**		**Uplink Configuration**	
	Modulation	**RB allocation**	**Modulation**	**RB allocation**
1	CP-OFDM QPSK	Full RB (NOTE 1)	CP-OFDM QPSK	REFSENS (NOTE 2)
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to Table 7.3.2.4.1-3 which defines uplink RB configuration and start RB location for each SCS, channel BW and NR band. NOTE 3: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.
4. The UL and DL Reference Measurement Channel is set according to Table 7.3D.2.4.1-1, Table 7.3.2.4.1-2, and Table 7.3.2.4.1-3.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.3D.2.4.3.

7.3D.2.4.2 Test procedure

Same test procedure as specified in 7.3.2.4.2 with the following exception:

Step 2: SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.3D.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

7.3D.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO and exceptions listed in clause 7.3.2.4.3

7.3D.2.5 Test requirement

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A3.2 with reference receive power level specified in Tables 7.3.2.5-1 and parameters specified Tables 7.3D.2.4.1-1, Tables 7.3.2.4.1-2 and Tables 7.3.2.4.1-3.

7.3E Reference sensitivity for V2X

7.3E.1 General

The reference sensitivity power level $P_{REFSENS\_V2X}$ is the minimum mean power applied to each one of the UE antenna ports for V2X UE, at which the throughput shall meet or exceed the requirements for the specified reference measurement channel.

7.3E.2 Reference sensitivity for V2X / non-concurrent operation

Editor's Note: The following aspects are not yet determined:

- Connection diagram is TBD

- Preconfiguration is TBD in 38.508-1

- Test state and generic procedure are TBD in 38.508-1

- TP analysis is FFS

7.3E.2.1 Test purpose

The test purpose is to verify the ability of the UE to receive V2X physical channel data with a given average throughput for a specified reference measurement channel, under conditions of low signal level, ideal propagation and no added noise.

7.3E.2.2 Test applicability

This test case applies to all types of NR UE release 16 and forward that support NR V2X sidelink communication.

7.3E.2.3 Minimum conformance requirements

When UE is configured for NR V2X reception non-concurrent with NR uplink transmissions for NR V2X operating bands specified in Table 5.2E-1, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.7.2 with parameters specified in Table 7.3E.2.3-1.

Table 7.3E.2.3-1: Reference sensitivity of NR V2X Bands (PC5)

		Channel bandwidth / $P_{REFSENS\_V2X}$(dBm)				
NR V2X Band	SCS kHz	10 MHz	20 MHz	30 MHz	40 MHz	Duplex Mode
n38	15	-96.5	-93.2	-91.4	-90.1	HD
	30	-96.1	-93.4	-91.7	-90.2	HD
	60	-96.9	-93.1	-91.9	-90.4	HD
n47	15	-92.5	-89.2	-87.4	-86.1	HD
	30	-92.1	-89.4	-87.7	-86.2	HD
	60	-92.9	-89.1	-87.9	-86.4	HD
NOTE 1: Reference measurement channel is defined in A.8. NOTE 2: The signal power is specified per antenna port. NOTE 3: Void.						

Table 7.3E.2.3-2: Sidelink TX configuration for reference sensitivity of NR V2X Bands (PC5)

NR Band / SCS / Channel bandwidth / Duplex mode						
NR V2X Band	SCS kHz	10 MHz	20 MHz	30 MHz	40 MHz	Duplex Mode
n38	15	50	105	160	216	HD
	30	24	50	75	105	HD
	60	10[2]	24	36	50	HD
n47	15	50	105	160	216	HD
	30	24	50	75	105	HD
	60	10[2]	24	36	50	HD
NOTE 1: The sidelink allocated RB (L_{CRB}) size could be adjusted according to resource pool configuration in [7]. NOTE 2: For the case, 11 RB is allowed for S-SS/PSBCH Block.						

The normative reference for this requirement is TS 38.101-1 [2] clauses 7.3E.2.

7.3E.2.4 Test description

7.3E.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 7.3E.2.4.1-1. The details of the V2X reference measurement channels (RMCs) are specified in Annexe A.7.2 and the GNSS configuration in TS 36.508 [7] subclause 4.11.

Table 7.3E.2.4.1-1: Test Configuration Table

Initial Conditions		
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		[Normal, TL/VL, TL/VH, TH/VL, TH/VH]
Test Frequencies as specified in TS 38.508-1 [5] subclause4.3.1		[Mid range]
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		[Lowest, Highest]
Test SCS as specified in Table 5.3.5-1		[Lowest]
Test Parameters		
Test ID	**V2X Configuration to receive**	
	Modulation	**RB allocation**
1	[CP-OFDM QPSK]	[Full RB (NOTE 1)]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3E.2.4.1-2.		

Table 7.3E.2.4.1-2: PSSCH Configuration for REFSENS

Channel Bandwidth	SCS(kHz)	LCRBmax	Outer RB allocation / Normal RB allocation
10MHz	15	52	50@0
	30	24	24@0
	60	11	10@0
20MHz	15	106	105@0
	30	51	50@0
	60	24	24@0
30MHz	15	160	160@0
	30	78	75@0
	60	38	36@0
40MHz	15	216	216@0
	30	106	105@0
	60	51	50@0
NOTE 1: Test Channel Bandwidths are checked separately for each NR band, the applicable channel bandwidths are specified in Table 5.3.5-1.			

1. Connect the SS to the UE antenna connectors and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [5] Annex A, Figure TBD for TE diagram and section TBD for UE diagram.

2. The parameter settings for the V2X sidelink transmission over PC5 are pre-configured according to TS 38.508-1 [5] subclause TBD. Message content exceptions are defined in clause 7.3E.2.4.3.

3. The V2X Reference Measurement Channel is set according to Table 6.2E.1.1.4.1-1.

4. The GNSS simulator is configured for Scenario #1: static in Geographical area #1, as defined in TS 36.508 [7] Table 4.11.2-2. Geographical area #1 is also pre-configured in the UE.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State TBD.

7. Trigger the UE to reset UTC time. (NOTE: The UTC time reset may be performed by MMI or AT command (+CUTCR).)

8. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal and start to transmit.

7.3E.2.4.2 Test procedure

1. The UE starts to perform the NR V2X sidelink communication according to SL-V2X-Preconfiguration and to schedule the V2X RMC according to Table 7.3G.1.4.1-1.

2. Set the signal level of V2X to the appropriate REFSENS value defined in Table 7.3G.1.3-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G.2.

7.3E.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 and 5.4.

7.3E.2.5 Test requirement

When UE is configured for NR V2X reception non-concurrent with NR uplink transmissions for NR V2X operating bands specified in Table 5.2E-1, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.7.2 with parameters specified in Table 7.3E.2.5-1.

Table 7.3E.2.5-1: Reference sensitivity of NR V2X Bands (PC5)

		Channel bandwidth / $P_{REFSENS\_V2X}$(dBm)				
NR V2X Band	SCS kHz	10 MHz	20 MHz	30 MHz	40 MHz	Duplex Mode
n38	15	-96.5+TT	-93.2+TT	-91.4+TT	-90.1+TT	HD
	30	-96.1+TT	-93.4+TT	-91.7+TT	-90.2+TT	HD
	60	-96.9+TT	-93.1+TT	-91.9+TT	-90.4+TT	HD
n47	15	-92.5+TT	-89.2+TT	-87.4+TT	-86.1+TT	HD
	30	-92.1+TT	-89.4+TT	-87.7+TT	-86.2+TT	HD
	60	-92.9+TT	-89.1+TT	-87.9+TT	-86.4+TT	HD
NOTE 1: Reference measurement channel is defined in A.8. NOTE 2: The signal power is specified per antenna port. NOTE 3: TT for each frequency and channel bandwidth is specified in Table 7.3.2.5-3.						

7.4 Maximum input level

7.4.1 Test purpose

Maximum input level tests the UE's ability to receive data with a given average throughput for a specified reference measurement channel, under conditions of high signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the coverage area near to a g-NodeB.

7.4.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

7.4.3 Minimum conformance requirements

Maximum input level is defined as the maximum mean power received at the UE antenna port, at which the specified relative throughput shall meet or exceed the minimum requirements for the specified reference measurement channel. The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4.3-1.

Table 7.4.3-1: Maximum input level

Rx Parameter	Units	Channel bandwidth												
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
Power in Transmission Bandwidth Configuration	dBm	-25[2]				-24[2]	-23[2]	-22[2]	-21[2]	-20[2]				
		-27[3]				-26[3]	-25[3]	-24[3]	-23[3]	-22[3]				
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum uplink configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ as defined in subclause 6.2.4. NOTE 2: Reference measurement channel is Annex A.3.2.3 or A.3.3.3 for 64 QAM. NOTE 3: Reference measurement channel is Annex A.3.2.4 or A.3.3.4 for 256 QAM.														

The normative reference for this requirement is TS 38.101-1 [2] clause 7.4.

7.4.4 Test description

7.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.4.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.4.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range (NOTE 5)	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest (NOTE 4)	
Test SCS as specified in Table 5.3.5-1		Lowest	
Test Parameters for Channel Bandwidths			
Downlink Configuration		**Uplink Configuration**	
Modulation	**RB allocation**	**Modulation**	**RB allocation**
CP-OFDM 64 QAM	NOTE 1	DFT-s-OFDM QPSK	NOTE 2
CP-OFDM 256 QAM	NOTE 1	DFT-s-OFDM QPSK	NOTE 2
NOTE 1: The specific configuration of downlink RB allocation is defined in Table 7.3.2.4.1-2. NOTE 2: The specific configuration of uplink RB allocation is defined in Table 7.3.2.4.1-3. NOTE 3: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected. NOTE 4: For n70, highest test channel bandwidth shall be Highest UL / Highest DL according to asymmetric channel bandwidths specified in clause 5.3.6. NOTE 5: For NR band n28, 30MHz test channel bandwidth is tested with High range test frequencies.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2 , and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.4.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.4.4.3.

7.4.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.4.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Tables 7.4.4.1-1. Since the UE has no payload data and no loopback data to send, the UE sends uplink MAC padding bits on the UL RMC.

3. Set the Downlink signal level to the value as defined in Table 7.4.5-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.4.5-1 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS

38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.4.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.4.5 Test requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 and A.3.3 with parameters specified in Tables 7.4.5-1.

Table 7.4.5-1: Maximum input level

Rx Parameter	Units	Channel bandwidth												
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
Power in Transmission Bandwidth Configuration	dBm	-25[2]-TT				-24[2]-TT	-23[2]-TT	-22[2]-TT	-21[2]-TT	-20[2]-TT				
		-27[3]-TT				-26[3]-TT	-25[3]-TT	-24[3]-TT	-23[3]-TT	-22[3]-TT				

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum uplink configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ as defined in subclause 6.2.4.
NOTE 2: Reference measurement channel is Annex A.3.2.3 or A.3.3.3 for 64 QAM.
NOTE 3: Reference measurement channel is Annex A.3.2.4 or A.3.3.4 for 256 QAM.
NOTE 4: TT for each frequency is specified in Table 7.4.5-3.

Table 7.4.5-2: Void

Table 7.4.5-3: Test Tolerance (Maximum input level)

f ≤ 3.0GHz	3.0GHz < f ≤6.0GHz
0.7 dB	1.0 dB

7.4A Maximum input level for CA

7.4A.0 Minimum conformance requirements

7.4A.0.1 Maximum input level for Intra-band contiguous CA

For intra-band contiguous carrier aggregation maximum input level is defined as the maximum mean power received at the UE antenna port, over the Transmission bandwidth configuration of each CC.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.4A.0.1-1 for each component carrier.

Table 7.4A.0.1-1: Maximum input level for Intra-band contiguous CA

Rx Parameter	Units	NR CA Bandwidth Class			
		B	C	D	
Power in largest transmission bandwidth configuration CC, $P_{largest\ BW}$	dBm	-23[2]	-23[2]	-25[2]	
		-25[3]	-25[3]	-27[3]	
Power in each other CC	dBm	$P_{largest\ BW}$ +10*log{($N_{RB,c}$*SCS_c)/($N_{RB,largest\ BW}$*$SCS_{largest\ BW}$)}			
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum uplink configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ as defined in subclause 6.2.4.3. NOTE 2: Reference measurement channel is A.3.2.3 or A.3.3.3 for 64 QAM. NOTE 3: Reference measurement channel is A.3.2.4 or A.3.3.4 for 256 QAM.					

7.4A.0.2 Maximum input level for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with one uplink carrier and two or more downlink sub-blocks, each larger than or equal to 5 MHz, the maximum input level requirements are defined with the uplink configuration in accordance with 7.3A.0.2.2-1. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified subclause 7.4.3 and Table 7.4A.0.1-1 for one component carrier and two component carriers per sub-block, respectively. The throughput of each downlink component carrier shall be ≥ 95% of the maximum throughput of the specified reference measurement channel as specified in Annex A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1 and A.5.2.1. The requirements apply with all downlink carriers active.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.4A.

7.4A.0.3 Maximum input level for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the maximum input level is defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.4.3 for each component carrier while all downlink carriers are active.

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1) for each component carrier.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.4A.

7.4A.1 Maximum input level for CA (2DL CA)

7.4A.1.1 Test purpose

The same test purpose as defined in 7.4.1.

7.4A.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 2DL CA.

7.4A.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.4A.0.

7.4A.1.4 Test description

7.4A.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state. The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in table 7.4A.1.4.1-1 or 7.4A.1.4.1-2. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.4A.1.4.1-1: Test configuration table for Intra-band contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			NOTE 1		
Test SCS as specified in Table 5.3.5-1			Lowest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM 64QAM	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
2	CP-OFDM 256QAM	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.1.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.4A.1.4.1-2: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range for PCC and SCC		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			NOTE 1		
Test SCS as specified in Table 5.3.5-1			Lowest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM 64QAM	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
2	CP-OFDM 256QAM	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.1.4.1-2. Only test points verifying non-exceptional REFSENS requirements are used for maximum input level. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.4A.1.4.1-3: Test configuration table for Intra-band non-contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range for PCC and SCC			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		NOTE 1			
Test SCS as specified in Table 5.3.5-1		Lowest			
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM 64QAM	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
2	CP-OFDM 256QAM	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.1.4.1-3. Only test points verifying non-exceptional REFSENS requirements are used for maximum input level. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.4A.1.4.1-1, Table 7.4A.1.4.1-2 or Table 7.4A.1.4.1-3.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.4A.1.4.3.

7.4A.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.4A.1.4.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.4A.1.4.1-1 for intra-band contiguous CA, 7.4A.1.4.1-2 for inter-band CA or 7.4A.1.4.1-3 for intra-band non-contiguous CA on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Tables 7.4A.1.4.1-1 for intra-band contiguous CA, 7.4A.1.4.1-2 for inter-band CA or 7.4A.1.4.1-3 for intra-band non-contiguous CA. Since the UE has no payload data and no loopback data to send, the UE sends uplink MAC padding bits on the UL RMC.

6. Set the Downlink signal level for PCC and SCC to the value as defined in Table 7.4A.1.5-1 for intra-band contiguous CA, Table 7.4A.1.5-2 for inter-band CA or Table 7.4A.1.5-3 for intra-band non-contiguous CA. Send uplink power control commands to the UE using 1dB step size to ensure that the UE output power measured by

the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.4A.1.5-1 for intra-band contiguous CA, Table 7.4A.1.5-2 for inter-band CA or 7.4A.1.5-3 for intra-band non-contiguous CA for at least the duration of the Throughput measurement ,where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

7. For intra-band contiguous and non-contiguous CA: measure the average throughput of each component carrier for a duration sufficient to achieve statistical significance according to Annex H.2A.

   For inter-band CA: measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to Annex H.2A.

7.4A.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.4A.1.5 Test requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3 with parameters specified in Table 7.4A.1.5-1 for intra-band contiguous CA or Table 7.4A.1.5-2 for inter-band CA.

Table 7.4A.1.5-1: Maximum input level for Intra-band contiguous CA

Rx Parameter	Units	NR CA Bandwidth Class		
		B	CD	E
Power in largest transmission bandwidth configuration CC, $P_{largest\ BW}$	dBm	-23[2]-TT	-23[2]-TT-25[2]-TT	-26[2]-TT
		-25[3]-TT	-25[3]-TT-27[3]-TT	-28[3]-TT
Power in each other CC	dBm	$P_{largest\ BW}$ +10*log{($N_{RB,c}$*SCS_c)/($N_{RB,largest\ BW}$*$SCS_{largest\ BW}$)} -TT		

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum uplink configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ as defined in subclause 6.2.4.3.
NOTE 2: Reference measurement channel is A.3.2.3 or A.3.3.3 for 64 QAM.
NOTE 3: Reference measurement channel is A.3.2.4 or A.3.3.4 for 256 QAM.
NOTE 4: TT for each frequency is specified in Table 7.4A.1.5-5.

Table 7.4A.1.5-2: Maximum input level for inter-band

Rx Parameter	Units	Channel bandwidth											
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
Power in Transmission Bandwidth Configuration	dBm	-25[2]-TT				-24[2]-TT	-23[2]-TT	-22[2]-TT	-21[2]-TT	-20[2]-TT			
		-27[3]-TT				-26[3]-TT	-25[3]-TT	-24[3]-TT	-23[3]-TT	-22[3]-TT			

NOTE 1: The transmitter shall be set to 4dB below P_{CMAX_L} at the minimum uplink configuration specified in Table 7.3.2.3-3 with P_{CMAX_L} as defined in subclause 6.2.4. NOTE 2: Reference measurement channel is Annex A.3.2.3/A.3.3.3 for 64-QAM. NOTE 3: Reference measurement channel is Annex A.3.2.4/A.3.3.4 for 256-QAM. NOTE 4: TT for each frequency is specified in Table 7.4A.1.5-5.

Table 7.4A.1.5-3: Maximum input level for intra-band non-contiguous

Rx Parameter	Units	Channel bandwidth											
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
Power in Transmission Bandwidth Configuration	dBm	-25[2]-TT				-24[2]-TT	-23[2]-TT	-22[2]-TT	-21[2]-TT	-20[2]-TT			
		-27[3]-TT				-26[3]-TT	-25[3]-TT	-24[3]-TT	-23[3]-TT	-22[3]-TT			
NOTE 1: The transmitter shall be set to 4dB below P_{CMAX_L} at the minimum uplink configuration specified in Table 7.3.2.3-3 with P_{CMAX_L} as defined in subclause 6.2.4. NOTE 2: Reference measurement channel is Annex A.3.2.3/A.3.3.3 for 64-QAM. NOTE 3: Reference measurement channel is Annex A.3.2.4/A.3.3.4 for 256-QAM. NOTE 4: TT for each frequency is specified in Table 7.4A.1.5-5.													

Table 7.4A.1.5-4: Void

Table 7.4A.1.5-5: Test Tolerance (Maximum input level)

f ≤ 3.0GHz	3.0GHz < f ≤6.0GHz
0.7 dB	1.0 dB

7.4A.2 Maximum input level for CA (3DL CA)

7.4A.2.1 Test purpose

The same test purpose as defined in 7.4.1.

7.4A.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 3DL CA.

7.4A.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.4A.0.

7.4A.2.4 Test description

7.4A.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state. The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in table 7.4A.2.4.1-1, 7.4A.2.4.1-2 or 7.4A.2.4.1-3. The details of the uplink and downlink reference measurement channels

(RMC) are specified in Annexes A.2 and A.3. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.4A.2.4.1-1: Test Configuration Table for 3DL CA

Default Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Intra-band contiguous: Mid range for PCC and SCCs Inter-band: Mid range for PCC and SCCs Intra-band contiguous + Inter-band: Mid range for PCC and SCCs Intra-band non-contiguous + Inter-band: NOTE 1 with Wgap for intra-band non-contiguous defined in table 7.3A.2.4.1-1			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			NOTE 1			
Test SCS as specified in Table 5.3.5-1			Lowest for PCC and SCCs			
Network signalling value			NS_01 by default			
Test Parameters						
	Downlink Configuration				**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC_1 RB allocation**	**SCC_2 RB allocation**	**CC Mod'n**	**PCC RB allocation**
Default Test Settings for a CA_nXD Configuration (Intra-band contiguous)						
1	CP-OFDM 64QAM	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
2	CP-OFDM 256QAM	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nXA-nYA-nZA Configuration (Inter-band)						
1	CP-OFDM 64QAM	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
2	CP-OFDM 256QAM	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nXC-nYA and CA_nXB-nYA Configurations (Intra-band contiguous + Inter-band)						
1	CP-OFDM 64QAM	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
2	CP-OFDM 256QAM	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nX(2A)-nYA Configuration (Intra-band non-contiguous + Inter-band)						
1	CP-OFDM 64QAM	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
2	CP-OFDM 256QAM	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.2.4.1-1. Only test points verifying non-exceptional REFSENS requirements are used for maximum input level testing. NOTE 2: CA Configuration Test CC Combination test settings are checked separately for each CA Configuration. NOTE 3: **Inter-band:** X,Y,Z correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n3A-n8A, X=1, Y=3, Z=8; **Intra-band contiguous + Inter-band:** X,Y correspond to the different bands in the CA Configuration, e.g. for CA_1C-3A, X=1,Y=3; **Intra-band non-contiguous + Inter-band:** X and Y correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n1A-n8A, X=1, Y =8. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.						

Table 7.4A.2.4.1-2: Void

Table7.4A.2.4.1-3: Void

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.4A.2.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.4A.2.4.3.

7.4A.2.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.4A.2.4.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.4A.2.4.1-1 to Table 7.4A.2.4.1-3 as appropriate for PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Tables 7.4A.2.4.1-1. Since the UE has no payload data and no loopback data to send, the UE sends uplink MAC padding bits on the UL RMC.

6. Set the Downlink signal level for PCC and SCCs to the value as defined in Table 7.4A.2.5-1 and Table 7.4A.2.5-2 according to the type of CA. Send uplink power control commands to the UE using 1dB step size to ensure that the PCC output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.4A.2.5-1 or Table 7.4A.2.5-2 as appropriate for at least the duration of the Throughput measurement ,where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

7. Measure the average throughput for the carrier(s) indicated in table 7.4A.2.4.2-1 for duration sufficient to achieve statistical significance according to Annex H.2A.

8. Repeat steps 6 to 7 for all component carriers indicated in Table 7.4A.2.4.2-1.

Table 7.4A.2.4.2-1: Test repetition and measurement configuration

CA configuration	Test ID (NOTE1)	CA configuration ID in REFSENS	Throughput measured on	Table with test parameters to select
Intra-band contiguous	1.2	1^5	PCC,SCC_1, SCC_2	Table 7.4A.2.5-1
Inter-band	1,2	1^2, 2^2, 3^2	SCC1, SCC2	Table 7.4A.2.5-2
Intra-band contiguous + Inter-band	1,2	1^3	SCC2	Table 7.4A.2.5-2
		2^3	SCC1, SCC2	Table 7.4A.2.5-1
Intra-band non-contiguous + Inter-band	1,2	1^4, 2^4	SCC2	Table 7.4A.2.5-2
		3^4	SCC1, SC2	Table 7.4A.2.5-2
NOTE 1: Refers to Test IDs in Table 7.4A.2.4.1-1 NOTE 2: CA configuration ID as defined in "Default Test Settings for a CA_nXA-nYA-nZA Configuration (Inter-band)" in table 7.3A.2.4.1-11. NOTE 3: CA configuration ID as defined in "Default Test Settings for a CA_XC-YA and CA_XB-YA Configurations (Intra-band contiguous + Inter-band)" in table 7.3A.2.4.1-2. NOTE 4: CA configuration ID as defined in "Default Test Settings for a CA_nX(2A)-nYA Configuration (Intra-band non-contiguous + Inter-band)" in table 7.3A.2.4.1-1. NOTE 5: CA configuration ID as defined in "Default Test Settings for a CA_nXD Configuration (Intra-band contiguous)" in table 7.3A.2.4.1-1.				

7.4A.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.4A.2.5 Test requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3 with parameters specified in Table 7.4A.2.5-1 and Table 7.4A.2.5-2 as applicable.

Table 7.4A.2.5-1: Maximum input level for 3DL CA (Intra-band contiguous)

Rx Parameter	Units	NR CA Bandwidth Class			
		B	C	D	
Power in largest transmission bandwidth configuration CC, $P_{largest\ BW}$	dBm	-23^2-TT	-23^2-TT	-25^2-TT	
		-25^3-TT	-25^3-TT	-27^3-TT	
Power in each other CC	dBm	$P_{largest\ BW}$ +10*log{($N_{RB,c}$*SCS_c)/($N_{RB,largest\ BW}$*$SCS_{largest\ BW}$)}			
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum uplink configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ as defined in clause 6.2.4. NOTE 2: Reference measurement channel is A.3.2.3 or A.3.3.3 for 64 QAM. NOTE 3: Reference measurement channel is A.3.2.4 or A.3.3.4 for 256 QAM. NOTE 4: TT for each frequency is specified in Table 7.4A.2.5-3 for each CC.					

Table 7.4A.2.5-2: Maximum input level for 3DL CA (Intra-band non-contiguous, Inter-band), per CC

Rx Parameter	Units	Channel bandwidth												
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	70 MHz	80 MHz	90 MHz	100 MHz
Power in Transmission Bandwidth Configuration	dBm	-25^{2}-TT				-24^{2}-TT	-23^{2}-TT	-22^{2}-TT	-21^{2}-TT	-20^{2}-TT				
		-27^{3}-TT				-26^{3}-TT	-25^{3}-TT	-24^{3}-TT	-23^{3}-TT	-22^{3}-TT				
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum uplink configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ as defined in clause 6.2.4. NOTE 2: Reference measurement channel is A.3.2.3 or A.3.3.3 for 64 QAM. NOTE 3: Reference measurement channel is A.3.2.4 or A.3.3.4 for 256 QAM. NOTE 4: TT for each frequency is specified in Table 7.4A.2.5-3 for each CC.														

Table 7.4A.2.5-3: Test Tolerance (Maximum input level), per CC

f ≤ 3.0GHz	3.0GHz < f ≤6.0GHz
0.7 dB	1.0 dB

7.4D Maximum input level for UL MIMO

7.4D.1 Test purpose

Maximum input level tests the ability of UE that supports UL MIMO to receive data with a given average throughput for a specified reference measurement channel, under conditions of high signal level, ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the coverage area near to an e-NodeB.

7.4D.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

7.4D.3 Minimum conformance requirements

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing, the minimum requirements specified in sub-clause 7.4 shall be met with the UL MIMO configurations described in sub-clause 6.2D.1. For UL MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clauses 7.4D and 7.4.

7.4D.4 Test description

7.4D.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.2-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 7.4D.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annex A.2 and Annex A.3 respectively. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.4D.4.1-1: Test Configuration Table

Initial Conditions			
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal	
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range	
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest	
Test SCS as specified in Table 5.3.5-1		**Lowest**	
Test Parameters for Channel Bandwidths			
Downlink Configuration		**Uplink Configuration**	
Modulation	**RB allocation**	**Modulation**	**RB allocation**
CP-OFDM 64 QAM	NOTE 1	CP-OFDM QPSK	NOTE 2
CP-OFDM 256 QAM	NOTE 1	CP-OFDM QPSK	NOTE 2
NOTE 1: The specific configuration of downlink RB allocation is defined in Table 7.3.2.4.1-2. NOTE 2: The specific configuration of uplink RB allocation is defined in Table 7.3.2.4.1-3. NOTE 3: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected.			

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A Figure A.3.1.1.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The UL and DL Reference Measurement Channel is set according to Table 7.4D.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.4D.4.3.

7.4D.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.4D.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Tables 7.4D.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2

3. Set the Downlink signal level to the value defined in Table 7.4D.5-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.4D.5-1 for at least the duration of the Throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

Table 7.4D.4-2-1: Void

7.4D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO

7.4D.5 Test requirement

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 and A3.3 with parameters specified in Table 7.4D.5-1.

Table 7.4D.5-1 Maximum input level

<table>
<tr><th rowspan="2">Rx Parameter</th><th rowspan="2">Units</th><th colspan="12">Channel bandwidth</th></tr>
<tr><th>5 MHz</th><th>10 MHz</th><th>15 MHz</th><th>20 MHz</th><th>25 MHz</th><th>30 MHz</th><th>40 MHz</th><th>50 MHz</th><th>60 MHz</th><th>80 MHz</th><th>90 MHz</th><th>100 MHz</th></tr>
<tr><td rowspan="2">Power in Transmission Bandwidth Configuration</td><td rowspan="2">dBm</td><td colspan="4">-25[2]-TT + TT</td><td>-24[2]-TT + TT</td><td>-23[2]-TT + TT</td><td>-22[2]-TT + TT</td><td>-21[2]-TT + TT</td><td colspan="4">-20-TT [2]+ TT</td></tr>
<tr><td colspan="4">-27[3]-TT + TT</td><td>-26[3]-TT + TT</td><td>-25[3]-TT + TT</td><td>-24[3]-TT + TT</td><td>-23[3]-TT + TT</td><td colspan="4">-22[3]-TT+ TT</td></tr>
<tr><td colspan="14">NOTE 1: The transmitter shall be set to 4dB below P_{CMAX_L} at the minimum uplink configuration specified in Table 7.3-3 with P_{CMAX_L} as defined in subclause 6.2.4.
NOTE 2: Reference measurement channel is A.3.2.3/A.3.3.3 for 64-QAM.
NOTE 3: Reference measurement channel is A.3.2.4/A.3.3.4 for 256-QAM.
NOTE 4: TT for each frequency is specified in Table 7.4D.5-2 Table 7.4.5-3.</td></tr>
</table>

Table 7.4D.5-2: Test Tolerance (Maximum input level)

f ≤ 3.0GHz	3.0GHz < f ≤6.0GHz
0.7 dB	1.0 dB

7.5 Adjacent channel selectivity

7.5.1 Test purpose

Adjacent channel selectivity (ACS) is a measure of a receiver's ability to receive an NR signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

7.5.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

7.5.3 Minimum conformance requirements

The UE shall fulfil the minimum requirements specified in Table 7.5.3-1 for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz and the minimum requirements specified in Table 7.5.3-2. for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz. These requirements apply for all values of an adjacent channel interferer up to -25 dBm and for any SCS specified for the channel bandwidth of the wanted signal. However, it is not possible to directly measure the ACS; instead the lower and upper range of test parameters are chosen as in Table 7.5.3-3 and Table 7.5.3-4 for verification of the requirements specified in Table 7.5.3-1 and as in Table 7.5.3-5, and Table 7.5.3-6 for verification of the requirements specified in Table 7.5.3-2. For these test parameters, the throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3(with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5). For operating bands with an unpaired DL part (as noted in Table 5.2-1), the requirements only apply for carriers assigned in the paired part.

Table 7.5.3-1: ACS for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
ACS	dB	33	33	30	27	26
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
ACS	dB	25.5	24	23	22.5	21
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
ACS	dB	20.5	20			

Table 7.5.3-2: ACS for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
ACS	dB	33	33	33	33	33
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
ACS	dB	33	33	33	33	

Table 7.5.3-3: Test parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 1

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 45.5 dB	REFSENS + 45.5 dB	REFSENS + 42.5 dB	REFSENS + 39.5 dB	REFSENS + 38.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 38 dB	REFSENS + 36.5 dB	REFSENS + 35.5 dB	REFSENS + 35 dB	REFSENS + 33.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 33 dB	REFSENS + 32.5 dB			
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset)	MHz	47.5 / -47.5	52.5 / -52.5			
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}| / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS NOTE 3: The interferer consists of the NR interferer RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

Table 7.5.3-4: Test parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 2

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	-56.5	-56.5	-53.5	-50.5	-49.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	-49	-47	-46.5	-46	-44.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	-44	-43.5			
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset)	MHz	47.5 / -47.5	52.5 / -52.5			
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

Table 7.5.3-5: Test parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 1

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 45.5 dB				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 45.5 dB	REFSENS + 45.5 dB	REFSENS + 45.5 dB	REFSENS + 45.5 dB	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5.3-6: Test parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 2

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	-56.5				
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	-56.5				
$P_{interferer}$	dBm	-25	-25	-25	-25	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

The normative reference for this requirement is TS 38.101-1 [2] clause 7.5.

7.5.4 Test description

7.5.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.5.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.5.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range (NOTE 4)			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Lowest, Mid, Highest (NOTE 3)			
Test SCS as specified in Table 5.3.5-1	Lowest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements. NOTE 3: For n70, highest test channel bandwidth shall be Highest UL / Highest DL according to asymmetric channel bandwidths specified in clause 5.3.6. NOTE 4: For NR band n28, 30MHz test channel bandwidth is tested with High range test frequencies.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.5.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.5.4.3.

7.5.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format [1_1] for C_RNTI to transmit the DL RMC according to Table 7.5.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 7.5.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3. Set the Downlink signal level to the value as defined in Table 7.5.5-2 or Table 7.5.5-5 as appropriate (Case 1). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5.5-2 or Table 7.5.5-5 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS

38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified in Table F.1.3-1.

4. Set the Interferer signal level to the value as defined in Table 7.5.5-2 or Table 7.5.5-5 as appropriate (Case 1) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.
5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.
6. Repeat steps from 3 to 5, using an interfering signal above the wanted signal in Case 1 at step 4.
7. Set the Downlink signal level to the value as defined in Table 7.5.5-3 or Table 7.5.5-6 as appropriate (Case 2). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5.5-3 or Table 7.5.5-6 for at least the duration of the Throughput measurement, where MU and Uplink power control window size are defined above.
8. Set the Interferer signal level to the value as defined in Table 7.5.5-3 or Table 7.5.5-6 as appropriate (Case 2) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.
9. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.
10. Repeat steps from 7 to 9, using an interfering signal above the wanted signal in Case 2 at step 8.
11. Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.5.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.5.5 Test requirement

For NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5.5-2 and 7.5.5-3.

Table 7.5.5-1: ACS for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
ACS	dB	33	33	30	27	26
RX parameter	Units	Channel bandwidth				
		30 MHz	40 MHz	50 MHz	60 MHz	80 MHz
ACS	dB	25.5	24	23	22.5	21
RX parameter	Units	Channel bandwidth				
		90 MHz	100 MHz			
ACS	dB	20.5	20			

Table 7.5.5-2: Test parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 1

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 45.5 dB	REFSENS + 45.5 dB	REFSENS + 42.5 dB	REFSENS + 39.5 dB	REFSENS + 38.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 38 dB	REFSENS + 36.5 dB	REFSENS + 35.5 dB	REFSENS + 35 dB	REFSENS + 33.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 33 dB	REFSENS + 32.5 dB			
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset)	MHz	47.5 / -47.5	52.5 / -52.5			

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS.

NOTE 3: The interferer consists of the NR interferer RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5.5-3: Test parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 2

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	-56.5	-56.5	-53.5	-50.5	-49.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	-49	-47	-46.5	-46	-44.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	-44	-43.5			
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset)	MHz	47.5 / -47.5	52.5 / -52.5			
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1..						

For NR bands with F_{DL_high} < 3300 MHz and F_{UL_high} < 3300 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in [Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1)] with parameters specified in Tables 7.5.5-5 and 7.5.5-6.

Table 7.5.5-4: ACS for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
ACS	dB	33	33	33	33	33
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
ACS	dB	33	33	33	33	

Table 7.5.5-5: Test parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 1

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 45.5 dB				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS + 45.5 dB	REFSENS + 45.5 dB	REFSENS + 45.5 dB	REFSENS + 45.5 dB	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1..

Table 7.5.5-6: Test parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 2

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Power in transmission bandwidth configuration	dBm	-56.5				
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	-56.5				
$P_{interferer}$	dBm	-25	-25	-25	-25	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

Table 7.5.5-7: Void

7.5A Adjacent channel selectivity for CA

7.5A.0 Minimum conformance requirements

7.5A.0.1 Adjacent channel selectivity for Intra-band contiguous CA

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. The UE shall fulfil the minimum requirement specified in Table 7.5A.0.1-1 and 7.5A.0.1-1a for an adjacent channel interferer on either side of the aggregated downlink signal at a specified frequency offset and for an interferer power up to -25 dBm.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5A.0.1-2, 7.5A.0.1-2a, 7.5A.0.1-3 and 7.5A.0.1-3a.

Table 7.5A.0.1-1: ACS for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

		CA Bandwidth Class		
Rx Parameter	**Units**	**B**	**C**	**D**
ACS	dB	26.0	33.0	25.2

Table 7.5A.0.1-1a: ACS for intra-band contiguous CA with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz

		CA Bandwidth Class	
Rx Parameter	**Units**	**B**	**C**
ACS	dB	20.0	17.0

Table 7.5A.0.1-2: Test parameters for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 1

Rx Parameter	Units	CA Bandwidth Class		
		B	**C**	**D**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB	REFSENS + 14 dB	REFSENS + 14 dB
$P_{Interferer}$	dBm	Aggregated power + 24.5 dB	Aggregated power + 31.5 dB	Aggregated power + 23.7 dB
$BW_{Interferer}$	MHz	20	$BW_{channel\ CA}$	50
$F_{Interferer}$ (offset)	MHz	10 + F_{offset} / -10 -F_{offset}	$BW_{channel\ CA}$ / -$BW_{channel\ CA}$	25 + F_{offset} / -25 -F_{offset}
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{\mathrm{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.				

Table 7.5A.0.1-2a: Test parameters for intra-band contiguous CA with F_{DL_low}<2700 MHz and F_{UL_low}<2700 MHz, case 1

Rx Parameter	Units	CA Bandwidth Class	
		B	C
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB	REFSENS + 14 dB
$P_{Interferer}$	dBm	Aggregated power + 18.5dB	Aggregated power + 15.5dB
$BW_{Interferer}$	MHz	5	5
$F_{Interferer}$ (offset)	MHz	2.5 + F_{offset} / -2.5 - F_{offset}	2.5 + F_{offset} / -2.5 - F_{offset}

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.
NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.0.1-3: Test parameters for intra-band contiguous CA with $F_{DL\_low} \geq$ 3300 MHz and $F_{UL\_low} \geq$ 3300 MHz, case 2

Rx Parameter	Units	CA Bandwidth Class		
		B	C	D
Pw in Transmission Bandwidth Configuration, per CC	dBm	-49.5 + 10log($N_{RB,c}$/N_{RB_agg})	-56.5	-48.7 + 10log($N_{RB,c}$/N_{RB_agg})
$P_{Interferer}$	dBm	-25	-25	-25
$BW_{Interferer}$	MHz	20	$BW_{channel\ CA}$	50
$F_{Interferer}$ (offset)	MHz	10 + F_{offset} / -10 -F_{offset}	$BW_{channel\ CA}$ / -$BW_{channel\ CA}$	25 + F_{offset} / -25 -F_{offset}

NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.
NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.0.1-3a: Test parameters for intra-band contiguous CA with F_{DL_low} <2700 MHz and F_{UL_low}<2700 MHz, case 2

Rx Parameter	Units	CA Bandwidth Class	
		B	C
Pw in Transmission Bandwidth Configuration, per CC	dBm	-43.5+ 10log($N_{RB,c}$/N_{RB_agg})	-40.5+ 10log($N_{RB,c}$/N_{RB_agg})
$P_{Interferer}$	dBm	-25	-25
$BW_{Interferer}$	MHz	5	5
$F_{Interferer}$ (offset)	MHz	2.5+ F_{offset} / -2.5- F_{offset}	2.5+ F_{offset} / -2.5- F_{offset}
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.			

7.5A.0.2 Adjacent channel selectivity Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz with one uplink carrier and two or more downlink sub-blocks, each larger than or equal to 5 MHz, the adjacent channel selectivity requirements are defined with the uplink configuration in accordance with Table 7.3A.0.2.2-1. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.5.3 and 7.5A.0.1 for one component carrier and two component carriers per sub-block, respectively. The UE shall fulfil the minimum requirements all values of a single adjacent channel interferer in-gap and out-of-gap up to a –25 dBm interferer power while all downlink carriers are active. For the lower range of test parameters (Case 1), the interferer power $P_{interferer}$ shall be set to the maximum of the levels given by the carriers of the respective sub-blocks as specified in Table 7.5.3-3 and Table 7.5A.0.1-2a for one component carrier and two component carriers per sub-block, respectively. The wanted signal power levels for the carriers of each sub-block shall then be adjusted relative to $P_{interferer}$ in accordance with the ACS requirement for each sub-block (Table 7.5.3-1 and Table 7.5A.0.1-1a). For the upper range of test parameters (Case 2) for which the interferer power $P_{interferer}$ is -25 dBm (Table 7.5.3-4 and Table 7.5A.0.1-3a) the wanted signal power levels for the carriers of each sub-block shall be adjusted relative to $P_{interferer}$ like for Case 1.

For intra-band non-contiguous carrier aggregation with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz with one uplink carrier and two or more downlink sub-blocks, each larger than or equal to 5 MHz, the adjacent channel selectivity requirements are defined with the uplink configuration in accordance with Table 7.3A.0.2.2-1. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.5.3 and 7.5A.0.1 for one component carrier and two component carriers per sub-block, respectively. The UE shall fulfil the minimum requirements all values of a single adjacent channel interferer in-gap and out-of-gap up to a –25 dBm interferer power while all downlink carriers are active. For the lower range of test parameters (Case 1), the interferer power $P_{interferer}$ shall be set to the maximum of the levels given by the carriers of the respective sub-blocks as specified in Table 7.5.3-3 and Table 7.5A.0.1-2 for one component carrier and two component carriers per sub-block, respectively. The wanted signal power levels for the carriers of each sub-block shall then be adjusted relative to $P_{interferer}$ in accordance with the ACS requirement for each sub-block (Table 7.5.3-1 and Table 7.5A.0.1-1). For the upper range of test parameters (Case 2) for which the interferer power $P_{interferer}$ is -25 dBm (Table 7.5.3 and Table 7.5A.0.1-3) the wanted signal power levels for the carriers of each sub-block shall be adjusted relative to $P_{interferer}$ like for Case 1.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

7.5A.0.3 Adjacent channel selectivity Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the adjacent channel requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. For NR CA configurations including an operating band without uplink operation or an operating band with an unpaired DL part (as noted in Table 5.2-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. The UE shall meet the requirements specified in subclause 7.5.3 for each component carrier while all downlink carriers are active.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

7.5A.1 Adjacent channel selectivity for 2DL CA

7.5A.1.1 Test Purpose

Adjacent channel selectivity for 2DL CA verifies the receiver's ability to receive a wanted 2DL carrier aggregated at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel.

7.5A.1.2 Test Applicability

This test case applies to all types of NR UE release 15 and forward that support 2DL CA.

7.5A.1.3 Minimum Conformance Requirements

The minimum conformance requirements are defined in clause 7.5A.0.

7.5A.1.4 Test Description

7.5A.1.4.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 7.5A.1.4.1-1, Table 7.5A.1.4.1-2 or Table 7.5A.1.4.1-3. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.5A.1.4.1-1: Test Configuration Table for intra-band contiguous 2CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Highest			
Test SCS as specified in Table 5.3.5-1		Lowest			
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.5A.1.4.1-2: Test Configuration Table for inter-band 2CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Highest			
Test SCS as specified in Table 5.3.5-1		Lowest			
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.5A.1.4.1-3: Test Configuration Table for intra-band non-conguous 2CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal				
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Highest				
Test SCS as specified in Table 5.3.5-1	Lowest				
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.5A.1.4.1-1, Table 7.5A.1.4.1-2 or Table 7.5A.1.4.1-3.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release on according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.5A.1.4.3.

7.5A.1.4.2 Test Procedure

1. Intra-band contiguous CA test:

1.1 Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

1.2 The SS shall configure SCC as per TS 38.508-1 [5] clause 5.1.1. Message contents are defined in clause 7.5A.1.4.3.

1.3 SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

1.4 SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.5A.1.4.1-1 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

1.5 SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.5A.1.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

1.6 Set the Downlink signal level for PCC and SCC to the value as defined in Table 7.5A.1.5-2 or 7.5A.1.5-2a as appropriate (Case 1). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.1.5-2 or Table 7.5A.1.5-2a for at least the duration of the Throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

1.7 Set the Interferer signal level to the value as defined in Table 7.5A.1.5-2 or 7.5A.1.5-2a as appropriate (Case 1) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

1.8 Measure the average throughput for each component carrier for a duration sufficient to achieve statistical significance according to Annex H.2A.

1.9 Repeat steps from 1.6 to 1.8, using an interfering signal above the wanted signal in Case 1 at step 1.7.

1.10 Set the Downlink signal level for PCC and SCC to the value as defined in Table 7.5A.1.5-3 or 7.5A.1.5-3a as appropriate (Case 2). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.1.5-3 or Table 7.5A.1.5-3a for at least the duration of the Throughput measurement, where MU and Uplink power control window size are defined above.

1.11 Set the Interferer signal level to the value as defined in Table 7.5A.1.5-3 or 7.5A.1.5-3a as appropriate (Case 2) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

1.12 Measure the average throughput for each component carrier for a duration sufficient to achieve statistical significance according to Annex H.2A.

1.13 Repeat steps from 1.10 to 1.12, using an interfering signal above the wanted signal in Case 2 at step 1.11.

1.14 Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

2. Inter-band CA test:

2.1 Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

2.2 The SS shall configure SCC as per TS 38.508-1 [5] clause 5.1.1. Message contents are defined in clause 7.5A.1.4.3.

2.3 SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

2.4 SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.5A.1.4.1-2 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

2.5 SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.5A.1.4.1-2. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

2.6 Set the Downlink signal level for PCC and SCC to the value as defined in Table 7.5A.1.5-5 or 7.5A.1.5-8 as appropriate (Case 1). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as

-MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.1.5-5 or Table 7.5A.1.5-8 for at least the duration of the Throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

2.7 Set the Interferer signal level to the value as defined in Table 7.5A.1.5-5 or 7.5A.1.5-8 as appropriate (Case 1) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

2.8 Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to Annex H.2A.

2.9 Repeat steps from 2.6 to 2.8, using an interfering signal above the wanted signal in Case 1 at step 2.7.

2.10 Set the Downlink signal level for PCC and SCC to the value as defined in Table 7.5A.1.5-6 or 7.5A.1.5-9 as appropriate (Case 2). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.1.5-6 or Table 7.5A.1.5-9 for at least the duration of the Throughput measurement, where MU and Uplink power control window size are defined above.

2.11 Set the Interferer signal level to the value as defined in Table 7.5A.1.5-6 or 7.5A.1.5-9 as appropriate (Case 2) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

2.12 Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to Annex H.2A.

2.13 Repeat steps from 2.10 to 2.12, using an interfering signal above the wanted signal in Case 2 at step 2.11.

2.14 Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

3. Intra-band non-contiguous CA test:

3.1 Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

3.2 The SS shall configure SCC as per TS 38.508-1 [5] clause 5.1.1. Message contents are defined in clause 7.5A.1.4.3.

3.3 SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

3.4 SS transmits PDSCH via PDCCH DCI format [1_1] for C_RNTI to transmit the DL RMC according to Table 7.5A.1.4.1-3 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

3.5 SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 7.5A.1.4.1-3. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3.6 Set the Downlink signal level for PCC and SCC to the value as defined in Table 7.5A.1.5-11 or 7.5A.1.5-14 as appropriate (Case 1). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.1.5-11 or Table 7.5A.1.5-14 for at least the duration of the Throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

3.7 Set the Interferer signal level to the value as defined in Table 7.5A.1.5-11 or 7.5A.1.5-14 as appropriate (Case 1) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

3.8 Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to Annex H.2A.

3.9 Repeat steps from 3.6 to 3.8, using an interfering signal above the wanted signal in Case 1 at step 3.7.

3.10 Set the Downlink signal level for PCC and SCC to the value as defined in Table 7.5A.1.5-12 or 7.5A.1.5-15 as appropriate (Case 2). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.1.5-6 or Table 7.5A.1.5-9 for at least the duration of the Throughput measurement, where MU and Uplink power control window size are defined above.

3.11 Set the Interferer signal level to the value as defined in Table 7.5A.1.5-12 or 7.5A.1.5-15 as appropriate (Case 2) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

3.12 Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to Annex H.2A.

3.13 Repeat steps from 3.10 to 3.12, using an interfering signal above the wanted signal in Case 2 at step 3.11.

3.14 Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

Table 7.5A.1.4.2-1: Void

7.5A.1.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.5A.1.5 Test Requirement

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5A.1.5-2, 7.5A.1.5-2a, 7.5A.1.5-3 and 7.5A.1.5-3a.

Table 7.5A.1.5-1: ACS for intra-band contiguous 2CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

		CA Bandwidth Class	
Rx Parameter	**Units**	**B**	**C**
ACS	dB	26.0	33.0

Table 7.5A.1.5-1a: ACS for intra-band contiguous CA with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz

		CA Bandwidth Class	
Rx Parameter	**Units**	**B**	**C**
ACS	dB	20.0	17.0

Table 7.5A.1.5-2: Test parameters for intra-band contiguous 2CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 1

Rx Parameter	Units	CA Bandwidth Class	
		B	**C**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB	REFSENS + 14 dB
$P_{Interferer}$	dBm	Aggregated power + 24.5 dB	Aggregated power + 31.5 dB
$BW_{Interferer}$	MHz	20	$BW_{channel\ CA}$
$F_{Interferer}$ (offset)	MHz	10 + F_{offset} / -10 -F_{offset}	$BW_{channel\ CA}$ / -$BW_{channel\ CA}$
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.3. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.			

Table 7.5A.1.5-2a: Test parameters for intra-band contiguous CA with F_{DL_low}<2700 MHz and F_{UL_low}<2700 MHz, case 1

Rx Parameter	Units	CA Bandwidth Class	
		B	**C**

Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB	REFSENS + 14 dB
$P_{Interferer}$	dBm	Aggregated power + 18.5 dB	Aggregated power + 15.5 dB
$BW_{Interferer}$	MHz	5	5
$F_{Interferer}$ (offset)	MHz	2.5 + F_{offset} / -2.5 - F_{offset}	2.5 + F_{offset} / -2.5 - F_{offset}

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{interferer}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.
NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.1.5-3: Test parameters for intra-band contiguous 2CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 2

Rx Parameter	Units	CA Bandwidth Class	
		B	C
Pw in Transmission Bandwidth Configuration, per CC	dBm	-49.5 + 10log($N_{RB,c}$/N_{RB_agg})	-56.5
$P_{Interferer}$	dBm	-25	-25
$BW_{Interferer}$	MHz	20	$BW_{channel\ CA}$
$F_{Interferer}$ (offset)	MHz	10 + F_{offset} / -10 -F_{offset}	$BW_{channel\ CA}$ / -$BW_{channel\ CA}$

NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.3.
NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{interferer}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.
NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.1.5-3a: Test parameters for intra-band contiguous CA with F_{DL_low} <2700 MHz and F_{UL_low}<2700 MHz, case 2

Rx Parameter	Units	CA Bandwidth Class	
		B	C

Pw in Transmission Bandwidth Configuration, per CC	dBm	-43.5+ 10log($N_{RB,c}$/N_{RB_agg})	-40.5+ 10log($N_{RB,c}$/N_{RB_agg})
$P_{Interferer}$	dBm	-25	-25
$BW_{Interferer}$	MHz	5	5
$F_{Interferer}$ (offset)	MHz	2.5+ F_{offset} / -2.5- F_{offset}	2.5+ F_{offset} / -2.5- F_{offset}
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.			

For NR SCC of inter-band CA with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in [Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1)] with parameters specified in Tables 7.5A.1.5-5 and 7.5A.1.5-6.

Table 7.5A.1.5-4: ACS for NR band with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	**Units**	**Channel bandwidth**				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
ACS	dB	33	33	30	27	26
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
ACS	dB	25.5	24	23	22.5	21
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
ACS	dB	20.5	20			

Table 7.5A.1.5-5: Test parameters for NR inter-band CA with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 1

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 42.5 dB	REFSENS for SCC + 39.5 dB	REFSENS for SCC + 38.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 38 dB	REFSENS for SCC + 36.5 dB	REFSENS for SCC + 35.5 dB	REFSENS for SCC + 35 dB	REFSENS for SCC + 33.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 33 dB	REFSENS for SCC + 32.5 dB			
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset from SCC)	MHz	47.5 / -47.5	52.5 / -52.5			

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the NR interferer RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.1.5-6: Test parameters for NR inter-band CA with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 2

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5	-56.5	-53.5	-50.5	-49.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-49	-47	-46.5	-46	-44.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Pw in Transmission Bandwidth Configuration, per CC	dBm	-44	-43.5			
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset from SCC)	MHz	47.5 / -47.5	52.5 / -52.5			

NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lfloor |F_{\text{interferer}}|/SCS \rfloor + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

For NR SCC of inter-band CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in [Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1)] with parameters specified in Tables 7.5A.1.5-8 and 7.5A.1.5-9.

Table 7.5A.1.5-7: ACS for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
ACS	dB	33	33	33	33	33
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
ACS	dB	33	33	33	33	

Table 7.5A.1.5-8: Test parameters for NR inter-band CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 1

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset from SCC)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset from SCC)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.1.5-9: Test parameters for NR inter-band CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 2

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5				
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset from SCC)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5				
$P_{interferer}$	dBm	-25	-25	-25	-25	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset from SCC)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

For NR SCC of intra-band non-contiguous CA with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 with parameters specified in Tables 7.5A.1.5-11 and 7.5A.1.5-12.

Table 7.5A.1.5-10: ACS for NR band with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
ACS	dB	33	33	30	27	26
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
ACS	dB	25.5	24	23	22.5	21
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
ACS	dB	20.5	20			

Table 7.5A.1.5-11: Test parameters for NR intra-band non-contiguous CA with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 1

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 42.5 dB	REFSENS for SCC + 39.5 dB	REFSENS for SCC + 38.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 38 dB	REFSENS for SCC + 36.5 dB	REFSENS for SCC + 35.5 dB	REFSENS for SCC + 35 dB	REFSENS for SCC + 33.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 33 dB	REFSENS for SCC + 32.5 dB			
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset from SCC)	MHz	47.5 / -47.5	52.5 / -52.5			

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the NR interferer RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.1.5-12: Test parameters for NR intra-band non-contiguous CA with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 2

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5	-56.5	-53.5	-50.5	-49.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-49	-47	-46.5	-46	-44.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Pw in Transmission Bandwidth Configuration, per CC	dBm	-44	-43.5			
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset from SCC)	MHz	47.5 / -47.5	52.5 / -52.5			

NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lfloor |F_{\text{interferer}}|/SCS \rfloor + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

For NR SCC of intra-band non-contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 with parameters specified in Tables 7.5A.1.5-14 and 7.5A.1.5-15.

Table 7.5A.1.5-13: ACS for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
ACS	dB	33	33	33	33	33
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
ACS	dB	33	33	33	33	

Table 7.5A.1.5-14: Test parameters for NR intra-band non-contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 1

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset from SCC)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset from SCC)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

Table 7.5A.1.5-15: Test parameters for NR intra-band non-contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 2

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5				
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset from SCC)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5				
$P_{interferer}$	dBm	-25	-25	-25	-25	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset from SCC)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	

NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

7.5A.2 Adjacent channel selectivity for 3DL CA

7.5A.2.1 Test Purpose

Adjacent channel selectivity for 3DL CA verifies the receiver's ability to receive a wanted 3DL carrier aggregated at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel.

7.5A.2.2 Test Applicability

This test case applies to all types of NR UE release 15 and forward that support 3DL CA.

7.5A.2.3 Minimum Conformance Requirements

The minimum conformance requirements are defined in clause 7.5A.0.

7.5A.2.4 Test Description

7.5A.2.4.1 Initial Conditions

Same as in clause 7.5A.1.4.1 with following exceptions:

- Instead of Table 7.5A.1.4.1-1→ use Table 7.5A.2.4.1-1.
- Instead of Table 7.5A.1.4.1-2→ use Table 7.5A.2.4.1-2.
- Instead of Table 7.5A.1.4.1-3→ use Table 7.5A.2.4.1-3.

Table 7.5A.2.4.1-1: Test Configuration Table for 3CA

Default Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal					
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Intra-band contiguous: Mid range for PCC and SCCs Inter-band CA: Mid range for PCC and SCCs Inter-band + Intra-band contiguous : NOTE 1 Inter-band + Intra-band non-contiguous : NOTE 1 with Wgap for intra-band non-contiguous defined in table 7.3A.2.4.1-1					
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Intra-band contiguous: Lowest N_{RB_agg}, Highest N_{RB_agg} Inter-band: Highest N_{RB_agg} Inter-band + + Intra-band contiguous : Highest N_{RB_agg} Inter-band + Intra-band non-contiguous : Highest N_{RB_agg}					
Test SCS as specified in Table 5.3.5-1	Lowest for PCC and SCCs					
Network signalling value	NS_01 Unless given by Table 7.3.2.3-4 for the band with active uplink carrier					
Test Parameters						
	Downlink Configuration				**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC_1 RB allocation**	**SCC_2 RB allocation**	**CC Mod'n**	**PCC RB allocation**
Default Test Settings for a CA_nXD Configuration (Intra-band contiguous)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nXA-nYA-nZA Configuration (Inter-band)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nXC-nYA and CA_nXB-nYA Configurations (Intra-band contiguous + Inter-band)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nX(2A)-nYA Configuration (Intra-band non-contiguous + Inter-band)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.2.4.1-1. Only test points verifying non-exceptional REFSENS requirements are used for ACS. NOTE 2: CA Configuration Test CC Combination test settings are checked separately for each CA Configuration. NOTE 3: **Inter-band:** X,Y,Z correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n3A-n8A, X=1, Y=3, Z=8; **Intra-band contiguous + Inter-band:** X,Y correspond to the different bands in the CA Configuration, e.g. for CA_1C-3A, X=1,Y=3; **Intra-band non-contiguous + Inter-band:** X and Y correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n1A-n8A, X=1, Y =8 NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.						

Default Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal					
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Intra-band contiguous: Mid range for PCC and SCCs Inter-band CA: Mid range for PCC and SCCs Inter-band + Intra-band contiguous : NOTE 1 Inter-band + Intra-band non-contiguous : NOTE 1 with Wgap for intra-band non-contiguous defined in table 7.3A.2.4.1-1					
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Intra-band contiguous: Lowest N_{RB_agg}, Highest N_{RB_agg} Inter-band: Highest N_{RB_agg} Inter-band + + Intra-band contiguous : Highest N_{RB_agg} Inter-band + Intra-band non-contiguous : Highest N_{RB_agg}					
Test SCS as specified in Table 5.3.5-1	Lowest for PCC and SCCs					
Network signalling value	NS_01 Unless given by Table 7.3.2.3-4 for the band with active uplink carrier					
Test Parameters						
	Downlink Configuration				**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC_1 RB allocation**	**SCC_2 RB allocation**	**CC Mod'n**	**PCC RB allocation**
Default Test Settings for a CA_nXD Configuration (Intra-band contiguous)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nXA-nYA-nZA Configuration (Inter-band)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nXC-nYA and CA_nXB-nYA Configurations (Intra-band contiguous + Inter-band)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nX(2A)-nYA Configuration (Intra-band non-contiguous + Inter-band)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.2.4.1-1. Only test points verifying non-exceptional REFSENS requirements are used for ACS. NOTE 2: CA Configuration Test CC Combination test settings are checked separately for each CA Configuration. NOTE 3: **Inter-band:** X,Y,Z correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n3A-n8A, X=1, Y=3, Z=8; **Intra-band contiguous + Inter-band:** X,Y correspond to the different bands in the CA Configuration, e.g. for CA_1C-3A, X=1,Y=3; **Intra-band non-contiguous + Inter-band:** X and Y correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n1A-n8A, X=1, Y =8 NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.						

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.1.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.5A.2.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.5A.2.4.3.

Table 7.5A.2.4.1-2: Void

Table 7.5A.2.4.1-3: Void

7.5A.2.4.2 Test Procedure

1 Configure SCCs according to Annex C.0, C.1, C.2 for all downlink physical channels.

2 The SS shall configure SCCs as per TS 38.508-1 [5] clause 5.1.1. Message contents are defined in clause 7.5A.2.4.3.

3 SS activates SCCs by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4 SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.5A.2.4.1-1 on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5 SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Table 7.5A.2.4.1-1 on PCC. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6 Set the Downlink signal level according to Table 7.5A.2.4.2-1 as appropriate (Case 1). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.2.4.2-1 for at least the duration of the Throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

7 Set the Interferer signal level to the value as defined in Table 7.5A.2.4.2-1 as appropriate (Case 1) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

8 Measure the average throughput for the carrier(s) indicated in Table 7.5A.2.4.2-1 for a duration sufficient to achieve statistical significance according to Annex H.2A.

9 Repeat steps from 6 to 8, using an interfering signal above the wanted signal in Case 1 at step 7.

10 Set the Downlink signal level according to Table 7.5A.2.4.2-1 as appropriate (Case 2). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.2.4.2-1 for at least the duration of the Throughput measurement, where MU and Uplink power control window size are defined above.

11 Set the Interferer signal level to the value as defined in 7.5A.2.4.2-1 as appropriate (Case 2) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

12 Measure the average throughput for the carrier(s) indicated in Table 7.5A.2.4.2-1 for a duration sufficient to achieve statistical significance according to Annex H.2A.

13 Repeat steps from 10 to 12, using an interfering signal above the wanted signal in Case 2 at step 11.

14 Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

Table 7.5A.2.4.2-1: Test repetition and measurement configuration

CA configuration	CA configuration ID in REFSENS	Throughput measured on	Table with test parameters to select
Intra-band contiguous	1[6]	PCC, SCC1, SCC2	7.5A.2.5-1[4] 7.5A.2.5-2[4] 7.5A.2.5-3[4]
Inter-band	1[1] 2[1] 3[1]	SCC1, SCC2	7.5A.2.5-4 7.5A.2.5-5 7.5A.2.5-6 7.5A.2.5-7 7.5A.2.5-8 7.5A.2.5-9
Intra-band contiguous + Inter-band	1[2]	SCC2	7.5A.2.5-4 7.5A.2.5-5 7.5A.2.5-6 7.5A.2.5-7 7.5A.2.5-8 7.5A.2.5-9
	2[2]	SCC1, SCC2	7.5A.2.5-1[5] 7.5A.2.5-1a[5] 7.5A.2.5-2[5] 7.5A.2.5-2a[5] 7.5A.2.5-3[5] 7.5A.2.5-3a[5]
Intra-band non-contiguous + Inter-band	2[3]	SCC2	7.5A.2.5-4 7.5A.2.5-5 7.5A.2.5-6 7.5A.2.5-7 7.5A.2.5-8 7.5A.2.5-9
	3[3]	SCC1, SCC2	7.5A.2.5-4 7.5A.2.5-5 7.5A.2.5-6 7.5A.2.5-7 7.5A.2.5-8 7.5A.2.5-9

NOTE 1: CA configuration ID as defined in “Default Test Settings for a CA_nXA-nYA-nZA Configuration (Inter-band)” in table 7.3A.2.4.1-1

NOTE 2: CA configuration ID as defined in “Default Test Settings for a CA_XC-YA and CA_XB-YA Configurations (Intra-band contiguous + Inter-band)” in table 7.3A.2.4.1-1.

NOTE 3: CA configuration ID as defined in “Default Test Settings for a CA_nX(2A)-nYA Configuration (Intra-band non-contiguous + Inter-band)” in table 7.3A.2.4.1-1.

NOTE 4: Test requirements and parameters refer to CA bandwidth D.

NOTE 5: Test requirements and parameters refer to CA bandwidth B or C.

NOTE 6: CA configuration ID as defined in “Default Test Settings for a CA_nXD Configuration (Intra-band contiguous)” in table 7.3A.2.4.1-1

7.5A.2.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.5A.2.5 Test Requirement

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5A.2.5-2 and 7.5A.2.5-3.

Table 7.5A.2.5-1: ACS for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

		NR CA bandwidth class			
Rx Parameter	**Units**	**B**	**C**	**D**	
ACS	dB	26.0	33.0	25.2	

Table 7.5A.2.5-1a: ACS for intra-band contiguous CA with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz

		NR CA bandwidth class	
Rx Parameter	**Units**	**B**	**C**
ACS	dB	20.0	17.0

Table 7.5A.2.5-2: Test parameters for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 1

Rx Parameter	Units	NR CA bandwidth class			
		B	C	D	
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB	REFSENS + 14 dB	REFSENS + 14 dB	
$P_{Interferer}$	dBm	Aggregated power + 24.5 dB	Aggregated power + 31.5 dB	Aggregated power + 23.7 dB	
$BW_{Interferer}$	MHz	20	$BW_{channel\ CA}$	50	
$F_{Interferer}$ (offset)	MHz	10 + Foffset / -10 - Foffset	$BW_{channel\ CA}$ / $-BW_{channel\ CA}$	25 + F_{offset} / -25 -F_{offset}	

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\left\lceil |F_{\text{interferer}}|/SCS \right\rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with an SCS equal to that of the closest carrier.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.2.5-2a: Test parameters for intra-band contiguous CA with F_{DL_low}<2700 MHz and F_{UL_low}<2700 MHz, case 1

Rx Parameter	Units	NR CA bandwidth class	
		B	C
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB	REFSENS + 14 dB
$P_{Interferer}$	dBm	Aggregated power + 18.5 dB	Aggregated power + 15.5 dB
$BW_{Interferer}$	MHz	5	5
$F_{Interferer}$ (offset)	MHz	2.5 + F_{offset} / -2.5 - F_{offset}	2.5 + F_{offset} / -2.5 - F_{offset}

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}| / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with 15 kHz SCS.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.2.5-3: Test parameters for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 2

Rx Parameter	Units	NR CA bandwidth class			
		B	C	D	
Pw in Transmission Bandwidth Configuration, per CC	dBm	-49.5 + 10log($N_{RB,c}$/N_{RB_agg})	-56.5	-48.7 + 10log($N_{RB,c}$/N_{RB_agg})	
$P_{Interferer}$	dBm	-25	-25	-25	
$BW_{Interferer}$	MHz	20	$BW_{channel\ CA}$	50	
$F_{Interferer}$ (offset)	MHz	10 + F_{offset} / -10 -F_{offset}	$BW_{channel\ CA}$ / -$BW_{channel\ CA}$	25 + F_{offset} / -25 -F_{offset}	

NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}| / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with an SCS equal to that of the closest carrier.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.2.5-3a: Test parameters for intra-band contiguous CA with F_{DL_low} <2700 MHz and F_{UL_low}<2700 MHz, case 2

Rx Parameter	Units	NR CA Bandwidth Class	
		B	C
Pw in Transmission Bandwidth Configuration, per CC	dBm	$-43.5 + 10\log(N_{RB,c}/N_{RB\_agg})$	$-40.5 + 10\log(N_{RB,c}/N_{RB\_agg})$
$P_{Interferer}$	dBm	-25	-25
$BW_{Interferer}$	MHz	5	5
$F_{Interferer}$ (offset)	MHz	2.5 + F_{offset} / -2.5 - F_{offset}	2.5 + F_{offset} / -2.5 - F_{offset}
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.			

For NR SCC of inter-band and intra-band non-contiguous CA with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5A.2.5-5 and 7.5A.2.5-6.

Table 7.5A.2.5-4: ACS for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz (inter-band, intra-band non-contiguous)

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
ACS	dB	33	33	30	27	26
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
ACS	dB	25.5	24	23	22.5	21
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
ACS	dB	20.5	20			

Table 7.5A.2.5-5: Test parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 1 (inter-band, intra-band non-contiguous)

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 42.5 dB	REFSENS for SCC + 39.5 dB	REFSENS for SCC + 38.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 38 dB	REFSENS for SCC + 36.5 dB	REFSENS for SCC + 35.5 dB	REFSENS for SCC + 35 dB	REFSENS for SCC + 33.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 33 dB	REFSENS for SCC + 32.5 dB			
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset from SCC)	MHz	47.5 / -47.5	52.5 / -52.5			

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the NR interferer RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.2.5-6: Test parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 2 (inter-band, intra-band non-contiguous)

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5	-56.5	-53.5	-50.5	-49.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-49	-47	-46.5	-46	-44.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Pw in Transmission Bandwidth Configuration, per CC	dBm	-44	-43.5			
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset from SCC)	MHz	47.5 / -47.5	52.5 / -52.5			
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

For NR SCC of inter-band and intra-band non-contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5A.2.5-8 and 7.5A.2.5-9.

Table 7.5A.2.5-7: ACS for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz (inter-band, intra-band non-contiguous)

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
ACS	dB	33	33	33	33	33
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
ACS	dB	33	33	33	33	

Table 7.5A.2.5-8: Test parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 1 (inter-band, intra-band non-contiguous)

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset from SCC)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset from SCC)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{interferer} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

Table 7.5A.2.5-9: Test parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 2 (inter-band, intra-band non-contiguous)

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5				
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset from SCC)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5				
$P_{interferer}$	dBm	-25	-25	-25	-25	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset from SCC)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{interferer}\rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

7.5A.3 Adjacent channel selectivity for 4DL CA

Editor's note:

- intra-band contiguous CA，intra-band non-contiguous CA is FFS

7.5A.3.1 Test Purpose

Adjacent channel selectivity for 4DL CA verifies the receiver's ability to receive a wanted 4DL carrier aggregated at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel.

7.5A.3.2 Test Applicability

This test case applies to all types of NR UE release 16 and forward that support 4DL CA.

7.5A.3.3 Minimum Conformance Requirements

The minimum conformance requirements are defined in clause 7.5A.0.

7.5A.3.4 Test Description

7.5A.3.4.1 Initial Conditions

Same as in clause 7.5A.1.4.1 with following exceptions:

- Instead of Table 7.5A.1.4.1-1→ use Table 7.5A.3.4.1-1.
- Instead of Table 7.5A.1.4.1-2→ use Table 7.5A.3.4.1-2.
- Instead of Table 7.5A.1.4.1-3→ use Table 7.5A.3.4.1-3.

Table 7.5A.3.4.1-1: Test Configuration Table for intra-band contiguous 4CA

FFS

Table 7.5A.3.4.1-2: Test Configuration Table for inter-band 4CA

Default Conditions													
Test Environment as specified in TS 38.508-1 [5] subclause 4.1							Normal						
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1							Mid range for all CCs, Note 1						
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1							Highest NRB_agg, Note 1						
Test SCS as specified in Table 5.3.5-1							Lowest for PCC and SCCs						
Network signalling value							NS_01 Unless given by Table 7.3.2.3-4 for the band with active uplink carrier						
Test Parameters for CA Configurations													
Test ID	**CA Configuration / CBW**									**DL RB Allocation**		**UL RB Allocation**	
	CA Configuration								**PCC、SCC1、SCC2、SCC3**	**CC MOD**	**PCC & SCC**	**CC MOD**	**PCC**
	PCC		**SCC1**		**SCC2**		**SCC3**						
	Band	**Range**	**Band**	**Range**	**Band**	**Range**	**Band**	**Range**					
Default Test Settings for a CA_nXA-nYA-nZA-nVA Configuration (Inter-band)													
1	nX	default	nY	default	nZ	default	nV	default	Highest	CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	Note 2
2	nY	default	nZ	default	nV	default	nX	default		CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	
3	nZ	default	nV	default	nX	default	nY	default		CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	
4	nV	default	nX	default	nY	default	nZ	default		CP-OFDM QPSK	Full RB	DFT-s-OFDM QPSK	
Note 1: The specific configuration of uplink and downlink are defined in Table 7.3A.2.4.1-2. Only test points verifying non-exceptional REFSENS requirements are used for ACS. Note 2: UL RB Allocation are defined in Table 7.3.2.4.1-3. Note 3: CA Configuration Test CC Combination test settings are checked separately for each CA Configuration. Note 4: **Inter-band**: X,Y,Z,V correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n3A-n7A-n28A, X=1, Y=3, Z=7,V=28													

Table

7.5A.3.4.1-1: Test Configuration Table for intra-band non-contiguous 4CA

FFS

7.5A.3.4.2 Test Procedure

1 Configure SCCs according to Annex C.0, C.1, C.2 for all downlink physical channels.

2 The SS shall configure SCCs as per TS 38.508-1 [5] clause 5.1.1. Message contents are defined in clause 7.5A.3.4.3.

3 SS activates SCCs by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause9.3).

4 SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.5A.3.4.1-2 on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5 SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.5A.3.4.1-2 on PCC. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6 Set the Downlink signal level according to Table 7.5A.3.5-2 or 7.5A.3.5-5 as appropriate (Case 1). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.3.5-2 or 7.5A.3.5-5 for at least the duration of the Throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

7 Set the Interferer signal level to the value as defined in Table 7.5A.3.5-2 or 7.5A.3.5-5 as appropriate (Case 1) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

8 Measure the average throughput for each component carrier for a duration sufficient to achieve statistical significance according to Annex H.2A.

9 Repeat steps from 6 to 8, using an interfering signal above the wanted signal in Case 1 at step 7.

10 Set the Downlink signal level according to Table 7.5A.3.5-3 or 7.5A.3.5-6 as appropriate (Case 2). Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.5A.3.5-3 or 7.5A.3.5-6 for at least the duration of the Throughput measurement, where MU and Uplink power control window size are defined above.

11 Set the Interferer signal level to the value as defined in Table 7.5A.3.5-3 or 7.5A.3.5-6 as appropriate (Case 2) and frequency below the wanted signal, using a modulated interferer bandwidth as defined in Annex D.

12 Measure the average throughput for each component carrier for a duration sufficient to achieve statistical significance according to Annex H.2A.

13 Repeat steps from 10 to 12, using an interfering signal above the wanted signal in Case 2 at step 11.

14 Repeat for applicable channel bandwidths and operating band combinations in both Case 1 and Case 2.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.5A.3.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.5A.3.5 Test Requirement

For NR PCC and SCCs of inter-band CA with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5A.3.5-2 and 7.5A.3.5-3.

Table 7.5A.3.5-1: ACS for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz (inter-band)

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
ACS	dB	33	33	30	27	26
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
ACS	dB	25.5	24	23	22.5	21
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
ACS	dB	20.5	20			

Table 7.5A.3.5-2: Test parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 1 (inter-band)

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 42.5 dB	REFSENS for SCC + 39.5 dB	REFSENS for SCC + 38.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 38 dB	REFSENS for SCC + 36.5 dB	REFSENS for SCC + 35.5 dB	REFSENS for SCC + 35 dB	REFSENS for SCC + 33.5 dB
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 33 dB	REFSENS for SCC + 32.5 dB			
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset from SCC)	MHz	47.5 / -47.5	52.5 / -52.5			

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the NR interferer RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.3.5-3: Test parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, case 2 (inter-band)

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5	-56.5	-53.5	-50.5	-49.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	5 / -5	7.5 / -7.5	10 / -10	12.5 / -12.5	15 / -15
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-49	-47	-46.5	-46	-44.5
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5	5	5	5
$F_{interferer}$ (offset from SCC)	MHz	17.5 / -17.5	22.5 / -22.5	27.5 / -27.5	32.5 / -32.5	42.5 / -42.5
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Pw in Transmission Bandwidth Configuration, per CC	dBm	-44	-43.5			
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	5	5			
$F_{interferer}$ (offset from SCC)	MHz	47.5 / -47.5	52.5 / -52.5			
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

For NR SCC of inter-band CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.5A.3.5-5 and 7.5A.3.5-6.

Table 7.5A.3.5-4: ACS for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz (inter-band)

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
ACS	dB	33	33	33	33	33
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
ACS	dB	33	33	33	33	

Table 7.5A.3.5-5: Test parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 1 (inter-band)

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset from SCC)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 14 dB				
$P_{interferer}$	dBm	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	REFSENS for SCC + 45.5 dB	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset from SCC)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{interferer}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.5A.3.5-6: Test parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, case 2 (inter-band)

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5				
$P_{interferer}$	dBm	-25				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{interferer}$ (offset from SCC)	MHz	10 / -10	15 / -15	20 / -20	40 / -40	50 / -50
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Pw in Transmission Bandwidth Configuration, per CC	dBm	-56.5				
$P_{interferer}$	dBm	-25	-25	-25	-25	
$BW_{interferer}$	MHz	60	80	90	100	
$F_{interferer}$ (offset from SCC)	MHz	60 / -60	80 / -80	90 / -90	100 / -100	
NOTE 1: The transmitter shall be set to 24 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 3: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

7.5D Adjacent channel selectivity for UL MIMO

7.5D.1 Test purpose

Adjacent channel selectivity (ACS) is a measure of a receiver's ability to receive an NR signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the centre frequency of the assigned channel. ACS is the ratio of the receive filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s).

7.5D.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

7.5D.3 Minimum conformance requirements

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements specified in sub-clause 7.5 shall be met with the UL MIMO configurations described in sub-clause 6.2D.1. For UL MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clauses 7.5D and 7.5.

7.5D.4 Test description

7.5D.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in Table 5.2-1. All of these configurations shall be tested with applicable test parameters for each channel bandwidth, and are shown in Table 7.5D.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annex A.2 and Annex A.3 respectively. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.5D.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid and Highest		
Test SCS as specified in Table 5.3.5-1		Lowest		
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	CP-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-2 and 7.3.2.4.1-3 for Downlink and Uplink respectively. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.4 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.5D.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* and Test Loop Function On according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.5D.4.3.

7.5D.4.2 Test procedure

Same test procedure as specified in 7.5.2.4.2 with the following exception:

- Instead of Table 7.5.4.1-1, use Table 7.5D.4.1-1 in step 1.

- Step 2: SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.5D.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

7.5D.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO

7.5D.5 Test requirement

Same test requirement as defined in Clause 7.5.5.

7.6 Blocking characteristics

The blocking characteristic is a measure of the receiver's ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occurs.

7.6.1 General

FFS

7.6.2 Inband Blocking

7.6.2.1 Test purpose

Inband blocking is defined for an unwanted interfering signal falling into the range from 15 MHz below to 15 MHz above the UE receive band, with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, or into an immediately adjacent frequency range up 3CBW below or above the UE receive band, with F_{DL_low} ≥3300 MHz and F_{UL_low} ≥ 3300 MHz, at which the relative throughput shall meet or exceed the requirement for the specified measurement channel.

7.6.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

7.6.2.3 Minimum conformance requirements

For NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, in-band blocking (IBB) is defined for an unwanted interfering signal falling into the UE receive band or into the first 15 MHz below or above the UE receive band. The throughput of the wanted signal shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL signal as described in Annex A.5) with parameters specified in Table 7.6.2.3-1 and Table 7.6.2.3-2. The relative throughput shall be met for any SCS specified for the channel bandwidth of the wanted signal. For operating bands with an unpaired DL part (as noted in Table 5.2-1), the requirements only apply for carriers assigned in the paired part.

Table 7.6.2.3-1: In-band blocking parameters for NR bands with FDL_high < 2700 MHz and FUL_high < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6	6	7	9	10
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	11	12	13	14	15
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	15.5	16			
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and 15 kHz SCS.						

Table 7.6.2.3-2: In-band blocking for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Case 1	Case 2	Case 3	Case 4
	$P_{interferer}$	dBm	-56	-44	-15	-38
	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and CBW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$		$-BW_{Channel}/2-11$
n1, n2, n3, n5, n7, n8, n12, n14, n20, n25, n26, n28, n34, n38, n39, n40, n41, n48[3], n50, n51, n53, n65, n66, n70, n74, n75, n76	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15		
n30	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15		F_{DL_low} – 11
n71	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 12 to F_{DL_high} + 15	F_{DL_low} – 12	
NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$ NOTE 3: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1.						

For NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, in-band blocking (IBB) is defined for an unwanted interfering signal falling into the UE receive band or into an immediately adjacent frequency range up to 3CBW below or above the UE receive band where CBW is the bandwidth of the wanted signal. The throughput of the wanted signal shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.2.3-3 and Table 7.6.2.3-4. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 7.6.2.3-3: In-band blocking parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{Ioffset, case 1}$	MHz	15	22.5	30	60	75
$F_{Ioffset, case 2}$	MHz	25	37.5	50	100	125
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6				
$BW_{interferer}$	MHz	60	80	90	100	
$F_{Ioffset, case 1}$	MHz	90	120	135	150	
$F_{Ioffset, case 2}$	MHz	150	200	225	250	
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

Table 7.6.2.3-4: In-band blocking for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
n77, n78, n79	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and BW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$
	$F_{interferer}$		NOTE 2	F_{DL_low} – 3CBW to F_{DL_high} + 3CBW
NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lfloor \lvert F_{\text{interferer}} \rvert / SCS \rfloor + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$ NOTE 3: CBW denotes the channel bandwidth of the wanted signal				

The normative reference for this requirement is TS 38.101-1 [2] clause 7.6.2.

7.6.2.4 Test description

7.6.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.6.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6.2.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range (NOTE 4)			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Lowest, Mid, Highest (NOTE 3)			
Test SCS as specified in Table 5.3.5-1	Lowest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	**CP-OFDM QPSK**	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements. NOTE 3: For n70, highest test channel bandwidth shall be Highest UL / Highest DL according to asymmetric channel bandwidths specified in clause 5.3.6. NOTE 4: For NR band n28, 30MHz test channel bandwidth is tested with High range test frequencies.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.6.2.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.6.2.4.3.

7.6.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6.2.4.1-1. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

3. Set the parameters of the signal generator for an interfering signal below the wanted signal in Case 1 according to Tables 7.6.2.5-1 and 7.6.2.5-2 or Tables 7.6.2.5-3 and 7.6.2.5-4 as appropriate depending on NR band.

4. Set the downlink signal level according to the table 7.6.2.5-1 or 7.6.2.5-3 as appropriate. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window

size) dB of the target power level in Table 7.6.2.5-1 or Table 7.6.2.5-3 for at least the duration of the Throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW.

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.
6. Repeat steps from 3 to 5, using an interfering signal above the wanted signal in Case 1 at step 3.
7. Repeat steps from 3 to 6, using interfering signals in Case 2 at step 3and 6. The ranges of case 2 are covered in steps equal to the interferer bandwidth. Interferer frequencies should be chosen starting with an offset nearest to the center frequency and sweep outwards towards the band edges. In order to ensure that full range is tested for interferer frequency, run last test steps at frequency equal to $F_{Interferer}$ range limit defined at the corresponding band edge.
8. If applicable based on NR band, repeat steps from 3 to 5, using interfering signals in Case 3 at step 3.
9. If applicable based on NR band, repeat steps from 3 to 5, using interfering signals in Case 4 at step 3.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.6.2.5 Test requirement

For NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex in Annexes A.2.2, A.2.3 and A.3.2 with parameters specified in Tables 7.6.2.5-1 and 7.6.2.5-2.

Table 7.6.2.5-1: In-band blocking parameters for NR bands with FDL_high < 2700 MHz and FUL_high < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6	6	7	9	10
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	11	12	13	14	15
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	15.5	16			
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						
NOTE 2: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and 15 kHz SCS..						

Table 7.6.2.5-2: In-band blocking for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Case 1	Case 2	Case 3	Case 4
	$P_{interferer}$	dBm	-56	-44	-15	-38
	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and CBW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$		-$BW_{Channel}$/2-11
n1, n2, n3, n5, n7, n8, n12, n14, n20, n25, n26, n28, n34, n38, n39, n40, n41, n48[3], n50, n51, n53, n65, n66, n70, n74	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15		
n30	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15		F_{DL_low} – 11
n71	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 12 to F_{DL_high} + 15	F_{DL_low} – 12	

NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lfloor |F_{\text{interferer}}| / SCS \rfloor + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS.

NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$

NOTE 3: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1.

For NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2 and A.3 with parameters specified in Tables 7.6.2.5-3 and 7.6.2.5-4.

Table 7.6.2.5-3: In-band blocking parameters for NR bands with $F_{DL\_low} \geq 3300$ MHz and $F_{UL\_low} \geq 3300$ MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{Ioffset, case 1}$	MHz	15	22.5	30	60	75
$F_{Ioffset, case 2}$	MHz	25	37.5	50	100	125
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6				
$BW_{interferer}$	MHz	60	80	90	100	
$F_{Ioffset, case 1}$	MHz	90	120	135	150	
$F_{Ioffset, case 2}$	MHz	150	200	225	250	

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.

Table 7.6.2.5-4: In-band blocking for NR bands with $F_{DL\_low} \geq 3300$ MHz and $F_{UL\_low} \geq 3300$ MHz

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
n77, n78, n79	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and BW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$
	$F_{interferer}$		NOTE 2	F_{DL_low} – 3CBW to F_{DL_high} + 3CBW

NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lfloor |F_{\text{interferer}}| / SCS \rfloor + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.

NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$

NOTE 3: CBW denotes the channel bandwidth of the wanted signal

Table 7.6.2.5-5: Void

7.6.3 Out-of-band blocking

7.6.3.1 Test Purpose

Out-of-band band blocking is defined for an unwanted CW interfering signal falling outside a frequency range 15 MHz below or above the UE receive band, with $F_{DL\_high} < 2700$ MHz and $F_{UL\_high} < 2700$ MHz, or falling outside a frequency range up to 3*$BW_{Channel}$ below or from 3*$BW_{Channel}$ above the UE receive band, with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, at which a given average throughput shall meet or exceed the requirement for the specified measurement channels.

7.6.3.2 Test Applicability

This test applies to all types of NR UE release 15 and forward.

7.6.3.3 Minimum Conformance Requirements

For NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz out-of-band band blocking is defined for an unwanted CW interfering signal falling outside a frequency range 15 MHz below or above the UE receive band. The throughput of the wanted signal shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.3-1 and Table 7.6.3.3-2. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal. For operating bands with an unpaired DL part (as noted in Table 5.2-1), the requirements only apply for carriers assigned in the paired part.

Table 7.6.3.3-1: Out-of-band blocking parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6	6	7	9	10
RX parameter	Units	Channel bandwidth				
		30 MHz	40 MHz	50 MHz	60 MHz	80 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	11	12	13	14	15
RX parameter	Units	Channel bandwidth				
		90 MHz	100 MHz			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	15.5	16			
NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.6.3.3-2: Out of-band blocking for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Range 1	Range 2	Range 3
n1, n2, n3, n5, n7, n8, n12, n14, n20, n25, n26, n30, n28, n34, n38, n39, n40, n41, n48[5], n50, n51, n53[8], n65, n66, n70, n71, n74, n75, n76	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} < -15 or 15 < f – F_{DL_high} < 60	-85 < f – F_{DL_low} ≤ -60 or 60 ≤ f – F_{DL_high} < 85	1 ≤ f ≤ F_{DL_low} – 85 or F_{DL_high} + 85 ≤ f ≤ 12750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: For band 51 the F_{DL_high} of band 50 is applied as F_{DL_high} for band 51. For band 50, the F_{DL_low} of band 51 is applied as F_{DL_low} for band 50. NOTE 3: For band 76 the F_{DL_high} of band 75 is applied as F_{DL_high} for band 76. For band 75, the F_{DL_low} of band 76 is applied as F_{DL_low} for band 75. NOTE 4: For UEs supporting both bands 38 and 41, the F_{DL_high} and F_{DL_low} of band 41 is applied as F_{DL_high} and F_{DL_low} for band 38. NOTE 5: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1. The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz. NOTE 6: Void. NOTE 7: For UE supporting both bands 25 and 70, the F_{DL_high} of band 70 is applied as F_{DL_high} for band 25, and the F_{DL_low} of band 25 is applied as F_{DL_low} for band 70. NOTE 8: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2580 MHz and $F_{Interferer}$ < 2775 MHz.					

For interferer frequencies across ranges 1, 2 and 3 in Table 7.6.3.3-2, a maximum of

$$\left\lfloor \max\left\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\right\} / \min\left\{\lfloor n\cdot N_{RB}/10\rfloor, 5\right\}\right\rfloor$$

exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a step size of $\min\left(\lfloor BW_{channel}/2\rfloor, 5\right)$ MHz with N_{RB} the number of resource blocks in the downlink transmission bandwidth configuration, $BW_{Channel}$ is the bandwidth of the frequency channel in MHz and n = 1,2,3 for SCS = 15,30,60 kHz, respectively. For these exceptions, the requirements in subclause 7.7 apply.

For NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz out-of-band band blocking is defined for an unwanted CW interfering signal falling outside a frequency range up to 3*$BW_{Channel}$ below or from 3*$BW_{Channel}$ above the UE receive band, where $BW_{Channel}$ is the channel bandwidth. The throughput of the wanted signal shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.3.3-3 and Table 7.6.3.3-4. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal.

Table 7.6.3.3-3: Out-of-band blocking parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	9	9	9	9	
NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.6.3.3-4: Out of-band blocking for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

NR band	Parameter	Unit	Range1	Range 2	Range 3
n77, n78 (NOTE 3)	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} ≤ -3*$BW_{Channel}$ or 3*$BW_{Channel}$ ≤ f – F_{DL_high} < 60	-200 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 200	1 ≤ f ≤ F_{DL_low} – MAX(200,3*$BW_{Channel}$) or F_{DL_high} + MAX(200,3*$BW_{Channel}$) ≤ f ≤ 12750
n79 (NOTE 4)	$F_{interferer}$ (CW)	MHz	N/A	-150 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 150	1 ≤ f ≤ F_{DL_low} – MAX(150,3*$BW_{Channel}$) or F_{DL_high} + MAX(150,3*$BW_{Channel}$) ≤ f ≤ 12750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: $BW_{Channel}$ denotes the channel bandwidth of the wanted signal NOTE 3: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz. For $BW_{Channel}$ > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. For $BW_{Channel}$ larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. NOTE 4: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 3650 MHz and $F_{Interferer}$ < 5750 MHz. For $BW_{Channel}$ ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge.					

For interferer frequencies across ranges 1, 2 and 3 in Table 7.6.3.3-4, a maximum of

$$\left\lfloor \max\left\{24,6\cdot\lceil n\cdot N_{RB}/6\rceil\right\}/\min\left(\left\lfloor n\cdot N_{RB}/10\right\rfloor,5\right)\right\rfloor$$

exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a step size of $\min\left(\left\lfloor BW_{channel}/2\right\rfloor,5\right)$ MHz with N_{RB} the number of resource blocks in the downlink transmission bandwidth configuration, $BW_{Channel}$ the bandwidth of the frequency channel in MHz and *n* = 1,2,3 for SCS = 15, 30, 60 kHz, respectively. For these exceptions, the requirements in subclause 7.7 apply.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.6.3.

7.6.3.4 Test Description

7.6.3.4.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in table 7.6.3.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.3.

Table 7.6.3.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		One frequency chosen arbitrarily from low or high range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest (NOTE 3)		
Test SCS as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest		
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements. NOTE 3: For n70, highest test channel bandwidth shall be Highest UL / Highest DL according to asymmetric channel bandwidths specified in clause 5.3.6.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508 [5] Annex A, in Figure A.3.1.4.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The UL and DL Reference Measurement channels are set according to Table 7.6.3.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.6.3.4.3.

7.6.3.4.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6.3.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6.3.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3. Set the parameters of the CW signal generator for an interfering signal below the wanted signal according to Table 7.6.3.5-2 or 7.6.3.5-4. The frequency step size is $\min\left(\left\lfloor BW_{channel}/2\right\rfloor, 5\right)$ MHz.

4. Set the downlink signal level according to the table 7.6.3.5-1 or 7.6.3.5-3. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.6.3.5-1 or Table 7.6.3.5-3 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.

6. Record the frequencies for which the throughput doesn't meet the requirements.

7. Repeat steps from 3 to 6, using an interfering signal above the wanted signal at step 3.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6.3.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

7.6.3.5 Test Requirement

For NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 and A.3.3 with parameters specified in Tables 7.6.3.5-1 and 7.6.3.5-2.

For NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, the number of spurious response frequencies recorded in the final step of test procedure shall not exceed $\left\lfloor \max\left\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\right\}/\min\left\{\lfloor n\cdot N_{RB}/10\rfloor, 5\right\}\right\rfloor$ in each assigned frequency channel when measured using a $\min\left(\left\lfloor BW_{channel}/2\right\rfloor, 5\right)$ MHz step size. For these exceptions the requirements of clause 7.7 Spurious Response are applicable.

Table 7.6.3.5-1: Out-of-band blocking parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	6	7	9	10
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	11	12	13	14	15
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	15.5	16			
NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.6.3.5-2: Out of-band blocking for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Range 1	Range 2	Range 3
n1, n2, n3, n5, n7, n8, n12, n14, n20, n25, n26, n28, n30, n34, n38, n39, n40, n41, n48[5], n50, n51, n53[8], n65, n66, n70, n71, n74	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	$-60 < f - F_{DL\_low} < -15$ or $15 < f - F_{DL\_high} < 60$	$-85 < f - F_{DL\_low} \leq -60$ or $60 \leq f - F_{DL\_high} < 85$	$1 \leq f \leq F_{DL\_low} - 85$ or $F_{DL\_high} + 85 \leq f \leq 12750$

NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz.
NOTE 2: For band 51 the F_{DL_high} of band 50 is applied as F_{DL_high} for band 51. For band 50, the F_{DL_low} of band 51 is applied as F_{DL_low} for band 50.
NOTE 3: For band 76 the F_{DL_high} of band 75 is applied as F_{DL_high} for band 76. For band 75, the F_{DL_low} of band 76 is applied as F_{DL_low} for band 75.
NOTE 4: For UEs supporting both bands 38 and 41, the F_{DL_high} and F_{DL_low} of band 41 is applied as F_{DL_high} and F_{DL_low} for band 38.
NOTE 5: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1. The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz.
NOTE 6: Void.
NOTE 7: For UE supporting both bands 25 and 70, the F_{DL_high} of band 70 is applied as F_{DL_high} for band 25, and the F_{DL_low} of band 25 is applied as F_{DL_low} for band 70.
NOTE 8: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2580 MHz and $F_{Interferer}$ < 2775 MHz.

For NR bands with $F_{DL\_low} \geq$ 3300 MHz and $F_{UL\_low} \geq$ 3300 MHz, the throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 and A.3.3 with parameters specified in Tables 7.6.3.5-3 and 7.6.3.5-4.

For NR bands with $F_{DL\_low} \geq$ 3300 MHz and $F_{UL\_low} \geq$ 3300 MHz, the number of spurious response frequencies recorded in the final step of test procedure shall not exceed $\left\lfloor \max\left\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\right\}/\min\left\{\lfloor n\cdot N_{RB}/10\rfloor, 5\right\}\right\rfloor$ in each assigned frequency channel when measured using a $\min\left(\lfloor BW_{channel}/2\rfloor, 5\right)$ MHz step size. For these exceptions the requirements of clause 7.7 Spurious Response are applicable.

Table 7.6.3.5-3: Out-of-band blocking parameters for NR bands with $F_{DL\_low} \geq$ 3300 MHz and $F_{UL\_low} \geq$ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	9	9	9	9	
NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.6.3.5-4: Out of-band blocking for NR bands with $F_{DL\_low} \geq$ 3300 MHz and $F_{UL\_low} \geq$ 3300 MHz

NR band	Parameter	Unit	Range1	Range 2	Range 3
n77, n78 (NOTE 3)	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} ≤ -3*$BW_{Channel}$ or 3*$BW_{Channel}$ ≤ f – F_{DL_high} < 60	-200 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 200	1 ≤ f ≤ F_{DL_low} – MAX(200,3*$BW_{Channel}$) or F_{DL_high} + MAX(200,3*$BW_{Channel}$) ≤ f ≤ 12750
n79 (NOTE 4)	$F_{interferer}$ (CW)	MHz	N/A	-150 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 150	1 ≤ f ≤ F_{DL_low} – MAX(150,3*$BW_{Channel}$) or F_{DL_high} + MAX(150,3*$BW_{Channel}$) ≤ f ≤ 12750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: $BW_{Channel}$ denotes the channel bandwidth of the wanted signal NOTE 3: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz. For $BW_{Channel}$ > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. For $BW_{Channel}$ larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. NOTE 4: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 3650 MHz and $F_{Interferer}$ < 5750 MHz. For $BW_{Channel}$ ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge.					

Table 7.6.3.5-5: Void

7.6.4 Narrow band blocking

7.6.4.1 Test Purpose

Verifies a receiver's ability to receive a NR signal at its assigned channel frequency in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

The lack of narrow-band blocking ability will decrease the coverage area when other NR Node B transmitters exist (except in the adjacent channels and spurious response).

7.6.4.2 Test Applicability

This test applies to all types of NR UE release 15 and forward.

7.6.4.3 Minimum Conformance Requirements

The relative throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6.4.3-1. For operating bands with an unpaired DL part (as noted in Table 5.2-1), the requirements only apply for carriers assigned in the paired part.

Table 7.6.4.3-1: Narrow Band Blocking

NR band	Parameter	Unit	Channel Bandwidth											
			5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
n1,n2, n3, n5, n7, n8, n12, n20, n25, n26, n28, n30, n34, n38, n39, n40, n41, n48, n50, n51, n53, n65, n66, n70, n71, n74, n75, n76	P_w	dBm	$P_{REFSENS}$ + channel bandwidth specific value below											
			16	13	14	16	16	16	16	16	16	16	16	16
	P_{uw} (CW)	dBm	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55
	F_{uw} (offset SCS= 15 kHz)	MHz	2.7075	5.2125	7.7025	10.2075	13.0275	15.6075	20.5575	25.7025	NA	NA	NA	NA
	F_{uw} (offset SCS= 30 kHz)	MHz	NA	NA	NA	NA	NA	NA	NA	NA	30.855	40.935	45.915	50.865
NOTE 1: The transmitter shall be set a 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 NOTE 2: Reference measurement channel is specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1. NOTE 3: The $P_{REFSENS}$ power level is specified in Table 7.3.2.3-1 and Table 7.3.2.3-2 for two and four antenna ports, respectively.														

The normative reference for this requirement is TS 38.101-1 [2] clause 7.6.4.

7.6.4.4 Test Description

7.6.4.4.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, and are shown in table 7.6.4.4.1-1. The details of the uplink and downlink reference measurement channels (RMCs) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6.4.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range (NOTE 4)		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid and Highest (NOTE 2)		
Test SCS as specified in TS 38.508-1 [5] subclause 4.3.1		TAccording to CH BW SCS in table 7.6.4.3-1		
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1. NOTE 2: For n70, highest test channel bandwidth shall be Highest UL / Highest DL according to asymmetric channel bandwidths specified in clause 5.3.6. NOTE 3: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements. NOTE 4: For NR band n28, 30MHz test channel bandwidth is tested with High range test frequencies.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2 , and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The UL and DL Reference Measurement channels are set according to Table 7.6.4.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.6.4.4.3.

7.6.4.4.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6.4.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6.4.4.1-1. Since the UE has no payload and no loopback data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3. Set the parameters of the CW signal generator for an interfering signal below the wanted signal according to Table 7.6.4.5-1.

4. Set the downlink signal level according to the table 7.6.4.5-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.6.4.5-1 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.

6. Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 3.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6.4.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

7.6.4.5 Test Requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 and A.3.3 with parameters specified in Table 7.6.4.5-1.

Table 7.6.4.5-1: Narrow-band blocking

NR band	Parameter	Unit	Channel Bandwidth											
			5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
n1, n2, n3, n5, n7, n8, n12, n20, n25, n26, n28, n30, n34, n38, n39, n40, n41, n48, n50, n51, n53, n65, n66, n70, n71, n74	P_w	dBm	$P_{REFSENS}$ + channel-bandwidth specific value below											
			16	13	14	16	16	16	16	16	16	16	16	16
	P_{uw} (CW)	dBm	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55
	F_{uw} (offset SCS=15 kHz)	MHz	2.7075	5.2125	7.7025	10.2075	13.0275	15.6075	20.5575	25.7025	NA	NA	NA	NA
	F_{uw} (offset SCS=30 kHz)	MHz	NA	NA	NA	NA	NA	NA	NA	NA	30.855	40.935	45.915	50.865

NOTE 1: The transmitter shall be set a 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4

NOTE 2: Reference measurement channel is specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.

Table 7.6.4.5-2 Void

7.6A Blocking characteristics for CA

7.6A.1 General

7.6A.2 Inband blocking for CA

7.6A.2.0 Minimum requirements

7.6A.2.0.1 In-band blocking for Intra-band contiguous CA

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. The UE shall fulfil the minimum requirement specified in Table 7.6A.2.0.1-1a for an adjacent channel interferer on either side of the aggregated downlink signal at a specified frequency offset and for an interferer power up to -25 dBm. The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

Table 7.6A.2.0.1-1: In-band blocking parameters for intra-band contiguous CA with $F_{DL\_low} \geq$ 3300 MHz and $F_{UL\_low} \geq$ 3300 MHz

Rx Parameter	Units	NR CA bandwidth class		
		B	C	D
Pw in Transmission Bandwidth Configuration, per CC	dB	REFSENS + CA bandwidth class specific value below		
		10.0	6	13.8
$BW_{Interferer}$	MHz	20	$BW_{channel\ CA}$	50
$F_{Ioffset,\ case\ 1}$	MHz	30	$BW_{channel\ CA}$+ $BW_{channel\ CA}$/2	75
$F_{Ioffset,\ case\ 2}$	MHz	50	$BW_{Interferer}$ + $F_{Ioffset,\ case\ 1}$	125
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the Reference measurement channel specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattrn OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1				

Table 7.6A.2.0.1-1a: In-band blocking parameters for intra-band contiguous CA with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz

Rx Parameter	Units	NR CA bandwidth class	
		B	C
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + NR CA bandwidth class specific value below	REFSENS + NR CA bandwidth class specific value below
		16.0	19.0
$BW_{Interferer}$	MHz	5	5
$F_{Ioffset,\ case\ 1}$	MHz	7.5	7.5
$F_{Ioffset,\ case\ 2}$	MHz	12.5	12.5
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the Reference measurement channel specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1			

Table 7.6A.2.0.1-2: In-band blocking for intra-band contiguous CA with $F_{DL\_low} \geq 3300$ MHz and $F_{UL\_low} \geq 3300$ MHz

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
n77, n78, n79	$F_{interferer}$ (offset)	MHz	$-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$ and $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$	$\leq -BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 2}$ and $\geq BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 2}$
	$F_{interferer}$	MHz	NOTE 2	$F_{DL\_low} - 3BW_{channel\ CA}$ to $F_{DL\_high} + 3BW_{channel\ CA}$

NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil |F_{\mathrm{interferer}}| / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with an SCS equal to that of the closest carrier.

NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: $-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$; b: $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$

NOTE 3: $BW_{channel\ CA}$ denotes the aggregated channel bandwidth of the wanted signal

Table 7.6A.2.0.1-2a: In-band blocking for intra-band contiguous CA with $F_{DL\_low} < 2700$ MHz and $F_{UL\_low} < 2700$ MHz

NR band	Parameter	Unit	Case 1	Case 2	Case 3
	$P_{interferer}$	dBm	-56	-44	
n66 n41 n48[4] n40	$F_{interferer}$ (offset)	MHz	$-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$ and $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$	$\leq -BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 2}$ and $\geq BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 2}$	
	$F_{interferer}$	MHz	NOTE 2	$F_{DL\_low} - 15$ to $F_{DL\_high} + 15$	
n71	$F_{interferer}$	MHz	NOTE 2	$F_{DL\_low} - 12$ to $F_{DL\_high} + 15$	$F_{DL\_low} - 12$

NOTE 1: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\mathrm{interferer}}| / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with 15 kHz SCS.

NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: $-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$; b: $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$

NOTE 3: $BW_{channel\ CA}$ denotes the aggregated channel bandwidth of the wanted signal.

NOTE 4: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1A.

7.6A.2.0.2 In-band blocking for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with one uplink carrier and two or more downlink sub-blocks, each larger than or equal to 5 MHz, the in-band blocking requirements are defined with the uplink configuration in accordance with Table 7.3A.0.3.2-1. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclause 7.6.2 and in this subclause for one component carrier and two component carriers per sub-block, respectively. The requirements apply for in-gap and out-of-gap interferers while all downlink carriers are active.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

7.6A.2.0.3 In-band blocking for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the in-band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.2 for each component carrier while all downlink carriers are active.

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.6.2.3-2 and 7.6.2.3-4 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

For E-UTRA CA configurations including an operating band without uplink operation or an operating band with an unpaired DL part (as noted in Table 5.2-1), the requirements for all downlinks shall be met with the single uplink carrier active in each band capable of UL operation. The requirements for the component carrier configured in the operating band without uplink operation are specified in Table 7.6A.2.3-1.

Table 7.6A.2.3-1: In-band blocking parameters for additional NR operating bands for carrier aggregation with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and CBW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$
n29	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15
NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$ NOTE 3: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal NOTE 4: CBW denotes the channel bandwidth of the wanted signal				

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

The normative reference for this requirement is TS 38.101-1 [2] clause 7.6A.2.

7.6A.2.1 In-band Blocking for CA (2DL CA)

7.6A.2.1.1 Test purpose

Inband blocking is defined for an unwanted interfering signal falling into the range from 15 MHz below to 15 MHz above the UE receive band, with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, or into an immediately adjacent frequency range up 3CBW below or above the UE receive band, with F_{DL_high} ≥ 3300 MHz and F_{UL_high} ≥ 3300 MHz, at which the relative throughput shall meet or exceed the requirement for the specified measurement channel.

7.6A.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support 2CA.

7.6A.2.1.3 Minimum conformance requirements

Minimum requirements are defined in clause 7.6A.2.0.

7.6A.2.1.4 Test description

7.6A.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in table 7.6A.2.1.4.1-1, 7.6A.2.1.4.1-2 or 7.6A.2.1.4.1-3. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2..

Table 7.6A.2.1.4.1-1: Test configuration table for Intra-band contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Highest N_{RB_agg}, NOTE 1			
Test SCS as specified in Table 5.3.5-1		Lowest			
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.1.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.6A.2.1.4.1-2: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Highest N_{RB_agg} for PCC and SCC, NOTE 1			
Test SCS as specified in Table 5.3.5-1		Lowest			
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.1.4.1-2. Only test points verifying non-exceptional REFSENS requirements are used forin-band blocking. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.6A.2.1.4.1-3: Test configuration table for Intraband non-contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal				
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	NOTE 1				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Highest N_{RB_agg} for PCC and SCC, NOTE 1				
Test SCS as specified in Table 5.3.5-1	Lowest				
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.1.4.1-3. Only test points verifying non-exceptional REFSENS requirements are used forin-band blocking. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.6A.2.1.4.1-1, 7.6A.2.1.4.1-2 or 7.6A.2.1.4.1-3.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.6A.2.1.4.3.

7.6A.2.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.6A.2.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format [1_1] for C_RNTI to transmit the DL RMC according to Tables 7.6A.2.1.4.1-1, 7.6A.2.1.4.1-2 or 7.6A.2.1.4.1-3 on both SCC and PCC. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Tables 7.6A.2.1.4.1-1, 7.6A.2.1.4.1-2 or 7.6A.2.1.4.1-3 on PCC. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.

6. For Intra-band contiguous CA: Set the parameters of the signal generator for an interfering signal below the aggregated component carriers in Case 1 according to Tables 7.6A.2.1.5.1-1 and 7.6A.2.1.5.1-2 or Tables 7.6A.2.1.5.1-1a and 7.6A.2.1.5.1-2a as appropriate depending on NR band.

For Inter-band CA: Set the parameters of the signal generator for an interfering signal below the SCC's wanted signal in Case 1 according to Tables 7.6A.2.1.5.3-1 and 7.6A.2.1.5.3-2 or Tables 7.6A.2.1.5.3-1a and 7.6A.2.1.5.3-2a as appropriate depending on NR band.

For Intra-band non-contiguous CA: Set the parameters of the signal generator for an interfering signal below the PCC's wanted signal in Case 1 according to 7.6A.2.1.5.3-1 and 7.6A.2.1.5.3-2 or Tables 7.6A.2.1.5.3-1a and 7.6A.2.1.5.3-2a as appropriate depending on NR bands as appropriate, excluding excluding frequencies where the interferer centre frequency falls within SCC carrier ±(BW/2 + $F_{Ioffset,case\ 1}$), where BW & offset refer to SCC.

7. Set the downlink signal level on both carriers according to the table 7.6A.2.1.5.1-1, 7.6A.2.1.5.1-1a or 7.6A.2.1.5.3-1, 7.6A.2.1.5.3-1a as appropriate. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in table 7.6A.2.1.5.1-1, 7.6A.2.1.5.1-1a or 7.6A.2.1.5.3-1, 7.6A.2.1.5.3-1a for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. For Intra-band contiguous CA: Measure the average throughput of both carriers for a duration sufficient to achieve statistical significance according to Annex H.2A.

   For Inter-band CA: Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to Annex H.2A.

   For Intra-band non-contiguous CA: Measure the average throughput of PCC for a duration sufficient to achieve statistical significance according to Annex H.2A.

9. Repeat steps from 6 to 8, using an interfering signal above the wanted signal in Case 1 at step 6.

10. For Intra-band non-contiguous only: Repeat steps from 6 to 9, using an interfering signal below and above the SCC in Case 1 and measuring SCC instead of PCC in step 8, excluding the frequencies where the interferer centre frequency falls within PCC carrier ±(BW/2 + $F_{Ioffset,case\ 1}$), where BW & offset refer to PCC.

11. Repeat steps from 6 to 10, using interfering signals in Case 2 at step 6 and 9. The ranges of case 2 are covered in steps equal to the interferer bandwidth.

12. Repeat steps from 6 to 10, using interfering signals in Case 3 as applicable at step 6and 9. The ranges of case 3 are covered in steps equal to the interferer bandwidth.

13. For Inter-band CA only: Repeat steps from 1 to 12 setting the original PCell as SCell and the original SCell as PCell in the corresponding CA configuration, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6A.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.6A.2.1.5 Test requirement

7.6A.2.1.5.1 Intra-band contiguous 2CA

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters defined in 7.6A.2.1.5.1-1a and 7.6A.2.1.5.1-2a.

Table 7.6A.2.1.5.1-1: In-band blocking parameters for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

Rx Parameter	Units	NR CA bandwidth class		
		B	C	
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + CA bandwidth class specific value below		
		10.0	6	
$BW_{Interferer}$	MHz	20	$BW_{channel\ CA}$	
$F_{Ioffset,\ case\ 1}$	MHz	30	$BW_{channel\ CA}$+ $BW_{channel\ CA}$/2	
$F_{Ioffset,\ case\ 2}$	MHz	50	$BW_{Interferer}$ + $F_{Ioffset,\ case\ 1}$	
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the Reference measurement channel specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattrn OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1				

Table 7.6A.2.1.5.1-1a: In-band blocking parameters for intra-band contiguous CA with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz

Rx Parameter	Units	NR CA bandwidth class	
		B	C
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + NR CA bandwidth class specific value below	REFSENS + NR CA bandwidth class specific value below
		16.0	19.0
$BW_{Interferer}$	MHz	5	5
$F_{Ioffset,\ case\ 1}$	MHz	7.5	7.5
$F_{Ioffset,\ case\ 2}$	MHz	12.5	12.5
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the Reference measurement channel specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1			

Table 7.6A.2.1.5.1-2: In-band blocking for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
n77, n78, n79	$F_{interferer}$ (offset)	MHz	$-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$ and $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$	$\leq -BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 2}$ and $\geq BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 2}$
	$F_{interferer}$	MHz	NOTE 2	$F_{DL\_low} - 3BW_{channel\ CA}$ to $F_{DL\_high} + 3BW_{channel\ CA}$

NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil |F_{interferer}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with an SCS equal to that of the closest carrier.

NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: $-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$; b: $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$

NOTE 3: $BW_{channel\ CA}$ denotes the aggregated channel bandwidth of the wanted signal

Table 7.6A.2.1.5.1-2a: In-band blocking for intra-band contiguous CA with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz

NR band	Parameter	Unit	Case 1	Case 2	Case 3
	$P_{interferer}$	dBm	-56	-44	
n66 n41 n48[4]	$F_{interferer}$ (offset)	MHz	$-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$ and $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$	$\leq -BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 2}$ and $\geq BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 2}$	
	$F_{interferer}$	MHz	NOTE 2	$F_{DL\_low} - 15$ to $F_{DL\_high} + 15$	
n71	$F_{interferer}$	MHz	NOTE 2	$F_{DL\_low} - 12$ to $F_{DL\_high} + 15$	$F_{DL\_low} - 12$

NOTE 1: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{interferer}|/SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with 15 kHz SCS.

NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: $-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$; b: $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$

NOTE 3: $BW_{channel\ CA}$ denotes the aggregated channel bandwidth of the wanted signal

NOTE 4: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1A

7.6A.2.1.5.2 In-band blocking for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with one uplink carrier and two or more downlink sub-blocks, each larger than or equal to 5 MHz, the in-band blocking requirements are defined with the uplink configuration in accordance with Table 7.3A.2.2-1. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclause 7.6.2. The requirements apply for in-gap and out-of-gap interferers while all downlink carriers are active.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters defined in 7.6A.2.1.5.3-1 and 7.6A.2.1.5.3-2.

7.6A.2.1.5.3 In-band blocking for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the in-band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements for each component carrier, when operated as SCell, while all downlink carriers are active.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters defined in 7.6A.2.1.5.3-1 and 7.6A.2.1.5.3-2.

Table 7.6A.2.1.5.3-1: In-band blocking parameters for NR bands with FDL_high < 2700 MHz and FUL_high < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6	6	7	9	10
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	11	12	13	14	15
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	15.5	16			
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and 15 kHz SCS..						

Table 7.6A.2.1.5.3-1a: In-band blocking parameters for NR bands with $F_{DL\_low} \geq$ 3300 MHz and $F_{UL\_low} \geq$ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6				
$BW_{interferer}$	MHz	10	15	20	40	50
$F_{Ioffset, case 1}$	MHz	15	22.5	30	60	75
$F_{Ioffset, case 2}$	MHz	25	37.5	50	100	125
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6				
$BW_{interferer}$	MHz	60	80	90	100	
$F_{Ioffset, case 1}$	MHz	90	120	135	150	
$F_{Ioffset, case 2}$	MHz	150	200	225	250	
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1.						

Table 7.6A.2.1.5.3-2: In-band blocking for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Case 1	Case 2	Case 3
	$P_{interferer}$	dBm	-56	-44	-15
n1, n2, n3, n5, n7, n8, n12, n20, n28, n38, n39, n40, n41, n48[3], n50, n51, n66, n70, n74, n75, n76	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and CBW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$	
	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15	
n71	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 12 to F_{DL_high} + 15	F_{DL_low} – 12
NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lfloor \lvert F_{\text{interferer}} \rvert / SCS \rfloor + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$ NOTE 3: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1A.					

Table 7.6A.2.1.5.3-2a: In-band blocking for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
n77, n78, n79	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and BW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$
	$F_{interferer}$		NOTE 2	F_{DL_low} – 3CBW to F_{DL_high} + 3CBW
NOTE 1:	The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal.			
NOTE 2:	For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$			
NOTE 3:	CBW denotes the channel bandwidth of the wanted signal			

Table 7.6A.2.1.5.3-2b: In-band blocking parameters for additional NR operating bands for carrier aggregation with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and CBW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$
n29	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15
NOTE 1:	For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band			
NOTE 2:	For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$			
NOTE 3:	The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal			
NOTE 4:	CBW denotes the channel bandwidth of the wanted signal			

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2-1, $P_{interferer}$ power defined in Table 7.6A.2.1.5.3-2 and 7.6A.2.1.5.3-2a is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2-1.

7.6A.2.2 In-band Blocking for CA (3DL CA)

7.6A.2.2.1 Test purpose

Same test purpose as in clause 7.6A.2.1.

7.6A.2.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support 3DL CA.

7.6A.2.2.3 Minimum conformance requirements

Minimum requirements are defined in clause 7.6A.2.0.

7.6A.2.2.4 Test description

7.6A.2.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configuration specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in table 7.6A.2.2.4.1-1, 7.6A.2.2.4.1-2 or 7.6A.2.2.4.1-3. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6A.2.2.4.1-1: Test Configuration Table for 3DL CA

Default Conditions						
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Intra-band contiguous: Mid range for all CCs Inter-band: Mid range for all CCs Intra-band contiguous + Inter-band: Mid range for PCC and SCCs Intra-band non-contiguous + Inter-band: NOTE 1 with Wgap for intra-band non-contiguous defined in table 7.3A.2.4.1-1			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg}, NOTE 1			
Test SCS as specified in Table 5.3.5-1			Lowest for PCC and SCCs			
Network signalling value			NS_01 Unless given by Table 7.3.2.3-4 for the band with active uplink carrier			
Test Parameters						
	Downlink Configuration				**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC_1 RB allocation**	**SCC_2 RB allocation**	**CC Mod'n**	**PCC RB allocation**
Default Test Settings for a CA_nXD Configuration (Intra-band contiguous CA)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nXA-nYA-nZA Configuration (Inter-band)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nXC-nYA and CA_nXB-nYA Configurations (Intra-band contiguous + Inter-band)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
Default Test Settings for a CA_nX(2A)-nYA Configurations (Intra-band non-contiguous + Inter-band)						
1	CP-OFDM QPSK	NOTE 1	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.2.4.1-1. Only test points verifying non-exceptional REFSENS requirements are used for in-band blocking testing. NOTE 2: CA Configuration Test CC Combination test settings are checked separately for each CA Configuration. NOTE 3: **Inter-band:** X,Y,Z correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n3A-n8A, X=1, Y=3, Z=8; **Intra-band contiguous + Inter-band:** X,Y correspond to the different bands in the CA Configuration, e.g. for CA_1C-3A, X=1,Y=3; **Intra-band non-contiguous + Inter-band:** X and Y correspond to the different bands in the CA Configuration. E.g. for CA_n1A-n1A-n8A, X=1, Y =8 NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.						

Table 7.6A.2.2.4.1-2: Void

Table 7.6A.2.2.4.1-3: Void

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.
4. The UL and Reference Measurement Channel is set according to Tables 7.6A.2.2.4.1-1.
5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.6A.2.2.4.3.

7.6A.2.2.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.6A.2.2.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).
4. SS transmits PDSCH via PDCCH DCI format [1_1] for C_RNTI to transmit the DL RMC according to Tables 7.6A.2.2.4.1-1, 7.6A.2.2.4.1-2 or 7.6A.2.2.4.1-3 on both SCC and PCC. The SS sends downlink MAC padding bits on the DL RMC.
5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format [0_1] for C_RNTI to schedule the UL RMC according to Tables 7.6A.2.2.4.1-1, 7.6A.2.2.4.1-2 or 7.6A.2.2.4.1-3 on PCC. Since the UL has no payload and no loopback data to send the UE sends uplink MAC padding bits on the UL RMC.
6. Set the parameters of the signal generator for an interfering signal below the aggregated component carriers in Case 1 according to Table 7.6A.2.2.4.2-1.

7 Set the downlink signal level according to the Table 7.6A.2.2.4.2-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in table 7.6A.2.2.4.2-1 for at least the duration of the Throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW
- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8 Measure the average throughput for the carrier(s) indicated in Table 7.6A.2.2.4.2-1 for duration sufficient to achieve statistical significance according to Annex H.2A.

9 Repeat steps from 6 to 8, using an interfering signal above the measured carrier(s) according to Table 7.6A.2.2.4.2-1 in Case 1 at step 6.

10 Repeat steps from 6 to 9, using interfering signals in Case 2 at step 6 and 9. The ranges of case 2 are covered in steps equal to the interferer bandwidth.

11. Repeat steps 1 to 10 for all component carriers listed in Table 7.6A.2.2.4.2-1.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

Table 7.6A.2.2.4.2-1: Test repetition and measurement configuration

CA configuration	CA configuration ID in REFSENS	Throughput measured on	Table with test parameters to select
Intra-band contiguous	1	PCC, SCC_1, SCC_2	7.6A.2.2.5-3 7.6A.2.2.5-3a 7.6A.2.2.5-4 7.6A.2.2.5-4a
Inter-band	1[1]	SCC1, SCC2	7.6A.2.2.5-1 7.6A.2.2.5-1a 7.6A.2.2.5-1b 7.6A.2.2.5-2 7.6A.2.2.5-2a
	2[1]		
	3[1]		
Intra-band contiguous + Inter-band	1[2]	SCC2	7.6A.2.2.5-1 7.6A.2.2.5-1a 7.6A.2.2.5-1b 7.6A.2.2.5-2 7.6A.2.2.5-2a
	2[2]	SCC1, SCC2	7.6A.2.2.5-3 7.6A.2.2.5-3a 7.6A.2.2.5-4 7.6A.2.2.5-4a
Intra-band non-contiguous + Inter-band	2[3]	SCC2	7.6A.2.2.5-1 7.6A.2.2.5-1a 7.6A.2.2.5-1b 7.6A.2.2.5-2 7.6A.2.2.5-2a
	3[3]	SCC1, SCC2	7.6A.2.2.5-1 7.6A.2.2.5-1a 7.6A.2.2.5-2 7.6A.2.2.5-2a
NOTE 1: CA configuration ID as defined in “Default Test Settings for a CA_nXA-nYA-nZA Configuration (Inter-band)” in table 7.3A.2.4.1-1. NOTE 2: CA configuration ID as defined in “Default Test Settings for a CA_XC-YA and CA_XB-YA Configurations (Intra-band contiguous + Inter-band)” in table 7.3A.2.4.1-1. NOTE 3: CA configuration ID as defined in “Default Test Settings for a CA_nX(2A)-nYA Configuration (Intra-band non-contiguous + Inter-band)” in table 7.3A.2.4.1-3.			

7.6A.2.2.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with TRANSFORM_PRECODER_ENABLED condition in Table 4.6.3-118 PUSCH-Config.

7.6A.2.2.5 Test requirement

The throughput measurement of each carrier derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic

OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables below, according to the type of CA.

Table 7.6A.2.2.5-1: In-band blocking parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz (inter-band, intra-band non-contiguous)

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	6	7	9	10
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	11	12	13	14	15
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	15.5	16			
$BW_{interferer}$	MHz	5				
$F_{Ioffset, case 1}$	MHz	7.5				
$F_{Ioffset, case 2}$	MHz	12.5				
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and 15 kHz SCS.						

Table 7.6A.2.2.5-1a: In-band blocking for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz (inter-band, intra-band non-contiguous)

NR band	Parameter	Unit	Case 1	Case 2	Case 3	Case 4
	$P_{interferer}$	dBm	-56	-44	-15	-38
	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and CBW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$		-CBW/2-11
n1, n2, n3, n5, n7, n8, n12, n14, n18, n20, n25, n26, n28,n34, n38,n39, n40, n41, n48[3], n50, n51, n53, n65, n66, n70, n74, n75, n76	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15		
n30	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15		F_{DL_low} – 11
n71	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 12 to F_{DL_high} + 15	F_{DL_low} – 12	
NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with 15 kHz SCS. NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$ NOTE 3: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1.						

7.6A.2.2.5-1b: In-band blocking for additional NR operating bands for carrier aggregation with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz (inter-band)

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and CBW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$
n29	$F_{interferer}$	MHz	NOTE 2	F_{DL_low} – 15 to F_{DL_high} + 15
NOTE 1: For certain bands, the unwanted modulated interfering signal may not fall inside the UE receive band, but within the first 15 MHz below or above the UE receive band				
NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$				
NOTE 3: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil \lvert F_{\mathrm{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal				
NOTE 4: CBW denotes the channel bandwidth of the wanted signal				

Table 7.6A.2.2.5-2: In-band blocking parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz (inter-band, intra-band non-contiguous)

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**25 MHz**	**30 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6				
$BW_{interferer}$	MHz	10	15	20	25	30
$F_{Ioffset, case 1}$	MHz	15	22.5	30	37.5	45
$F_{Ioffset, case 2}$	MHz	25	37.5	50	62.5	75
RX parameter	**Units**	**Channel bandwidth**				
		40 MHz	**50 MHz**	**60 MHz**	**70 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6				
$BW_{interferer}$	MHz	40	50	60	70	80
$F_{Ioffset, case 1}$	MHz	60	75	90	105	120
$F_{Ioffset, case 2}$	MHz	100	125	150	175	200
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6				
$BW_{interferer}$	MHz	90	100			
$F_{Ioffset, case 1}$	MHz	135	150			
$F_{Ioffset, case 2}$	MHz	225	250			
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						
NOTE 2: The interferer consists of the RMC specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1						

Table 7.6A.2.2.5-2a: In-band blocking for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz (inter-band, intra-band non-contiguous)

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
n77, n78, n79	$F_{interferer}$ (offset)	MHz	-CBW/2 – $F_{Ioffset, case 1}$ and BW/2 + $F_{Ioffset, case 1}$	≤ -CBW/2 – $F_{Ioffset, case 2}$ and ≥ CBW/2 + $F_{Ioffset, case 2}$
	$F_{interferer}$		NOTE 2	F_{DL_low} – 3CBW to F_{DL_high} + 3CBW
NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil \lvert F_{\text{interferer}} \rvert / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the wanted signal in MHz. The interferer is an NR signal with an SCS equal to that of the wanted signal. NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: -CBW/2 – $F_{Ioffset, case 1}$; b: CBW/2 + $F_{Ioffset, case 1}$ NOTE 3: CBW denotes the channel bandwidth of the wanted signal				

Table 7.6A.2.2.5-3: In-band blocking parameters with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz (intra-band contiguous CA)

Rx Parameter	Units	NR CA bandwidth class			
		B	C	D	
Pw in Transmission Bandwidth Configuration, per CC	dB	REFSENS + CA bandwidth class specific value below			
		10.0	6	13.8	
$BW_{Interferer}$	MHz	20	$BW_{channel\ CA}$	50	
$F_{Ioffset, case 1}$	MHz	30	$BW_{channel\ CA}$+ $BW_{channel\ CA}$/2	75	
$F_{Ioffset, case 2}$	MHz	50	$BW_{Interferer}$ + $F_{Ioffset, case 1}$	125	
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the Reference measurement channel specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattrn OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1					

Table 7.6A.2.2.5-3a: In-band blocking parameters with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz (intra-band contiguous CA)

Rx Parameter	Units	NR CA bandwidth class	
		B	C
Pw in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + NR CA bandwidth class specific value below	
		16.0	19.0
$BW_{Interferer}$	MHz	5	5
$F_{Ioffset, case 1}$	MHz	7.5	7.5
$F_{Ioffset, case 2}$	MHz	12.5	12.5
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: The interferer consists of the Reference measurement channel specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1 and set-up according to Annex C.3.1			

Table7.6A.2.2.5-4: In-band blocking with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz (intra-band contiguous CA)

NR band	Parameter	Unit	Case 1	Case 2
	$P_{interferer}$	dBm	-56	-44
n77, n78, n79	$F_{interferer}$ (offset)	MHz	$-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$ and $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$	≤ $-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 2}$ and ≥ $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 2}$
	$F_{interferer}$	MHz	NOTE 2	$F_{DL\_low} - 3BW_{channel\ CA}$ to $F_{DL\_high} + 3BW_{channel\ CA}$

NOTE 1: The absolute value of the interferer offset Finterferer (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}| / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with an SCS equal to that of the closest carrier.
NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: $-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$; b: $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$
NOTE 3: $BW_{channel\ CA}$ denotes the aggregated channel bandwidth of the wanted signal

Table 7.6A.2.2.5-4a: In-band blocking with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz (intra-band contiguous CA)

NR band	Parameter	Unit	Case 1	Case 2	Case 3
	$P_{interferer}$	dBm	-56	-44	
n41, n66, n48[4], n40	$F_{interferer}$ (offset)	MHz	$-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$ and $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$	≤ $-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 2}$ and ≥ $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 2}$	
	$F_{interferer}$	MHz	NOTE 2	$F_{DL\_low} - 15$ to $F_{DL\_high} + 15$	
n71	$F_{interferer}$	MHz	NOTE 2	$F_{DL\_low} - 12$ to $F_{DL\_high} + 15$	$F_{DL\_low} - 12$

NOTE 1: The absolute value of the interferer offset $F_{interferer}$ (offset) shall be further adjusted to $\left(\lceil |F_{\text{interferer}}| / SCS \rceil + 0.5\right) SCS$ MHz with SCS the sub-carrier spacing of the carrier closest to the interferer in MHz. The interferer is an NR signal with 15 kHz SCS.
NOTE 2: For each carrier frequency, the requirement applies for two interferer carrier frequencies: a: $-BW_{channel\ CA}/2 - F_{Ioffset,\ case\ 1}$; b: $BW_{channel\ CA}/2 + F_{Ioffset,\ case\ 1}$
NOTE 3: $BW_{channel\ CA}$ denotes the aggregated channel bandwidth of the wanted signal
NOTE 4: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1A.

For the UE which supports inter-band CA configuration in Table 7.3A.3.2.3-1, $P_{interferer}$ power defined in Table 7.6A.2.2.5-1a and Table 7.6A.2.2.5-2a is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.3.2.3-1.

7.6A.3 Out-of-band blocking for CA

7.6A.3.0 Minimum conformance requirements

7.6A.3.0.1 Out-of-band blocking for Intra-band contiguous CA

For intra-band contiguous carrier aggregation the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test.

The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Tables 7.6A.3.0.1-1 and Tables 7.6A.3.0.1-2 being on either side of the aggregated signal. The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

Table 7.6A.3.0.1-1: Out-of-band blocking parameters for intra-band contiguous CA

RX parameter	Units	CA bandwidth class			
		B	C	D	
Power in transmission bandwidth configuration	dBm	REFSENS + CA bandwidth class specific value below			
	dB	9	9	9	
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.					

Table 7.6A.3.0.1-2: Out of-band blocking for intra-band contiguous CA

NR band	Parameter	Unit	Range1	Range 2	Range 3
	$P_{interferer}$	dBm	-45	-30	-15
n41, n48[5], n66, n71	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} < -15 or 15 < f – F_{DL_high} < 60	-85 < f – F_{DL_low} ≤ -60 or 60 ≤ f – F_{DL_high} < 85	1 ≤ f ≤ F_{DL_low} – 85 or F_{DL_high} + 85 ≤ f ≤ 12750
n77, n78 (NOTE 3)	$F_{interferer}$ (CW)	MHz	N/A	N/A	1 ≤ f ≤ F_{DL_low} – MAX(200,3*$BW_{Channel\_CA}$) or F_{DL_high}+ MAX(200,3*$BW_{Channel\_CA}$) ≤ f ≤ 12750
n79 (NOTE 4)	$F_{interferer}$ (CW)	MHz	N/A	N/A	1 ≤ f ≤ F_{DL_low} – MAX(150,3*$BW_{Channel\_CA}$) or F_{DL_high} + MAX(150,3*$BW_{Channel\_CA}$) ≤ f ≤ 12750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: $BW_{Channel\_CA}$ denotes the aggregated channel bandwidth of the wanted signal NOTE 3: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz. For $BW_{Channel\_CA}$ > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3*$BW_{Channel\_CA}$ from the band edge. For $BW_{Channel\_CA}$ larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel\_CA}$ from the band edge. NOTE 4: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 3650 MHz and $F_{Interferer}$ < 5750 MHz. For $BW_{Channel\_CA}$ ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel\_CA}$ from the band edge. NOTE 5: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz					

7.6A.3.0.2 Out-of-band blocking for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with one uplink carrier and two or more downlink sub-blocks, the out-of-band blocking requirements are defined with the uplink configuration in accordance with table 7.3A.0.2.3-1. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.6.3 and 7.6A.3.0.1 for one component carrier and two component carriers per sub-block, respectively. The requirements apply with all downlink carriers active.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

7.6A.3.0.3 Out-of-band blocking for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the out-of-band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.3 for each component carrier while all downlink carriers are active.

For inter-band carrier aggregation with component carriers in operating bands < 2.7GHz including n48, and for $F_{DL\_Low(j)} - 15\ \text{MHz} \le f \le F_{DL\_High(j)} + 15\ \text{MHz}$, the appropriate adjacent channel selectivity and in-band blocking requirements in the respective subclauses 7.5 and 7.6.2 shall be applied for carrier *j*. For inter-band carrier aggregation with component carriers in operating bands > 2.7GHz excluding n48, and for $F_{DL\_Low(j)} - 3^* BW_{Channel} \le f \le F_{DL\_High(j)} + 3^* BW_{Channel}$, the appropriate adjacent channel selectivity and in-band blocking requirements in the respective subclauses 7.5 and 7.6.2 shall be applied for carrier *j*. $F_{DL\_Low(j)}$ and $F_{DL\_High(j)}$ denote the respective lower and upper frequency limits of the operating band containing carrier *j*, *j* = 1,…,X, with carriers numbered in increasing order of carrier frequency and X the number of component carriers in the band combination. $BW_{Channel}$ denotes the channel bandwidth of the wanted signal component carrier j. If CW interferer falls in a gap between $F_{DL\_High(j)}$ and $F_{DL\_Low(j+1)}$ where the corresponding OOB ranges 1 and 2 overlap, then the lower level interferer limit of the overlapping OOB ranges applies.

For inter-band carrier aggregation with uplink assigned to two NR bands, the out-of-band blocking requirements specified in subclause 7.6.3 shall be met with the transmitter power for the uplink set to 7 dB below $P_{CMAX\_L,f,c}$ for each serving cell c.

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.6.3.3-2 and 7.6.3.3-4 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

For inter-band CA combination listed in Table 7.6A.3.0.3-1, exceptions to the requirement specified in Table 7.6A.3.0.3-2 are allowed when the second order intermodulation product of the lower frequency band UL carrier and the CW interfering signal fully or partially overlaps with the higher frequency band DL carrier.

Table 7.6A.3.0.3-1: CA band combination with exceptions allowed

CA band combination
CA_n8-n78
CA_n8-n79
CA_n28-n78

Table 7.6A.3.0.3-2: Requirement for out-of-band blocking exceptions

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44[1]
$\left\|f_{Interferer} \pm f_{UL}^{LB} - f_{DL}^{HB}\right\| \le (BW_{UL}^{LB} + BW_{DL}^{HB})/2$ NOTE 1: The requirement applies when $\left\|f_{Interferer} \pm f_{UL}^{LB} - f_{DL}^{HB}\right\| \le (BW_{UL}^{LB} + BW_{DL}^{HB})/2$, where $f_{UL}^{LB} f_{UL}^{LB}$ and $f_{DL}^{HB} f_{DL}^{HB}$ are the carrier frequencies for lower frequency band UL and higher frequency band DL, respectively. $BW_{UL}^{LB} BW_{UL}^{LB}$ and $BW_{DL}^{HB} BW_{DL}^{HB}$ are the channel bandwidths configured for lower frequency band UL carrier and higher frequency band DL carrier in MHz, respectively.		

For all interferer frequency ranges specified in subclause 7.6.3 a maximum of

$$\left\lfloor \max\left(24, 6 \cdot \lceil n \cdot N_{RB}/6 \rceil\right) / \min\left(\lfloor n \cdot N_{RB}/10 \rfloor, 5\right) \right\rfloor$$

exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a step size of $\min\left(\lfloor BW_{channel}/2 \rfloor, 5\right)$ MHz with N_{RB} the number of resource blocks in the downlink transmission bandwidth configuration, $BW_{Channel}$ the bandwidth of the frequency channel in MHz and n = 1, 2, 3 for SCS = 15, 30, 60 kHz, respectively. For these exceptions, the requirements in subclause 7.7 apply.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

The normative reference for this requirement is TS 38.101-1 [2] clause 7.6A.3.

7.6A.3.1 Out-of-band blocking for CA (2DL CA)

7.6A.3.1.1 Test purpose

Out-of-band band blocking for CA is defined for an unwanted CW interfering signal falling more than 15 MHz or $3*BW_{Channel\_CA}$ below or above the UE receive band, at which a given average throughput shall meet or exceed the requirement for the specified measurement channels.

For the first 15 MHz or $3* BW_{Channel\_CA}$ below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in sub-clause 7.5A and sub-clause 7.6A.2 shall be applied.

The lack of out-of-band blocking ability will decrease the coverage area when other e-NodeB transmitters exist (except in the adjacent channels and spurious response).

7.6A.3.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 2DL CA.

7.6A.3.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.6A.3.0.

7.6A.3.1.4 Test description

7.6A.3.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in table 7.6A.3.1.4.1-1, 7.6A.3.1.4.1-2 or 7.6A.3.1.4.1-3. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6A.3.1.4.1-1: Test configuration table for Intra-band contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal				
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Highest N_{RB_agg} (NOTE 3)				
Test SCS as specified in Table 5.3.5-1	Lowest				
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to table 7.3.2.4.1-3. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.6A.3.1.4.1-2: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal				
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range for PCC and SCC				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Highest N_{RB_agg} for PCC and SCC				
Test SCS as specified in Table 5.3.5-1	Lowest				
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to table 7.3.2.4.1-3. NOTE 3: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.6A.3.1.4.1-3: Test configuration table for Intra-band non-contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		NOTE 1			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Highest N_{RB_agg} for PCC and SCC, NOTE 1			
Test SCS as specified in Table 5.3.5-1		Lowest			
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.1.4.1-3. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.6A.3.1.4.1-1, Table 7.6A.3.1.4.1-2 or Table 7.6A.3.1.4.1-3.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.6A.3.1.4.3.

7.6A.3.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.6A.3.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6A.3.1.4.1-1, 7.6A.3.1.4.1-2 or 7.6A.3.1.4.1-3 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6A.3.1.4.1-1, 7.6A.3.1.4.1-2 or 7.6A.3.1.4.1-3 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6. Set the parameters of the CW signal generator for an interfering signal below the CA Band for intra-band CA, or below the SCC's operating band for inter-band CA according to table 7.6A.3.1.5.1-2, 7.6A.3.1.5.3-2 or 7.6A.3.1.5.3-4. The frequency step size is $\min\left(\left\lfloor BW_{channel}/2\right\rfloor, 5\right)$ MHz.

If CW interferer falls in a gap between $F_{DL\_High(j)}$ and $F_{DL\_Low(j+1)}$ where the corresponding OOB ranges 1 and 2 overlap, then the lower level interferer limit of the overlapping OOB ranges applies.

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.6A.3.1.5.3-2 and 7.6A.3.1.5.3-4 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

For inter-band CA combination listed in Table 7.6A.3.1.5.3-5, exceptions to the requirement specified in Table 7.6A.3.1.5.3-6 are allowed when the second order intermodulation product of the lower frequency band UL carrier and the CW interfering signal fully or partially overlaps with the higher frequency band DL carrier.

7. Set the downlink signal level according to the table 7.6A.3.1.5.1-1, 7.6A.3.1.5.3-1 or 7.6A.3.1.5.3-3 for both carriers. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.6A.3.1.5.1-1, 7.6A.3.1.5.3-1 or 7.6A.3.1.5.3-3 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to Annex H.2A for inter-band CA. Measure the average throughput of both carriers for a duration sufficient to achieve statistical significance according to Annex H.2A for intra-band CA.

9. Record the frequencies for which the throughput doesn't meet the requirements.

10. Repeat steps from 6 to 9, using an interfering signal above the CA Band for intra-band CA, or above the SCC's operating band for inter-band CA at step 6.

11. For Inter-band CA: Switch the SCell into PCell and repeat steps 1 to 10, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6A.3.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.6A.3.1.5 Test requirement

7.6A.3.1.5.1 Out-of-band blocking for Intra-band contiguous CA

Except for the spurious response frequencies recorded in step 9 of test procedure, the throughput measurement derived in the test procedure of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6A.3.1.5.1-1 and 7.6A.3.1.5.1-2.

The number of spurious response frequencies recorded in step 9 of test procedure shall not exceed

$$\left\lfloor \max\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\}/\min\{\lfloor n\cdot N_{RB}/10\rfloor, 5\}\right\rfloor$$

in each assigned frequency channel when measured using a

$$\min\left(\lfloor BW_{channel}/2\rfloor, 5\right)$$

MHz step size. For these exceptions the requirements of clause 7.7A Spurious Response are applicable.

Table 7.6A.3.1.5.1-1: Out-of-band blocking parameters for intra-band contiguous CA

RX parameter	Units	CA bandwidth class	
		B	C
Power in transmission bandwidth configuration	dBm	REFSENS + CA bandwidth class specific value below	
	dB	9	9
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.			

7.6A.3.1.5.1-2: Out of-band blocking for intra-band contiguous CA

NR band	Parameter	Unit	Range1	Range 2	Range 3
	$P_{interferer}$	dBm	-45	-30	-15
n41, n48[5], n66, n71	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} < -15 or 15 < f – F_{DL_high} < 60	-85 < f – F_{DL_low} ≤ -60 or 60 ≤ f – F_{DL_high} < 85	1 ≤ f ≤ F_{DL_low} – 85 or F_{DL_high} + 85 ≤ f ≤ 12750
n77, n78 (NOTE 3)	$F_{interferer}$ (CW)	MHz	N/A	N/A	1 ≤ f ≤ F_{DL_low} – MAX(200,3*$BW_{Channel\_CA}$) or F_{DL_high}+ MAX(200,3*$BW_{Channel\_CA}$) ≤ f ≤ 12750
n79 (NOTE 4)	$F_{interferer}$ (CW)	MHz	N/A	N/A	1 ≤ f ≤ F_{DL_low} – MAX(150,3*$BW_{Channel\_CA}$) or F_{DL_high} + MAX(150,3*$BW_{Channel\_CA}$) ≤ f ≤ 12750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: $BW_{Channel\_CA}$ denotes the aggregated channel bandwidth of the wanted signal NOTE 3: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz. For $BW_{Channel\_CA}$ > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3*$BW_{Channel\_CA}$ from the band edge. For $BW_{Channel\_CA}$ larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel\_CA}$ from the band edge. NOTE 4: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 3650 MHz and $F_{Interferer}$ < 5750 MHz. For $BW_{Channel\_CA}$ ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel\_CA}$ from the band edge. NOTE 5: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz					

7.6A.3.1.5.2 Out-of-band blocking for Intra-band non-contiguous CA

Except for the spurious response frequencies recorded in step 9 of test procedure, the throughput measurement derived in the test procedure of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the

DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6A.3.1.5.3-1 and 7.6A.3.1.5.3-2 for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz and Tables 7.6A.3.1.5.3-3 and 7.6A.3.1.5.3-4 for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz.

The number of spurious response frequencies recorded in step 9 of test procedure shall not exceed $\left\lfloor \max\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\}/\min\{\lfloor n\cdot N_{RB}/10\rfloor, 5\}\right\rfloor$ in each assigned frequency channel when measured using a $\min\left(\lfloor BW_{channel}/2\rfloor, 5\right)$ MHz step size. For these exceptions the requirements of clause 7.7A Spurious Response are applicable.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

7.6A.3.1.5.3 Out-of-band blocking for Inter-band CA

Except for the spurious response frequencies recorded in step 9 of test procedure, the throughput measurement derived in the test procedure of SCC shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6A.3.1.5.3-1 and 7.6A.3.1.5.3-2 for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz and Tables 7.6A.3.1.5.3-3 and 7.6A.3.1.5.3-4 for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz.

The number of spurious response frequencies recorded in step 9 of test procedure shall not exceed $\left\lfloor \max\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\}/\min\{\lfloor n\cdot N_{RB}/10\rfloor, 5\}\right\rfloor$ in each assigned frequency channel when measured using a $\min\left(\lfloor BW_{channel}/2\rfloor, 5\right)$ MHz step size. For these exceptions the requirements of clause 7.7A Spurious Response are applicable.

Table 7.6A.3.1.5.3-1: Out-of-band blocking parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	6	7	9	10
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	11	12	13	14	15
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	15.5	16			
NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.6A.3.1.5.3-2: Out of-band blocking for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Range 1	Range 2	Range 3
n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n34, n38, n39, n40, n41, n48[5], n50, n51, n66, n70, n71, n74, n75, n76	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} < -15 or 15 < f – F_{DL_high} < 60	-85 < f – F_{DL_low} ≤ -60 or 60 ≤ f – F_{DL_high} < 85	1 ≤ f ≤ F_{DL_low} – 85 or F_{DL_high} + 85 ≤ f ≤ 12750

NOTE1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz.

NOTE 2: For band 51 the F_{DL_high} of band 50 is applied as F_{DL_high} for band 51. For band 50, the F_{DL_low} of band 51 is applied as F_{DL_low} for band 50.

NOTE 3: For band 76 the F_{DL_high} of band 75 is applied as F_{DL_high} for band 76. For band 75, the F_{DL_low} of band 76 is applied as F_{DL_low} for band 75.

NOTE 4: For UEs supporting both bands 38 and 41, the F_{DL_high} and F_{DL_low} of band 41 is applied as F_{DL_high} and F_{DL_low} for band 38.

NOTE 5: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1. The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz.

NOTE 6: Void.

NOTE 7: For UE supporting both bands 25 and 70, the F_{DL_high} of band 70 is applied as F_{DL_high} for band 25, and the F_{DL_low} of band 25 is applied as F_{DL_low} for band 70.

Table 7.6A.3.1.5.3-3: Out-of-band blocking parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	9	9	9	9	

NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

Table 7.6A.3.1.5.3-4: Out of-band blocking for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

NR band	Parameter	Unit	Range1	Range 2	Range 3
n77, n78 (NOTE 3)	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} ≤ -3*$BW_{Channel}$ or 3*$BW_{Channel}$ ≤ f – F_{DL_high} < 60	-200 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 200	1 ≤ f ≤ F_{DL_low} – MAX(200,3*$BW_{Channel}$) or F_{DL_high} + MAX(200,3*$BW_{Channel}$) ≤ f ≤ 12750
n79 (NOTE 4)	$F_{interferer}$ (CW)	MHz	N/A	-150 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 150	1 ≤ f ≤ F_{DL_low} – MAX(150,3*$BW_{Channel}$) or F_{DL_high} + MAX(150,3*$BW_{Channel}$) ≤ f ≤ 12750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: $BW_{Channel}$ denotes the channel bandwidth of the wanted signal NOTE 3: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz. For $BW_{Channel}$ > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. For $BW_{Channel}$ larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. NOTE 4: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 3650 MHz and $F_{Interferer}$ < 5750 MHz. For $BW_{Channel}$ ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge.					

If CW interferer falls in a gap between $F_{DL\_High(j)}$ and $F_{DL\_Low(j+1)}$ where the corresponding OOB ranges 1 and 2 overlap, then the lower level interferer limit of the overlapping OOB ranges applies.

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.6A.3.1.5.3-2 and 7.6A.3.1.5.3-4 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

For inter-band CA combination listed in Table 7.6A.3.1.5.3-5, exceptions to the requirement specified in Table 7.6A.3.1.5.3-6 are allowed when the second order intermodulation product of the lower frequency band UL carrier and the CW interfering signal fully or partially overlaps with the higher frequency band DL carrier.

Table 7.6A.3.1.5.3-5: CA band combination with exceptions allowed

CA band combination
CA_n8-n78
CA_n8-n79
CA_n28-n78

Table 7.6A.3.1.5.3-6: Requirement for out-of-band blocking exceptions

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44[1]
NOTE 1: The requirement applies when $\left|f_{Interferer} \pm f_{UL}^{LB} - f_{DL}^{HB}\right| \leq (BW_{UL}^{LB} + BW_{DL}^{HB})/2$, where f_{UL}^{LB} and f_{DL}^{HB} are the carrier frequencies for lower frequency band UL and higher frequency band DL, respectively. BW_{UL}^{LB} and BW_{DL}^{HB} are the channel bandwidths configured for lower frequency band UL carrier and higher frequency band DL carrier in MHz, respectively.		

7.6A.3.2 Out-of-band blocking for CA (3DL CA)

7.6A.3.2.1 Test purpose

Out-of-band band blocking for CA is defined for an unwanted CW interfering signal falling more than 15 MHz or $3*BW_{Channel\_CA}$ below or above the UE receive band, at which a given average throughput shall meet or exceed the requirement for the specified measurement channels.

For the first 15 MHz or $3*BW_{Channel\_CA}$ below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in sub-clause 7.5A and sub-clause 7.6A.2 shall be applied.

The lack of out-of-band blocking ability will decrease the coverage area when other e-NodeB transmitters exist (except in the adjacent channels and spurious response).

7.6A.3.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 3DL CA.

7.6A.3.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.6A.3.0.

7.6A.3.2.4 Test description

7.6A.3.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 7.6A.3.2.4.1-1 or 7.6A.3.2.4.1-2. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6A.3.2.4.1-1: Test configuration table for Intra-band contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg} (NOTE 3)		
Test SCS as specified in Table 5.3.5-1			Lowest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCCs RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.6A.3.2.4.1-2: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Inter-band : Mid range for PCC and SCCs Intra-band contiguous + Inter-band: Mid range for PCC and SCCs Intra-band non-contiguous + Inter-band: Mid range for PCC and SCCs with maxWGap for Intra-band non-contiguous		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg} for PCC and SCCs(NOTE 3)		
Test SCS as specified in Table 5.3.5-1			Lowest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCCs RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.6A.3.2.4.1-1 or Table 7.6A.3.2.4.1-2.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.6A.3.2.4.3.

7.6A.3.2.4.2 Test procedure

1. Configure SCCs according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.6A.3.2.4.3.

3. SS activates SCCs by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6A.3.2.4.1-1 or 7.6A.3.2.4.1-2 on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6A.3.2.4.1-1 or 7.6A.3.2.4.1-2 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6. Set the parameters of the CW signal generator for an interfering signal below the CA Band for intra-band CA, or below each SCC's operating band for inter-band CA according to Table 7.6A.3.2.5.1-2, 7.6A.3.2.5.2-2 or 7.6A.3.2.5.2-4. The frequency step size is $\min\left(\left\lfloor BW_{channel}/2\right\rfloor,5\right)$ MHz.

   If CW interferer falls in a gap between $F_{DL\_High(j)}$ and $F_{DL\_Low(j+1)}$ where the corresponding OOB ranges 1 and 2 overlap, then the lower level interferer limit of the overlapping OOB ranges applies.

   For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.6A.3.2.5.2-2 and 7.6A.3.2.5.2-4 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1. Use the highest $\Delta R_{IB,c}$ among CA bands for $P_{interferer}$ calculation.

   For inter-band CA combination listed in Table 7.6A.3.2.5.2-5, exceptions to the requirement specified in Table 7.6A.3.2.5.2-6 are allowed when the second order intermodulation product of the lower frequency band UL carrier and the CW interfering signal fully or partially overlaps with the higher frequency band DL carrier.

7. Set the downlink signal level according to Table 7.6A.3.2.5.1-1, 7.6A.3.2.5.2-1 or 7.6A.3.2.5.2-3 for all carriers. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.6A.3.2.5.1-1, 7.6A.3.2.5.2-1 or 7.6A.3.2.5.2-3 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. Measure the average throughput of SCCs simultaneously for a duration sufficient to achieve statistical significance according to Annex H.2A for inter-band CA. Measure the average throughput of all carriers simultaneously for a duration sufficient to achieve statistical significance according to Annex H.2A for intra-band CA.

9. Record the frequencies for which the throughput doesn't meet the requirements and for each frequency, the carriers for which the throughput was not met.

10. Repeat steps 6 to 8 for each recorded frequency-carrier pair, with exception of pairs for which $\Delta R_{IB,c}$ is the same as ΔR_{IB} used in Step 6. In Step 6 use only recorded frequencies for interferer placement and use $\Delta R_{IB,c}$ relevant to recorded carrier for $P_{interferer}$ calculation. Remove the frequency-carrier pairs that meet the throughput requirements from the record.

11. Repeat steps from 6 to 10, using an interfering signal above the CA Band for intra-band CA, or above each SCC's operating band for inter-band CA at step 6.

12. For Inter-band CA: Switch the SCell into PCell and repeat steps 1 to 11, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6A.3.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.6A.3.2.5 Test requirement

7.6A.3.2.5.1 Out-of-band blocking for Intra-band contiguous CA

Except for the spurious response frequencies recorded in step 9 of test procedure, the throughput measurement derived in the test procedure of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6A.3.2.5.1-1 and 7.6A.3.2.5.1-2.

The number of spurious response frequencies recorded in step 9 of test procedure shall not exceed $\left\lfloor \max\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\}/\min\{\lfloor n\cdot N_{RB}/10\rfloor, 5\}\right\rfloor$ in each assigned frequency channel when measured using a $\min(\lfloor BW_{channel}/2\rfloor, 5)$ MHz step size. For these exceptions the requirements of clause 7.7A Spurious Response are applicable.

Table 7.6A.3.2.5.1-1: Out-of-band blocking parameters for intra-band contiguous CA

RX parameter	Units	CA bandwidth class	
		D	
Power in transmission bandwidth configuration	dBm	REFSENS + CA bandwidth class specific value below	
	dB	9	
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.			

7.6A.3.2.5.1-2: Out of-band blocking for intra-band contiguous CA

NR band	Parameter	Unit	Range1	Range 2	Range 3
	$P_{interferer}$	dBm	-45	-30	-15
n41, n48[5], n66, n71	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} < -15 or 15 < f – F_{DL_high} < 60	-85 < f – F_{DL_low} ≤ -60 or 60 ≤ f – F_{DL_high} < 85	1 ≤ f ≤ F_{DL_low} – 85 or F_{DL_high} + 85 ≤ f ≤ 12750
n77, n78 (NOTE 3)	$F_{interferer}$ (CW)	MHz	N/A	N/A	1 ≤ f ≤ F_{DL_low} – MAX(200,3*$BW_{Channel\_CA}$) or F_{DL_high}+ MAX(200,3*$BW_{Channel\_CA}$) ≤ f ≤ 12750
n79 (NOTE 4)	$F_{interferer}$ (CW)	MHz	N/A	N/A	1 ≤ f ≤ F_{DL_low} – MAX(150,3*$BW_{Channel\_CA}$) or F_{DL_high} + MAX(150,3*$BW_{Channel\_CA}$) ≤ f ≤ 12750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: $BW_{Channel\_CA}$ denotes the aggregated channel bandwidth of the wanted signal NOTE 3: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz. For $BW_{Channel\_CA}$ > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3*$BW_{Channel\_CA}$ from the band edge. For $BW_{Channel\_CA}$ larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel\_CA}$ from the band edge. NOTE 4: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 3650 MHz and $F_{Interferer}$ < 5750 MHz. For $BW_{Channel\_CA}$ ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel\_CA}$ from the band edge. NOTE 5: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz.					

7.6A.3.2.5.2 Out-of-band blocking for Inter-band CA

Except for the spurious response frequencies recorded in step 9 and step 10 of test procedure, the throughput measurement derived in the test procedure of SCCs shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6A.3.2.5.2-1 and 7.6A.3.2.5.2-2 for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz and Tables 7.6A.3.2.5.2-3 and 7.6A.3.2.5.2-4 for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz.

The number of spurious response frequencies recorded in step 9 and step 10 of test procedure shall not exceed $\left\lfloor \max\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\}/\min\{\lfloor n\cdot N_{RB}/10\rfloor, 5\}\right\rfloor$ in each assigned frequency channel when measured using a $\min(\lfloor BW_{channel}/2\rfloor, 5)$ MHz step size. For these exceptions the requirements of clause 7.7A Spurious Response are applicable.

Table 7.6A.3.2.5.2-1: Out-of-band blocking parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	6	7	9	10
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	11	12	13	14	15
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	15.5	16			
NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.6A.3.2.5.2-2: Out of-band blocking for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Range 1	Range 2	Range 3
n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n34, n38, n39, n40, n41, n48[5], n50, n51, n66, n70, n71, n74, n75, n76	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	$-60 < f - F_{DL\_low} < -15$ or $15 < f - F_{DL\_high} < 60$	$-85 < f - F_{DL\_low} \le -60$ or $60 \le f - F_{DL\_high} < 85$	$1 \le f \le F_{DL\_low} - 85$ or $F_{DL\_high} + 85 \le f \le 12750$

NOTE1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz.

NOTE 2: For band 51 the F_{DL_high} of band 50 is applied as F_{DL_high} for band 51. For band 50, the F_{DL_low} of band 51 is applied as F_{DL_low} for band 50.

NOTE 3: For band 76 the F_{DL_high} of band 75 is applied as F_{DL_high} for band 76. For band 75, the F_{DL_low} of band 76 is applied as F_{DL_low} for band 75.

NOTE 4: For UEs supporting both bands 38 and 41, the F_{DL_high} and F_{DL_low} of band 41 is applied as F_{DL_high} and F_{DL_low} for band 38.

NOTE 5: n48 follows the requirement in this frequency range according to the general requirement defined in Clause 7.1. The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz.

NOTE 6: Void.

NOTE 7: For UE supporting both bands 25 and 70, the F_{DL_high} of band 70 is applied as F_{DL_high} for band 25, and the F_{DL_low} of band 25 is applied as F_{DL_low} for band 70.

Table 7.6A.3.2.5.2-3: Out-of-band blocking parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	9	9	9	9	
NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.6A.3.2.5.2-4: Out of-band blocking for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

NR band	Parameter	Unit	Range1	Range 2	Range 3
n77, n78 (NOTE 3)	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} ≤ -3*$BW_{Channel}$ or 3*$BW_{Channel}$ ≤ f – F_{DL_high} < 60	-200 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 200	1 ≤ f ≤ F_{DL_low} – MAX(200,3*$BW_{Channel}$) or F_{DL_high} + MAX(200,3*$BW_{Channel}$) ≤ f ≤ 12750
n79 (NOTE 4)	$F_{interferer}$ (CW)	MHz	N/A	-150 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 150	1 ≤ f ≤ F_{DL_low} – MAX(150,3*$BW_{Channel}$) or F_{DL_high} + MAX(150,3*$BW_{Channel}$) ≤ f ≤ 12750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: $BW_{Channel}$ denotes the channel bandwidth of the wanted signal NOTE 3: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz. For $BW_{Channel}$ > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. For $BW_{Channel}$ larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. NOTE 4: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 3650 MHz and $F_{Interferer}$ < 5750 MHz. For $BW_{Channel}$ ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge.					

If CW interferer falls in a gap between $F_{DL\_High(j)}$ and $F_{DL\_Low(j+1)}$ where the corresponding OOB ranges 1 and 2 overlap, then the lower level interferer limit of the overlapping OOB ranges applies.

For the UE which supports inter-band CA configuration in Table 7.3A.3.5.1.3-5, $P_{interferer}$ power defined in Table 7.6A.3.2.5.2-2 and 7.6A.3.2.5.2-4 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.3.5.1.3-1.

For inter-band CA combination listed in Table 7.6A.3.2.5.2-5, exceptions to the requirement specified in Table 7.6A.3.2.5.2-6 are allowed when the second order intermodulation product of the lower frequency band UL carrier and the CW interfering signal fully or partially overlaps with the higher frequency band DL carrier.

Table 7.6A.3.2.5.2-5: CA band combination with exceptions allowed

CA band combination
CA_n8-n78
CA_n8-n79
CA_n28-n78

Table 7.6A.3.2.5.2-6: Requirement for out-of-band blocking exceptions

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44[1]
NOTE 1: The requirement applies when $\left|f_{Interferer} \pm f_{UL}^{LB} - f_{DL}^{HB}\right| \le (BW_{UL}^{LB} + BW_{DL}^{HB})/2$, where f_{UL}^{LB} and f_{DL}^{HB} are the carrier frequencies for lower frequency band UL and higher frequency band DL, respectively. BW_{UL}^{LB} and BW_{DL}^{HB} are the channel bandwidths configured for lower frequency band UL carrier and higher frequency band DL carrier in MHz, respectively.		

7.6A.3.3 Out-of-band blocking for CA (4DL CA)

7.6A.3.3.1 Test purpose

Out-of-band band blocking for CA is defined for an unwanted CW interfering signal falling more than 15 MHz or 3*$BW_{Channel\_CA}$ below or above the UE receive band, at which a given average throughput shall meet or exceed the requirement for the specified measurement channels.

For the first 15 MHz or 3*$BW_{Channel\_CA}$ below or above the UE receive band the appropriate in-band blocking or adjacent channel selectivity in sub-clause 7.5A and sub-clause 7.6A.2 shall be applied.

The lack of out-of-band blocking ability will decrease the coverage area when other e-NodeB transmitters exist (except in the adjacent channels and spurious response).

7.6A.3.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 4DL CA.

7.6A.3.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.6A.3.0.

7.6A.3.3.4 Test description

7.6A.3.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 7.6A.3.3.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6A.3.3.4.1-1: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Inter-band : Mid range for PCC and SCCs Intra-band contiguous + Inter-band: Mid range for PCC and SCCs Intra-band non-contiguous + Inter-band: Mid range for PCC and SCCs with maxWGap for Intra-band non-contiguous		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg} for PCC and SCCs(NOTE 3)		
Test SCS as specified in Table 5.3.5-1			Lowest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCCs RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.6A.3.3.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.6A.3.3.4.3.

7.6A.3.3.4.2 Test procedure

1. Configure SCCs according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.6A.3.3.4.3.

3. SS activates SCCs by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6A.3.3.4.1-1 on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6A.3.3.4.1-1 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6. Set the parameters of the CW signal generator for an interfering signal below each SCC's operating band for inter-band CA according to Table 7.6A.3.3.5.1-2 or 7.6A.3.3.5.1-4. The frequency step size is $\min\left(\lfloor BW_{channel}/2 \rfloor, 5\right)$ MHz.

   If CW interferer falls in a gap between $F_{DL\_High(j)}$ and $F_{DL\_Low(j+1)}$ where the corresponding OOB ranges 1 and 2 overlap, then the lower level interferer limit of the overlapping OOB ranges applies.

   For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.6A.3.3.5.1-2 and 7.6A.3.3.5.1-4 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1. Use the highest $\Delta R_{IB,c}$ among CA bands for $P_{interferer}$ calculation.

   For inter-band CA combination listed in Table 7.6A.3.3.5.1-5, exceptions to the requirement specified in Table 7.6A.3.3.5.1-6 are allowed when the second order intermodulation product of the lower frequency band UL carrier and the CW interfering signal fully or partially overlaps with the higher frequency band DL carrier.

7. Set the downlink signal level according to the Table 7.6A.3.3.5.1-1,or 7.6A.3.3.5.1-3 for all carriers. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.6A.3.3.5.1-1, or 7.6A.3.3.5.1-3 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. Measure the average throughput of SCCs simultaneously for a duration sufficient to achieve statistical significance according to Annex H.2A for inter-band CA.

9. Record the frequencies for which the throughput doesn't meet the requirements and for each frequency, the carriers for which the throughput was not met.

10. Repeat steps 6 to 8 for each recorded frequency-carrier pair, with exception of pairs for which $\Delta R_{IB,c}$ is the same as ΔR_{IB} used in Step 6. In Step 6 use only recorded frequencies for interferer placement and use $\Delta R_{IB,c}$ relevant to recorded carrier for $P_{interferer}$ calculation. Remove the frequency-carrier pairs that meet the throughput requirements from the record.

11. Repeat steps from 6 to 10, using an interfering signal above each SCC's operating band for inter-band CA at step 6.

12. For Inter-band CA: Switch the SCell into PCell and repeat steps 1 to 11, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6A.3.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.6A.3.3.5 Test requirement

7.6A.3.3.5.1 Out-of-band blocking for Inter-band CA

Except for the spurious response frequencies recorded in step 9 and step 10 of test procedure, the throughput measurement derived in the test procedure of SCCs shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Tables 7.6A.3.3.5.1-1 and 7.6A.3.3.5.1-2 for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz and Tables 7.6A.3.3.5.1-3 and 7.6A.3.3.5.1-4 for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz.

The number of spurious response frequencies recorded in step 9 and step 10 of test procedure shall not exceed $\left\lfloor \max\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\}/\min\{\lfloor n\cdot N_{RB}/10\rfloor, 5\}\right\rfloor$ in each assigned frequency channel when measured using a $\min(\lfloor BW_{channel}/2\rfloor, 5)$ MHz step size. For these exceptions the requirements of clause 7.7A Spurious Response are applicable.

Table 7.6A.3.3.5.1-1: Out-of-band blocking parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	**10 MHz**	**15 MHz**	**20 MHz**	**25 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	6	7	9	10
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	11	12	13	14	15
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	15.5	16			
NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.6A.3.3.5.1-2: Out of-band blocking for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

NR band	Parameter	Unit	Range 1	Range 2	Range 3
n1, n2, n3, n5, n7, n8, n12, n20, n25, n28, n34, n38, n39, n40, n41, n50, n51, n66, n70, n71, n74, n75, n76	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	$-60 < f - F_{DL\_low} < -15$ or $15 < f - F_{DL\_high} < 60$	$-85 < f - F_{DL\_low} \le -60$ or $60 \le f - F_{DL\_high} < 85$	$1 \le f \le F_{DL\_low} - 85$ or $F_{DL\_high} + 85 \le f \le 12750$
NOTE1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: For band 51 the F_{DL_high} of band 50 is applied as F_{DL_high} for band 51. For band 50, the F_{DL_low} of band 51 is applied as F_{DL_low} for band 50. NOTE 3: For band 76 the F_{DL_high} of band 75 is applied as F_{DL_high} for band 76. For band 75, the F_{DL_low} of band 76 is applied as F_{DL_low} for band 75. NOTE 4: For UEs supporting both bands 38 and 41, the F_{DL_high} and F_{DL_low} of band 41 is applied as F_{DL_high} and F_{DL_low} for band 38. NOTE 6: Void. NOTE 7: For UE supporting both bands 25 and 70, the F_{DL_high} of band 70 is applied as F_{DL_high} for band 25, and the F_{DL_low} of band 25 is applied as F_{DL_low} for band 70.					

Table 7.6A.3.3.5.1-3: Out-of-band blocking parameters for NR bands with $F_{DL\_low} \ge$ 3300 MHz and $F_{UL\_low} \ge$ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**40 MHz**	**50 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	9	9	9	9	
NOTE: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.6A.3.3.5.1-4: Out of-band blocking for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

NR band	Parameter	Unit	Range1	Range 2	Range 3
n77, n78 (NOTE 3)	$P_{interferer}$	dBm	-44	-30	-15
	$F_{interferer}$ (CW)	MHz	-60 < f – F_{DL_low} ≤ -3*$BW_{Channel}$ or 3*$BW_{Channel}$ ≤ f – F_{DL_high} < 60	-200 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 200	1 ≤ f ≤ F_{DL_low} – MAX(200,3*$BW_{Channel}$) or F_{DL_high} + MAX(200,3*$BW_{Channel}$) ≤ f ≤ 12750
n79 (NOTE 4)	$F_{interferer}$ (CW)	MHz	N/A	-150 < f – F_{DL_low} ≤ -MAX(60,3*$BW_{Channel}$) or MAX(60,3*$BW_{Channel}$) ≤ f – F_{DL_high} < 150	1 ≤ f ≤ F_{DL_low} – MAX(150,3*$BW_{Channel}$) or F_{DL_high} + MAX(150,3*$BW_{Channel}$) ≤ f ≤ 12750
NOTE 1: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm for $F_{Interferer}$ > 6000 MHz. NOTE 2: $BW_{Channel}$ denotes the channel bandwidth of the wanted signal NOTE 3: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 2700 MHz and $F_{Interferer}$ < 4800 MHz. For $BW_{Channel}$ > 15 MHz, the requirement for Range 1 is not applicable and Range 2 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. For $BW_{Channel}$ larger than 60 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge. NOTE 4: The power level of the interferer ($P_{Interferer}$) for Range 3 shall be modified to -20 dBm, for $F_{Interferer}$ > 3650 MHz and $F_{Interferer}$ < 5750 MHz. For $BW_{Channel}$ ≥ 40 MHz, the requirement for Range 2 is not applicable and Range 3 applies from the frequency offset of 3*$BW_{Channel}$ from the band edge.					

If CW interferer falls in a gap between $F_{DL\_High(j)}$ and $F_{DL\_Low(j+1)}$ where the corresponding OOB ranges 1 and 2 overlap, then the lower level interferer limit of the overlapping OOB ranges applies.

For the UE which supports inter-band CA configuration in Table 7.3A.3.5.1.3-5, $P_{interferer}$ power defined in Table 7.6A.3.3.5.1-2 and 7.6A.3.3.5.1-4 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.3.5.1.3-1.

For inter-band CA combination listed in Table 7.6A.3.3.5.1-5, exceptions to the requirement specified in Table 7.6A.3.3.5.1-6 are allowed when the second order intermodulation product of the lower frequency band UL carrier and the CW interfering signal fully or partially overlaps with the higher frequency band DL carrier.

Table 7.6A.3.3.5.1-5: CA band combination with exceptions allowed

CA band combination
CA_n8-n78
CA_n8-n79
CA_n28-n78

Table 7.6A.3.3.5.1-6: Requirement for out-of-band blocking exceptions

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44[1]
NOTE 1: The requirement applies when $\left\|f_{Interferer} \pm f_{UL}^{LB} - f_{DL}^{HB}\right\| \leq (BW_{UL}^{LB} + BW_{DL}^{HB})/2$, where f_{UL}^{LB} and f_{DL}^{HB} are the carrier frequencies for lower frequency band UL and higher frequency band DL, respectively. BW_{UL}^{LB} and BW_{DL}^{HB} are the channel bandwidths configured for lower frequency band UL carrier and higher frequency band DL carrier in MHz, respectively.		

7.6A.4 Narrow band blocking for CA

7.6A.4.0 Minimum conformance requirements

7.6A.4.0.1 Narrow band blocking for Intra-band contiguous CA

For intra-band contiguous carrier aggregation, the downlink SCC(s) shall be configured at nominal channel spacing to the PCC. For FDD, the PCC shall be configured closest to the uplink band. All downlink carriers shall be active throughout the test. The uplink output power shall be set as specified in Table 7.6A.4.0.1-1 with the uplink configuration. For UE(s) supporting one uplink, the uplink configuration of the PCC shall be in accordance with Table 7.3.2.3-3. The UE shall fulfil the minimum requirement in presence of an interfering signal specified in Table 7.6A.4.0.1-1 being on either side of the aggregated signal. The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6A.4.0.1-1.

Table 7.6A.4.0.1-1: Narrow-band blocking for intra-band contiguous CA

NR band	Parameter	Unit	NR CA bandwidth class	
			B	C
n41, n66, n71	P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + NA CA Bandwidth Class specific value below	REFSENS + NA CA Bandwidth Class specific value below
			16	16
	P_{uw} (CW)	dBm	-55	-55
	F_{uw} (offset for Δf = 15 kHz, 30 kHz)	MHz	- F_{offset} – 0.2 / + F_{offset} + 0.2	- F_{offset} – 0.2 / + F_{offset} + 0.2
NOTE 1: The transmitter shall be set a 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.				
NOTE 2: Reference measurement channel is specified in Annexes A.3.2 and A3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.				
NOTE 3: The PREFSENS power level is specified in Table 7.3.2.3-1 and Table 7.3.2.3-2 for two and four antenna ports, respectively.				
NOTE 4: The F_{uw} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to $\left\lfloor F_{interferer}/0.015 + 0.5 \right\rfloor 0.015 + 0.0075$ MHz to be offset from the sub-carrier raster.				

7.6A.4.0.2 Narrow band blocking for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with FDL_low < 2700 MHz and FUL_low < 2700 MHz with one uplink carrier and two or more downlink sub-blocks, the narrow band blocking requirements are defined with the uplink configuration in accordance with Table 7.3A.0.2.2-1. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclauses 7.6.4 and 7.6A.4.0.1 for one component carrier and two component carriers per sub-block, respectively. The requirements apply for in-gap and out-of-gap interferers while all downlink carriers are active.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

7.6A.4.0.3 Narrow band blocking for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the narrow band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.6.4 for each component carrier while all downlink carriers are active.

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, P_{UW} power defined in Table 7.6.4.3-1 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

The normative reference for this requirement is TS 38.101-1 [2] clause 7.6A.4.

7.6A.4.1 Narrow band blocking for CA (2DL CA)

7.6A.4,1.1 Test purpose

Verifies a receiver's ability to receive an NR signal at its assigned CA channel frequencies in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

The lack of narrow-band blocking ability will decrease the coverage area when other e-NodeB transmitters exist (except in the adjacent channels and spurious response).

7.6A.4.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 2DL CA.

7.6A.4.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.6A.4.0.

7.6A.4.1.4 Test description

7.6A.4.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 7.6A.4.1.4.1-1, 7.6A.4.1.4.1-2 or 7.6A.4.1.4.1-3. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6A.4.1.4.1-1: Test configuration table for Intra-band contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal				
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Highest N_{RB_agg} (NOTE 3)				
Test SCS as specified in Table 5.3.5-1	Lowest				
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.6A.4.1.4.1-2: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal				
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range for PCC and SCC				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Highest N_{RB_agg} for PCC and SCC				
Test SCS as specified in Table 5.3.5-1	Lowest				
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.6A.4.1.4.1-3: Test configuration table for Intra-band non-contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal				
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	NOTE 1				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Highest N_{RB_agg} for PCC and SCC, NOTE 1				
Test SCS as specified in Table 5.3.5-1	Lowest				
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.1.4.1-3. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.
4. The DL and UL Reference Measurement Channels are set according to Table 7.6A.4.1.4.1-1, Table 7.6A.4.1.4.1-2 or Table 7.6A.4.1.4.1-3.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.6A.4.1.4.3.

7.6A.4.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.6A.4.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6A.4.1.4.1-1, 7.6A.4.1.4.1-2 or 7.6A.4.1.4.1-3 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.
5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6A.4.1.4.1-1, 7.6A.4.1.4.1-2 or 7.6A.4.1.4.1-3 on PCC. Since the UE has no payload and no loopback data to send, the UE transmits uplink MAC padding bits on the UL RMC.
6. Set the parameters of the CW signal generator for an interfering signal below the CA Band for intra-band CA, or below the SCC's operating band for inter-band CA according to Table 7.6A.4.1.5.1-1 or 7.6A.4.1.5.3-1. For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, P_{UW} power defined in Table 7.6A.4.1.5.3-1is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

7. Set the downlink signal level for both carriers according to 7.6A.4.1.5.1-1 or 7.6A.1.4.5.3-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.6A.4.1.5.1-1 or 7.6A.1.4.5.3-1 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to Annex H.2A for inter-band CA. Measure the average throughput of both carriers for a duration sufficient to achieve statistical significance according to Annex H.2A for intra-band CA.

9. Repeat steps from 6 to 8, using an interfering signal above the CA Band for intra-band CA, and between PCC's and SCC's wanted signal for intra-band non-contiguous CA, or above the SCC's operating band for inter-band CA at step 6.

10. For Inter-band CA: Switch the SCell into PCell and repeat steps 1 to 9, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6A.4.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.6A.4.1.5 Test requirement

7.6A.4.1.5.1 Narrow band blocking for Intra-band contiguous CA

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6A.4.1.5.1-1.

Table 7.6A.4.1.5.1-1: Narrow-band blocking for intra-band contiguous CA

<table>
<tr><th rowspan="2">NR band</th><th rowspan="2">Parameter</th><th rowspan="2">Unit</th><th colspan="2">NR CA bandwidth class</th></tr>
<tr><th>B</th><th>C</th></tr>
<tr><td rowspan="4">n41, n66, n71</td><td rowspan="2">P_w in Transmission Bandwidth Configuration, per CC</td><td rowspan="2">dBm</td><td>REFSENS + NA CA Bandwidth Class specific value below</td><td>REFSENS + NA CA Bandwidth Class specific value below</td></tr>
<tr><td>16</td><td>16</td></tr>
<tr><td>P_{uw} (CW)</td><td>dBm</td><td>-55</td><td>-55</td></tr>
<tr><td>F_{uw} (offset for Δf = 15 kHz, 30 kHz)</td><td>MHz</td><td>- F_{offset} – 0.2
/
+ F_{offset} + 0.2</td><td>- F_{offset} – 0.2
/
+ F_{offset} + 0.2</td></tr>
</table>

NOTE 1:	The transmitter shall be set a 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2:	Reference measurement channel is specified in Annexes A.3.2 and A3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.
NOTE 3:	The PREFSENS power level is specified in Table 7.3.2.3-1 and Table 7.3.2.3-2 for two and four antenna ports, respectively.
NOTE 4:	The F_{uw} (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer and shall be further adjusted to $\lfloor F_{\text{interferer}}/0.015+0.5\rfloor 0.015+0.0075$ MHz to be offset from the sub-carrier raster.

7.6A.4.1.5.2 Narrow band blocking for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz with one uplink carrier and two downlink carriers, the narrow band blocking requirements are defined with the uplink configuration in accordance with Table 7.3A.0.2.2-1. The UE shall meet the requirements for each carrier as specified in subclause 7.6.4 for each component carrier respectively. The requirements apply for in-gap and out-of-gap interferers while all downlink carriers are active.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6A.4.1.5.3-1.

7.6A.4.1.5.3 Narrow band blocking for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the narrow band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested, i.e. the requirements are tested only for the SCell downlink.

The throughput of each carrier, when operated as SCC, shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6A.4.1.5.3-1.

Table 7.6A.4.1.5.3-1: Narrow-band blocking

NR band	Parameter	Unit	Channel Bandwidth											
			5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100MHz
n1, n2, n3, n5, n7, n8, n12, n20, n25 n28, n34, n38, n39, n40, n41, n48, n50, n51, n66,	P_w	dBm	$P_{REFSENS}$ + channel-bandwidth specific value below											
			16	13	14	16	16	16	16	16	16	16	16	16
	P_{uw} (CW)	dBm	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55
	F_{uw} (offset SCS=15 kHz)	MHz	2.7075	5.2125	7.7025	10.2075	13.0275	15.6075	20.5575	25.7025	NA	NA	NA	NA
	F_{uw} (offset SCS=30 kHz)	MHz	NA	NA	NA	NA	NA	NA	NA	NA	30.855	40.935	45.915	50.865

n70, n71, n74														
NOTE 1: The transmitter shall be set a 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 NOTE 2: Reference measurement channel is specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.														

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, P_{UW} power defined in Table 7.6A.4.1.5.3-1 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

7.6A.4.2 Narrow band blocking for CA (3DL CA)

7.6A.4.2.1 Test purpose

Verifies a receiver's ability to receive an NR signal at its assigned CA channel frequencies in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

The lack of narrow-band blocking ability will decrease the coverage area when other e-NodeB transmitters exist (except in the adjacent channels and spurious response).

7.6A.4.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 3DL CA.

7.6A.4.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.6A.4.0.

7.6A.4.2.4 Test description

7.6A.4.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 7.6A.4.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6A.4.2.4.1-1: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Inter-band : Mid range for PCC and SCCs Intra-band contiguous + Inter-band: Mid range for PCC and SCCs Intra-band non-contiguous + Inter-band: Mid range for PCC and SCCs with maxWGap for Intra-band non-contiguous		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg} for PCC and SCCs(NOTE 3)		
Test SCS as specified in Table 5.3.5-1			Lowest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCCs RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.6A.4.2.4.1-1 or Table 7.6A.4.2.4.1-2.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.6A.4.2.4.3.

7.6A.4.2.4.2 Test procedure

1. Configure SCCs according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.6A.4.2.4.3.

3. SS activates SCCs by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6A.4.2.4.1-1 on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6A.4.2.4.1-1 on PCC. Since the UE has no payload and no loopback data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6. Set the parameters of the CW signal generator for an interfering signal below each SCC's operating band for inter-band CA according to Table 7.6A.4.2.5.1-1. For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, P_{UW} power defined in Table 7.6A.4.2.5.1-1is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

7. Set the downlink signal level for all carriers according to Table 7.6A.4.2.5.1-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.6A.4.2.5.1-1 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. Measure the average throughput of SCCs for a duration sufficient to achieve statistical significance according to Annex H.2A for inter-band CA.

9. Repeat steps from 6 to 8, using an interfering signal above each SCC's operating band for inter-band CA at step 6.

10. For Inter-band CA: Switch the SCell into PCell and repeat steps 1 to 9, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6A.4.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.6A.4.2.5 Test requirement

7.6A.4.2.5.1 Narrow band blocking for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the narrow band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested, i.e. the requirements are tested only for the SCell downlink.

The throughput of each carrier, when operated as SCC, shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6A.4.2.5.1-1.

Table 7.6A.4.2.5.1-1: Narrow-band blocking

NR band	Parameter	Unit	Channel Bandwidth											
			5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100MHz
n1, n2, n3,	P_w	dBm	$P_{REFSENS}$ + channel-bandwidth specific value below											
			16	13	14	16	16	16	16	16	16	16	16	16
	P_{uw} (CW)	dBm	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55

n5, n7, n8, n12, n20, n25 n28, n34, n38, n39, n40	F_{uw} (offset SCS= 15 kHz)	MHz	2.7075	5.2125	7.7025	10.2075	13.0275	15.6075	20.5575	25.7025	NA	NA	NA	NA
	F_{uw} (offset SCS= 30 kHz)	MHz	NA	NA	NA	NA	NA	NA	NA	NA	30.855	40.935	45.915	50.865
NOTE 1: The transmitter shall be set a 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 NOTE 2: Reference measurement channel is specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.														

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, P_{UW} power defined in Table 7.6A.4.2.5.1-1 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

7.6A.4.3 Narrow band blocking for CA (4DL CA)

7.6A.4.3.1 Test purpose

Verifies a receiver's ability to receive an NR signal at its assigned CA channel frequencies in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing.

The lack of narrow-band blocking ability will decrease the coverage area when other e-NodeB transmitters exist (except in the adjacent channels and spurious response).

7.6A.4.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 4DL CA.

7.6A.4.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.6A.4.0.

7.6A.4.3.4 Test description

7.6A.4.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 7.6A.4.3.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3 respectively. The details of the

OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6A.4.3.4.1-1: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Inter-band : Mid range for PCC and SCCs Intra-band contiguous + Inter-band: Mid range for PCC and SCCs Intra-band non-contiguous + Inter-band: Mid range for PCC and SCCs with maxWGap for Intra-band non-contiguous		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg} for PCC and SCCs(NOTE 3)		
Test SCS as specified in Table 5.3.5-1			Lowest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCCs RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.6A.4.3.4.1-1 or Table 7.6A.4.3.4.1-2.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.6A.4.3.4.3.

7.6A.4.3.4.2 Test procedure

1. Configure SCCs according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.6A.4.3.4.3.

3. SS activates SCCs by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6A.4.3.4.1-1 on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6A.4.3.4.1-1 on PCC. Since the UE has no payload and no loopback data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6. Set the parameters of the CW signal generator for an interfering signal below each SCC's operating band for inter-band CA according to Table 7.6A.4.3.5.1-1. For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, P_{UW} power defined in Table 7.6A.4.3.5.1-1is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

7. Set the downlink signal level for all carriers according to Table 7.6A.4.3.5.1-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.6A.4.3.5.1-1 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. Measure the average throughput of SCCs for a duration sufficient to achieve statistical significance according to Annex H.2A for inter-band CA.

9. Repeat steps from 6 to 8, using an interfering signal above each SCC's operating band for inter-band CA at step 6.

10. For Inter-band CA: Switch the SCell into PCell and repeat steps 1 to 9, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.6A.4.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.6A.4.3.5 Test requirement

7.6A.4.3.5.1 Narrow band blocking for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the narrow band blocking requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested, i.e. the requirements are tested only for the SCell downlink.

The throughput of each carrier, when operated as SCC, shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.6A.4.3.5.1-1.

Table 7.6A.4.3.5.1-1: Narrow-band blocking

NR band	Parameter	Unit	Channel Bandwidth											
			5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100MHz

n1, n2, n3, n5, n7, n8, n12, n20, n25 n28, n34, n38, n39, n40, n41, n50, n51, n66, n70, n71, n74, n75, n76	P_{w}	dBm	$P_{REFSENS}$ + channel-bandwidth specific value below											
			16	13	14	16	16	16	16	16	16	16	16	16
	P_{uw} (CW)	dBm	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55	-55
	F_{uw} (offset SCS= 15 kHz)	MHz	2.7075	5.2125	7.7025	10.2075	13.0275	15.6075	20.5575	NA	NA	NA	NA	NA
	F_{uw} (offset SCS= 30 kHz)	MHz	NA	NA	NA	NA	NA	NA	NA	25.7025	30.855	40.935	45.915	50.865
NOTE 1: The transmitter shall be set a 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4 NOTE 2: Reference measurement channel is specified in Annexes A.3.2 and A.3.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.														

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, P_{UW} power defined in Table 7.6A.4.3.5.1-1 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

7.6C Blocking characteristics for SUL

7.6C.1 General

FFS

7.6C.2 Inband Blocking for SUL

7.6C.2.1 Test purpose

Same test purpose as in clause 7.6.2.1.

7.6C.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

7.6C.2.3 Minimum conformance requirements

For SUL operation, the in-band blocking requirement for downlink bands specified in clause 7.6.2.3 shall be met.

The normative reference for this requirement is TS 38.101-1 [2] clauses 7.6C.2.

7.6C.2.4 Test description

Same test description as specified in clause 7.6.2.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1

Instead of table 7.6.2.4.1-1 → use Table 7.6C.2.4-1.

Table 7.6C.2.4-1: Test Configuration Table

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range for both SUL carrier and Non-SUL carrier		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Lowest, Mid, Highest for SUL carrier Lowest for Non-SUL carrier		
Test SCS as specified in Table 5.3.5-1			15kHz for both SUL carrier and Non-SUL carrier		
Test Parameters					
Test ID	**DL Configuration**		**UL Configuration**	**SUL Configuration**	
	Mod'n	**RB allocation**	N/A	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1		DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of SUL and DL are defined in Table 7.3C.2.4.1-1. NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1. NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.8 for TE diagram and section A.3.2 for UE diagram.
- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.
- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND RF, Tables 4.6.3-14, 4.6.3-15 and 4.6.3-19 with conditions SUL, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL, additionally the following exceptions shown in Table 7.6C.2.4-2 is considered.

Table 7.6C.2.4-2: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

Table 7.6C.2.4-3: Void

7.6C.2.5 Test requirement

Same test requirement specified in clause 7.6.2.5 for downlink bands shall be met for in-band blocking testing for SUL.

7.6C.3 Out-of-band blocking for SUL

7.6C.3.1 Test Purpose

Same test purpose as in clause 7.6.3.1.

7.6C.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that support SUL operating on the SUL bands.

7.6C.3.3 Minimum conformance requirements

For SUL operation, the out-of-band blocking requirement for downlink bands specified in clause 7.6.3 shall be met. For operation band combination listed in Table 7.6C.3.3-1, exceptions to the requirement specified in Table 7.6C.3.3-2 are allowed when the second order intermodulation product of the SUL carrier and the CW interfering signal fully or partially overlaps with the DL carrier.

Table 7.6C.3.3-1: SUL operating band combination with exceptions allowed

NR Band combination for SUL
SUL_n78-n81
SUL_n78-n82
SUL_n78-n83
SUL_n79-n81

Table 7.6C.3.3-2: Requirement for out-of-band blocking exceptions

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44[1]
NOTE 1: The requirement applies when $\lvert f_{Interferer} \pm f_{SUL} - f_{DL} \rvert \le (BW_{SUL} + BW_{DL})/2$, where BW_{SUL} and BW_{DL} are the channel bandwidths configured for SUL and DL (victim) bands in MHz, respectively.		

For all interferer frequency ranges specified in clause 7.6.3 a maximum of

$$\left\lfloor \max\left(24, 6 \cdot \lceil n \cdot N_{RB}/6 \rceil\right) / \min\left(\lfloor n \cdot N_{RB}/10 \rfloor, 5\right) \right\rfloor$$

exceptions are allowed for spurious response frequencies in each assigned frequency channel when measured using a step size of $\min\left(\lfloor CBW/2 \rfloor, 5\right)$ MHz with N_{RB} the number of resource blocks in the downlink transmission bandwidth configuration, *CBW* the bandwidth of the frequency channel in MHz and n = 1, 2, 3 for SCS = 15, 30, 60 kHz, respectively. For these exceptions, the requirements in clause 7.7 apply.

The normative reference for this requirement is TS 38.101-1 [2] clauses 7.6C.3.

7.6C.3.4 Test description

Same test description as specified in clause 7.6.3.4 with following exceptions:

Instead of table 5.3.5-1 → use Table 5.5C-1

Instead of table 7.6.3.4.1-1 → use Table 7.6C.3.4-1.

Table 7.6C.3.4-1: Test Configuration Table

<table>
<tr><th colspan="6">Default Conditions</th></tr>
<tr><td colspan="2">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="4">Normal</td></tr>
<tr><td colspan="2">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="4">Mid range for both Non-SUL carrier
One frequency chosen arbitrarily from low or high range for SUL carrier</td></tr>
<tr><td colspan="2">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="4">Lowest, Mid, Highest for SUL carrier
Lowest for Non-SUL carrier</td></tr>
<tr><td colspan="2">Test SCS as specified in Table 5.3.5-1</td><td colspan="4">15kHz for both SUL carrier and Non-SUL carrier</td></tr>
<tr><th colspan="6">Test Parameters</th></tr>
<tr><th>Test ID</th><th colspan="2">DL Configuration</th><th>UL Configuration</th><th colspan="2">SUL Configuration</th></tr>
<tr><td></td><th>Mod'n</th><th>RB allocation</th><td rowspan="2">N/A</td><th>Mod'n</th><th>RB allocation</th></tr>
<tr><td>1</td><td>CP-OFDM QPSK</td><td>NOTE 1</td><td>DFT-s-OFDM QPSK</td><td>NOTE 1</td></tr>
<tr><td colspan="6">NOTE 1: The specific configuration of SUL and DL are defined in Table 7.3C.2.4.1-1.
NOTE 2: Test Channel Bandwidths are checked separately for each SUL band combination, the applicable channel bandwidths are specified in Table 5.5C-1.
NOTE 3: DFT-s-OFDM PI/2 BPSK test applies only for UEs which supports half Pi BPSK in FR1.
NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.</td></tr>
</table>

- Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.9 for TE diagram and section A.3.2 for UE diagram.

- The parameter setting for the cell are set up according to the TS 38.508-1 [5] subclause 4.4.3.

- Downlink signals are initially setup according to Annex C.0, C.1, C.2 and uplink signals according to Annex G.0, G.1, G.2, and G.3.0 with consideration of supplementary uplink physical channels.

Message contents in initial conditions are according to TS 38.508-1 [5] subclause 4.3.6.1.1.2 ensuring UL/SUL indicator in Table 4.3.6.1.1.2-1 with condition SUL, subclause 4.6 ensuring Table 4.6.1-28 with condition SUL AND RF, Tables 4.6.3-14, 4.6.3-15 and 4.6.3-19 with conditions SUL, and Table 4.6.3-167 with condition PUSCH_PUCCH_ON_SUL, additionally the following exceptions shown in Table 7.6C.3.4-2 is considered.

Table 7.6C.3.4-2: *PUSCH-Config*

Derivation Path: TS 38.508-1 [5], Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED

Table 7.6C.3.4-3: Void

7.6C.3.5 Test Requirement

For SUL operation, the out-of-band blocking requirement for downlink bands specified in clause 7.6.3.5 shall be met. For operation band combination listed in Table 7.6C.3.5-1, exceptions to the requirement specified in Table 7.6C.3.5-2 are allowed when the second order intermodulation product of the SUL carrier and the CW interfering signal fully or partially overlaps with the DL carrier.

Table 7.6C.3.5-1: SUL operating band combination with exceptions allowed

NR Band combination for SUL
SUL_n78-n81
SUL_n78-n82
SUL_n78-n83
SUL_n79-n81

Table 7.6C.3.5-2: Requirement for out-of-band blocking exceptions

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44[1]
NOTE 1: The requirement applies when $\lvert f_{Interferer} \pm f_{SUL} - f_{DL} \rvert \le (BW_{SUL} + BW_{DL})/2$, where BW_{SUL} and BW_{DL} are the channel bandwidths configured for SUL and DL (victim) bands in MHz, respectively.		

For all interferer frequency ranges, a maximum of

$$\left\lfloor \max\{24, 6\cdot\lceil n\cdot N_{RB}/6\rceil\}/\min\{\lfloor n\cdot N_{RB}/10\rfloor, 5\}\right\rfloor$$

exceptions are allowed for the spurious response frequencies recorded in the final step of test procedure in each assigned frequency channel when measured using a step size of $\min(\lfloor CBW/2\rfloor, 5)$ MHz with N_{RB} the number of resource blocks in the downlink transmission bandwidth configuration, *CBW* the bandwidth of the frequency channel in MHz and n = 1, 2, 3 for SCS = 15, 30, 60 kHz, respectively. For these exceptions, the requirements in clause 7.7 apply.

7.6D Blocking characteristics for UL MIMO

7.6D.1 General

The blocking characteristic for UL MIMO is a measure of the receiver's ability of an UE that support UL MIMO to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the spurious response or the adjacent channels, without this unwanted input signal causing a degradation of the performance of the receiver beyond a specified limit. The blocking performance shall apply at all frequencies except those at which a spurious response occur.

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements specified in subclause 7.6 shall be met with the UL MIMO configurations described in sub-clause 6.2D.1. For UL MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

7.6D.2 Inband blocking for UL MIMO

7.6D.2.1 Test purpose

In-band blocking for UL MIMO is defined for an unwanted interfering signal falling into the range from 15MHz below to 15MHz above the receive band of an UE that support UL MIMO, with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, or into the range from 3CBW below to 3CBW above the receive band of an UE that support UL MIMO, with F_{DL_high} <

3300 MHz and F_{UL_high} < 3300 MHz, at which the relative throughput shall meet or exceed the requirement for the specified measurement channels.

The lack of in-band blocking ability will decrease the coverage area when other g-NodeB transmitters exist (except in the adjacent channels and spurious response).

7.6D.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

7.6D.2.3 Minimum conformance requirements

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements specified in subclause 7.6 shall be met with the UL MIMO configurations described in sub-clause 6.2D.1. For UL MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.6D.

7.6D.2.4 Test description

7.6D.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.6D.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6D.2.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Lowest, Mid, Highest			
Test SCS as specified in Table 5.3.5-1	Lowest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	CP-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3D.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.				

1. Connect the SS and interfering source to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.4 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.6D.2.4.1-1.
5. Propagation conditions are set according to Annex B.0.
6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* , Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.6D.2.4.3.

7.6D.2.4.2 Test procedure

Same test procedure as specified in 7.6.2.4.2.

7.6D.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

7.6D.2.5 Test requirement

Same test requirement as specified in 7.6.2.5.

Table 7.6D.2.5-1: Void

7.6D.3 Out-of-band blocking for UL MIMO

7.6D.3.1 Test purpose

Out-of-band blocking for UL MIMO is defined for an unwanted CW interfering signal falling more than 15 MHz below or above the receive band of an UE that support UL MIMO, with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz, or falling more than 3CBW below or above the receive band of an UE that support UL MIMO, with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz, at which a given average throughput shall meet or exceed the requirement for the specified measurement channels.

The lack of out-of-band blocking ability will decrease the coverage area when other g-NodeB transmitters exist (except in the adjacent channels and spurious response).

7.6D.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

7.6D.3.3 Minimum conformance requirements

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements specified in subclause 7.6 shall be met with the UL MIMO configurations described in sub-clause 6.2D.1. For UL MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.6D.

7.6D.3.4 Test description

7.6D.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.6D.3.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6D.3.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	One frequency chosen arbitrarily from low or high range			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Lowest, Mid, Highest			
Test SCS as specified in Table 5.3.5-1	Lowest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	CP-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3D.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.				

1. Connect the SS and interfering source to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.5 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.1.
4. The DL and UL Reference Measurement channels are set according to Table 7.6D.3.4.1-1.
5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* , Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.6D.3.4.3.

7.6D.3.4.2 Test procedure

Same test procedure as specified in 7.6.3.4.2.

7.6D.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

7.6D.3.5 Test requirement

Same test requirement as specified in 7.6.3.5.

Table 7.6D.3.5-1: Void

7.6D.4 Narrow band blocking for UL MIMO

7.6D.4.1 Test purpose

Narrow band blocking for UL MIMO is defined for a receiver's ability of an UE that supports UL MIMO to receive a NR signal at its assigned channel frequency in the presence of an unwanted narrow band CW interferer at a frequency, which is less than the nominal channel spacing, at which a given average throughput shall meet or exceed the requirement for the specified measurement channels.

The lack of narrow-band blocking ability will decrease the coverage area when other g-NodeB transmitters exist (except in the adjacent channels and spurious response).

7.6D.4.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

7.6D.4.3 Minimum conformance requirements

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements specified in subclause 7.6 shall be met with the UL MIMO configurations described in sub-clause 6.2D.1. For UL MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.6D.

7.6D.4.4 Test description

7.6D.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.6D.4.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.6D.4.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Lowest, Mid, Highest			
Test SCS as specified in Table 5.3.5-1	Lowest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	CP-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3D.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.				

1. Connect the SS and interfering source to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.5 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.6D.4.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* , Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.6D.4.4.3.

7.6D.4.4.2 Test procedure

Same test procedure as specified in 7.6.4.4.2.

7.6D.4.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

7.6D.4.5 Test requirement

Same test requirement as specified in 7.6.4.5.

Table 7.6D.4.5-1: Void

7.7 Spurious response

7.7.1 Test Purpose

Spurious response is a measure of the ability of the receiver to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency for which a response is obtained, i.e. for which the out-of-band blocking limit as specified in subclause 7.6.3 is not met.

The lack of the spurious response ability decreases the coverage area when other unwanted interfering signal exists at any other frequency.

7.7.2 Test Applicability

This test applies to all types of NR UE release 15 and forward.

7.7.3 Minimum Conformance Requirements

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3(with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters for the wanted signal as specified in Table 7.7.3-1 for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz and in Table 7.7.3-1a for NR bands with F_{DL_high} ≥ 3300 MHz and

F_{UL_high} ≥ 3300 MHz and for the interferer as specified in Table 7.7.3-2. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal. For operating bands with an unpaired DL part (as noted in Table 5.2-1), the requirements only apply for carriers assigned in the paired part.

Table 7.7.3-1: Spurious response parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	6	7	9	10
RX parameter	**Units**	**Channel bandwidth**				
		30 MHz	**40 MHz**	**50 MHz**	**60 MHz**	**80 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	11	12	13	14	15
RX parameter	**Units**	**Channel bandwidth**				
		90 MHz	**100 MHz**			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	15.5	16			
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.7.3-1a: Spurious response parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		60 MHz	**80 MHz**	**90 MHz**	**100 MHz**	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	9	9	9	9	
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.7.3-2: Spurious response

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies

The normative reference for this requirement is TS 38.101-1 [2] clause 7.7.

7.7.4 Test Description

7.7.4.1 Initial Conditions

The initial conditions shall be the same as in clause 7.6.3.4.1 in order to test spurious responses obtained in clause 7.6.3 under the same conditions.

7.7.4.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.6.3.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.6.3.4.1-1. Since the UE has no payload and no loopback data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3. Set the parameters of the CW signal generator for an interfering signal according to Table 7.7.5-2. The spurious frequencies are taken from records in the final step of test procedures in clause 7.6.3.4.2.

4. Set the downlink signal level according to the table 7.7.5-1 or 7.7.5-1a. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.7.5-1 or 7.7.5-1a for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

5. For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.7.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

7.7.5 Test Requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 and A.3.3 with parameters for the wanted signal as specified in Table 7.7.5-1 for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz and in Table 7.7.5-1a for NR bands with F_{DL_high} ≥ 3300 MHz and F_{UL_high} ≥ 3300 MHz and for the interferer as specified in Table 7.7.5-2.

Table 7.7.5-1: Spurious response parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

RX parameter	Units	Channel bandwidth				
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	6	7	9	10
RX parameter	Units	Channel bandwidth				
		30 MHz	40 MHz	50 MHz	60 MHz	80 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	11	12	13	14	15
RX parameter	Units	Channel bandwidth				
		90 MHz	100 MHz			
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	15.5	16			
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.7.5-1a: Spurious response parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

RX parameter	Units	Channel bandwidth				
		10 MHz	15 MHz	20 MHz	40 MHz	50 MHz
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	6	7	9	9	9
RX parameter	Units	Channel bandwidth				
		60 MHz	80 MHz	90 MHz	100 MHz	
Power in transmission bandwidth configuration	dBm	REFSENS + channel bandwidth specific value below				
	dB	9	9	9	9	
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.						

Table 7.7.5-2: Spurious response

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies

Table 7.7.5-3: Void

7.7A Spurious response for CA

7.7A.0 Minimum conformance requirements

7.7A.0.1 Minimum conformance requirements for intra-band contiguous CA

The normative reference for this requirement is TS 38.101-1 [2] clause 7.7A.1.

Table 7.7A.0.1-1: Spurious response parameters for intra-band contiguous CA

RX parameter	Units	BW Class		
		B	C	D
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below		
	dB	9	9	9
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.				

Table 7.7A.0.1-2: Spurious response for CA

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies

7.7A.0.2 Void

7.7A.0.3 Minimum conformance requirements for inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the spurious response are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.7 for each component carrier while all downlink carriers are active.

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.7.3-2 is increased by the amount given by $\Delta R_{IB,c}$ defined in Table 7.3A.0.3.2.1-1.

The throughput of each carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

The normative reference for this requirement is TS 38.101-1 [2] clause 7.7A.3.

7.7A.0.4 Minimum conformance requirements for intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with one uplink carrier and two or more downlink sub-blocks, the spurious response requirements are defined with the uplink configuration in accordance with Table 7.3A.0.2.2-1. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in clauses 7.7 and 7.7A.1 for one component carrier and two component carriers per sub-block, respectively. The requirements apply with all downlink carriers active.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

7.7A.1 Spurious response for 2DL CA

7.7A.1.1 Test Purpose

Spurious response for 2DL CA verifies the receiver's ability to receive a wanted 2DL carrier aggregated signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking limit as specified in sub-clause 7.6A.3 is not met.

The lack of the spurious response ability decreases the coverage area when other unwanted interfering signal exists at any other frequency.

7.7A.1.2 Test Applicability

This test case applies to all types of NR UE release 15 and forward that support 2DL CA.

7.7A.1.3 Minimum Conformance Requirements

The minimum conformance requirements are defined in clause 7.7A.0.

7.7A.1.4 Test Description

7.7A.1.4.1 Initial Conditions

The initial conditions shall be the same as in clause 7.6A.3.1.4.1 in order to test spurious responses obtained in clause 7.6A.3.1 under the same conditions.

7.7A.1.4.2 Test Procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.7A.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Test Configuration Table 7.6A.3.1.4.1-1, 7.6A.3.1.4.1-2 or 7.6A.3.1.4.1-3 in Clause 7.6A.3 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Test Configuration Table 7.6A.3.1.4.1-1, 7.6A.3.1.4.1-2 or 7.6A.3.1.4.1-3 in Clause 7.6A.3 on both PCC and SCC. Since the UE has no payload data to send, the UE sends uplink MAC padding bits on the UL RMC.

6. Set the parameters of the CW signal generator for an interfering signal according to Table 7.7A.0.1-2. The spurious frequencies are taken from records in the final step of test procedures in clause 7.6A.3 Out-of-band blocking for CA.

7. Set the downlink signal level according to Table 7.7A.0.1-1 for both carriers. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of

the target power level in Table 7.7A.0.1-1 + (10log(P_L_{CRB}/N_{RB_alloc}) for PCC, 10log(S_L_{CRB}/N_{RB_alloc}) for SCC) for at least the duration of the Throughput measurement, where:

- MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

- Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. For each spurious frequency, measure the average throughput for each component carrier for duration sufficient to achieve statistical significance according to Annex H.2A.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

Table 7.7A.1.4.2-1: Void

7.7A.1.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

7.7A.1.5 Test Requirement

The throughput measurement of each carrier derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.7A.0.1-1 and 7.7A.0.1-2. For the UE which supports inter-band 2DL CA configuration in Table7.3A.0.3.2.1-1, $P_{Interferer}$ power defined in Table 7.7A.0.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

7.7A.2 Spurious response for 3DL CA

7.7A.2.1 Test Purpose

Spurious response for 3DL CA verifies the receiver's ability to receive a wanted 3DL carrier aggregated signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking limit as specified in sub-clause 7.6A.3 is not met.

The lack of the spurious response ability decreases the coverage area when other unwanted interfering signal exists at any other frequency.

7.7A.2.2 Test Applicability

This test case applies to all types of NR UE release 15 and forward that support 3DL CA.

7.7A.2.3 Minimum Conformance Requirements

The minimum conformance requirements are defined in clause 7.7A.0.

7.7A.2.4 Test Description

7.7A.2.4.1 Initial Conditions

The initial conditions shall be the same as in clause 7.6A.3.2.4.1 in order to test spurious responses obtained in clause 7.6A.3.2 under the same conditions.

7.7A.2.4.2 Test Procedure

Same test procedure as sub-clause 7.7A.1.4.2 with the following exceptions:

Step 1, 2 and 4 of Test Procedure as in clause 7.7A.1.4.2 is replaced by:

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Test Configuration Table 7.6A.3.1.4.1-1, 7.6A.3.1.4.1-2 or 7.6A.3.1.4.1-3 in Clause 7.6A.3 on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Test Configuration Table 7.6A.3.1.4.1-1, 7.6A.3.1.4.1-2 or 7.6A.3.1.4.1-3 in Clause 7.6A.3 on both PCC and SCCs. Since the UE has no payload data to send, the UE sends uplink MAC padding bits on the UL RMC.

4. Set the downlink signal level according to Table 7.7A.0.1-1 for both carriers. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.7A.0.1-1 + (10log(P_L_{CRB}/N_{RB_alloc}) for PCC, 10log(S_L_{CRB}/N_{RB_alloc}) for SCC) for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

7.7A.2.4.3 Message Contents

Same message contents as sub-clause 7.7A.1.4.3.

7.7A.2.5 Test Requirement

The throughput measurement of each carrier derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.7A.0.1-1 and 7.7A.0.1-2. For the UE which supports inter-band 3DL CA configuration in Table 7.3A.0.3.2.3-1, $P_{Interferer}$ power defined in Table 7.7A.0.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.3-1.

7.7A.3 Spurious response for 4DL CA

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- The content of sub-clause 7.6A.3 is FFS.

- Table [7.3A.2.0.4.2.3-1] $\Delta R_{IB,c}$ due to CA (four bands) has not been defined yet.

- The content of clause "7.6A.3.3.4.1 Initial Conditions" for Out-of-band blocking for 4DL CA has not been defined yet.

7.7A.3.1 Test Purpose

Spurious response for 4DL CA verifies the receiver's ability to receive a wanted 4DL carrier aggregated signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking limit as specified in sub-clause 7.6A.3 is not met.

The lack of the spurious response ability decreases the coverage area when other unwanted interfering signal exists at any other frequency.

7.7A.3.2 Test Applicability

This test case applies to all types of NR UE release 15 and forward that support 4DL CA.

7.7A.3.3 Minimum Conformance Requirements

The minimum conformance requirements are defined in clause 7.7A.0.

7.7A.3.4 Test Description

7.7A.3.4.1 Initial Conditions

The initial conditions shall be the same as in clause 7.6A.3.3.4.1 in order to test spurious responses obtained in clause 7.6A.3.3 under the same conditions.

7.7A.3.4.2 Test Procedure

Same test procedure as sub-clause 7.7A.2.4.2.

7.7A.3.4.3 Message Contents

Same message contents as sub-clause 7.7A.1.4.3.

7.7A.3.5 Test Requirement

The throughput measurement of each carrier derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.7A.0.1-1 and 7.7A.0.1-2.For the UE which supports inter-band 4DL CA configuration in Table 7.3.2_1.3-1 and Table [7.3A.2.0.4.2.3-1], $P_{Interferer}$ power defined in Table 7.7A.0.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3.2_1.3-1 and Table [7.3A.2.0.4.2.3-1].

7.7D Spurious response for UL MIMO

7.7D.1 Test Purpose

Spurious response verifies the ability of the UE that support UL MIMO to receive a wanted signal on its assigned channel frequency without exceeding a given degradation due to the presence of an unwanted CW interfering signal at any other frequency at which a response is obtained i.e. for which the out of band blocking for UL MIMO limit as specified in sub-clause 7.6D.3 is not met.

The lack of the spurious response ability decreases the coverage area when other unwanted interfering signal exists at any other frequency.

7.7D.2 Test Applicability

This test applies to all types of NR UE release 15 and forward that support UL MIMO.

7.7D.3 Minimum Conformance Requirements

For UE with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in Clause 7.7D.3 shall be met with the UL MIMO configurations specified in Table 6.2D.1.4.1-1 in Clause 6.2 D.1 UE maximum output power for UL MIMO. For UL MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmitter antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.7D.

7.7D.4 Test Description

7.7D.4.1 Initial Conditions

The initial conditions shall be the same as in clause 7.6D.3.4.1 in order to test spurious responses obtained in clause 7.6D.3 under the same conditions.

7.7D.4.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Test Configuration Table 7.6D.3.4.1-1 in Clause 7.6D.3. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Test Configuration Table 7.6D.3.4.1-1 in Clause 7.6D.3. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC. The PDCCH DCI format 0_1 is specified with condition 2TX_UL_MIMO in 38.508-1 [5] subclause 4.3.6.1.1.2.

3. Set the parameters of the CW signal generator for an interfering signal according to Table 7.7D.5-2. The spurious frequencies are taken from records in the final step of test procedures in clause 7.6D.3.4.2.

4. Set the downlink signal level according to the Table 7.7D.5-1. Send uplink power control commands to the UE (less or equal to 1dB step size should be used), to ensure that the UE output power is within +0, - 3.4 dB of the target level in table 7.7D.5-1 for carrier frequency f ≤ 3.0GHz or within +0, -4.0 dB of the target level for carrier frequency 3.0GHz < f ≤ 4.2GHz, for at least the duration of the throughput measurement.

5. For the spurious frequency, measure the average throughput for a duration sufficient to achieve statistical significance according to Annex H.2.

7.7D.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] clause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

7.7D.5 Test Requirement

The throughput measurement derived in test procedure shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3 with parameters specified in Tables 7.7D.5-1 and 7.7D.5-2.

Table 7.7D.5-1: Spurious response parameters

RX parameter	Units	Channel bandwidth				
		10 MHz	**15 MHz**	**20 MHz**	**30MHz**	**40 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	6	7	9	9	9
RX parameter	**Units**	**Channel bandwidth**				
		50 MHz	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
Power in transmission bandwidth configuration	dBm	REFSENS + channel specific value below				
	dB	9	9	9	9	9
Note 1: The transmitter shall be set to 4dB below P_{CMAX_L} with P_{CMAX_L} as defined in clause 6.2.4. Note 2: The reference measurement channel is specified in Annex A.3 with one sided dynamic OCNG Pattern OP.1 FDD/TDD as described in Annex A.5.1.1/A.5.2.1.						

Table 7.7D.5-2: Spurious Response

Parameter	Unit	Level
$P_{Interferer}$ (CW)	dBm	-44
$F_{Interferer}$	MHz	Spurious response frequencies

7.8 Intermodulation characteristics

7.8.1 General

Intermodulation response rejection is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal

7.8.2 Wide band Intermodulation

7.8.2.1 Test purpose

Intermodulation response tests the UE's ability to receive data with a given average throughput for a specified reference measurement channel, in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal, under conditions of ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the coverage area when two or more interfering signals exist which have a specific frequency relationship to the wanted signal.

7.8.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

7.8.2.3 Minimum conformance requirements

The wide band intermodulation requirement is defined using a CW carrier and modulated NR signal as interferer 1 and interferer 2 respectively.

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.8.2.3-1 for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz and Table 7.8.2.3-2 for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz. The relative throughput requirement shall be met for any SCS specified for the channel bandwidth of the wanted signal. For operating bands with an unpaired DL part (as noted in Table 5.2-1), the requirements only apply for carriers assigned in the paired part.

Table 7.8.2.3-1: Wide band intermodulation parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

Rx parameter	Units	Channel bandwidth											
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + channel bandwidth specific value below											
		6	6	7	9	10	11	12	13	14	15	15	16
$P_{Interferer\ 1}$ (CW)	dBm	-46											
$P_{Interferer\ 2}$ (Modulated)	dBm	-46											
$BW_{Interferer\ 2}$	MHz	5											
$F_{Interferer\ 1}$ (Offset)	MHz	-BW/2 – 7.5 / +BW/2 + 7.5											
$F_{Interferer\ 2}$ (Offset)	MHz	2*$F_{Interferer\ 1}$											

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and 15 kHz SCS.

NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.

Table 7.8.2.3-2: Wide band intermodulation parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

Rx parameter	Units	Channel bandwidth							
		10 MHz	20 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 6							
$P_{Interferer\ 1}$ (CW)	dBm	-46							
$P_{Interferer\ 2}$ (Modulated)	dBm	-46							
$BW_{Interferer\ 2}$	MHz	BW							
$F_{Interferer\ 1}$ (Offset)	MHz	-2BW / +2BW							
$F_{Interferer\ 2}$ (Offset)	MHz	2*$F_{Interferer\ 1}$							
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the wanted signal. NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.									

The normative reference for this requirement is TS 38.101-1 [2] clause 7.8.2.

7.8.2.4 Test description

7.8.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.8.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.8.2.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1		Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1		Mid range (NOTE 4)		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1		Lowest, Mid, Highest (NOTE 3)		
Test SCS as specified in Table 5.3.5-1		Highest		
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements. NOTE 3: For n70, highest test channel bandwidth shall be Highest UL / Highest DL according to asymmetric channel bandwidths specified in clause 5.3.6. NOTE 4: For NR band n28, 30MHz test channel bandwidth is tested with High range test frequencies.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2 , C.3.1 , and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.5.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.5.4.3.

7.8.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.8.2.4.1-1. The SS sends downlink MAC padding bits on the DL RMC.

2. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.8.2.4.1-1. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

3. Set the Downlink signal level to the value as defined in Table 7.8.2.5-1. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.8.2.5-1 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS

38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

4. Set the Interfering signal levels to the values as defined in Table 7.8.2.5-1 and frequency below the wanted signal.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G.2.

6. Repeat steps from 3 to 5, using an interfering signal above the wanted signal at step 4.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.8.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 with DFT-s-OFDM condition in Table 4.6.3-118 PUSCH-Config.

7.8.2.5 Test requirement

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 with parameters specified in Table 7.8.2.5-1 for the specified wanted signal mean power in the presence of two interfering signals.

Table 7.8.2.5-1: Wide band intermodulation parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

Rx parameter	Units	Channel bandwidth											
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + channel bandwidth specific value below											
		6	6	7	9	10	11	12	13	14	15	15	16
$P_{Interferer\ 1}$ (CW)	dBm	-46											
$P_{Interferer\ 2}$ (Modulated)	dBm	-46											
$BW_{Interferer\ 2}$	MHz	5											
$F_{Interferer\ 1}$ (Offset)	MHz	-BW/2 – 7.5 / +BW/2 + 7.5											
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$											

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and 15 kHz SCS.

NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.

Table 7.8.2.5-2: Wide band intermodulation parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

Rx parameter	Units	Channel bandwidth							
		10 MHz	20 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 6							
$P_{Interferer\ 1}$ (CW)	dBm	-46							
$P_{Interferer\ 2}$ (Modulated)	dBm	-46							
$BW_{Interferer\ 2}$	MHz	BW							
$F_{Interferer\ 1}$ (Offset)	MHz	-2BW / +2BW							
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$							

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the wanted signal.

NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.

Table 7.8.2.5-3: Void

7.8A Intermodulation characteristics for CA

7.8A.1 General

Intermodulation response rejection for CA is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

7.8A.2 Wide band Intermodulation for CA

7.8A.2.0 Minimum conformance requirements

7.8A.2.0.1 Wide band Intermodulation for Intra-band contiguous CA

Table 7.8A.2.0.1-1: Wide band intermodulation parameters for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

Rx parameter	Units	NR CA bandwidth class		
		BC	C	D
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 10	REFSENS + 6	REFSENS + 13.8
$P_{Interferer\ 1}$ (CW)	dBm	-46		
$P_{Interferer\ 2}$ (Modulated)	dBm	-46		
$BW_{Interferer\ 2}$	MHz	$BW_{Channel_CA}$20	$BW_{Channel\_CA}$	50
$F_{Interferer\ 1}$ (Offset)	MHz	$-F_{offset}$-30 / F_{offset}+30	$-2BW_{Channel\_CA}$ / $+2BW_{Channel\_CA}$	$-F_{offset}$-75 / F_{offset}+75
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$		

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the closest carrier.
NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the modulated interferer.

Table 7.8A.2.0.1-2: Wide band intermodulation parameters for intra-band contiguous CA with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz

Rx parameter	Units	NR CA bandwidth class	
		B	C
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 16	REFSENS + 19
$P_{Interferer\ 1}$ (CW)	dBm	-46	-46
$P_{Interferer\ 2}$ (Modulated)	dBm	-46	-46
$BW_{Interferer\ 2}$	MHz	5	5
$F_{Interferer\ 1}$ (Offset)	MHz	$-F_{offset}$-7.5 / F_{offset}+7.5	$-F_{offset}$-7.5 / F_{offset}+7.5
$F_{Interferer\ 2}$ (Offset)	MHz	2*$F_{Interferer\ 1}$	2*$F_{Interferer\ 1}$

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the 15 kHz SCS.
NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the modulated interferer.

7.8A.2.0.2 Wide band intermodulation for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with one uplink carrier and two or more downlink sub-blocks, the wide band intermodulation requirements are defined with the uplink configuration in accordance with Table 7.3A.0.2.3-1. For this uplink configuration, the UE shall meet the requirements for each sub-block as specified in subclause 7.8.2 and 7.8A.2.0.1 for one component carrier and two component carriers per sub-block, respectively. The requirements apply for out-of-gap interferers while all downlink carriers are active.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

7.8A.2.0.3 Wide band Intermodulation for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the wide band intermodulation requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested. The UE shall meet the requirements specified in subclause 7.8 for each component carrier while all downlink carriers are active.

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.8.2.3-1 and 7.8.2.3-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

The normative reference for this requirement is TS 38.101-1 [2] clause 7.8A.2.

7.8A.2.1 Wide band Intermodulation for CA (2DL CA)

7.8A.2.1.1 Test purpose

Intermodulation response tests the UE's ability to receive data with a given average throughput for a specified reference measurement channel, in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal, under conditions of ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the coverage area when two or more interfering signals exist which have a specific frequency relationship to the wanted signal.

7.8A.2.1.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 2DL CA.

7.8A.2.1.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.8A.2.0.

7.8A.2.1.4 Test description

7.8A.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 7.8A.2.1.4.1-1, 7.8A.2.1.4.1-2 or 7.8A.2.1.4.1-3. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.8A.2.1.4.1-1: Test configuration table for Intra-band contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg} (NOTE 3)		
Test SCS as specified in Table 5.3.5-1			Highest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.8A.2.1.4.1-2: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Mid range for PCC and SCC		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg} for PCC and SCC		
Test SCS as specified in Table 5.3.5-1			Highest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.8A.1.4.1-3: Test configuration table for Intraband non-contiguous CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			NOTE 1		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg} for PCC and SCC, NOTE 1		
Test SCS as specified in Table 5.3.5-1			Highest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCC RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	NOTE 1	NOTE 1	DFT-s-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3A.1.4.1-3. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.8A.2.1.4.1-1, Table 7.8A.2.1.4.1-2 or Table 7.8A.2.1.4.1-3.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.8A.2.1.4.3.

7.8A.2.1.4.2 Test procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.8A.2.1.4.3.

3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.8A.2.1.4.1-1, 7.8A.2.1.4.1-2 or 7.8A.2.1.4.1-3 on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.8A.2.1.4.1-1, 7.8A.2.1.4.1-2 or 7.8A.2.1.4.1-3 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6. Set the Interfering signal levels to the values as defined in Table 7.8A.2.1.5.1-1, 7.8A.2.1.5.1-2, 7.8A.2.1.5.3-1 or 7.8A.2.1.5.3-2 and frequency below the CA Band for intra-band CA, or below the SCC's operating band for inter-band CA according to Table 7.8A.2.1.5.1-1, 7.8A.2.1.5.1-2, 7.8A.2.1.5.3-1 or 7.8A.2.1.5.3-2, using a modulated interferer bandwidth as defined in Annex D of the present document. For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.8A.2.1.5.3-1 and 7.8A.2.1.5.3-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

7. Set the Downlink signal level for PCC and SCC to the value as defined in Table 7.8A.2.1.5.1-1, 7.8A.2.1.5.1-2, 7.8A.2.1.5.3-1 or 7.8A.2.1.5.3-2. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.8A.2.1.5.1-1, 7.8A.2.1.5.1-2, 7.8A.2.1.5.3-1 or 7.8A.2.1.5.3-2 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. Measure the average throughput of SCC for a duration sufficient to achieve statistical significance according to Annex H.2A for inter-band CA. Measure the average throughput of both carriers for a duration sufficient to achieve statistical significance according to Annex H.2A for intra-band CA.

9. Repeat steps from 6 to 8, using an interfering signal above the CA Band for intra-band CA, or above the SCC's operating band for inter-band CA at step 6.

10. For Inter-band CA: Switch the SCell into PCell and repeat steps 1 to 9, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.8A.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.8A.2.1.5 Test requirement

7.8A.2.1.5.1 Wide band intermodulation for Intra-band contiguous CA

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 with parameters specified in Table 7.8A.2.1.5.1-1 or 7.8A.2.1.5.1-2 for the specified wanted signal mean power in the presence of two interfering signals.

Table 7.8A.2.1.5.1-1: Wide band intermodulation parameters for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

Rx parameter	Units	NR CA bandwidth class	
		B	C
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 10	REFSENS + 6
$P_{Interferer\ 1}$ (CW)	dBm	-46	
$P_{Interferer\ 2}$ (Modulated)	dBm	-46	
$BW_{Interferer\ 2}$	MHz	20	$BW_{Channel\_CA}$
$F_{Interferer\ 1}$ (Offset)	MHz	$-F_{offset}-30$ / $F_{offset}+30$	$-2BW_{Channel\_CA}$ / $+2BW_{Channel\_CA}$
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$	
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the closest carrier. NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the modulated interferer.			

Table 7.8A.2.1.5.1-2: Wide band intermodulation parameters for intra-band contiguous CA with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz

Rx parameter	Units	NR CA bandwidth class	
		B	C
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 16	REFSENS + 19
$P_{Interferer\ 1}$ (CW)	dBm	-46	-46
$P_{Interferer\ 2}$ (Modulated)	dBm	-46	-46
$BW_{Interferer\ 2}$	MHz	5	5
$F_{Interferer\ 1}$ (Offset)	MHz	$-F_{offset}$-7.5 / F_{offset}+7.5	$-F_{offset}$-7.5 / F_{offset}+7.5
$F_{Interferer\ 2}$ (Offset)	MHz	2*$F_{Interferer\ 1}$	2*$F_{Interferer\ 1}$
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the 15 kHz SCS. NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the modulated interferer.			

7.8A.2.1.5.2 Wide band intermodulation for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with one uplink carrier and two downlink carriers, the wide band intermodulation requirements are defined with the uplink configuration in accordance with Table 7.3A.0.2.3-1. For this uplink configuration, the UE shall meet the requirements for each carrier as specified in subclause 7.8.2 for each component carrier respectively. The requirements apply for out-of-gap interferers while all downlink carriers are active.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters defined in Table 7.8A.2.1.5.3-1 or 7.8A.2.1.5.3-2.

7.8A.2.1.5.3 Wide band intermodulation for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the wide band intermodulation requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters defined in Table 7.8A.2.1.5.3-1 or 7.8A.2.1.5.3-2.

Table 7.8A.2.1.5.3-1: Wide band intermodulation parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

Rx parameter	Units	Channel bandwidth											
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz

P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + channel bandwidth specific value below											
		6	6	7	9	10	11	12	13	14	15	15	16
$P_{Interferer\ 1}$ (CW)	dBm	-46											
$P_{Interferer\ 2}$ (Modulated)	dBm	-46											
$BW_{Interferer\ 2}$	MHz	5											
$F_{Interferer\ 1}$ (Offset)	MHz	-BW/2 – 7.5 / +BW/2 + 7.5											
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$											
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and 15 kHz SCS. NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.													

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.8A.2.1.5.3-1 and 7.8A.2.1.5.3-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

Table 7.8A.2.1.5.3-2: Wide band intermodulation parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

Rx parameter	Units	Channel bandwidth							
		10 MHz	20 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 6							
$P_{Interferer\ 1}$ (CW)	dBm	-46							
$P_{Interferer\ 2}$ (Modulated)	dBm	-46							
$BW_{Interferer\ 2}$	MHz	BW							
$F_{Interferer\ 1}$ (Offset)	MHz	-2BW / +2BW							
$F_{Interferer\ 2}$ (Offset)	MHz	2*$F_{Interferer\ 1}$							

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the wanted signal.
NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.

7.8A.2.2 Wide band Intermodulation for CA (3DL CA)

7.8A.2.2.1 Test purpose

Intermodulation response tests the UE's ability to receive data with a given average throughput for a specified reference measurement channel, in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal, under conditions of ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the coverage area when two or more interfering signals exist which have a specific frequency relationship to the wanted signal.

7.8A.2.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 3DL CA.

7.8A.2.2.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.8A.2.0.

7.8A.2.2.4 Test description

7.8A.2.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 7.8A.2.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.8A.2.2.4.1-1: Test configuration table for CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal				
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Intra-band contiguous: Mid range Inter-band: NOTE 3 Intra-band contiguous + Inter-band: NOTE 3 Intra-band non-contiguous + Inter-band: NOTE 3				
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Highest N_{RB_agg} for PCC and SCCs (NOTE 4)				
Test SCS as specified in Table 5.3.5-1	Highest				
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCCs RB allocation**	**CC Mod'n**	**PCC RB allocation**
Default Test Settings for a CA_nXD Configuration (Intra-band contiguous)					
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
Default Test Settings for a CA_nXA-nYA-nZA Configuration (Inter-band)					
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
Default Test Settings for a CA_nXC-nYA and CA_nXB-nYA Configurations (Intra-band contiguous + Inter-band)					
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
Default Test Settings for a CA_nX(2A)-nYA Configuration (Intra-band non-contiguous + Inter-band)					
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: The specific test frequencies for PCC and SCCs and Wgap for intra-band non-contiguous are defined in Table 7.3A.2.4.1-1. Only test points verifying non-exceptional REFSENS requirements are used for wide band blocking testing. NOTE 4: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 5: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

Table 7.8A.2.2.4.1-2: Void

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.8A.2.2.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.8A.2.2.4.3.

7.8A.2.2.4.2 Test procedure

1. Configure SCCs according to Annex C.0, C.1, C.2 for all downlink physical channels.
2. The SS shall configure SCCs as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.8A.2.2.4.3.
3. SS activates SCCs by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).
4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.8A.2.2.4.1-1 on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.
5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.8A.2.2.4.1-1 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.
6. Set the Interfering signal levels to the values as defined in Table 7.8A.2.2.5.1-1, 7.8A.2.2.5.1-2, 7.8A.2.2.5.2-1 or 7.8A.2.2.5.2-2 and frequency below the CA Band for intra-band CA, or below each SCC’s operating band for inter-band CA according to Table 7.8A.2.2.5.1-1, 7.8A.2.2.5.1-2, 7.8A.2.2.5.2-1 or 7.8A.2.2.5.2-2, using a modulated interferer bandwidth as defined in Annex D of the present document. For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.8A.2.2.5.2-1 and 7.8A.2.2.5.2-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.
7. Set the Downlink signal level for PCC and SCCs to the value as defined in Table 7.8A.2.2.5.1-1, 7.8A.2.2.5.1-2, 7.8A.2.2.5.2-1 or 7.8A.2.2.5.2-2. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.8A.2.2.5.1-1, 7.8A.2.2.5.1-2, 7.8A.2.2.5.2-1 or 7.8A.2.2.5.2-2 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. Measure the average throughput of SCCs for a duration sufficient to achieve statistical significance according to Annex H.2A for inter-band CA. Measure the average throughput of all carriers for a duration sufficient to achieve statistical significance according to Annex H.2A for intra-band CA.
9. Repeat steps from 6 to 8, using an interfering signal above the CA Band for intra-band CA, or above the each SCC’s operating band for inter-band CA at step 6.
10. For Inter-band CA: Switch the SCell into PCell and repeat steps 1 to 9, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.8A.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.8A.2.2.5 Test requirement

7.8A.2.2.5.1 Wide band intermodulation for Intra-band contiguous CA

The throughput shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annex A.3.2 with parameters specified in Table 7.8A.2.2.5.1-1 or 7.8A.2.2.5.1-2 for the specified wanted signal mean power in the presence of two interfering signals.

Table 7.8A.2.2.5.1-1: Wide band intermodulation parameters for intra-band contiguous CA with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

Rx parameter	Units	NR CA bandwidth class		
		B	C	D
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 10	REFSENS + 6	REFSENS + 13.8
$P_{Interferer\ 1}$ (CW)	dBm	-46		
$P_{Interferer\ 2}$ (Modulated)	dBm	-46		
$BW_{Interferer\ 2}$	MHz	20	$BW_{Channel\_CA}$	50
$F_{Interferer\ 1}$ (Offset)	MHz	$-F_{offset}$-30 / F_{offset}+30	$-2BW_{Channel\_CA}$ / $+2BW_{Channel\_CA}$	$-F_{offset}$-75 / F_{offset}+75
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$		
NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the closest carrier. NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.				

Table 7.8A.2.2.5.1-2: Wide band intermodulation parameters for intra-band contiguous CA with F_{DL_low} < 2700 MHz and F_{UL_low} < 2700 MHz

Rx parameter	Units	NR CA bandwidth class	
		B	C
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 16	REFSENS + 22
$P_{Interferer\ 1}$ (CW)	dBm	-46	-46
$P_{Interferer\ 2}$ (Modulated)	dBm	-46	-46
$BW_{Interferer\ 2}$	MHz	5	5
$F_{Interferer\ 1}$ (Offset)	MHz	$-F_{offset}$-7.5 / F_{offset}+7.5	$-F_{offset}$-7.5 / F_{offset}+7.5
$F_{Interferer\ 2}$ (Offset)	MHz	2*$F_{Interferer\ 1}$	2*$F_{Interferer\ 1}$

NOTE 1: The transmitter shall be set to 4 dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.
NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).
NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the 15 kHz SCS.
NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.

7.8A.2.2.5.2 Wide band intermodulation for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the wide band intermodulation requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters defined in Table 7.8A.2.2.5.2-1 or 7.8A.2.2.5.2-2.

Table 7.8A.2.2.5.2-1: Wide band intermodulation parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

Rx parameter	Units	Channel bandwidth											
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + channel bandwidth specific value below											
		6	6	7	9	10	11	12	13	14	15	15	16

$P_{Interferer\ 1}$ (CW)	dBm	-46
$P_{Interferer\ 2}$ (Modulated)	dBm	-46
$BW_{Interferer\ 2}$	MHz	5
$F_{Interferer\ 1}$ (Offset)	MHz	-BW/2 – 7.5 / +BW/2 + 7.5
$F_{Interferer\ 2}$ (Offset)	MHz	2*$F_{Interferer\ 1}$
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and 15 kHz SCS. NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.		

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.8A.2.2.5.2-1 and 7.8A.2.2.5.2-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

Table 7.8A.2.2.5.2-2: Wide band intermodulation parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

Rx parameter	Units	Channel bandwidth							
		10 MHz	20 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 6							
$P_{Interferer\ 1}$ (CW)	dBm	-46							
$P_{Interferer\ 2}$ (Modulated)	dBm	-46							
$BW_{Interferer\ 2}$	MHz	BW							
$F_{Interferer\ 1}$ (Offset)	MHz	-2BW / +2BW							
$F_{Interferer\ 2}$ (Offset)	MHz	2*$F_{Interferer\ 1}$							
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the wanted signal. NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.									

7.8A.2.3 Wide band Intermodulation for CA (4DL CA)

7.8A.2.3.1 Test purpose

Intermodulation response tests the UE's ability to receive data with a given average throughput for a specified reference measurement channel, in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal, under conditions of ideal propagation and no added noise.

A UE unable to meet the throughput requirement under these conditions will decrease the coverage area when two or more interfering signals exist which have a specific frequency relationship to the wanted signal.

7.8A.2.3.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that supports 4DL CA.

7.8A.2.3.3 Minimum conformance requirements

The minimum conformance requirements are defined in clause 7.8A.2.0.

7.8A.2.3.4 Test description

7.8A.2.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR CA configurations specified in clause 5.5A. All of these configurations shall be tested with applicable test parameters for each CA configuration, are shown in Table 7.8A.2.3.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3 respectively. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.8A.2.3.4.1-1: Test configuration table for Inter-band CA

Default Conditions					
Test Environment as specified in TS 38.508-1 [5] subclause 4.1			Normal		
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1			Inter-band : Mid range for PCC and SCCs Intra-band contiguous + Inter-band: Mid range for PCC and SCCs Intra-band non-contiguous + Inter-band: Mid range for PCC and SCCs with maxWGap for Intra-band non-contiguous		
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1			Highest N_{RB_agg} for PCC and SCCs(NOTE 3)		
Test SCS as specified in Table 5.3.5-1			Highest		
Test Parameters					
	Downlink Configuration			**Uplink Configuration**	
Test ID	**CC Mod'n**	**PCC RB allocation**	**SCCs RB allocation**	**CC Mod'n**	**PCC RB allocation**
1	CP-OFDM QPSK	Full RB[1]	Full RB[1]	DFT-s-OFDM QPSK	REFSENS[2]
NOTE 1: Full RB allocation shall be used per each SCS and channel BW as specified in Table 7.3.2.4.1-2. NOTE 2: REFSENS refers to the single carrier Uplink RB allocation for reference sensitivity according to Table 7.3.2.4.1-3. NOTE 3: If the UE supports multiple CC Combinations in the CA Configuration with the same NRB_agg, only the combination with the highest NRB_PCC is tested. NOTE 4: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.					

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, Figure A.3.1.4.7 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, and C.3.1, and uplink signals according to Annex G.0, G.1, G.2, and G.3.1.

4. The DL and UL Reference Measurement Channels are set according to Table 7.8A.2.3.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in State RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On*, Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.8A.2.3.4.3.

7.8A.2.3.4.2 Test procedure

1. Configure SCCs according to Annex C.0, C.1, C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 7.8A.2.3.4.3.

3. SS activates SCCs by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1_1 for C_RNTI to transmit the DL RMC according to Table 7.8A.2.3.4.1-1 on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. SS sends uplink scheduling information for each UL HARQ process via PDCCH DCI format 0_1 for C_RNTI to schedule the UL RMC according to Table 7.8A.2.3.4.1-1 on PCC. Since the UE has no payload data to send, the UE transmits uplink MAC padding bits on the UL RMC.

6. Set the Interfering signal levels to the values as defined in Table 7.8A.2.3.5.2-1 or Table 7.8A.2.3.5.1-2 and frequency below each SCC's operating band for inter-band CA according to Table 7.8A.2.3.5.2-1 or Table 7.8A.2.3.5.1-2, using a modulated interferer bandwidth as defined in Annex D of the present document. For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.8A.2.3.5.1-1 and 7.8A.2.3.5.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

7. Set the Downlink signal level for PCC and SCCs to the value as defined in Table 7.8A.2.3.5.2-1 or Table 7.8A.2.3.5.1-2. Send uplink power control commands to the UE using 1dB power step size to ensure that the UE output power measured by the test system is within the Uplink power control window, defined as -MU to -(MU + Uplink power control window size) dB of the target power level in Table 7.8A.2.3.5.2-1 or Table 7.8A.2.3.5.1-2 for at least the duration of the Throughput measurement, where:

   - MU is the test system uplink power measurement uncertainty and is specified in Table F.1.3-1 for the carrier frequency f and the channel bandwidth BW

   - Uplink power control window size = 1dB (UE power step size) + 0.7dB (UE power step tolerance) + (Test system relative power measurement uncertainty), where, the UE power step tolerance is specified in TS 38.101-1 [2], Table 6.3.4.3-1 and is 0.7dB for 1dB power step size, and the Test system relative power measurement uncertainty is specified for test case 6.3.4.3 in Table F.1.2-1.

8. Measure the average throughput of SCCs for a duration sufficient to achieve statistical significance according to Annex H.2A for inter-band CA.

9. Repeat steps from 6 to 8, using an interfering signal above the each SCC's operating band for inter-band CA at step 6.

10. For Inter-band CA: Switch the SCell into PCell and repeat steps 1 to 9, except for operating bands without uplink band.

NOTE: The purpose of the Uplink power control window is to ensure that the actual UE output power is no greater than the target power level, and as close as possible to the target power level. The relationship between the Uplink power control window, the target power level and the corresponding possible actual UE Uplink power window is illustrated in Annex F.4.3.

7.8A.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 Table 4.6.3-118 with condition TRANSFORM_PRECODER_ENABLED.

7.8A.2.3.5 Test requirement

7.8A.2.3.5.1 Wide band intermodulation for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band, the wide band intermodulation requirements are defined with the uplink active on the band(s) other than the band whose downlink is being tested.

The throughput of each carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters defined in Table 7.8A.2.3.5.1-1 or 7.8A.2.3.5.1-2.

Table 7.8A.2.3.5.1-1: Wide band intermodulation parameters for NR bands with F_{DL_high} < 2700 MHz and F_{UL_high} < 2700 MHz

Rx parameter	Units	Channel bandwidth											
		5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + channel bandwidth specific value below											
		6	6	7	9	10	11	12	13	14	15	15	16
$P_{Interferer\ 1}$ (CW)	dBm	-46											
$P_{Interferer\ 2}$ (Modulated)	dBm	-46											
$BW_{Interferer\ 2}$	MHz	5											
$F_{Interferer\ 1}$ (Offset)	MHz	-BW/2 – 7.5 / +BW/2 + 7.5											
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$											
NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4. NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1). NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and 15 kHz SCS. NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.													

For the UE which supports inter-band CA configuration in Table 7.3A.0.3.2.1-1, $P_{interferer}$ power defined in Table 7.8A.2.3.5.1-1 and 7.8A.2.3.5.1-2 is increased by the amount given by $\Delta R_{IB,c}$ in Table 7.3A.0.3.2.1-1.

Table 7.8A.2.3.5.1-2: Wide band intermodulation parameters for NR bands with F_{DL_low} ≥ 3300 MHz and F_{UL_low} ≥ 3300 MHz

Rx parameter	Units	Channel bandwidth							
		10 MHz	20 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
P_w in Transmission Bandwidth Configuration, per CC	dBm	REFSENS + 6							
$P_{Interferer\ 1}$ (CW)	dBm	-46							
$P_{Interferer\ 2}$ (Modulated)	dBm	-46							
$BW_{Interferer\ 2}$	MHz	BW							
$F_{Interferer\ 1}$ (Offset)	MHz	-2BW / +2BW							
$F_{Interferer\ 2}$ (Offset)	MHz	$2*F_{Interferer\ 1}$							

NOTE 1: The transmitter shall be set to 4dB below $P_{CMAX\_L,f,c}$ at the minimum UL configuration specified in Table 7.3.2.3-3 with $P_{CMAX\_L,f,c}$ defined in clause 6.2.4.

NOTE 2: Reference measurement channel is specified in Annexes A.2.2, A.2.3, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1).

NOTE 3: The modulated interferer consists of the Reference measurement channel specified in Annexes A.3.2.2 and A.3.3.2 with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1 and the same SCS as the wanted signal.

NOTE 4: The $F_{interferer\ 1}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the CW interferer and $F_{interferer\ 2}$ (offset) is the frequency separation of the centre frequency of the carrier closest to the interferer and the centre frequency of the modulated interferer.

7.8D Intermodulation characteristics for UL MIMO

7.8D.1 General

Intermodulation response rejection for UL MIMO is a measure of the capability of the receiver of an UE that support UL MIMO to receive a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal.

7.8D.2 Wide band Intermodulation for UL MIMO

7.8D.2.1 Test purpose

Wide band Intermodulation for UL MIMO tests the ability of UE that support UL MIMO to receive data with a given average throughput for a specified reference measurement channel, in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal, under conditions of ideal propagation and no added noise.

An UE unable to meet the throughput requirement under these conditions will decrease the coverage area when two or more interfering signals exist which have a specific frequency relationship to the wanted signal.

7.8D.2.2 Test applicability

This test case applies to all types of NR UE release 15 and forward that support UL MIMO.

7.8D.2.3 Minimum conformance requirements

For UE(s) with two transmitter antenna connectors in closed-loop spatial multiplexing scheme, the minimum requirements in subclause 7.8 shall be met with the UL MIMO configurations described in sub-clause 6.2D.1. For UL MIMO, the parameter P_{CMAX_L} is defined as the total transmitter power over the two transmit antenna connectors.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.8D.

7.8D.2.4 Test description

7.8D.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.8D.2.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. The details of the OCNG patterns used are specified in Annex A.5. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.8D.2.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Mid range			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Lowest, Mid, Highest			
Test SCS as specified in Table 5.3.5-1	Highest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	CP-OFDM QPSK	NOTE 1	CP-OFDM QPSK	NOTE 1
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3D.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.				

1. Connect the SS and interfering sources to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.4.6 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2, C.3.1, and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.8D.2.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR*, Connected without release *On* , Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.8D.2.4.3.

7.8D.2.4.2 Test procedure

Same test procedure as specified in 7.8.2.4.2.

7.8D.2.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6 ensuring Table 4.6.3-182 with condition 2TX_UL_MIMO.

7.8D.2.5 Test requirement

Same test requirement as specified in 7.8.2.5.

Table 7.8D.2.5-1: Void

7.9 Spurious emissions

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

7.9.1 Test purpose

Test verifies the UE's spurious emissions meet the requirements described in clause 7.9.3.

Excess spurious emissions increase the interference to other systems.

7.9.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

7.9.3 Minimum conformance requirements

The spurious emissions power is the power of emissions generated or amplified in a receiver that appear at the UE antenna connector.

The power of any narrow band CW spurious emission shall not exceed the maximum level specified in Table 7.9.3-1

Table 7.9.3-1: General receiver spurious emission requirements

Frequency range	Measurement bandwidth	Maximum level	NOTE
30 MHz ≤ f < 1 GHz	100 kHz	-57 dBm	
1 GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	
12.75 GHz ≤ f ≤ 5th harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 dBm	2
12.75 GHz – 26 GHz	1 MHz	-47 dBm	3
NOTE 1: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH as defined in Annex C.3.1. NOTE 2: Applies for Band that the upper frequency edge of the DL Band more than 2.69 GHz. NOTE 3: Applies for Band that the upper frequency edge of the DL Band more than 5.2 GHz.			

The normative reference for this requirement is TS 38.101-1 [2] clause 7.9.

7.9.4 Test description

7.9.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1. All of these configurations shall be tested with applicable test parameters for each combination of channel bandwidth and sub-carrier spacing, are shown in table 7.9.4.1-1. The details of the uplink and downlink reference measurement channels (RMC) are specified in Annexes A.2 and A.3. Configuration of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.9.4.1-1: Test Configuration Table

Default Conditions				
Test Environment as specified in TS 38.508-1 [5] subclause 4.1	Normal			
Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1	Low range, Mid range, High range (NOTE 4)			
Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1	Highest (NOTE 3)			
Test SCS as specified in Table 5.3.5-1	Highest			
Test Parameters				
	Downlink Configuration		**Uplink Configuration**	
Test ID	**Mod'n**	**RB allocation**	**Mod'n**	**RB allocation**
1	N/A	0	N/A	0
NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1. NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements. NOTE 3: For n70, highest test channel bandwidth shall be Highest UL / Highest DL according to asymmetric channel bandwidths specified in clause 5.3.6. NOTE 4: For NR band n28, 30MHz test channel bandwidth is tested with Low range and High range test frequencies.				

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.5.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.

3. Downlink signals are initially set up according to Annex C.0, C.1, C.2 , C.3.1 , and uplink signals according to Annex G.0, G.1, G.2, G.3.1.

4. The DL and UL Reference Measurement channels are set according to Table 7.9.4.1-1.

5. Propagation conditions are set according to Annex B.0.

6. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On,* Test Mode *On* and Test Loop Function *On* according to TS 38.508-1 [5] clause 4.5. Message content are defined in clause 7.5.4.3.

7.9.4.2 Test procedure

1. Sweep the spectrum analyzer (or equivalent equipment) over a frequency range and measure the average power of spurious emission.

2. Repeat step 1 for all NR Rx antennas of the UE.

7.9.4.3 Message contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

7.9.5 Test requirement

The measured spurious emissions derived in step 1), shall not exceed the maximum level specified in Table 7.9.5-1.

Table 7.9.5-1: General receiver spurious emission requirements

Frequency range	Measurement bandwidth	Maximum level	NOTE
30 MHz ≤ f < 1 GHz	100 kHz	-57 dBm	
1 GHz ≤ f ≤ 12.75 GHz	1 MHz	-47 dBm	
12.75 GHz ≤ f ≤ 5th harmonic of the upper frequency edge of the DL operating band in GHz	1 MHz	-47 dBm	2
12.75 GHz – 26 GHz	1 MHz	-47 dBm	3
NOTE 1: Unused PDCCH resources are padded with resource element groups with power level given by PDCCH as defined in Annex C.3.1. NOTE 2: Applies for Band that the upper frequency edge of the DL Band more than 2.69 GHz. NOTE 3: Applies for Band that the upper frequency edge of the DL Band more than 5.2 GHz.			

7.9A Spurious emissions for CA

7.9A.0 Minimum conformance requirements

For inter-band carrier aggregation including an operating band without uplink band, the UE shall meet the Rx spurious emissions requirements specified in subclause 7.9 for each component carrier while all downlink carriers are active.

The normative reference for this requirement is TS 38.101-1 [2] clause 7.9A.3.

7.9A.1 Spurious emission for 2DL CA

7.9A.1.1 Test Purpose

Test verifies the UE's spurious emissions meet the requirements described in clause 7.9A.1.3.

Excess spurious emissions increase the interference to other systems.

7.9A.1.2 Test Applicability

This test case applies to all types of NR UE release 15 and forward that support inter-band 2DL CA with a DL-only band.

7.9A.1.3 Minimum Conformance Requirements

The minimum conformance requirements are defined in clause 7.9A.0.

7.9A.1.4 Test Description

7.9A.1.4.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, and channel bandwidths based on NR CA bands specified in Table 5.5A.3-1. All of these configurations shall be tested with applicable test parameters for each CA Configuration, and are shown in Table 7.9A.1.4.1-1. The details of the uplink reference measurement channels (RMCs) are specified in Annexe A.2. Configurations of PDSCH and PDCCH before measurement are specified in Annex C.2.

Table 7.9A.1.4.1-1: Test Configuration Table

<table>
<tr><th colspan="7">Initial Conditions</th></tr>
<tr><td colspan="3">Test Environment as specified in TS 38.508-1 [5] subclause 4.1</td><td colspan="4">Normal</td></tr>
<tr><td colspan="3">Test Frequencies as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="4">Low range, Mid range, High range</td></tr>
<tr><td colspan="3">Test Channel Bandwidths as specified in TS 38.508-1 [5] subclause 4.3.1</td><td colspan="4">Highest N_{RB_agg}</td></tr>
<tr><td colspan="3">Test SCS as specified in Table 5.3.5-1</td><td colspan="4">Highest</td></tr>
<tr><th colspan="7">Test Parameters for CA Configurations</th></tr>
<tr><th colspan="2">Ch Configuration / N_{RB_agg}</th><th colspan="3">Downlink Configuration</th><th colspan="2">Uplink Configuration</th></tr>
<tr><th>PCC
N_{RB}</th><th>SCCs
N_{RB}</th><th>Mod'n</th><th colspan="2">PCC & SCC
RB allocation</th><th>Mod'n</th><th>PCC
RB allocation</th></tr>
<tr><td>100</td><td>100</td><td>N/A</td><td>0</td><td>0</td><td>N/A</td><td>0</td></tr>
<tr><td colspan="7">NOTE 1: The specific configuration of uplink and downlink are defined in Table 7.3.2.4.1-1.
NOTE 2: In a band where UE supports 4Rx, the test shall be performed only with 4Rx antennas ports connected and 4Rx REFSENS requirement (Table 7.3.2.5-2) is used in the test requirements.</td></tr>
</table>

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [5] Annex A, in Figure A.3.1.5.2 for TE diagram and section A.3.2 for UE diagram.
2. The parameter settings for the cell are set up according to TS 38.508-1 [5] subclause 4.4.3.
3. Downlink signals for PCC are initially set up according to Annex C.0, C.1, C.2.
4. Propagation conditions are set according to Annex B.0.
5. Ensure the UE is in state RRC_CONNECTED with generic procedure parameters Connectivity *NR* according to TS 38.508-1 [5] clause 4.5. Message contents are defined in clause 7.9A.1.4.3.

7.9A.1.4.2 Test Procedure

1. Configure SCC according to Annex C.0, C.1, C.2 for all downlink physical channels.
2. The SS shall configure SCC as per TS 38.508-1 [5] clause 5.5.1. Message contents are defined in clause 6.5A.2.2.1.4.3.
3. SS activates SCC by sending the activation MAC CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 2 seconds (Refer TS 38.133 [19], clause9.3).
4. Sweep the spectrum analyzer (or equivalent equipment) over a frequency range and measure the average power of spurious emission. During measurement SS sends no uplink scheduling information to the UE.
5. Repeat step 1 for all NR Rx antennas of the UE.

7.9A.1.4.3 Message Contents

Message contents are according to TS 38.508-1 [5] subclause 4.6.

7.9A.1.5 Test Requirement

The measured spurious emissions derived in step 1), shall not exceed the maximum level specified in Table 7.9.5-1.

Annex A (normative): Measurement channels

A.1 General

The throughput values defined in the measurement channels specified in Annex A, are calculated and are valid per datastream (codeword). For multi-stream (more than one codeword) transmissions, the throughput referenced in the minimum requirements is the sum of throughputs of all datastreams (codewords).

The UE category entry in the definition of the reference measurement channel in Annex A is only informative and reveals the UE categories, which can support the corresponding measurement channel. Whether the measurement channel is used for testing a certain UE category or not is specified in the individual minimum requirements.

A.2 UL reference measurement channels

A.2.1 General

The measurement channels in the following subclauses are defined to derive the requirements in clause 6 (Transmitter Characteristics) and clause 7 (Receiver Characteristics). The measurement channels represent example configurations of physical channels for different data rates.

A.2.2 Reference measurement channels for FDD

A.2.2.1 DFT-s-OFDM Pi/2-BPSK

Table A.2.2.1-1: Reference Channels for DFT-s-OFDM Pi/2-BPSK for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	pi/2 BPSK	0	1/4	32	16	2	1	132	132
	5	15	12	11	pi/2 BPSK	0	1/4	384	16	2	1	1584	1584
	5	15	25	11	pi/2 BPSK	0	1/4	808	16	2	1	3300	3300
	10	15	25	11	pi/2 BPSK	0	1/4	808	16	2	1	3300	3300
	10	15	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	15	15	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	15	15	75	11	pi/2 BPSK	0	1/4	2408	16	2	1	9900	9900
	20	15	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	20	15	100	11	pi/2 BPSK	0	1/4	3104	16	2	1	13200	13200
	25	15	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	25	15	128	11	pi/2 BPSK	0	1/4	3976	24	2	2	16896	16896
	30	15	80	11	pi/2 BPSK	0	1/4	2472	16	2	1	10560	10560
	30	15	160	11	pi/2 BPSK	0	1/4	4872	24	2	2	21120	21120
	40	15	108	11	pi/2 BPSK	0	1/4	3368	16	2	1	14256	14256
	40	15	216	11	pi/2 BPSK	0	1/4	6664	24	2	2	28512	28512
	50	15	135	11	pi/2 BPSK	0	1/4	4104	24	2	2	17820	17820
	50	15	270	11	pi/2 BPSK	0	1/4	8448	24	2	3	35640	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.1-2: Reference Channels for DFT-s-OFDM Pi/2-BPSK for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	pi/2 BPSK	0	1/4	32	16	2	1	132	132
	5	30	5	11	pi/2 BPSK	0	1/4	160	16	2	1	660	660
	5	30	10	11	pi/2 BPSK	0	1/4	320	16	2	1	1320	1320
	10	30	12	11	pi/2 BPSK	0	1/4	384	16	2	1	1584	1584
	10	30	24	11	pi/2 BPSK	0	1/4	768	16	2	1	3168	3168
	15	30	18	11	pi/2 BPSK	0	1/4	576	16	2	1	2376	2376
	15	30	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	20	30	25	11	pi/2 BPSK	0	1/4	808	16	2	1	3300	3300
	20	30	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	25	30	32	11	pi/2 BPSK	0	1/4	1032	16	2	1	4224	4224
	25	30	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	30	30	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	30	30	75	11	pi/2 BPSK	0	1/4	2408	16	2	1	9900	9900
	40	30	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	40	30	100	11	pi/2 BPSK	0	1/4	3104	16	2	1	13200	13200
	50	30	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	50	30	128	11	pi/2 BPSK	0	1/4	3976	24	2	2	16896	16896
	60	30	81	11	pi/2 BPSK	0	1/4	2536	16	2	1	10692	10692
	60	30	162	11	pi/2 BPSK	0	1/4	5000	24	2	2	21384	21384
	80	30	108	11	pi/2 BPSK	0	1/4	3368	16	2	1	14256	14256
	80	30	216	11	pi/2 BPSK	0	1/4	6664	24	2	2	28512	28512
	90	30	120	11	pi/2 BPSK	0	1/4	3752	16	2	1	15840	15840
	90	30	243	11	pi/2 BPSK	0	1/4	7560	24	2	2	32076	32076
	100	30	135	11	pi/2 BPSK	0	1/4	4104	24	2	2	17820	17820
	100	30	270	11	pi/2 BPSK	0	1/4	8448	24	2	3	35640	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.1-3: Reference Channels for DFT-s-OFDM Pi/2-BPSK for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	pi/2 BPSK	0	1/4	32	16	2	1	132	132
	10	60	5	11	pi/2 BPSK	0	1/4	160	16	2	1	660	660
	10	60	10	11	pi/2 BPSK	0	1/4	320	16	2	1	1320	1320
	15	60	9	11	pi/2 BPSK	0	1/4	288	16	2	1	1188	1188
	15	60	18	11	pi/2 BPSK	0	1/4	576	16	2	1	2376	2376
	20	60	12	11	pi/2 BPSK	0	1/4	384	16	2	1	1584	1584
	20	60	24	11	pi/2 BPSK	0	1/4	768	16	2	1	3168	3168
	25	60	15	11	pi/2 BPSK	0	1/4	480	16	2	1	1980	1980
	25	60	30	11	pi/2 BPSK	0	1/4	984	16	2	1	3960	3960
	30	60	18	11	pi/2 BPSK	0	1/4	576	16	2	1	2376	2376
	30	60	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	40	60	25	11	pi/2 BPSK	0	1/4	808	16	2	1	3300	3300
	40	60	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	50	60	32	11	pi/2 BPSK	0	1/4	1032	16	2	1	4224	4224
	50	60	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	60	60	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	60	60	75	11	pi/2 BPSK	0	1/4	2408	16	2	1	9900	9900
	80	60	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	80	60	100	11	pi/2 BPSK	0	1/4	3104	16	2	1	13200	13200
	90	60	60	11	pi/2 BPSK	0	1/4	1864	16	2	1	7920	7920
	90	60	120	11	pi/2 BPSK	0	1/4	3752	16	2	1	15840	15840
	100	60	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	100	60	135	11	pi/2 BPSK	0	1/4	4104	24	2	2	17820	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.2 DFT-s-OFDM QPSK

Table A.2.2.2-1: Reference Channels for DFT-s-OFDM QPSK for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	QPSK	2	1/6	48	16	2	1	264	132
	5	15	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	5	15	20	11	QPSK	2	1/6	1032	16	2	1	5280	2640
	5	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	10	15	20	11	QPSK	2	1/6	1032	16	2	1	5280	2640
	10	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	10	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	15	15	20	11	QPSK	2	1/6	1032	16	2	1	5280	2640
	15	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	15	15	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	15	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	15	15	75	11	QPSK	2	1/6	3752	16	2	1	19800	9900
	20	15	20	11	QPSK	2	1/6	1032	16	2	1	5280	2640
	20	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	20	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	20	15	100	11	QPSK	2	1/6	5000	24	2	2	26400	13200
	25	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	25	15	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	25	15	128	11	QPSK	2	1/6	6408	24	2	2	33792	16896
	30	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	30	15	80	11	QPSK	2	1/6	3976	24	2	2	21120	10560
	30	15	160	11	QPSK	2	1/6	7944	24	2	3	42240	21120
	40	15	108	11	QPSK	2	1/6	5384	24	2	2	28512	14256
	40	15	216	11	QPSK	2	1/6	10752	24	2	3	57024	28512

	50	15	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820
	50	15	270	11	QPSK	2	1/6	13320	24	2	4	71280	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.2-2: Reference Channels for DFT-s-OFDM QPSK for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	QPSK	2	1/6	48	16	2	1	264	132
	5	30	5	11	QPSK	2	1/6	256	16	2	1	1320	660
	5	30	10	11	QPSK	2	1/6	504	16	2	1	2640	1320
	10	30	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	10	30	24	11	QPSK	2	1/6	1192	16	2	1	6336	3168
	15	30	18	11	QPSK	2	1/6	928	16	2	1	4752	2376
	15	30	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	20	30	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	20	30	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	25	30	32	11	QPSK	2	1/6	1608	16	2	1	8448	4224
	25	30	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	30	30	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	30	30	75	11	QPSK	2	1/6	3752	16	2	1	19800	9900
	40	30	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	40	30	100	11	QPSK	2	1/6	5000	24	2	2	26400	13200
	50	30	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	50	30	128	11	QPSK	2	1/6	6408	24	2	2	33792	16896
	60	30	81	11	QPSK	2	1/6	4040	24	2	2	21384	10692
	60	30	162	11	QPSK	2	1/6	8064	24	2	3	42768	21384
	80	30	108	11	QPSK	2	1/6	5384	24	2	2	28512	14256
	80	30	216	11	QPSK	2	1/6	10752	24	2	3	57024	28512
	90	30	120	11	QPSK	2	1/6	5896	24	2	2	31680	15840
	90	30	243	11	QPSK	2	1/6	12040	24	2	4	64152	32076
	100	30	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820

	100	30	270	11	QPSK	2	1/6	13320	24	2	4	71280	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.2-3: Reference Channels for DFT-s-OFDM QPSK for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	QPSK	2	1/6	48	16	2	1	264	132
	10	60	5	11	QPSK	2	1/6	256	16	2	1	1320	660
	10	60	10	11	QPSK	2	1/6	504	16	2	1	2640	1320
	15	60	9	11	QPSK	2	1/6	456	16	2	1	2376	1188
	15	60	18	11	QPSK	2	1/6	928	16	2	1	4752	2376
	20	60	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	20	60	24	11	QPSK	2	1/6	1192	16	2	1	6336	3168
	25	60	15	11	QPSK	2	1/6	768	16	2	1	3960	1980
	25	60	30	11	QPSK	2	1/6	1544	16	2	1	7920	3960
	30	60	18	11	QPSK	2	1/6	928	16	2	1	4752	2376
	30	60	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	40	60	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	40	60	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	50	60	32	11	QPSK	2	1/6	1608	16	2	1	8448	4224
	50	60	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	60	60	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	60	60	75	11	QPSK	2	1/6	3752	16	2	1	19800	9900
	80	60	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	80	60	100	11	QPSK	2	1/6	5000	24	2	2	26400	13200
	90	60	60	11	QPSK	2	1/6	3104	16	2	1	15840	7920
	90	60	120	11	QPSK	2	1/6	5896	24	2	2	31680	15840
	100	60	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	100	60	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820

Note 1:	PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2:	MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3:	If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.3 DFT-s-OFDM 16QAM

Table A.2.2.3-1: Reference Channels for DFT-s-OFDM 16QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	16QAM	10	1/3	176	16	2	1	528	132
	5	15	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	5	15	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	10	15	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	10	15	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	15	15	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	15	15	75	11	16QAM	10	1/3	13064	24	1	2	39600	9900
	20	15	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	20	15	100	11	16QAM	10	1/3	17424	24	1	3	52800	13200
	25	15	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	25	15	128	11	16QAM	10	1/3	22536	24	1	3	67584	16896
	30	15	80	11	16QAM	10	1/3	14088	24	1	2	42240	10560
	30	15	160	11	16QAM	10	1/3	28168	24	1	4	84480	21120
	40	15	108	11	16QAM	10	1/3	18960	24	1	3	57024	14256
	40	15	216	11	16QAM	10	1/3	37896	24	1	5	114048	28512
	50	15	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820
	50	15	270	11	16QAM	10	1/3	47112	24	1	6	142560	35640

Note 1:	PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2:	MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3:	If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.3-2: Reference Channels for DFT-s-OFDM 16QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	16QAM	10	1/3	176	16	2	1	528	132
	5	30	5	11	16QAM	10	1/3	888	16	2	1	2640	660
	5	30	10	11	16QAM	10	1/3	1800	16	2	1	5280	1320
	10	30	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	10	30	24	11	16QAM	10	1/3	4224	24	1	1	12672	3168
	15	30	18	11	16QAM	10	1/3	3240	16	2	1	9504	2376
	15	30	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	20	30	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	20	30	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	25	30	32	11	16QAM	10	1/3	5632	24	1	1	16896	4224
	25	30	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	30	30	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	30	30	75	11	16QAM	10	1/3	13064	24	1	2	39600	9900
	40	30	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	40	30	100	11	16QAM	10	1/3	17424	24	1	3	52800	13200
	50	30	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	50	30	128	11	16QAM	10	1/3	22536	24	1	3	67584	16896
	60	30	81	11	16QAM	10	1/3	14088	24	1	2	42768	10692
	60	30	162	11	16QAM	10	1/3	28168	24	1	4	85536	21384
	80	30	108	11	16QAM	10	1/3	18960	24	1	3	57024	14256
	80	30	216	11	16QAM	10	1/3	37896	24	1	5	114048	28512
	90	30	120	11	16QAM	10	1/3	21000	24	1	3	63360	15840
	90	30	243	11	16QAM	10	1/3	43032	24	1	6	128304	32076
	100	30	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820
	100	30	270	11	16QAM	10	1/3	47112	24	1	6	142560	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.3-3: Reference Channels for DFT-s-OFDM 16QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	16QAM	10	1/3	176	16	2	1	528	132
	10	60	5	11	16QAM	10	1/3	888	16	2	1	2640	660
	10	60	10	11	16QAM	10	1/3	1800	16	2	1	5280	1320
	15	60	9	11	16QAM	10	1/3	1608	16	2	1	4752	1188
	15	60	18	11	16QAM	10	1/3	3240	16	2	1	9504	2376
	20	60	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	20	60	24	11	16QAM	10	1/3	4224	24	1	1	12672	3168
	25	60	15	11	16QAM	10	1/3	2664	16	2	1	7920	1980
	25	60	30	11	16QAM	10	1/3	5248	24	1	1	15840	3960
	30	60	18	11	16QAM	10	1/3	3240	16	2	1	9504	2376
	30	60	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	40	60	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	40	60	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	50	60	32	11	16QAM	10	1/3	5632	24	1	1	16896	4224
	50	60	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	60	60	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	60	60	75	11	16QAM	10	1/3	13064	24	1	2	39600	9900
	80	60	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	80	60	100	11	16QAM	10	1/3	17424	24	1	3	52800	13200
	90	60	60	11	16QAM	10	1/3	10504	24	1	2	31680	7920
	90	60	120	11	16QAM	10	1/3	21000	24	1	3	63360	15840
	100	60	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	100	60	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.4 DFT-s-OFDM 64QAM

Table A.2.2.4-1: Reference Channels for DFT-s-OFDM 64QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	**MHz**	**kHz**						**Bits**	**Bits**			**Bits**	
	5	15	25	11	64QAM	18	1/2	9992	24	1	2	19800	3300
	10	15	50	11	64QAM	18	1/2	19968	24	1	3	39600	6600
	15	15	75	11	64QAM	18	1/2	30216	24	1	4	59400	9900
	20	15	100	11	64QAM	18	1/2	39936	24	1	5	79200	13200
	25	15	128	11	64QAM	18	1/2	51216	24	1	7	101376	16896
	30	15	160	11	64QAM	18	1/2	63528	24	1	8	126720	21120
	40	15	216	11	64QAM	18	1/2	86040	24	1	11	171072	28512
	50	15	270	11	64QAM	18	1/2	108552	24	1	13	213840	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.4-2: Reference Channels for DFT-s-OFDM 64QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5	30	10	11	64QAM	18	1/2	3968	24	1	1	7920	1320
	10	30	24	11	64QAM	18	1/2	9480	24	1	2	19008	3168
	15	30	36	11	64QAM	18	1/2	14344	24	1	2	28512	4752
	20	30	50	11	64QAM	18	1/2	19968	24	1	3	39600	6600
	25	30	64	11	64QAM	18	1/2	25608	24	1	4	50688	8448
	30	30	75	11	64QAM	18	1/2	30216	24	1	4	59400	9900
	40	30	100	11	64QAM	18	1/2	39936	24	1	5	79200	13200
	50	30	128	11	64QAM	18	1/2	51216	24	1	7	101376	16896
	60	30	162	11	64QAM	18	1/2	64552	24	1	8	128304	21384
	80	30	216	11	64QAM	18	1/2	86040	24	1	11	171072	28512
	90	30	243	11	64QAM	18	1/2	96264	24	1	12	192456	32076
	100	30	270	11	64QAM	18	1/2	108552	24	1	13	213840	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.4-3: Reference Channels for DFT-s-OFDM 64QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	10	60	10	11	64QAM	18	1/2	3968	24	1	1	7920	1320
	15	60	18	11	64QAM	18	1/2	7168	24	1	1	14256	2376
	20	60	24	11	64QAM	18	1/2	9480	24	1	2	19008	3168
	25	60	30	11	64QAM	18	1/2	12040	24	1	2	23760	3960
	30	60	36	11	64QAM	18	1/2	14344	24	1	2	28512	4752
	40	60	50	11	64QAM	18	1/2	19968	24	1	3	39600	6600
	50	60	64	11	64QAM	18	1/2	25608	24	1	4	50688	8448
	60	60	75	11	64QAM	18	1/2	30216	24	1	4	59400	9900
	80	60	100	11	64QAM	18	1/2	39936	24	1	5	79200	13200
	90	60	120	11	64QAM	18	1/2	48168	24	1	6	95040	15840
	100	60	135	11	64QAM	18	1/2	54296	24	1	7	106920	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.5 DFT-s-OFDM 256QAM

Table A.2.2.5-1: Reference Channels for DFT-s-OFDM 256QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5	15	25	11	256QAM	20	2/3	17424	24	1	3	26400	3300
	10	15	50	11	256QAM	20	2/3	34816	24	1	5	52800	6600
	15	15	75	11	256QAM	20	2/3	53288	24	1	7	79200	9900
	20	15	100	11	256QAM	20	2/3	69672	24	1	9	105600	13200
	25	15	128	11	256QAM	20	2/3	90176	24	1	11	135168	16896
	30	15	160	11	256QAM	20	2/3	112648	24	1	14	168960	21120
	40	15	216	11	256QAM	20	2/3	151608	24	1	18	228096	28512
	50	15	270	11	256QAM	20	2/3	188576	24	1	23	285120	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.5-2: Reference Channels for DFT-s-OFDM 256QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5	30	10	11	256QAM	20	2/3	7040	24	1	1	10560	1320
	10	30	24	11	256QAM	20	2/3	16896	24	1	3	25344	3168
	15	30	36	11	256QAM	20	2/3	25104	24	1	3	38016	4752
	20	30	50	11	256QAM	20	2/3	34816	24	1	5	52800	6600
	25	30	64	11	256QAM	20	2/3	45096	24	1	6	67584	8448
	30	30	75	11	256QAM	20	2/3	53288	24	1	7	79200	9900
	40	30	100	11	256QAM	20	2/3	69672	24	1	9	105600	13200
	50	30	128	11	256QAM	20	2/3	90176	24	1	11	135168	16896
	60	30	162	11	256QAM	20	2/3	114776	24	1	14	171072	21384
	80	30	216	11	256QAM	20	2/3	151608	24	1	18	228096	28512
	90	30	243	11	256QAM	20	2/3	172176	24	1	21	256608	32076
	100	30	270	11	256QAM	20	2/3	188576	24	1	23	285120	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.5-3: Reference Channels for DFT-s-OFDM 256QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	**MHz**	**kHz**						**Bits**	**Bits**			**Bits**	
	10	60	10	11	256QAM	20	2/3	7040	24	1	1	10560	1320
	15	60	18	11	256QAM	20	2/3	12552	24	1	2	19008	2376
	20	60	24	11	256QAM	20	2/3	16896	24	1	3	25344	3168
	25	60	30	11	256QAM	20	2/3	21000	24	1	3	31680	3960
	30	60	36	11	256QAM	20	2/3	25104	24	1	3	38016	4752
	40	60	50	11	256QAM	20	2/3	34816	24	1	5	52800	6600
	50	60	64	11	256QAM	20	2/3	45096	24	1	6	67584	8448
	60	60	75	11	256QAM	20	2/3	53288	24	1	7	79200	9900
	80	60	100	11	256QAM	20	2/3	69672	24	1	9	105600	13200
	90	60	120	11	256QAM	20	2/3	83976	24	1	10	126720	15840
	100	60	135	11	256QAM	20	2/3	94248	24	1	12	142560	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.6 CP-OFDM QPSK

Table A.2.2.6-1: Reference Channels for CP-OFDM QPSK for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	QPSK	2	1/6	48	16	2	1	264	132
	5	15	13	11	QPSK	2	1/6	672	16	2	1	3432	1716
	5	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	10	15	26	11	QPSK	2	1/6	1288	16	2	1	6864	3432
	10	15	52	11	QPSK	2	1/6	2600	16	2	1	13728	6864
	15	15	40	11	QPSK	2	1/6	2024	16	2	1	10560	5280
	15	15	79	11	QPSK	2	1/6	3912	24	2	2	20856	10428
	20	15	53	11	QPSK	2	1/6	2664	16	2	1	13992	6996
	20	15	106	11	QPSK	2	1/6	5256	24	2	2	27984	13992
	25	15	67	11	QPSK	2	1/6	3368	16	2	1	17688	8844
	25	15	133	11	QPSK	2	1/6	6664	24	2	2	35112	17556
	30	15	80	11	QPSK	2	1/6	3976	24	2	2	21120	10560
	30	15	160	11	QPSK	2	1/6	7944	24	2	3	42240	21120
	40	15	108	11	QPSK	2	1/6	5384	24	2	2	28512	14256
	40	15	216	11	QPSK	2	1/6	10752	24	2	3	57024	28512
	50	15	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820
	50	15	270	11	QPSK	2	1/6	13320	24	2	4	71280	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.6-2: Reference Channels for CP-OFDM QPSK for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	QPSK	2	1/6	48	16	2	1	264	132
	5	30	6	11	QPSK	2	1/6	304	16	2	1	1584	792
	5	30	11	11	QPSK	2	1/6	552	16	2	1	2904	1452
	10	30	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	10	30	24	11	QPSK	2	1/6	1192	16	2	1	6336	3168
	15	30	19	11	QPSK	2	1/6	984	16	2	1	5016	2508
	15	30	38	11	QPSK	2	1/6	1928	16	2	1	10032	5016
	20	30	26	11	QPSK	2	1/6	1288	16	2	1	6864	3432
	20	30	51	11	QPSK	2	1/6	2536	16	2	1	13464	6732
	25	30	33	11	QPSK	2	1/6	1672	16	2	1	8712	4356
	25	30	65	11	QPSK	2	1/6	3240	16	2	1	17160	8580
	30	30	39	11	QPSK	2	1/6	2024	16	2	1	10296	5148
	30	30	78	11	QPSK	2	1/6	3848	24	2	2	20592	10296
	40	30	53	11	QPSK	2	1/6	2664	16	2	1	13992	6996
	40	30	106	11	QPSK	2	1/6	5256	24	2	2	27984	13992
	50	30	67	11	QPSK	2	1/6	3368	16	2	1	17688	8844
	50	30	133	11	QPSK	2	1/6	6664	24	2	2	35112	17556
	60	30	81	11	QPSK	2	1/6	4040	24	2	2	21384	10692
	60	30	162	11	QPSK	2	1/6	8064	24	2	3	42768	21384
	80	30	109	11	QPSK	2	1/6	5384	24	2	2	28776	14388
	80	30	217	11	QPSK	2	1/6	10752	24	2	3	57288	28644
	90	30	123	11	QPSK	2	1/6	6152	24	2	2	32472	16236
	90	30	245	11	QPSK	2	1/6	12296	24	2	4	64680	32340
	100	30	137	11	QPSK	2	1/6	6792	24	2	2	36168	18084
	100	30	273	11	QPSK	2	1/6	13576	24	2	4	72072	36036

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.6-3: Reference Channels for CP-OFDM QPSK for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	QPSK	2	1/6	48	16	2	1	264	132
	10	60	6	11	QPSK	2	1/6	304	16	2	1	1584	792
	10	60	11	11	QPSK	2	1/6	552	16	2	1	2904	1452
	15	60	9	11	QPSK	2	1/6	456	16	2	1	2376	1188
	15	60	18	11	QPSK	2	1/6	928	16	2	1	4752	2376
	20	60	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	20	60	24	11	QPSK	2	1/6	1192	16	2	1	6336	3168
	25	60	16	11	QPSK	2	1/6	808	16	2	1	4224	2112
	25	60	31	11	QPSK	2	1/6	1544	16	2	1	8184	4092
	30	60	19	11	QPSK	2	1/6	984	16	2	1	5016	2508
	30	60	38	11	QPSK	2	1/6	1928	16	2	1	10032	5016
	40	60	26	11	QPSK	2	1/6	1288	16	2	1	6864	3432
	40	60	51	11	QPSK	2	1/6	2536	16	2	1	13464	6732
	50	60	33	11	QPSK	2	1/6	1672	16	2	1	8712	4356
	50	60	65	11	QPSK	2	1/6	3240	16	2	1	17160	8580
	60	60	40	11	QPSK	2	1/6	2024	16	2	1	10560	5280
	60	60	79	11	QPSK	2	1/6	3912	24	2	2	20856	10428
	80	60	54	11	QPSK	2	1/6	2664	16	2	1	14256	7128
	80	60	107	11	QPSK	2	1/6	5256	24	2	2	28248	14124
	90	60	61	11	QPSK	2	1/6	3104	16	2	1	16104	8052
	90	60	121	11	QPSK	2	1/6	6024	24	2	2	31944	15972
	100	60	68	11	QPSK	2	1/6	3368	16	2	1	17952	8976
	100	60	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.7 CP-OFDM 16QAM

Table A.2.2.7-1: Reference Channels for CP-OFDM 16QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	16QAM	10	1/3	176	16	2	1	528	132
	5	15	13	11	16QAM	10	1/3	2280	16	2	1	6864	1716
	5	15	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	10	15	26	11	16QAM	10	1/3	4480	24	1	1	13728	3432
	10	15	52	11	16QAM	10	1/3	9224	24	1	2	27456	6864
	15	15	40	11	16QAM	10	1/3	7040	24	1	1	21120	5280
	15	15	79	11	16QAM	10	1/3	13832	24	1	2	41712	10428
	20	15	53	11	16QAM	10	1/3	9224	24	1	2	27984	6996
	20	15	106	11	16QAM	10	1/3	18432	24	1	3	55968	13992
	25	15	67	11	16QAM	10	1/3	11784	24	1	2	35376	8844
	25	15	133	11	16QAM	10	1/3	23040	24	1	3	70224	17556
	30	15	80	11	16QAM	10	1/3	14088	24	1	2	42240	10560
	30	15	160	11	16QAM	10	1/3	28168	24	1	4	84480	21120
	40	15	108	11	16QAM	10	1/3	18960	24	1	3	57024	14256
	40	15	216	11	16QAM	10	1/3	37896	24	1	5	114048	28512
	50	15	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820
	50	15	270	11	16QAM	10	1/3	47112	24	1	6	142560	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.7-2: Reference Channels for CP-OFDM 16QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	16QAM	10	1/3	176	16	2	1	528	132
	5	30	6	11	16QAM	10	1/3	1064	16	2	1	3168	792
	5	30	11	11	16QAM	10	1/3	1928	16	2	1	5808	1452
	10	30	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	10	30	24	11	16QAM	10	1/3	4224	24	1	1	12672	3168
	15	30	19	11	16QAM	10	1/3	3368	16	2	1	10032	2508
	15	30	38	11	16QAM	10	1/3	6656	24	1	1	20064	5016
	20	30	26	11	16QAM	10	1/3	4480	24	1	1	13728	3432
	20	30	51	11	16QAM	10	1/3	8968	24	1	2	26928	6732
	25	30	33	11	16QAM	10	1/3	5760	24	1	1	17424	4356
	25	30	65	11	16QAM	10	1/3	11272	24	1	2	34320	8580
	30	30	39	11	16QAM	10	1/3	6784	24	1	1	20592	5148
	30	30	78	11	16QAM	10	1/3	13576	24	1	2	41184	10296
	40	30	53	11	16QAM	10	1/3	9224	24	1	2	27984	6996
	40	30	106	11	16QAM	10	1/3	18432	24	1	3	55968	13992
	50	30	67	11	16QAM	10	1/3	11784	24	1	2	35376	8844
	50	30	133	11	16QAM	10	1/3	23040	24	1	3	70224	17556
	60	30	81	11	16QAM	10	1/3	14088	24	1	2	42768	10692
	60	30	162	11	16QAM	10	1/3	28168	24	1	4	85536	21384
	80	30	109	11	16QAM	10	1/3	18960	24	1	3	57552	14388
	80	30	217	11	16QAM	10	1/3	37896	24	1	5	114576	28644
	90	30	123	11	16QAM	10	1/3	21504	24	1	3	64944	16236
	90	30	245	11	16QAM	10	1/3	43032	24	1	6	129360	32340
	100	30	137	11	16QAM	10	1/3	24072	24	1	3	72336	18084
	100	30	273	11	16QAM	10	1/3	48168	24	1	6	144144	36036

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.7-3: Reference Channels for CP-OFDM 16QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	16QAM	10	1/3	176	16	2	1	528	132
	10	60	6	11	16QAM	10	1/3	1064	16	2	1	3168	792
	10	60	11	11	16QAM	10	1/3	1928	16	2	1	5808	1452
	15	60	9	11	16QAM	10	1/3	1608	16	2	1	4752	1188
	15	60	18	11	16QAM	10	1/3	3240	16	2	1	9504	2376
	20	60	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	20	60	24	11	16QAM	10	1/3	4224	24	1	1	12672	3168
	25	60	16	11	16QAM	10	1/3	2792	16	2	1	8448	2112
	25	60	31	11	16QAM	10	1/3	5376	24	1	1	16368	4092
	30	60	19	11	16QAM	10	1/3	3368	16	2	1	10032	2508
	30	60	38	11	16QAM	10	1/3	6656	24	1	1	20064	5016
	40	60	26	11	16QAM	10	1/3	4480	24	1	1	13728	3432
	40	60	51	11	16QAM	10	1/3	8968	24	1	2	26928	6732
	50	60	33	11	16QAM	10	1/3	5760	24	1	1	17424	4356
	50	60	65	11	16QAM	10	1/3	11272	24	1	2	34320	8580
	60	60	40	11	16QAM	10	1/3	7040	24	1	1	21120	5280
	60	60	79	11	16QAM	10	1/3	13832	24	1	2	41712	10428
	80	60	54	11	16QAM	10	1/3	9480	24	1	2	28512	7128
	80	60	107	11	16QAM	10	1/3	18960	24	1	3	56496	14124
	90	60	61	11	16QAM	10	1/3	10760	24	1	2	32208	8052
	90	60	121	11	16QAM	10	1/3	21000	24	1	3	63888	15972
	100	60	68	11	16QAM	10	1/3	11784	24	1	2	35904	8976
	100	60	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.8 CP-OFDM 64QAM

Table A.2.2.8-1: Reference Channels for CP-OFDM 64QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	**MHz**	**kHz**						**Bits**	**Bits**			**Bits**	
	5	15	25	11	64QAM	19	1/2	9992	24	1	2	19800	3300
	10	15	52	11	64QAM	19	1/2	21000	24	1	3	41184	6864
	15	15	79	11	64QAM	19	1/2	31752	24	1	4	62568	10428
	20	15	106	11	64QAM	19	1/2	42016	24	1	5	83952	13992
	25	15	133	11	64QAM	19	1/2	53288	24	1	7	105336	17556
	30	15	160	11	64QAM	19	1/2	63528	24	1	8	126720	21120
	40	15	216	11	64QAM	19	1/2	86040	24	1	11	171072	28512
	50	15	270	11	64QAM	19	1/2	108552	24	1	13	213840	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.8-2: Reference Channels for CP-OFDM 64QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5	30	11	11	64QAM	19	1/2	4352	24	1	1	8712	1452
	10	30	24	11	64QAM	19	1/2	9480	24	1	2	19008	3168
	15	30	38	11	64QAM	19	1/2	15112	24	1	2	30096	5016
	20	30	51	11	64QAM	19	1/2	20496	24	1	3	40392	6732
	25	30	65	11	64QAM	19	1/2	26120	24	1	4	51480	8580
	30	30	78	11	64QAM	19	1/2	31240	24	1	4	61776	10296
	40	30	106	11	64QAM	19	1/2	42016	24	1	5	83952	13992
	50	30	133	11	64QAM	19	1/2	53288	24	1	7	105336	17556
	60	30	162	11	64QAM	19	1/2	64552	24	1	8	128304	21384
	80	30	217	11	64QAM	19	1/2	86040	24	1	11	171864	28644
	90	30	245	11	64QAM	19	1/2	98376	24	1	12	194040	32340
	100	30	273	11	64QAM	19	1/2	108552	24	1	13	216216	36036

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.8-3: Reference Channels for CP-OFDM 64QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	**MHz**	**kHz**						**Bits**	**Bits**			**Bits**	
	10	60	11	11	64QAM	19	1/2	4352	24	1	1	8712	1452
	15	60	18	11	64QAM	19	1/2	7168	24	1	1	14256	2376
	20	60	24	11	64QAM	19	1/2	9480	24	1	2	19008	3168
	25	60	31	11	64QAM	19	1/2	12296	24	1	2	24552	4092
	30	60	38	11	64QAM	19	1/2	15112	24	1	2	30096	5016
	40	60	51	11	64QAM	19	1/2	20496	24	1	3	40392	6732
	50	60	65	11	64QAM	19	1/2	26120	24	1	4	51480	8580
	60	60	79	11	64QAM	19	1/2	31752	24	1	4	62568	10428
	80	60	107	11	64QAM	19	1/2	43032	24	1	6	84744	14124
	90	60	121	11	64QAM	19	1/2	48168	24	1	6	95832	15972
	100	60	135	11	64QAM	19	1/2	54296	24	1	7	106920	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.2.9 CP-OFDM 256QAM

Table A.2.2.9-1: Reference Channels for CP-OFDM 256QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	5	15	25	11	256QAM	20	2/3	17424	24	1	3	26400	3300
	10	15	52	11	256QAM	20	2/3	36896	24	1	5	54912	6864
	15	15	79	11	256QAM	20	2/3	55304	24	1	7	83424	10428
	20	15	106	11	256QAM	20	2/3	73776	24	1	9	111936	13992
	25	15	133	11	256QAM	20	2/3	94248	24	1	12	140448	17556
	30	15	160	11	256QAM	20	2/3	112648	24	1	14	168960	21120
	40	15	216	11	256QAM	20	2/3	151608	24	1	18	228096	28512
	50	15	270	11	256QAM	20	2/3	188576	24	1	23	285120	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.9-2: Reference Channels for CP-OFDM 256QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	**MHz**	**kHz**						**Bits**	**Bits**			**Bits**	
	5	30	11	11	256QAM	20	2/3	7680	24	1	1	11616	1452
	10	30	24	11	256QAM	20	2/3	16896	24	1	3	25344	3168
	15	30	38	11	256QAM	20	2/3	26632	24	1	4	40128	5016
	20	30	51	11	256QAM	20	2/3	35856	24	1	5	53856	6732
	25	30	65	11	256QAM	20	2/3	46104	24	1	6	68640	8580
	30	30	78	11	256QAM	20	2/3	55304	24	1	7	82368	10296
	40	30	106	11	256QAM	20	2/3	73776	24	1	9	111936	13992
	50	30	133	11	256QAM	20	2/3	94248	24	1	12	140448	17556
	60	30	162	11	256QAM	20	2/3	114776	24	1	14	171072	21384
	80	30	217	11	256QAM	20	2/3	151608	24	1	18	229152	28644
	90	30	245	11	256QAM	20	2/3	172176	24	1	21	258720	32340
	100	30	273	11	256QAM	20	2/3	192624	24	1	23	288288	36036

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.2.9-3: Reference Channels for CP-OFDM 256QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size	Transport block CRC	LDPC Base Graph	Number of code blocks per slot (Note 3)	Total number of bits per slot	Total modulated symbols per slot
Unit	MHz	kHz						Bits	Bits			Bits	
	10	60	11	11	256QAM	20	2/3	7680	24	1	1	11616	1452
	15	60	18	11	256QAM	20	2/3	12552	24	1	2	19008	2376
	20	60	24	11	256QAM	20	2/3	16896	24	1	3	25344	3168
	25	60	31	11	256QAM	20	2/3	22032	24	1	3	32736	4092
	30	60	38	11	256QAM	20	2/3	26632	24	1	4	40128	5016
	40	60	51	11	256QAM	20	2/3	35856	24	1	5	53856	6732
	50	60	65	11	256QAM	20	2/3	46104	24	1	6	68640	8580
	60	60	79	11	256QAM	20	2/3	55304	24	1	7	83424	10428
	80	60	107	11	256QAM	20	2/3	75792	24	1	9	112992	14124
	90	60	121	11	256QAM	20	2/3	86040	24	1	11	127776	15972
	100	60	135	11	256QAM	20	2/3	94248	24	1	12	142560	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.3 Reference measurement channels for TDD

TDD slot patterns defined for reference sensitivity tests will be used for UL RMCs defined below.

A.2.3.1 DFT-s-OFDM Pi/2-BPSK

Table A.2.3.1-1: Reference Channels for DFT-s-OFDM Pi/2-BPSK for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 4 and 9	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 4 and 9 (Note 3)	Total number of bits per slot for slots 4 and 9	Total modulated symbols per slot for slots 4 and 9
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	pi/2 BPSK	0	1/4	32	16	2	1	132	132
	5	15	12	11	pi/2 BPSK	0	1/4	384	16	2	1	1584	1584
	5	15	25	11	pi/2 BPSK	0	1/4	808	16	2	1	3300	3300
	10	15	25	11	pi/2 BPSK	0	1/4	808	16	2	1	3300	3300
	10	15	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	15	15	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	15	15	75	11	pi/2 BPSK	0	1/4	2408	16	2	1	9900	9900
	20	15	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	20	15	100	11	pi/2 BPSK	0	1/4	3104	16	2	1	13200	13200
	25	15	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	25	15	128	11	pi/2 BPSK	0	1/4	3976	24	2	2	16896	16896
	30	15	80	11	pi/2 BPSK	0	1/4	2472	16	2	1	10560	10560
	30	15	160	11	pi/2 BPSK	0	1/4	4872	24	2	2	21120	21120
	40	15	108	11	pi/2 BPSK	0	1/4	3368	16	2	1	14256	14256
	40	15	216	11	pi/2 BPSK	0	1/4	6664	24	2	2	28512	28512
	50	15	135	11	pi/2 BPSK	0	1/4	4104	24	2	2	17820	17820
	50	15	270	11	pi/2 BPSK	0	1/4	8448	24	2	3	35640	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.1-2: Reference Channels for DFT-s-OFDM Pi/2-BPSK for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 8, 9, 18 and 19	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 8, 9, 18 and 19 (Note 3)	Total number of bits per slot for slots 8, 9, 18 and 19	Total modulated symbols per slot for slots 8, 9, 18 and 19
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	pi/2 BPSK	0	1/4	32	16	2	1	132	132
	5	30	5	11	pi/2 BPSK	0	1/4	160	16	2	1	660	660
	5	30	10	11	pi/2 BPSK	0	1/4	320	16	2	1	1320	1320
	10	30	12	11	pi/2 BPSK	0	1/4	384	16	2	1	1584	1584
	10	30	24	11	pi/2 BPSK	0	1/4	768	16	2	1	3168	3168
	15	30	18	11	pi/2 BPSK	0	1/4	576	16	2	1	2376	2376
	15	30	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	20	30	25	11	pi/2 BPSK	0	1/4	808	16	2	1	3300	3300
	20	30	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	25	30	32	11	pi/2 BPSK	0	1/4	1032	16	2	1	4224	4224
	25	30	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	30	30	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	30	30	75	11	pi/2 BPSK	0	1/4	2408	16	2	1	9900	9900
	40	30	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	40	30	100	11	pi/2 BPSK	0	1/4	3104	16	2	1	13200	13200
	50	30	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	50	30	128	11	pi/2 BPSK	0	1/4	3976	24	2	2	16896	16896
	60	30	81	11	pi/2 BPSK	0	1/4	2536	16	2	1	10692	10692
	60	30	162	11	pi/2 BPSK	0	1/4	5000	24	2	2	21384	21384
	80	30	108	11	pi/2 BPSK	0	1/4	3368	16	2	1	14256	14256
	80	30	216	11	pi/2 BPSK	0	1/4	6664	24	2	2	28512	28512
	90	30	120	11	pi/2 BPSK	0	1/4	3752	16	2	1	15840	15840
	90	30	243	11	pi/2 BPSK	0	1/4	7560	24	2	2	32076	32076
	100	30	135	11	pi/2 BPSK	0	1/4	4104	24	2	2	17820	17820
	100	30	270	11	pi/2 BPSK	0	1/4	8448	24	2	3	35640	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.1-3: Reference Channels for DFT-s-OFDM Pi/2-BPSK for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 16, 17, 18, 19, 36, 37, 38 and 39	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39 (Note 3)	Total number of bits per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39	Total modulated symbols per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	pi/2 BPSK	0	1/4	32	16	2	1	132	132
	10	60	5	11	pi/2 BPSK	0	1/4	160	16	2	1	660	660
	10	60	10	11	pi/2 BPSK	0	1/4	320	16	2	1	1320	1320
	15	60	9	11	pi/2 BPSK	0	1/4	288	16	2	1	1188	1188
	15	60	18	11	pi/2 BPSK	0	1/4	576	16	2	1	2376	2376
	20	60	12	11	pi/2 BPSK	0	1/4	384	16	2	1	1584	1584
	20	60	24	11	pi/2 BPSK	0	1/4	768	16	2	1	3168	3168
	25	60	15	11	pi/2 BPSK	0	1/4	480	16	2	1	1980	1980
	25	60	30	11	pi/2 BPSK	0	1/4	984	16	2	1	3960	3960
	30	60	18	11	pi/2 BPSK	0	1/4	576	16	2	1	2376	2376
	30	60	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	40	60	25	11	pi/2 BPSK	0	1/4	808	16	2	1	3300	3300
	40	60	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	50	60	32	11	pi/2 BPSK	0	1/4	1032	16	2	1	4224	4224
	50	60	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	60	60	36	11	pi/2 BPSK	0	1/4	1128	16	2	1	4752	4752
	60	60	75	11	pi/2 BPSK	0	1/4	2408	16	2	1	9900	9900
	80	60	50	11	pi/2 BPSK	0	1/4	1544	16	2	1	6600	6600
	80	60	100	11	pi/2 BPSK	0	1/4	3104	16	2	1	13200	13200
	90	60	60	11	pi/2 BPSK	0	1/4	1864	16	2	1	7920	7920
	90	60	120	11	pi/2 BPSK	0	1/4	3752	16	2	1	15840	15840
	100	60	64	11	pi/2 BPSK	0	1/4	2024	16	2	1	8448	8448
	100	60	135	11	pi/2 BPSK	0	1/4	4104	24	2	2	17820	17820

Note 1:	PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2:	MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3:	If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.3.2 DFT-s-OFDM QPSK

Table A.2.3.2-1: Reference Channels for DFT-s-OFDM QPSK for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 4 and 9	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 4 and 9 (Note 3)	Total number of bits per slot for slots 4 and 9	Total modulated symbols per slot for slots 4 and 9
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	QPSK	2	1/6	48	16	2	1	264	132
	5	15	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	5	15	20	11	QPSK	2	1/6	1032	16	2	1	5280	2640
	5	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	10	15	20	11	QPSK	2	1/6	1032	16	2	1	5280	2640
	10	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	10	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	15	15	20	11	QPSK	2	1/6	1032	16	2	1	5280	2640
	15	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	15	15	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	15	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	15	15	75	11	QPSK	2	1/6	3752	16	2	1	19800	9900
	20	15	20	11	QPSK	2	1/6	1032	16	2	1	5280	2640
	20	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	20	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	20	15	100	11	QPSK	2	1/6	5000	24	2	2	26400	13200
	25	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	25	15	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	25	15	128	11	QPSK	2	1/6	6408	24	2	2	33792	16896
	30	15	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	30	15	80	11	QPSK	2	1/6	3976	24	2	2	21120	10560
	30	15	160	11	QPSK	2	1/6	7944	24	2	3	42240	21120
	40	15	108	11	QPSK	2	1/6	5384	24	2	2	28512	14256
	40	15	216	11	QPSK	2	1/6	10752	24	2	3	57024	28512
	50	15	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820
	50	15	270	11	QPSK	2	1/6	13320	24	2	4	71280	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.2-2: Reference Channels for DFT-s-OFDM QPSK for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 8, 9, 18 and 19	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 8, 9, 18 and 19 (Note 3)	Total number of bits per slot for slots 8, 9, 18 and 19	Total modulated symbols per slot for slots 8, 9, 18 and 19
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	QPSK	2	1/6	48	16	2	1	264	132
	5	30	5	11	QPSK	2	1/6	256	16	2	1	1320	660
	5	30	10	11	QPSK	2	1/6	504	16	2	1	2640	1320
	10	30	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	10	30	24	11	QPSK	2	1/6	1192	16	2	1	6336	3168
	15	30	18	11	QPSK	2	1/6	928	16	2	1	4752	2376
	15	30	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	20	30	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	20	30	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	25	30	32	11	QPSK	2	1/6	1608	16	2	1	8448	4224
	25	30	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	30	30	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	30	30	75	11	QPSK	2	1/6	3752	16	2	1	19800	9900
	40	30	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	40	30	100	11	QPSK	2	1/6	5000	24	2	2	26400	13200
	50	30	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	50	30	128	11	QPSK	2	1/6	6408	24	2	2	33792	16896
	60	30	81	11	QPSK	2	1/6	4040	24	2	2	21384	10692
	60	30	162	11	QPSK	2	1/6	8064	24	2	3	42768	21384
	80	30	108	11	QPSK	2	1/6	5384	24	2	2	28512	14256
	80	30	216	11	QPSK	2	1/6	10752	24	2	3	57024	28512
	90	30	120	11	QPSK	2	1/6	5896	24	2	2	31680	15840
	90	30	243	11	QPSK	2	1/6	12040	24	2	4	64152	32076
	100	30	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820
	100	30	270	11	QPSK	2	1/6	13320	24	2	4	71280	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.2-3: Reference Channels for DFT-s-OFDM QPSK for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 16, 17, 18, 19, 36, 37, 38 and 39	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39 (Note 3)	Total number of bits per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39	Total modulated symbols per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	QPSK	2	1/6	48	16	2	1	264	132
	10	60	5	11	QPSK	2	1/6	256	16	2	1	1320	660
	10	60	10	11	QPSK	2	1/6	504	16	2	1	2640	1320
	15	60	9	11	QPSK	2	1/6	456	16	2	1	2376	1188
	15	60	18	11	QPSK	2	1/6	928	16	2	1	4752	2376
	20	60	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	20	60	24	11	QPSK	2	1/6	1192	16	2	1	6336	3168
	25	60	15	11	QPSK	2	1/6	768	16	2	1	3960	1980
	25	60	30	11	QPSK	2	1/6	1544	16	2	1	7920	3960
	30	60	18	11	QPSK	2	1/6	928	16	2	1	4752	2376
	30	60	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	40	60	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	40	60	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	50	60	32	11	QPSK	2	1/6	1608	16	2	1	8448	4224
	50	60	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	60	60	36	11	QPSK	2	1/6	1800	16	2	1	9504	4752
	60	60	75	11	QPSK	2	1/6	3752	16	2	1	19800	9900
	80	60	50	11	QPSK	2	1/6	2472	16	2	1	13200	6600
	80	60	100	11	QPSK	2	1/6	5000	24	2	2	26400	13200
	90	60	60	11	QPSK	2	1/6	3104	16	2	1	15840	7920
	90	60	120	11	QPSK	2	1/6	5896	24	2	2	31680	15840
	100	60	64	11	QPSK	2	1/6	3240	16	2	1	16896	8448
	100	60	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.3.3 DFT-s-OFDM 16QAM

Table A.2.3.3-1: Reference Channels for DFT-s-OFDM 16QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 4 and 9	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 4 and 9 (Note 3)	Total number of bits per slot for slots 4 and 9	Total modulated symbols per slot for slots 4 and 9
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	16QAM	10	1/3	176	16	2	1	528	132
	5	15	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	5	15	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	10	15	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	10	15	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	15	15	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	15	15	75	11	16QAM	10	1/3	13064	24	1	2	39600	9900
	20	15	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	20	15	100	11	16QAM	10	1/3	17424	24	1	3	52800	13200
	25	15	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	25	15	128	11	16QAM	10	1/3	22536	24	1	3	67584	16896
	30	15	80	11	16QAM	10	1/3	14088	24	1	2	42240	10560
	30	15	160	11	16QAM	10	1/3	28168	24	1	4	84480	21120
	40	15	108	11	16QAM	10	1/3	18960	24	1	3	57024	14256
	40	15	216	11	16QAM	10	1/3	37896	24	1	5	114048	28512
	50	15	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820
	50	15	270	11	16QAM	10	1/3	47112	24	1	6	142560	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM’ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.3-2: Reference Channels for DFT-s-OFDM 16QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 8, 9, 18 and 19	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 8, 9, 18 and 19 (Note 3)	Total number of bits per slot for slots 8, 9, 18 and 19	Total modulated symbols per slot for slots 8, 9, 18 and 19
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	16QAM	10	1/3	176	16	2	1	528	132
	5	30	5	11	16QAM	10	1/3	888	16	2	1	2640	660
	5	30	10	11	16QAM	10	1/3	1800	16	2	1	5280	1320
	10	30	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	10	30	24	11	16QAM	10	1/3	4224	24	1	1	12672	3168
	15	30	18	11	16QAM	10	1/3	3240	16	2	1	9504	2376
	15	30	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	20	30	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	20	30	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	25	30	32	11	16QAM	10	1/3	5632	24	1	1	16896	4224
	25	30	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	30	30	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	30	30	75	11	16QAM	10	1/3	13064	24	1	2	39600	9900
	40	30	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	40	30	100	11	16QAM	10	1/3	17424	24	1	3	52800	13200
	50	30	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	50	30	128	11	16QAM	10	1/3	22536	24	1	3	67584	16896
	60	30	81	11	16QAM	10	1/3	14088	24	1	2	42768	10692
	60	30	162	11	16QAM	10	1/3	28168	24	1	4	85536	21384
	80	30	108	11	16QAM	10	1/3	18960	24	1	3	57024	14256
	80	30	216	11	16QAM	10	1/3	37896	24	1	5	114048	28512
	90	30	120	11	16QAM	10	1/3	21000	24	1	3	63360	15840
	90	30	243	11	16QAM	10	1/3	43032	24	1	6	128304	32076
	100	30	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820
	100	30	270	11	16QAM	10	1/3	47112	24	1	6	142560	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.3-3: Reference Channels for DFT-s-OFDM 16QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 16, 17, 18, 19, 36, 37, 38 and 39	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39 (Note 3)	Total number of bits per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39	Total modulated symbols per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	16QAM	10	1/3	176	16	2	1	528	132
	10	60	5	11	16QAM	10	1/3	888	16	2	1	2640	660
	10	60	10	11	16QAM	10	1/3	1800	16	2	1	5280	1320
	15	60	9	11	16QAM	10	1/3	1608	16	2	1	4752	1188
	15	60	18	11	16QAM	10	1/3	3240	16	2	1	9504	2376
	20	60	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	20	60	24	11	16QAM	10	1/3	4224	24	1	1	12672	3168
	25	60	15	11	16QAM	10	1/3	2664	16	2	1	7920	1980
	25	60	30	11	16QAM	10	1/3	5248	24	1	1	15840	3960
	30	60	18	11	16QAM	10	1/3	3240	16	2	1	9504	2376
	30	60	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	40	60	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	40	60	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	50	60	32	11	16QAM	10	1/3	5632	24	1	1	16896	4224
	50	60	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	60	60	36	11	16QAM	10	1/3	6272	24	1	1	19008	4752
	60	60	75	11	16QAM	10	1/3	13064	24	1	2	39600	9900
	80	60	50	11	16QAM	10	1/3	8712	24	1	2	26400	6600
	80	60	100	11	16QAM	10	1/3	17424	24	1	3	52800	13200
	90	60	60	11	16QAM	10	1/3	10504	24	1	2	31680	7920
	90	60	120	11	16QAM	10	1/3	21000	24	1	3	63360	15840
	100	60	64	11	16QAM	10	1/3	11272	24	1	2	33792	8448
	100	60	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820

Note 1:	PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2:	MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3:	If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.3.4 DFT-s-OFDM 64QAM

Table A.2.3.4-1: Reference Channels for DFT-s-OFDM 64QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 4 and 9	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 4 and 9 (Note 3)	Total number of bits per slot for slots 4 and 9	Total modulated symbols per slot for slots 4 and 9
Unit	MHz	kHz						Bits	Bits			Bits	
	5	15	25	11	64QAM	18	1/2	9992	24	1	2	19800	3300
	10	15	50	11	64QAM	18	1/2	19968	24	1	3	39600	6600
	15	15	75	11	64QAM	18	1/2	30216	24	1	4	59400	9900
	20	15	100	11	64QAM	18	1/2	39936	24	1	5	79200	13200
	25	15	128	11	64QAM	18	1/2	51216	24	1	7	101376	16896
	30	15	160	11	64QAM	18	1/2	63528	24	1	8	126720	21120
	40	15	216	11	64QAM	18	1/2	86040	24	1	11	171072	28512
	50	15	270	11	64QAM	18	1/2	108552	24	1	13	213840	35640

Note 1:	PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2:	MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].
Note 3:	If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.4-2: Reference Channels for DFT-s-OFDM 64QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 8, 9, 18 and 19	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 8, 9, 18 and 19 (Note 3)	Total number of bits per slot for slots 8, 9, 18 and 19	Total modulated symbols per slot for slots 8, 9, 18 and 19
Unit	**MHz**	**kHz**						**Bits**	**Bits**			**Bits**	
	5	30	10	11	64QAM	18	1/2	3968	24	1	1	7920	1320
	10	30	24	11	64QAM	18	1/2	9480	24	1	2	19008	3168
	15	30	36	11	64QAM	18	1/2	14344	24	1	2	28512	4752
	20	30	50	11	64QAM	18	1/2	19968	24	1	3	39600	6600
	25	30	64	11	64QAM	18	1/2	25608	24	1	4	50688	8448
	30	30	75	11	64QAM	18	1/2	30216	24	1	4	59400	9900
	40	30	100	11	64QAM	18	1/2	39936	24	1	5	79200	13200
	50	30	128	11	64QAM	18	1/2	51216	24	1	7	101376	16896
	60	30	162	11	64QAM	18	1/2	64552	24	1	8	128304	21384
	80	30	216	11	64QAM	18	1/2	86040	24	1	11	171072	28512
	90	30	243	11	64QAM	18	1/2	96264	24	1	12	192456	32076
	100	30	270	11	64QAM	18	1/2	108552	24	1	13	213840	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.4-3: Reference Channels for DFT-s-OFDM 64QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 16, 17, 18, 19, 36, 37, 38 and 39	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39 (Note 3)	Total number of bits per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39	Total modulated symbols per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39
Unit	MHz	kHz						Bits	Bits			Bits	
	10	60	10	11	64QAM	18	1/2	3968	24	1	1	7920	1320
	15	60	18	11	64QAM	18	1/2	7168	24	1	1	14256	2376
	20	60	24	11	64QAM	18	1/2	9480	24	1	2	19008	3168
	25	60	30	11	64QAM	18	1/2	12040	24	1	2	23760	3960
	30	60	36	11	64QAM	18	1/2	14344	24	1	2	28512	4752
	40	60	50	11	64QAM	18	1/2	19968	24	1	3	39600	6600
	50	60	64	11	64QAM	18	1/2	25608	24	1	4	50688	8448
	60	60	75	11	64QAM	18	1/2	30216	24	1	4	59400	9900
	80	60	100	11	64QAM	18	1/2	39936	24	1	5	79200	13200
	90	60	120	11	64QAM	18	1/2	48168	24	1	6	95040	15840
	100	60	135	11	64QAM	18	1/2	54296	24	1	7	106920	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 6.1.4.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.3.5 DFT-s-OFDM 256QAM

Table A.2.3.5-1: Reference Channels for DFT-s-OFDM 256QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 4 and 9	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 4 and 9 (Note 3)	Total number of bits per slot for slots 4 and 9	Total modulated symbols per slot for slots 4 and 9
Unit	MHz	kHz						Bits	Bits			Bits	
	5	15	25	11	256QAM	20	2/3	17424	24	1	3	26400	3300
	10	15	50	11	256QAM	20	2/3	34816	24	1	5	52800	6600
	15	15	75	11	256QAM	20	2/3	53288	24	1	7	79200	9900
	20	15	100	11	256QAM	20	2/3	69672	24	1	9	105600	13200
	25	15	128	11	256QAM	20	2/3	90176	24	1	11	135168	16896
	30	15	160	11	256QAM	20	2/3	112648	24	1	14	168960	21120
	40	15	216	11	256QAM	20	2/3	151608	24	1	18	228096	28512
	50	15	270	11	256QAM	20	2/3	188576	24	1	23	285120	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.5-2: Reference Channels for DFT-s-OFDM 256QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 8, 9, 18 and 19	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 8, 9, 18 and 19 (Note 3)	Total number of bits per slot for slots 8, 9, 18 and 19	Total modulated symbols per slot for slots 8, 9, 18 and 19
Unit	**MHz**	**kHz**						**Bits**	**Bits**			**Bits**	
	5	30	10	11	256QAM	20	2/3	7040	24	1	1	10560	1320
	10	30	24	11	256QAM	20	2/3	16896	24	1	3	25344	3168
	15	30	36	11	256QAM	20	2/3	25104	24	1	3	38016	4752
	20	30	50	11	256QAM	20	2/3	34816	24	1	5	52800	6600
	25	30	64	11	256QAM	20	2/3	45096	24	1	6	67584	8448
	30	30	75	11	256QAM	20	2/3	53288	24	1	7	79200	9900
	40	30	100	11	256QAM	20	2/3	69672	24	1	9	105600	13200
	50	30	128	11	256QAM	20	2/3	90176	24	1	11	135168	16896
	60	30	162	11	256QAM	20	2/3	114776	24	1	14	171072	21384
	80	30	216	11	256QAM	20	2/3	151608	24	1	18	228096	28512
	90	30	243	11	256QAM	20	2/3	172176	24	1	21	256608	32076
	100	30	270	11	256QAM	20	2/3	188576	24	1	23	285120	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.5-3: Reference Channels for DFT-s-OFDM 256QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	DFT-s-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 16, 17, 18, 19, 36, 37, 38 and 39	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39 (Note 3)	Total number of bits per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39	Total modulated symbols per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39
Unit	**MHz**	**kHz**						**Bits**	**Bits**			**Bits**	
	10	60	10	11	256QAM	20	2/3	7040	24	1	1	10560	1320
	15	60	18	11	256QAM	20	2/3	12552	24	1	2	19008	2376
	20	60	24	11	256QAM	20	2/3	16896	24	1	3	25344	3168
	25	60	30	11	256QAM	20	2/3	21000	24	1	3	31680	3960
	30	60	36	11	256QAM	20	2/3	25104	24	1	3	38016	4752
	40	60	50	11	256QAM	20	2/3	34816	24	1	5	52800	6600
	50	60	64	11	256QAM	20	2/3	45096	24	1	6	67584	8448
	60	60	75	11	256QAM	20	2/3	53288	24	1	7	79200	9900
	80	60	100	11	256QAM	20	2/3	69672	24	1	9	105600	13200
	90	60	120	11	256QAM	20	2/3	83976	24	1	10	126720	15840
	100	60	135	11	256QAM	20	2/3	94248	24	1	12	142560	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.3.6 CP-OFDM QPSK

Table A.2.3.6-1: Reference Channels for CP-OFDM QPSK for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 4 and 9	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 4 and 9 (Note 3)	Total number of bits per slot for slots 4 and 9	Total modulated symbols per slot for slots 4 and 9
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	QPSK	2	1/6	48	16	2	1	264	132
	5	15	13	11	QPSK	2	1/6	672	16	2	1	3432	1716
	5	15	25	11	QPSK	2	1/6	1256	16	2	1	6600	3300
	10	15	26	11	QPSK	2	1/6	1288	16	2	1	6864	3432
	10	15	52	11	QPSK	2	1/6	2600	16	2	1	13728	6864
	15	15	40	11	QPSK	2	1/6	2024	16	2	1	10560	5280
	15	15	79	11	QPSK	2	1/6	3912	24	2	2	20856	10428
	20	15	53	11	QPSK	2	1/6	2664	16	2	1	13992	6996
	20	15	106	11	QPSK	2	1/6	5256	24	2	2	27984	13992
	25	15	67	11	QPSK	2	1/6	3368	16	2	1	17688	8844
	25	15	133	11	QPSK	2	1/6	6664	24	2	2	35112	17556
	30	15	80	11	QPSK	2	1/6	3976	24	2	2	21120	10560
	30	15	160	11	QPSK	2	1/6	7944	24	2	3	42240	21120
	40	15	108	11	QPSK	2	1/6	5384	24	2	2	28512	14256
	40	15	216	11	QPSK	2	1/6	10752	24	2	3	57024	28512
	50	15	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820
	50	15	270	11	QPSK	2	1/6	13320	24	2	4	71280	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.6-2: Reference Channels for CP-OFDM QPSK for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 8, 9, 18 and 19	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 8, 9, 18 and 19 (Note 3)	Total number of bits per slot for slots 8, 9, 18 and 19	Total modulated symbols per slot for slots 8, 9, 18 and 19
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	QPSK	2	1/6	48	16	2	1	264	132
	5	30	6	11	QPSK	2	1/6	304	16	2	1	1584	792
	5	30	11	11	QPSK	2	1/6	552	16	2	1	2904	1452
	10	30	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	10	30	24	11	QPSK	2	1/6	1192	16	2	1	6336	3168
	15	30	19	11	QPSK	2	1/6	984	16	2	1	5016	2508
	15	30	38	11	QPSK	2	1/6	1928	16	2	1	10032	5016
	20	30	26	11	QPSK	2	1/6	1288	16	2	1	6864	3432
	20	30	51	11	QPSK	2	1/6	2536	16	2	1	13464	6732
	25	30	33	11	QPSK	2	1/6	1672	16	2	1	8712	4356
	25	30	65	11	QPSK	2	1/6	3240	16	2	1	17160	8580
	30	30	39	11	QPSK	2	1/6	2024	16	2	1	10296	5148
	30	30	78	11	QPSK	2	1/6	3848	24	2	2	20592	10296
	40	30	53	11	QPSK	2	1/6	2664	16	2	1	13992	6996
	40	30	106	11	QPSK	2	1/6	5256	24	2	2	27984	13992
	50	30	67	11	QPSK	2	1/6	3368	16	2	1	17688	8844
	50	30	133	11	QPSK	2	1/6	6664	24	2	2	35112	17556
	60	30	81	11	QPSK	2	1/6	4040	24	2	2	21384	10692
	60	30	162	11	QPSK	2	1/6	8064	24	2	3	42768	21384
	80	30	109	11	QPSK	2	1/6	5384	24	2	2	28776	14388
	80	30	217	11	QPSK	2	1/6	10752	24	2	3	57288	28644
	90	30	123	11	QPSK	2	1/6	6152	24	2	2	32472	16236
	90	30	245	11	QPSK	2	1/6	12296	24	2	4	64680	32340
	100	30	137	11	QPSK	2	1/6	6792	24	2	2	36168	18084
	100	30	273	11	QPSK	2	1/6	13576	24	2	4	72072	36036

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.6-3: Reference Channels for CP-OFDM QPSK for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 16, 17, 18, 19, 36, 37, 38 and 39	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39 (Note 3)	Total number of bits per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39	Total modulated symbols per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	QPSK	2	1/6	48	16	2	1	264	132
	10	60	6	11	QPSK	2	1/6	304	16	2	1	1584	792
	10	60	11	11	QPSK	2	1/6	552	16	2	1	2904	1452
	15	60	9	11	QPSK	2	1/6	456	16	2	1	2376	1188
	15	60	18	11	QPSK	2	1/6	928	16	2	1	4752	2376
	20	60	12	11	QPSK	2	1/6	608	16	2	1	3168	1584
	20	60	24	11	QPSK	2	1/6	1192	16	2	1	6336	3168
	25	60	16	11	QPSK	2	1/6	808	16	2	1	4224	2112
	25	60	31	11	QPSK	2	1/6	1544	16	2	1	8184	4092
	30	60	19	11	QPSK	2	1/6	984	16	2	1	5016	2508
	30	60	38	11	QPSK	2	1/6	1928	16	2	1	10032	5016
	40	60	26	11	QPSK	2	1/6	1288	16	2	1	6864	3432
	40	60	51	11	QPSK	2	1/6	2536	16	2	1	13464	6732
	50	60	33	11	QPSK	2	1/6	1672	16	2	1	8712	4356
	50	60	65	11	QPSK	2	1/6	3240	16	2	1	17160	8580
	60	60	40	11	QPSK	2	1/6	2024	16	2	1	10560	5280
	60	60	79	11	QPSK	2	1/6	3912	24	2	2	20856	10428
	80	60	54	11	QPSK	2	1/6	2664	16	2	1	14256	7128
	80	60	107	11	QPSK	2	1/6	5256	24	2	2	28248	14124
	90	60	61	11	QPSK	2	1/6	3104	16	2	1	16104	8052
	90	60	121	11	QPSK	2	1/6	6024	24	2	2	31944	15972
	100	60	68	11	QPSK	2	1/6	3368	16	2	1	17952	8976
	100	60	135	11	QPSK	2	1/6	6664	24	2	2	35640	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.3.7 CP-OFDM 16QAM

Table A.2.3.7-1: Reference Channels for CP-OFDM 16QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 4 and 9	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 4 and 9 (Note 3)	Total number of bits per slot for slots 4 and 9	Total modulated symbols per slot for slots 4 and 9
Unit	MHz	kHz						Bits	Bits			Bits	
	5-50	15	1	11	16QAM	10	1/3	176	16	2	1	528	132
	5	15	13	11	16QAM	10	1/3	2280	16	2	1	6864	1716
	5	15	25	11	16QAM	10	1/3	4352	24	1	1	13200	3300
	10	15	26	11	16QAM	10	1/3	4480	24	1	1	13728	3432
	10	15	52	11	16QAM	10	1/3	9224	24	1	2	27456	6864
	15	15	40	11	16QAM	10	1/3	7040	24	1	1	21120	5280
	15	15	79	11	16QAM	10	1/3	13832	24	1	2	41712	10428
	20	15	53	11	16QAM	10	1/3	9224	24	1	2	27984	6996
	20	15	106	11	16QAM	10	1/3	18432	24	1	3	55968	13992
	25	15	67	11	16QAM	10	1/3	11784	24	1	2	35376	8844
	25	15	133	11	16QAM	10	1/3	23040	24	1	3	70224	17556
	30	15	80	11	16QAM	10	1/3	14088	24	1	2	42240	10560
	30	15	160	11	16QAM	10	1/3	28168	24	1	4	84480	21120
	40	15	108	11	16QAM	10	1/3	18960	24	1	3	57024	14256
	40	15	216	11	16QAM	10	1/3	37896	24	1	5	114048	28512
	50	15	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820
	50	15	270	11	16QAM	10	1/3	47112	24	1	6	142560	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.7-2: Reference Channels for CP-OFDM 16QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 8, 9, 18 and 19	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 8, 9, 18 and 19 (Note 3)	Total number of bits per slot for slots 8, 9, 18 and 19	Total modulated symbols per slot for slots 8, 9, 18 and 19
Unit	MHz	kHz						Bits	Bits			Bits	
	5-100	30	1	11	16QAM	10	1/3	176	16	2	1	528	132
	5	30	6	11	16QAM	10	1/3	1064	16	2	1	3168	792
	5	30	11	11	16QAM	10	1/3	1928	16	2	1	5808	1452
	10	30	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	10	30	24	11	16QAM	10	1/3	4224	24	1	1	12672	3168
	15	30	19	11	16QAM	10	1/3	3368	16	2	1	10032	2508
	15	30	38	11	16QAM	10	1/3	6656	24	1	1	20064	5016
	20	30	26	11	16QAM	10	1/3	4480	24	1	1	13728	3432
	20	30	51	11	16QAM	10	1/3	8968	24	1	2	26928	6732
	25	30	33	11	16QAM	10	1/3	5760	24	1	1	17424	4356
	25	30	65	11	16QAM	10	1/3	11272	24	1	2	34320	8580
	30	30	39	11	16QAM	10	1/3	6784	24	1	1	20592	5148
	30	30	78	11	16QAM	10	1/3	13576	24	1	2	41184	10296
	40	30	53	11	16QAM	10	1/3	9224	24	1	2	27984	6996
	40	30	106	11	16QAM	10	1/3	18432	24	1	3	55968	13992
	50	30	67	11	16QAM	10	1/3	11784	24	1	2	35376	8844
	50	30	133	11	16QAM	10	1/3	23040	24	1	3	70224	17556
	60	30	81	11	16QAM	10	1/3	14088	24	1	2	42768	10692
	60	30	162	11	16QAM	10	1/3	28168	24	1	4	85536	21384
	80	30	109	11	16QAM	10	1/3	18960	24	1	3	57552	14388
	80	30	217	11	16QAM	10	1/3	37896	24	1	5	114576	28644
	90	30	123	11	16QAM	10	1/3	21504	24	1	3	64944	16236
	90	30	245	11	16QAM	10	1/3	43032	24	1	6	129360	32340
	100	30	137	11	16QAM	10	1/3	24072	24	1	3	72336	18084
	100	30	273	11	16QAM	10	1/3	48168	24	1	6	144144	36036

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].
Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.7-3: Reference Channels for CP-OFDM 16QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 16, 17, 18, 19, 36, 37, 38 and 39	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39 (Note 3)	Total number of bits per slot for slots 416, 17, 18, 19, 36, 37, 38 and 39	Total modulated symbols per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39
Unit	MHz	kHz						Bits	Bits			Bits	
	10-100	60	1	11	16QAM	10	1/3	176	16	2	1	528	132
	10	60	6	11	16QAM	10	1/3	1064	16	2	1	3168	792
	10	60	11	11	16QAM	10	1/3	1928	16	2	1	5808	1452
	15	60	9	11	16QAM	10	1/3	1608	16	2	1	4752	1188
	15	60	18	11	16QAM	10	1/3	3240	16	2	1	9504	2376
	20	60	12	11	16QAM	10	1/3	2088	16	2	1	6336	1584
	20	60	24	11	16QAM	10	1/3	4224	24	1	1	12672	3168
	25	60	16	11	16QAM	10	1/3	2792	16	2	1	8448	2112
	25	60	31	11	16QAM	10	1/3	5376	24	1	1	16368	4092
	30	60	19	11	16QAM	10	1/3	3368	16	2	1	10032	2508
	30	60	38	11	16QAM	10	1/3	6656	24	1	1	20064	5016
	40	60	26	11	16QAM	10	1/3	4480	24	1	1	13728	3432
	40	60	51	11	16QAM	10	1/3	8968	24	1	2	26928	6732
	50	60	33	11	16QAM	10	1/3	5760	24	1	1	17424	4356
	50	60	65	11	16QAM	10	1/3	11272	24	1	2	34320	8580
	60	60	40	11	16QAM	10	1/3	7040	24	1	1	21120	5280
	60	60	79	11	16QAM	10	1/3	13832	24	1	2	41712	10428
	80	60	54	11	16QAM	10	1/3	9480	24	1	2	28512	7128
	80	60	107	11	16QAM	10	1/3	18960	24	1	3	56496	14124
	90	60	61	11	16QAM	10	1/3	10760	24	1	2	32208	8052
	90	60	121	11	16QAM	10	1/3	21000	24	1	3	63888	15972
	100	60	68	11	16QAM	10	1/3	11784	24	1	2	35904	8976
	100	60	135	11	16QAM	10	1/3	23568	24	1	3	71280	17820

Note 1:	PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data.
Note 2:	MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].
Note 3:	If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.3.8 CP-OFDM 64QAM

Table A.2.3.8-1: Reference Channels for CP-OFDM 64QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 4 and 9	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 4 and 9 (Note 3)	Total number of bits per slot for slots 4 and 9	Total modulated symbols per slot for slots 4 and 9
Unit	MHz	kHz						Bits	Bits			Bits	
	5	15	25	11	64QAM	19	1/2	9992	24	1	2	19800	3300
	10	15	52	11	64QAM	19	1/2	21000	24	1	3	41184	6864
	15	15	79	11	64QAM	19	1/2	31752	24	1	4	62568	10428
	20	15	106	11	64QAM	19	1/2	42016	24	1	5	83952	13992
	25	15	133	11	64QAM	19	1/2	53288	24	1	7	105336	17556
	30	15	160	11	64QAM	19	1/2	63528	24	1	8	126720	21120
	40	15	216	11	64QAM	19	1/2	86040	24	1	11	171072	28512
	50	15	270	11	64QAM	19	1/2	108552	24	1	13	213840	35640

Note 1:	PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.
Note 2:	MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].
Note 3:	If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.8-2: Reference Channels for CP-OFDM 64QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 8, 9, 18 and 19	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 8, 9, 18 and 19 (Note 3)	Total number of bits per slot for slots 8, 9, 18 and 19	Total modulated symbols per slot for slots 8, 9, 18 and 19
Unit	MHz	kHz						Bits	Bits			Bits	
	5	30	11	11	64QAM	19	1/2	4352	24	1	1	8712	1452
	10	30	24	11	64QAM	19	1/2	9480	24	1	2	19008	3168
	15	30	38	11	64QAM	19	1/2	15112	24	1	2	30096	5016
	20	30	51	11	64QAM	19	1/2	20496	24	1	3	40392	6732
	25	30	65	11	64QAM	19	1/2	26120	24	1	4	51480	8580
	30	30	78	11	64QAM	19	1/2	31240	24	1	4	61776	10296
	40	30	106	11	64QAM	19	1/2	42016	24	1	5	83952	13992
	50	30	133	11	64QAM	19	1/2	53288	24	1	7	105336	17556
	60	30	162	11	64QAM	19	1/2	64552	24	1	8	128304	21384
	80	30	217	11	64QAM	19	1/2	86040	24	1	11	171864	28644
	90	30	245	11	64QAM	19	1/2	98376	24	1	12	194040	32340
	100	30	273	11	64QAM	19	1/2	108552	24	1	13	216216	36036

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.8-3: Reference Channels for CP-OFDM 64QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 16, 17, 18, 19, 36, 37, 38 and 39	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39 (Note 3)	Total number of bits per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39	Total modulated symbols per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39
Unit	MHz	kHz						Bits	Bits			Bits	
	10	60	11	11	64QAM	19	1/2	4352	24	1	1	8712	1452
	15	60	18	11	64QAM	19	1/2	7168	24	1	1	14256	2376
	20	60	24	11	64QAM	19	1/2	9480	24	1	2	19008	3168
	25	60	31	11	64QAM	19	1/2	12296	24	1	2	24552	4092
	30	60	38	11	64QAM	19	1/2	15112	24	1	2	30096	5016
	40	60	51	11	64QAM	19	1/2	20496	24	1	3	40392	6732
	50	60	65	11	64QAM	19	1/2	26120	24	1	4	51480	8580
	60	60	79	11	64QAM	19	1/2	31752	24	1	4	62568	10428
	80	60	107	11	64QAM	19	1/2	43032	24	1	6	84744	14124
	90	60	121	11	64QAM	19	1/2	48168	24	1	6	95832	15972
	100	60	135	11	64QAM	19	1/2	54296	24	1	7	106920	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-1 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.2.3.9 CP-OFDM 256QAM

Table A.2.3.9-1: Reference Channels for CP-OFDM 256QAM for 15kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 4 and 9	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 4 and 9 (Note 3)	Total number of bits per slot for slots 4 and 9	Total modulated symbols per slot for slots 4 and 9
Unit	MHz	kHz						Bits	Bits			Bits	
	5	15	25	11	256QAM	20	2/3	17424	24	1	3	26400	3300
	10	15	52	11	256QAM	20	2/3	36896	24	1	5	54912	6864
	15	15	79	11	256QAM	20	2/3	55304	24	1	7	83424	10428
	20	15	106	11	256QAM	20	2/3	73776	24	1	9	111936	13992
	25	15	133	11	256QAM	20	2/3	94248	24	1	12	140448	17556
	30	15	160	11	256QAM	20	2/3	112648	24	1	14	168960	21120
	40	15	216	11	256QAM	20	2/3	151608	24	1	18	228096	28512
	50	15	270	11	256QAM	20	2/3	188576	24	1	23	285120	35640

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.9-2: Reference Channels for CP-OFDM 256QAM for 30kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 8, 9, 18 and 19	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 8, 9, 18 and 19 (Note 3)	Total number of bits per slot for slots 8, 9, 18 and 19	Total modulated symbols per slot for slots 8, 9, 18 and 19
Unit	MHz	kHz						Bits	Bits			Bits	
	5	30	11	11	256QAM	20	2/3	7680	24	1	1	11616	1452
	10	30	24	11	256QAM	20	2/3	16896	24	1	3	25344	3168
	15	30	38	11	256QAM	20	2/3	26632	24	1	4	40128	5016
	20	30	51	11	256QAM	20	2/3	35856	24	1	5	53856	6732
	25	30	65	11	256QAM	20	2/3	46104	24	1	6	68640	8580
	30	30	78	11	256QAM	20	2/3	55304	24	1	7	82368	10296
	40	30	106	11	256QAM	20	2/3	73776	24	1	9	111936	13992
	50	30	133	11	256QAM	20	2/3	94248	24	1	12	140448	17556
	60	30	162	11	256QAM	20	2/3	114776	24	1	14	171072	21384
	80	30	217	11	256QAM	20	2/3	151608	24	1	18	229152	28644
	90	30	245	11	256QAM	20	2/3	172176	24	1	21	258720	32340
	100	30	273	11	256QAM	20	2/3	192624	24	1	23	288288	36036

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

Table A.2.3.9-3: Reference Channels for CP-OFDM 256QAM for 60kHz SCS

Parameter	Channel bandwidth	Subcarrier Spacing	Allocated resource blocks	CP-OFDM Symbols per slot (Note 1)	Modulation	MCS Index (Note 2)	Target Coding Rate	Payload size for slots 16, 17, 18, 19, 36, 37, 38 and 39	Transport block CRC	LDPC Base Graph	Number of code blocks per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39 (Note 3)	Total number of bits per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39	Total modulated symbols per slot for slots 16, 17, 18, 19, 36, 37, 38 and 39
Unit	MHz	kHz						Bits	Bits			Bits	
	10	60	11	11	256QAM	20	2/3	7680	24	1	1	11616	1452
	15	60	18	11	256QAM	20	2/3	12552	24	1	2	19008	2376
	20	60	24	11	256QAM	20	2/3	16896	24	1	3	25344	3168
	25	60	31	11	256QAM	20	2/3	22032	24	1	3	32736	4092
	30	60	38	11	256QAM	20	2/3	26632	24	1	4	40128	5016
	40	60	51	11	256QAM	20	2/3	35856	24	1	5	53856	6732
	50	60	65	11	256QAM	20	2/3	46104	24	1	6	68640	8580
	60	60	79	11	256QAM	20	2/3	55304	24	1	7	83424	10428
	80	60	107	11	256QAM	20	2/3	75792	24	1	9	112992	14124
	90	60	121	11	256QAM	20	2/3	86040	24	1	11	127776	15972
	100	60	135	11	256QAM	20	2/3	94248	24	1	12	142560	17820

Note 1: PUSCH mapping Type-A and single-symbol DM-RS configuration Type-1 with 2 additional DM-RS symbols, such that the DM-RS positions are set to symbols 2, 7, 11. DMRS is [TDM'ed] with PUSCH data. DM-RS symbols are not counted.

Note 2: MCS Index is based on MCS table 5.1.3.1-2 defined in TS 38.214 [12].

Note 3: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)

A.3 DL reference measurement channels

A.3.1 General

Unless otherwise stated, Tables A.3.2.2-1, A.3.2.2-2, A.3.2.2-3, A.3.3.2-1, A.3.3.2-2 and A.3.3.2-3 are applicable for measurements of the Receiver Characteristics (clause 7) with the exception of subclauses 7.4 (Maximum input level).

Unless otherwise stated, Tables A.3.2.3-1, A.3.2.3-2, A.3.2.3-3, A.3.3.3-1, A.3.3.3-2 and A.3.3.3-3 are applicable for subclauses 7.4 (Maximum input level) and for UE not supporting PDSCH 256QAM,

Unless otherwise stated, Tables A.3.2.4-1, A.3.2.4-2, A.3.2.4-3, A.3.3.4-1, A.3.3.4-2 and A.3.3.4-3 are applicable for subclauses 7.4 (Maximum input level) and for UE supporting PDSCH 256QAM,

Unless otherwise stated, Tables A.3.2.2-1, A.3.2.2-2, A.3.2.2-3, A.3.3.2-1, A.3.3.2-2 and A.3.3.2-3 also apply for the modulated interferer used in Clauses 7.5, 7.6 and 7.8 with test specific bandwidths.

Table A.3.1-1: Common reference channel parameters

Parameter		Unit	Value
CORESET frequency domain allocation			Full BW
CORESET time domain allocation			2 OFDM symbols at the begin of each slot
PDSCH mapping type			Type A
PDSCH start symbol index (S)			2
Number of consecutive PDSCH symbols (L)			12
PDSCH PRB bundling		PRBs	2
Dynamic PRB bundling			false
Overhead value for TBS determination			0
First DMRS position for Type A PDSCH mapping			2
DMRS type			Type 1
Number of additional DMRS			2
FDM between DMRS and PDSCH			Disable
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS (k0)		0 for CSI-RS resource 1,2,3,4
	OFDM symbols in the PRB used for CSI-RS		l_0 = 6 for CSI-RS resource 1 and 3 l_0 = 10 for CSI-RS resource 2 and 4
	Number of CSI-RS ports		1 for CSI-RS resource 1,2,3,4
	CDM Type		'No CDM' for CSI-RS resource 1,2,3,4
	Density (ρ)		3 for CSI-RS resource 1,2,3,4
	CSI-RS periodicity	Slots	15 kHz SCS: 10 for CSI-RS resource 1,2,3,4 30 kHz SCS: 20 for CSI-RS resource 1,2,3,4 60 kHz SCS: 40 for CSI-RS resource 1,2,3,4
	CSI-RS offset	Slots	15 kHz SCS: 0 for CSI-RS resource 1 and 2 1 for CSI-RS resource 3 and 4 30 kHz SCS: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 60 kHz SCS: 2 for CSI-RS resource 1 and 2 3 for CSI-RS resource 3 and 4
	Frequency Occupation		Start PRB 0 Number of PRB = BWP size
	QCL info		TCI state #0
PTRS configuration			PTRS is not configured

A.3.2 DL reference measurement channels for FDD

A.3.2.1 General

Table A.3.2.1-1: Additional reference channels parameters for FDD

Parameter	Unit	Value
Number of HARQ Processes		4
K1 value		2 for all slots

A.3.2.2 FRC for receiver requirements for QPSK

Table A.3.2.2-1: Fixed reference channel for receiver requirements (SCS 15 kHz, FDD, QPSK 1/3)

Parameter	Unit	Value							
Channel bandwidth	MHz	5	10	15	20	25	30	40	50
Subcarrier spacing	kHz	15	15	15	15	15	15	15	15
Subcarrier spacing configuration μ		0	0	0	0	0	0	0	0
Allocated resource blocks		25	52	79	106	133	160	216	270
Subcarriers per resource block		12	12	12	12	12	12	12	12
Allocated slots per Frame		8	8	8	8	8	8	8	8
MCS Index		4	4	4	4	4	4	4	4
MCS Table for TBS determination		64QAM							
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1
Information Bit Payload per Slot									
For Slots 0,1	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,3,4,5,6,7,8,9	Bits	1672	3368	5120	6912	8712	10504	14088	17424
Transport block CRC	Bits	16	16	24	24	24	24	24	24
LDPC base graph		2	2	1	1	1	1	1	1
Number of Code Blocks per Slot									
For Slots 0,1	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,3,4,5,6,7,8,9	CBs	1	1	1	1	2	2	2	3
Binary Channel Bits per Slot									
For Slots 0,1	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,3,4,5,6,7,8,9	Bits	5400	11232	17064	22896	28728	34560	46656	58320
Max. Throughput averaged over 1 frame	Mbps	1.338	2.694	4.096	5.530	6.970	8.403	11.270	13.9392
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). Note 3: SS/PBCH block is transmitted in slot #0 of each frame. Note 4: Slot i is slot index per frame.									

Table A.3.2.2-2: Fixed reference channel for receiver requirements (SCS 30 kHz, FDD, QPSK 1/3)

Parameter	Unit	Value											
Channel bandwidth	MHz	5	10	15	20	25	30	40	50	60	80	90	100
Subcarrier spacing configuration μ		1	1	1	1	1	1	1	1	1	1	1	1
Allocated resource blocks		11	24	38	51	65	78	106	133	162	217	245	273
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		17	17	17	17	17	17	17	17	17	17	17	17
MCS Index		4	4	4	4	4	4	4	4	4	4	4	4
MCS Table for TBS determination		64QAM											
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot													
For Slots 0,1,2	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 3,…,19	Bits	736	1608	2472	3368	4224	4992	6912	8712	10504	14088	15880	17928
Transport block CRC	Bits	16	16	16	16	24	24	24	24	24	24	24	24
LDPC base graph		2	2	2	2	1	1	1	1	1	1	1	1
Number of Code Blocks per Slot													
For Slots 0,1,2	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 3,…,19	CBs	1	1	1	1	1	1	1	2	2	2	2	3
Binary Channel Bits per Slot													
For Slots 0,1,2	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 3,…,19	Bits	2376	5184	8208	11016	14040	16848	22896	28728	34992	46872	52920	58968
Max. Throughput averaged over 1 frame	Mbps	1.251	2.734	4.202	5.726	7.181	8.486	11.750	14.810	17.857	23.950	26.996	30.478

Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1.
Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
Note 3: SS/PBCH block is transmitted in slot #0 of each frame.
Note 4: Slot i is slot index per frame.

Table A.3.2.2-3: Fixed reference channel for receiver requirements (SCS 60 kHz, FDD, QPSK 1/3)

Parameter	Unit	Value										
Channel bandwidth	MHz	10	15	20	25	30	40	50	60	80	90	100
Subcarrier spacing configuration μ		2	2	2	2	2	2	2	2	2	2	2
Allocated resource blocks		11	18	24	31	38	51	65	79	107	121	135
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		36	36	36	36	36	36	36	36	36	36	36
MCS Index		4	4	4	4	4	4	4	4	4	4	4
MCS Table for TBS Determination		64QAM										
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot												
For Slots 0,1,2,3	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 4,…,39	Bits	736	1192	1608	2024	2472	3368	4224	5120	6912	7808	8712
Transport block CRC	Bits	16	16	16	16	16	16	24	24	24	24	24
LDPC base graph		2	2	2	2	2	2	1	1	1	1	1
Number of Code Blocks per Slot												
For Slots 0,1,2,3	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 4,…,39	CBs	1	1	1	1	1	1	1	1	1	1	2
Binary Channel Bits per Slot												
For Slots 0,1,2,3	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 4,…,39	Bits	2376	3888	5184	6696	8208	11016	14040	17064	23112	26136	29160
Max. Throughput averaged over 1 frame	Mbps	2.650	4.291	5.789	7.286	8.899	12.125	15.206	18.432	24.883	28.109	31.363

NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1.
NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
NOTE 3: SS/PBCH block is transmitted in slot #0 of each frame.
NOTE 4: Slot i is slot index per frame.

A.3.2.3 FRC for maximum input level for 64QAM

Table A.3.2.3-1: Fixed reference channel for maximum input level receiver requirements (SCS 15 kHz, FDD, 64QAM)

Parameter	Unit	Value							
Channel bandwidth	MHz	5	10	15	20	25	30	40	50
Subcarrier spacing	kHz	15	15	15	15	15	15	15	15
Subcarrier spacing configuration μ		0	0	0	0	0	0	0	0
Allocated resource blocks		25	52	79	106	133	160	216	270
Subcarriers per resource block		12	12	12	12	12	12	12	12
Allocated slots per Frame		8	8	8	8	8	8	8	8
MCS Index		24	24	24	24	24	24	24	24
MCS Table for TBS determination		64QAM							
Modulation		64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1
Information Bit Payload per Slot									
For Slots 0,1	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,3,4,5,6,7,8,9	Bits	12296	25608	38936	52224	64552	77896	106576	131176
Transport block CRC	Bits	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1
Number of Code Blocks per Slot									
For Slots 0,1	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,3,4,5,6,7,8,9	CBs	2	4	5	7	8	10	13	16
Binary Channel Bits per Slot									
For Slots 0,1	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,3,4,5,6,7,8,9	Bits	16200	33696	51192	68688	86184	103680	139968	174960
Max. Throughput averaged over 1 frame	Mbps	9.837	20.486	31.149	41.779	51.642	62.317	85.261	104.941

NOTE 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1.
NOTE 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
NOTE 3: SS/PBCH block is transmitted in slot 0 of each frame
NOTE 4: Slot i is slot index per frame

Table A.3.2.3-2: Fixed reference channel for maximum input level receiver requirements (SCS 30 kHz, FDD, 64QAM)

Parameter	Unit	Value										
Channel bandwidth	MHz	5	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		1	1	1	1	1	1	1	1	1	1	1
Allocated resource blocks		11	24	38	51	65	78	106	133	162	217	273
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		17	17	17	17	17	17	17	17	17	17	17
MCS Index		24	24	24	24	24	24	24	24	24	24	24
MCS Table for TBS determination		64QAM										
Modulation		64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot												
For Slots 0,1,2	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 3,…,19	Bits	5376	11784	18432	25104	31752	37896	52224	64552	79896	106576	135296
Transport block CRC	Bits	24	24	24	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1	1	1	1
Number of Code Blocks per Slot												
For Slots 0,1,2	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 3,…,19	CBs	1	2	3	3	4	5	7	8	10	13	17
Binary Channel Bits per Slot												
For Slots 0,1,2	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 3,…,19	Bits	7128	15552	24624	33048	42120	50544	68688	86184	104976	140616	176904
Max. Throughput averaged over 1 frame	Mbps	9.139	20.033	31.334	42.677	53.978	64.423	88.781	109.738	135.823	181.179	230.003
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1 Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot 0 of each frame. Note 4: Slot i is slot index per frame.												

Table A.3.2.3-3: Fixed Reference Channel for Maximum input level receiver requirements (SCS 60 kHz, FDD, 64QAM)

Parameter	Unit	Value									
Channel bandwidth	MHz	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		2	2	2	2	2	2	2	2	2	2
Allocated resource blocks		11	18	24	31	38	51	65	79	107	135
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		36	36	36	36	36	36	36	36	36	36
MCS Index		24	24	24	24	24	24	24	24	24	24
MCS Table for TBS determination		64QAM									
Modulation		64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot											
For Slots 0,1,2,3	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 4,…,39	Bits	5376	8712	11784	15112	18432	25104	31752	38936	52224	65576
Transport block CRC	Bits	24	24	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1	1	1
Number of Code Blocks per Slot											
For Slots 0,1,2,3	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 4,…,39	CBs	1	2	2	2	3	3	4	5	7	8
Binary Channel Bits per Slot											
For Slots 0,12,3	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 4,…,39	Bits	7128	11664	15552	20088	24624	33048	42120	51192	69336	87480
Max. Throughput averaged over 1 frame	Mbps	19.354	31.363	42.422	54.403	66.355	90.374	114.307	140.170	188.006	236.074
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot #0 of each frame. Note 4: Slot i is slot index per frame.											

A.3.2.4 FRC for maximum input level for 256 QAM

Table A.3.2.4-1: Fixed reference channel for maximum input level receiver requirements (SCS 15 kHz, FDD, 256QAM)

Parameter	Unit	Value							
Channel bandwidth	MHz	5	10	15	20	25	30	40	50
Subcarrier spacing	kHz	15	15	15	15	15	15	15	15
Subcarrier spacing configuration μ		0	0	0	0	0	0	0	0
Allocated resource blocks		25	52	79	106	133	160	216	270
Subcarriers per resource block		12	12	12	12	12	12	12	12
Allocated slots per Frame		8	8	8	8	8	8	8	8
MCS Index		23	23	23	23	23	23	23	23
MCS Table for TBS determination		256QAM							
Modulation		256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1
Information Bit Payload per Slot									
For Slots 0,1	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,3,4,5,6,7,8,9	Bits	16896	34816	53288	71688	90176	108552	143400	180376
Transport block CRC	Bits	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1
Number of Code Blocks per Slot									
For Slots 0,1	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,3,4,5,6,7,8,9	CBs	3	5	7	9	12	14	18	23
Binary Channel Bits per Slot									
For Slots 0,1	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,3,4,5,6,7,8,9	Bits	21600	44928	68256	91584	114912	138240	186624	233280
Max. Throughput averaged over 1 frame	Mbps	13.517	27.853	42.630	57.350	72.141	86.842	114.720	144.310

Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1.
Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)
Note 3: SS/PBCH block is transmitted in slot 0 of each frame.
Note 4: Slot i is slot index per frame.

Table A.3.2.4-2: Fixed reference channel for maximum input level receiver requirements (SCS 30 kHz, FDD, 256QAM)

Parameter	Unit	Value										
Channel bandwidth	MHz	5	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		1	1	1	1	1	1	1	1	1	1	1
Allocated resource blocks		11	24	38	51	65	78	106	133	162	217	273
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		17	17	17	17	17	17	17	17	17	17	17
MCS Index		23	23	23	23	23	23	23	23	23	23	23
MCS Table for TBS determination		256QAM										
Modulation		256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot												
For Slots 0,1,2	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 3,…,19	Bits	7424	16136	25608	33816	44040	52224	71688	90176	108552	147576	184424
Transport block CRC	Bits	24	24	24	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1	1	1	1
Number of Code Blocks per Slot												
For Slots 0,1,2	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 3,…,19	CBs	1	3	4	5	6	7	9	12	14	19	23
Binary Channel Bits per Slot												
For Slots 0,1,2	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 3,…,19	Bits	9504	20736	32832	44064	56160	67392	91584	114912	139968	187488	235872
Max. Throughput averaged over 1 frame	Mbps	12.621	27.431	43.534	57.487	74.868	88.781	121.870	153.299	184.538	250.879	313.521
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot 0 of each frame. Note 4: Slot i is slot index per frame.												

Table A.3.2.4-3: Fixed reference channel for maximum input level receiver requirements (SCS 60 kHz, FDD, 256QAM)

Parameter	Unit	Value									
Channel bandwidth	MHz	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		2	2	2	2	2	2	2	2	2	2
Allocated resource blocks		11	18	24	31	38	51	65	79	107	135
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		36	36	36	36	36	36	36	36	36	36
MCS Index		23	23	23	23	23	23	23	23	23	23
MCS Table for TBS determination		256QAM									
Modulation		256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot											
For Slots 0,1,2,3	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 4,…,39	Bits	7424	12040	16136	21000	25608	33816	44040	53288	71688	90176
Transport block CRC	Bits	24	24	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1	1	1
Number of Code Blocks per Slot											
For Slots 0,1,2,3	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 4,…,39	CBs	1	2	3	3	4	5	6	7	9	12
Binary Channel Bits per Slot											
For Slots 0,1,2,3	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 4,…,39	Bits	9504	15552	20736	26784	32832	44064	56160	68256	92448	116640
Max. Throughput averaged over 1 frame	Mbps	26.726	43.344	58.090	75.600	92.189	121.738	158.544	191.837	258.077	324.634
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.2.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot #0 of each frame. Note 4: Slot i is slot index per frame.											

A.3.3 DL reference measurement channels for TDD

A.3.3.1 General

Table A.3.3.1-1: Additional reference channels parameters for TDD

Parameter		Value		
		SCS 15 kHz (μ=0)	**SCS 30 kHz (μ=1)**	**SCS 60 kHz (μ=2)**
TDD Slot Configuration pattern (Note 1)		DDDSU	7DS2U	14DS$_1$S$_2$4U
Special Slot Configuration (Note 2)		10D+2G+2U	6D+4G+4U	S_1=12D+2G, S_2=6G+8U
referenceSubcarrierSpacing		15 kHz	30 kHz	60 kHz
UL-DL configuration	*dl-UL-TransmissionPeriodicity*	5 ms	5 ms	5 ms
	nrofDownlinkSlots	3	7	14
	nrofDownlinkSymbols	10	6	12
	nrofUplinkSlot	1	2	4
	nrofUplinkSymbols	2	4	8
Number of HARQ Processes		8	8	16
The number of slots between PDSCH and corresponding HARQ-ACK information (Note 3)		K1 = 4 if mod(i,5) = 0 K1 = 3 if mod(i,5) = 1 K1 = 2 if mod(i,5) = 2 where i is slot index per frame; i = {0,…,9}	K1 = 8 if mod(i,10) = 0 K1 = 7 if mod(i,10) = 1 K1 = 6 if mod(i,10) = 2 K1 = 5 if mod(i,10) = 3 K1 = 4 if mod(i,10) = 4 K1 = 3 if mod(i,10) = 5 K1 = 2 if mod(i,10) = 6 where i is slot index per frame; i = {0,…,19}	K1 = 13 if mod(i,20) = 2 K1 = 12 if mod(i,20) = 3 K1 = 11 if mod(i,20) = 4 K1 = 10 if mod(i,20) = 5 K1 = 9 if mod(i,20) = 6 K1 = 8 if mod(i,20) = 7 K1 = 7 if mod(i,20) = 8 K1 = 6 if mod(i,20) = 9 K1 = 6 if mod(i,20) = 10 K1 = 6 if mod(i,20) = 11 K1 = 6 if mod(i,20) = 12 K1 = 6 if mod(i,20) = 13 where i is slot index per frame; i = {0,…,39}

NOTE 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information.
NOTE 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information.
NOTE 3: i is the slot index per frame.

A.3.3.2 FRC for receiver requirements for QPSK

Table A.3.3.2-1: Fixed reference channel for receiver requirements (SCS 15 kHz, TDD, QPSK 1/3)

Parameter	Unit	Value							
Channel bandwidth	MHz	5	10	15	20	25	30	40	50
Subcarrier spacing	kHz	15	15	15	15	15	15	15	15
Subcarrier spacing configuration μ		0	0	0	0	0	0	0	0
Allocated resource blocks		25	52	79	106	133	160	216	270
Subcarriers per resource block		12	12	12	12	12	12	12	12
Allocated slots per Frame		4	4	4	4	4	4	4	4
MCS Index		4	4	4	4	4	4	4	4
MCS Table for TBS determination		64QAM							
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1
Information Bit Payload per Slot									
For Slots 0,1,3,4,8,9	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,5,6,7	Bits	1672	3368	5120	6912	8712	10504	14088	17424
Transport block CRC	Bits	16	16	24	24	24	24	24	24
LDPC base graph		2	2	1	1	1	1	1	1
Number of Code Blocks per Slot									
For Slots 0,1,3,4,8,9	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,5,6,7	CBs	1	1	1	1	2	2	2	3
Binary Channel Bits per Slot									
For Slots 0,1,3,4,8,9	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,5,6,7	Bits	5400	11232	17064	22896	28728	34560	46656	58320
Max. Throughput averaged over 1 frame	Mbps	0.669	1.347	2.048	2.765	3.485	4.202	5.635	6.970

Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1.
Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)
Note 3: SS/PBCH block is transmitted in slot 0 of each frame.
Note 4: Slot i is slot index per frame.

Table A.3.3.2-2: Fixed reference channel for receiver requirements (SCS 30 kHz, TDD, QPSK 1/3)

Parameter	Unit	Value										
Channel bandwidth	MHz	5	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		1	1	1	1	1	1	1	1	1	1	1
Allocated resource blocks		11	24	38	51	65	78	106	133	162	217	273
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		11	11	11	11	11	11	11	11	11	11	11
MCS Index		4	4	4	4	4	4	4	4	4	4	4
MCS Table for TBS determination		64QAM										
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot												
For Slots 0,1,2 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,19}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,19}	Bits	736	1608	2472	3368	4224	4992	6912	8712	10504	14088	17928
Transport block CRC	Bits	16	16	16	16	24	24	24	24	24	24	24
LDPC base graph		2	2	2	2	1	1	1	1	1	1	1
Number of Code Blocks per Slot												
For Slots 0,1,2 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,19}	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,19}	CBs	1	1	1	1	1	1	1	2	2	2	3
Binary Channel Bits per Slot												
For Slots 0,1,2 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,19}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,19}	Bits	2376	5184	8208	11016	14040	16848	22896	28728	34992	46872	58968
Max. Throughput averaged over 1 frame	Mbps	0.810	2.1.769	2.719	3.705	4.646	5.491	7.603	9.583	11.554	15.497	19.721
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot #0 of each frame. Note 4: Slot i is slot index per frame.												

Table A.3.3.2-3: Fixed reference channel for receiver requirements (SCS 60 kHz, TDD, QPSK 1/3)

Parameter	Unit	Value									
Channel bandwidth	MHz	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		2	2	2	2	2	2	2	2	2	2
Allocated resource blocks		11	18	24	31	38	51	65	79	107	135
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		24	24	24	24	24	24	24	24	24	24
MCS Index		4	4	4	4	4	4	4	4	4	4
MCS Table for TBS determination		64QAM									
Modulation		QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK	QPSK
Target Coding Rate		1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot											
For Slots 0,1,2,3 and Slot i, if mod(i, 20) = {14, 15, 16, 17, 18, 19} for i from {0,…,39}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 20) = {0,…,13} for i from {4,…,39}	Bits	736	1192	1608	2024	2472	3368	4224	5120	6912	8712
Transport block CRC	Bits	16	16	16	16	16	16	24	24	24	24
LDPC base graph		2	2	2	2	2	2	1	1	1	1
Number of Code Blocks per Slot											
For Slots 0,1,2,3 and Slot i, if mod(i, 20) = {14, 15, 16, 17, 18, 19} for i from {0,…,39}	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 20) = {0,…,13} for i from {4,…,39}	CBs	1	1	1	1	1	1	1	1	1	2
Binary Channel Bits per Slot											
For Slots 0,1,2,3 and Slot i, if mod(i, 20) = {14, 15, 16, 17, 18, 19} for i from {0,…,39}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 5) = {0,…,13} for i from {4,…,39}	Bits	2376	3888	5184	6696	8208	11016	14040	17064	23112	29160
Max. Throughput averaged over 1 frame	Mbps	1.766	3.2.861	3.859	4.858	5.933	8.083	10.138	12.288	16.589	20.909
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot #0 of each frame. Note 4: Slot i is slot index per frame.											

A.3.3.3 FRC for maximum input level for 64QAM

Table A.3.3.3-1: Fixed reference channel for maximum input level receiver requirements (SCS 15 kHz, TDD, 64QAM)

Parameter	Unit	Value							
Channel bandwidth	MHz	5	10	15	20	25	30	40	50
Subcarrier spacing	kHz	15	15	15	15	15	15	15	15
Subcarrier spacing configuration μ		0	0	0	0	0	0	0	0
Allocated resource blocks		25	52	79	106	133	160	216	270
Subcarriers per resource block		12	12	12	12	12	12	12	12
Allocated slots per Frame		4	4	4	4	4	4	4	4
MCS Index		24	24	24	24	24	24	24	24
MCS Table for TBS determination		64QAM							
Modulation		64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1
Information Bit Payload per Slot									
For Slots 0,1,3,4,8,9	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,5,6,7	Bits	12296	25608	38936	52224	64552	77896	106576	131176
Transport block CRC	Bits	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1
Number of Code Blocks per Slot									
For Slots 0,1,3,4,8,9	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,5,6,7	CBs	2	4	5	7	8	10	13	16
Binary Channel Bits per Slot									
For Slots 0,1,3,4,8,9	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,5,6,7	Bits	16200	33696	51192	68688	86184	103680	139968	174960
Max. Throughput averaged over 1 frame	Mbps	4.918	10.243	15.574	20.890	20.890	31.158	42.630	52.470
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot 0 of each frame. Note 4: Slot i is slot index per frame.									

Table A.3.3.3-2: Fixed reference channel for maximum input level receiver requirements (SCS 30 kHz, TDD, 64QAM)

Parameter	Unit	Value										
Channel bandwidth	MHz	5	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		1	1	1	1	1	1	1	1	1	1	1
Allocated resource blocks		11	24	38	51	65	78	106	133	162	217	273
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		11	11	11	11	11	11	11	11	11	11	11
MCS Index		24	24	24	24	24	24	24	24	24	24	24
MCS Table for TBS determination		64QAM										
Modulation		64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot												
For Slots 0,1,2 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,19}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,19}	Bits	5376	11784	18432	25104	31752	37896	52224	64552	79896	106576	135296
Transport block CRC	Bits	24	24	24	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1	1	1	1
Number of Code Blocks per Slot												
For Slots 0,1,2 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,19}	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,19}	CBs	1	2	3	3	4	5	7	8	10	13	17
Binary Channel Bits per Slot												
For Slots 0,1,2 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,19}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,19}	Bits	7128	15552	24624	33048	42120	50544	68688	86184	104976	140616	176904
Max. Throughput averaged over 1 frame	Mbps	5.914	12.962	20.275	27.614	34.927	41.686	57.446	71.007	87.886	117.234	148.826
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot #0 of each frame. Note 4: Slot i is slot index per frame.												

Table A.3.3.3-3: Fixed reference channel for maximum input level receiver requirements (SCS 60 kHz, TDD, 64QAM)

Parameter	Unit	Value									
Channel bandwidth	MHz	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		2	2	2	2	2	2	2	2	2	2
Allocated resource blocks		11	18	24	31	38	51	65	79	107	135
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		24	24	24	24	24	24	24	24	24	24
MCS Index		24	24	24	24	24	24	24	24	24	24
MCS Table for TBS determination		64QAM									
Modulation		64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM	64 QAM
Target Coding Rate		3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4	3/4
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot											
For Slots 0,1,2,3 and Slot i, if mod(i, 20) = {14, 15, 16, 17, 18, 19} for i from {0,…,39}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 5) = {0,…,13} for i from {4,…,39}	Bits	5376	8712	11784	15112	18432	25104	31752	38936	52224	65576
Transport block CRC	Bits	24	24	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1	1	1
Number of Code Blocks per Slot											
For Slots 0,1,2,3 and Slot i, if mod(i, 20) = {14, 15, 16, 17, 18, 19} for i from {0,…,39}	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 5) = {0, …,13} for i from {4,…,39}	CBs	1	2	2	2	3	3	4	5	7	8
Binary Channel Bits per Slot											
For Slots 0,1,2,3 and Slot i, if mod(i, 20) = {14, 15, 16, 17, 18, 19} for i from {0,…,39}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 5) = {0, …,13} for i from {4,…,39}	Bits	7128	11664	15552	20088	24624	33048	42120	51192	69336	87480
Max. Throughput averaged over 1 frame	Mbps	12.902	20.909	28.282	36.269	44.237	60.250	76.205	93.446	125.338	157.382
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot #0 of each frame. Note 4: Slot i is slot index per frame.											

A.3.3.4 FRC for maximum input level for 256 QAM

Table A.3.3.4-1: Fixed reference channel for maximum input level receiver requirements (SCS 15 kHz, TDD, 256QAM)

Parameter	Unit	Value							
Channel bandwidth	MHz	5	10	15	20	25	30	40	50
Subcarrier spacing	kHz	15	15	15	15	15	15	15	15
Subcarrier spacing configuration μ		0	0	0	0	0	0	0	0
Allocated resource blocks		25	52	79	106	133	160	216	270
Subcarriers per resource block		12	12	12	12	12	12	12	12
Allocated slots per Frame		4	4	4	4	4	4	4	4
MCS Index		23	23	23	23	23	23	23	23
MCS Table for TBS determination		256QAM							
Modulation		256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1
Information Bit Payload per Slot									
For Slots 0,1,3,4,8,9	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,5,6,7	Bits	16896	34816	53288	71688	90176	108552	143400	180376
Transport block CRC	Bits	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1
Number of Code Blocks per Slot									
For Slots 0,1,3,4,8,9	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,5,6,7	CBs	3	5	7	9	12	14	18	23
Binary Channel Bits per Slot									
For Slots 0,1,3,4,8,9	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slots 2,5,6,7	Bits	21600	44928	68256	91584	114912	138240	186624	233280
Max. Throughput averaged over 1 frame	Mbps	6.758	13.926	21.315	28.675	36.070	43.421	57.360	72.150
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot 0 of each frame. Note 4: Slot i is slot index per frame.									

Table A.3.3.4-2: Fixed Reference channel for maximum input level receiver requirements (SCS 30 kHz, TDD, 256QAM)

Parameter	Unit	Value										
Channel bandwidth	MHz	5	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		1	1	1	1	1	1	1	1	1	1	1
Allocated resource blocks		11	24	38	51	65	78	106	133	162	217	273
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		11	11	11	11	11	11	11	11	11	11	11
MCS Index		23	23	23	23	23	23	23	23	23	23	23
MCS Table for TBS determination		256QAM										
Modulation		256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot												
For Slots 01,2 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,19}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,19}	Bits	7424	16136	25608	33816	44040	52224	71688	90176	108552	147576	184424
Transport block CRC	Bits	24	24	24	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1	1	1	1
Number of Code Blocks per Slot												
For Slots 0,1,2 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,19}	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,19}	CBs	1	1	1	1	1	1	1	2	2	2	3
Binary Channel Bits per Slot												
For Slots 0,1,2 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,19}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {3,…,19}	Bits	9504	20736	32832	44064	56160	67392	91584	114912	139968	187488	235872
Max. Throughput averaged over 1 frame	Mbps	8.166	17.750	28.169	37.198	48.444	57.446	78.857	99.194	119.407	162.334	202.866
Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1. Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit) Note 3: SS/PBCH block is transmitted in slot #0 of each frame. Note 4: Slot i is slot index per frame.												

Table A.3.3.4-3: Fixed reference channel for maximum input level receiver requirements (SCS 60 kHz, TDD, 256QAM)

Parameter	Unit	Value									
Channel bandwidth	MHz	10	15	20	25	30	40	50	60	80	100
Subcarrier spacing configuration μ		2	2	2	2	2	2	2	2	2	2
Allocated resource blocks		11	18	24	31	38	51	65	79	107	135
Subcarriers per resource block		12	12	12	12	12	12	12	12	12	12
Allocated slots per Frame		24	24	24	24	24	24	24	24	24	24
MCS Index		23	23	23	23	23	23	23	23	23	23
MCS Table for TBS determination		256QAM									
Modulation		256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM	256 QAM
Target Coding Rate		4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5	4/5
Maximum number of HARQ transmissions		1	1	1	1	1	1	1	1	1	1
Information Bit Payload per Slot											
For Slots 0,1,2,3 and Slot i, if mod(i, 20) = {14, 15, 16, 17, 18, 19} for i from {0,…,39}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 20) = {0,…,13 } for i from {4,…,39}	Bits	7424	12040	16136	21000	25608	33816	44040	53288	71688	90176
Transport block CRC	Bits	24	24	24	24	24	24	24	24	24	24
LDPC base graph		1	1	1	1	1	1	1	1	1	1
Number of Code Blocks per Slot											
For Slots 0,1,2,3 and Slot i, if mod(i, 20) = {14, 15, 16, 17, 18, 19} for i from {0,…,39}	CBs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 5) = {0, …,13} for i from {4,…,39}	CBs	1	2	3	3	4	5	6	7	9	12
Binary Channel Bits per Slot											
For Slots 0,1,2,3 and Slot i, if mod(i, 20) = {14, 15, 16, 17, 18, 19} for i from {0,…,39}	Bits	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 5) = {0, …,13} for i from {4,…,39}	Bits	9504	15552	20736	26784	32832	44064	56160	68256	92448	116640
Max. Throughput averaged over 1 frame	Mbps	17.818	28.896	38.726	50.400	61.459	81.158	105.696	127.891	172.051	216.422

Note 1: Additional parameters are specified in Table A.3.1-1 and Table A.3.3.1-1.
Note 2: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit)
Note 3: SS/PBCH block is transmitted in slot #0 of each frame.
Note 4: Slot i is slot index per frame.

A.4 CSI reference measurement channels

TBD

A.5 OFDMA Channel Noise Generator (OCNG)

A.5.1 OCNG Patterns for FDD

A.5.1.1 OCNG FDD pattern 1: Generic OCNG FDD Pattern for all unused REs

Table A.5.1.1-1: OP.1 FDD: Generic OCNG FDD Pattern for all unused REs

OCNG Distribution OCNG Parameters	Control Region (Core Set)	Data Region
Resources allocated	All unused REs (Note 1)	All unused REs (Note 2)
Structure	PDCCH	PDSCH
Content	Uncorrelated pseudo random QPSK modulated data	Uncorrelated pseudo random QPSK modulated data
Transmission scheme for multiple antennas ports transmission	Single Tx port transmission	Spatial multiplexing using any precoding matrix with dimensions same as the precoding matrix for PDSCH
Subcarrier Spacing	Same as for RMC PDCCH in the active BWP	Same as for RMC PDSCH in the active BWP
Power Level	Same as for RMC PDCCH	Same as for RMC PDSCH
Note 1: All unused REs in the active CORESETS appointed by the search spaces in use. Note 2: Unused available REs refer to REs in PRBs not allocated for any physical channels, CORESETs, synchronization signals or reference signals in channel bandwidth.		

A.5.2 OCNG Patterns for TDD

A.5.2.1 OCNG TDD pattern 1: Generic OCNG TDD Pattern for all unused REs

Table A.5.2.1-1: OP.1 TDD: Generic OCNG TDD Pattern for all unused REs

OCNG Distribution OCNG Parameters	Control Region (Core Set)	Data Region
Resources allocated	All unused REs (Note 1)	All unused REs (Note 2)
Structure	PDCCH	PDSCH
Content	Uncorrelated pseudo random QPSK modulated data	Uncorrelated pseudo random QPSK modulated data
Transmission scheme for multiple antennas ports transmission	Single Tx port transmission	Spatial multiplexing using any precoding matrix with dimensions same as the precoding matrix for PDSCH
Subcarrier Spacing	Same as for RMC PDCCH in the active BWP	Same as for RMC PDSCH in the active BWP
Power Level	Same as for RMC PDCCH	Same as for RMC PDSCH
Note 1: All unused REs in the active CORESETS appointed by the search spaces in use. Note 2: Unused available REs refer to REs in PRBs not allocated for any physical channels, CORESETs, synchronization signals or reference signals in channel bandwidth.		

A.6

A.7 V2X reference measurement channels

A.7.1 General

The algorithm for determining the payload size A is as follows; given a desired coding rate R and radio block allocation NRB

1. Calculate the RE number of 2nd stage SCI Q_SCI2^' that can be transmitted in a given sub-frame, where in order to make sure that the code-rate of 2-A is approximate to SCI 1-A, a beta offset is selected based on MCS, and vacant resource elements γ value is determined based on NRB and DMRS frequency density.

2. Transport Block Size is determined according to section 8.1.3.2 of TS 38.214 [12] based on Table A.7.1-1.

3. Calculate Binary Channel Bits per Slot for PSSCH as below.

Binary Channel Bits per Slot = (NRB* Subcarriers per resource block*CP-OFDM symbols per slot – DMRS resource REs – PSCCH resource Res - Q_SCI2^') * Qm

Where Qm is the modulation order corresponding to MCS.

In Table A.7.1-1 Common reference channel parameters are listed the Sidelink reference measurement channels specified in annexes A.7.2 to A.7.6.

Table A.7.1-1: Common reference channel parameters

Parameter	Value	remark
Number of HARQ Processes	1	
Channel state	AWGN	
Subcarriers per resource block	12	
Number of DMRS per slot	2	symbol4 and symbol 10 in each slot FDMed with PSSCH within DMRS symbol Frequency density is ½
CP-OFDM symbols per slot (Note1)	12 for all slots	Excluding the first OFDM symbol in one SL slot used for AGC
PSCCH resource	10 PRBs, 3 symbols in time domain	
Slot number in 10ms	$10 * 2^{\mu}$	$\mu = 0,1,2\mu = 0,1,2$ for 15kHz, 30kHz, 60kHz
PT-RS	disable	
CSI-RS	disable	
x-overhead	0	
PSFCH period	0	
2nd stage SCI payload size	59	35bits SCI-2A + 24bits CRC

A.7.2 FRC for maximum input level for QPSK

For V2X transmission over PC5, Table A.7.2-1, Table A.7.2-2 and Table A.7.2-3 are applicable for measurements on the Receiver Characteristics with the exception of Maximum input level.

Table A.7.2-1: Fixed reference channel for V2X receiver requirements (SCS 15 kHz, QPSK)

Parameter	Unit	Value			
Channel bandwidth	MHz	**10**	**20**	**30**	**40**
Subcarrier spacing	kHz	15	15	15	15
Allocated resource blocks		50	105	160	216
MCS Index		4	4	4	4
MCS Table for TBS determination	64QAM				
Modulation		QPSK	QPSK	QPSK	QPSK
Transport Block Size		3624	7936	12296	16896
Transport block CRC	Bits	16	24	24	24
LDPC base graph		2	1	1	1
Number of Code Blocks per Slot		1	1	2	3
Beta offset for 2nd stage SCI		2.25	2.25	2.25	2.25
$\gamma\gamma$ value when 2nd stage SCI rate match		1	1	1	1
Binary Channel Bits per Slot		12036	26556	41076	55860
Max. Throughput averaged over 100ms	Mbps	0.3624	0.7936	1.2296	1.6896
NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). NOTE 2: $\gamma\gamma$ is the number of vacant resource elements in the resource block to which the last coded symbol of the 2nd-stage SCI belongs.					

Table A.7.2-2: Fixed reference channel for V2X receiver requirements (SCS 30 kHz, QPSK)

Parameter	Unit	Value			
Channel bandwidth	MHz	**10**	**20**	**30**	**40**
Subcarrier spacing	kHz	30	30	30	30
Allocated resource blocks		24	50	75	105
MCS Index		4	4	4	4
MCS Table for TBS determination	64QAM				
Modulation		QPSK	QPSK	QPSK	QPSK
Transport Block Size		1608	3624	5632	7936
Transport block CRC	Bits	16	16	24	24
LDPC base graph		2	2	1	1
Number of Code Blocks per Slot		1	1	1	1
Beta offset for 2nd stage SCI		2.25	2.25	2.25	2.25
γ value when 2nd stage SCI rate match		7	1	1	1
Binary Channel Bits per Slot		5160	12036	18636	26556
Max. Throughput averaged over 100ms	Mbps	0.3216	0.7248	1.1264	1.5872
NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). NOTE 2: γ is the number of vacant resource elements in the resource block to which the last coded symbol of the 2^{nd}-stage SCI belongs.					

Table A.7.2-3: Fixed reference channel for V2X receiver requirements (SCS 60 kHz, QPSK)

Parameter	Unit	Value			
Channel bandwidth	MHz	**10**	**20**	**30**	**40**
Subcarrier spacing	kHz	60	60	60	60
Allocated resource blocks		10	24	36	50
MCS Index		4	4	4	4
MCS Table for TBS determination	64QAM				
Modulation		QPSK	QPSK	QPSK	QPSK
Transport Block Size		456	1608	2536	3624
Transport block CRC	Bits	16	16	16	16
LDPC base graph		2	2	2	2
Number of Code Blocks per Slot		1	1	1	1
Beta offset for 2nd stage SCI		2.25	2.25	2.25	2.25
γ value when 2nd stage SCI rate match		7	7	7	1
Binary Channel Bits per Slot		1464	5160	8328	12036
Max. Throughput averaged over 100ms	Mbps	0.1824	0.6432	1.0144	1.4496
NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). NOTE 2: γ is the number of vacant resource elements in the resource block to which the last coded symbol of the 2^{nd}-stage SCI belongs.					

A.7.3 FRC for maximum input level for 64QAM

For V2X transmission over PC5, Table A.7.3-1, Table A.7.3-2 and TableA.7.3-3 are applicable for Maximum input level when the maximum modulation order is 64QAM.

Table A.7.3-1: Fixed reference channel for V2X receiver requirements (SCS 15 kHz, 64QAM)

Parameter	Unit	Value			
Channel bandwidth	MHz	**10**	**20**	**30**	**40**
Subcarrier spacing	kHz	15	15	15	15
Allocated resource blocks		50	105	160	216
MCS Index		24	24	24	24
MCS Table for TBS determination	64QAM				
Modulation		64QAM	64QAM	64QAM	64QAM
Transport Block Size		27144	60456	92200	127080
Transport block CRC	Bits	24	24	24	24
LDPC base graph		1	1	1	1
Number of Code Blocks per Slot		4	8	11	16
Beta offset for 2nd stage SCI		6.25	6.25	6.25	6.25
γ value when 2nd stage SCI rate match		1	1	1	1
Binary Channel Bits per Slot		35964	79524	123084	167436
Max. Throughput averaged over 100ms	Mbps	2.7144	6.0456	9.22	12.708
NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). NOTE 2: γ is the number of vacant resource elements in the resource block to which the last coded symbol of the 2nd-stage SCI belongs.					

Table A.7.3-2: Fixed reference channel for V2X receiver requirements (SCS 30 kHz, 64QAM)

Parameter	Unit	Value			
Channel bandwidth	MHz	**10**	**20**	**30**	**40**
Subcarrier spacing	kHz	30	30	30	30
Allocated resource blocks		24	50	75	105
MCS Index		24	24	24	24
MCS Table for TBS determination	64QAM				
Modulation		64QAM	64QAM	64QAM	64QAM
Transport Block Size		11528	27144	42016	60456
Transport block CRC	Bits	24	24	24	24
LDPC base graph		1	1	1	1
Number of Code Blocks per Slot		2	4	5	8
Beta offset for 2nd stage SCI		6.25	6.25	6.25	6.25
γ value when 2nd stage SCI rate match		7	1	1	1
Binary Channel Bits per Slot		15336	35964	55764	79524
Max. Throughput averaged over 100ms	Mbps	2.3056	5.4288	8.4032	12.091
NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). NOTE 2: γ is the number of vacant resource elements in the resource block to which the last coded symbol of the 2nd-stage SCI belongs.					

TableA.7.3-3: Fixed reference channel for V2X receiver requirements (SCS 60 kHz, 64QAM)

Parameter	Unit	Value			
Channel bandwidth	MHz	**10**	**20**	**30**	**40**
Subcarrier spacing	kHz	60	60	60	60
Allocated resource blocks		10	24	36	50
MCS Index		24	24	24	24
MCS Table for TBS determination	64QAM				
Modulation		64QAM	64QAM	64QAM	64QAM
Transport Block Size		3240	11528	18960	27144
Transport block CRC	Bits	16	24	24	24
LDPC base graph		2	1	1	1
Number of Code Blocks per Slot		1	2	3	4
Beta offset for 2nd stage SCI		6.25	6.25	6.25	6.25
γ value when 2nd stage SCI rate match		7	7	7	1
Binary Channel Bits per Slot		4248	15336	24840	35964
Max. Throughput averaged over 100ms	Mbps	1.296	4.6112	7.584	10.858
NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). NOTE 2: γ is the number of vacant resource elements in the resource block to which the last coded symbol of the 2^{nd}-stage SCI belongs.					

A.7.4 FRC for maximum input level for 256QAM

For V2X transmission over PC5, Table A.7.4-1, Table A.7.4-2 and Table A.7.4-3 are applicable for Maximum input level when the 256QAM is supported.

Table A.7.4-1: Fixed reference channel for V2X receiver requirements (SCS 15 kHz, 256QAM)

Parameter	Unit	Value			
Channel bandwidth	MHz	**10**	**20**	**30**	**40**
Subcarrier spacing	kHz	15	15	15	15
Allocated resource blocks		50	105	160	216
MCS Index		23	23	23	23
MCS Table for TBS determination	256QAM				
Modulation		256QAM	256QAM	256QAM	256QAM
Transport Block Size		36896	81976	127080	172176
Transport block CRC	Bits	24	24	24	24
LDPC base graph		1	1	1	1
Number of Code Blocks per Slot		5	10	16	21
Beta offset for 2nd stage SCI		6.25	6.25	6.25	6.25
γ value when 2nd stage SCI rate match		3	3	3	3
Binary Channel Bits per Slot		48000	106080	164160	223296
Max. Throughput averaged over 100ms	Mbps	3.6896	8.1976	12.708	17.218
NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit). NOTE 2: γ is the number of vacant resource elements in the resource block to which the last coded symbol of the 2^{nd}-stage SCI belongs.					

Table A.7.4-2: Fixed reference channel for V2X receiver requirements (SCS 30 kHz, 256QAM)

Parameter	Unit	Value			
Channel bandwidth	MHz	**10**	**20**	**30**	**40**
Subcarrier spacing	kHz	30	30	30	30
Allocated resource blocks		24	50	75	105
MCS Index		23	23	23	23
MCS Table for TBS determination	256QAM				
Modulation		256QAM	256QAM	256QAM	256QAM
Transport Block Size		15880	36896	58384	81976
Transport block CRC	Bits	24	24	24	24
LDPC base graph		1	1	1	1
Number of Code Blocks per Slot		2	5	7	10
Beta offset for 2nd stage SCI		6.25	6.25	6.25	6.25
γ value when 2nd stage SCI rate match		3	3	3	3
Binary Channel Bits per Slot		20544	48000	74400	106080
Max. Throughput averaged over 100ms	Mbps	3.176	7.3792	11.677	16.395

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

NOTE 2: γ is the number of vacant resource elements in the resource block to which the last coded symbol of the 2nd-stage SCI belongs.

Table A.7.4-3: Fixed reference channel for V2X receiver requirements (SCS 60kHz, 256QAM)

Parameter	Unit	Value			
Channel bandwidth	MHz	**10**	**20**	**30**	**40**
Subcarrier spacing	kHz	60	60	60	60
Allocated resource blocks		10	24	36	50
MCS Index		23	23	23	23
MCS Table for TBS determination	256QAM				
Modulation		256QAM	256QAM	256QAM	256QAM
Transport Block Size		4480	15880	25608	36896
Transport block CRC	Bits	24	24	24	24
LDPC base graph		1	1	1	1
Number of Code Blocks per Slot		1	2	4	5
Beta offset for 2nd stage SCI		6.25	6.25	6.25	6.25
γ value when 2nd stage SCI rate match		3	3	3	3
Binary Channel Bits per Slot		5760	20544	33216	48000
Max. Throughput averaged over 100ms	Mbps	1.792	6.352	10.243	14.758

NOTE 1: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

NOTE 2: γ is the number of vacant resource elements in the resource block to which the last coded symbol of the 2nd-stage SCI belongs.

Annex B (normative): Propagation Conditions

The propagation conditions and channel models for various environments are specified. For each environment a propagation model is used to evaluate the propagation pathless due to the distance. Channel models are formed by combining delay profiles with a Doppler spectrum, with the addition of correlation properties in the case of a multi-antenna scenario.

B.0 No interference

The downlink connection between the System Simulator and the UE is without Additive White Gaussian Noise, and has no fading or multipath effects.

Annex C (normative): Downlink physical channels

This annex specifies the downlink physical channels that are needed for setting a connection and channels that are needed during a connection.

C.0 Downlink signal levels

The downlink power settings in Table C.0-1 is used unless otherwise specified in a test case.

If the UE has more than one Rx antenna, the downlink signal is applied to each one. All UE Rx antennas shall be connected.

If the UE has one Rx antenna, the downlink signal is applied to it.

Table C.0-1: Default Downlink power levels for NR

SCS (kHz)		Unit	Channel bandwidth											
			5 MHz	10 MHz	15 MHz	20 MHz	25 MHz	30 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
15	Number of RBs		25	52	79	106	133	160	216	270	N/A	N/A	N/A	N/A
	Channel BW power	dBm	-60	-57	-55	-54	-53	-52	-51	-50	N/A	N/A	N/A	N/A
30	Number of RBs		11	24	38	51	65	78	106	133	162	217	245	273
	Channel BW power	dBm	-61	-57	-55	-54	-53	-52	-51	-50	-49	-48	-47	-47
60	Number of RBs		N/A	11	18	24	31	38	51	65	79	107	121	135
	Channel BW power	dBm	N/A	-58	-56	-54	-53	-52	-51	-50	-49	-48	-47	-47
	RS EPRE	dBm/15kHz	-85	-85	-85	-85	-85	-85	-85	-85	-85	-85	-85	-85
	Note 1: The channel bandwidth powers are informative, based on -85dBm/15kHz SS/PBCH SSS EPRE, then scaled according to the number of RBs and rounded to the nearest integer dBm value. Full RE allocation with no boost or deboost is assumed. Note 2: The power level is specified at each UE Rx antenna. Note 3: DL level is applied for any of the Subcarrier Spacing configuration ( ) with the same power spectrum density of -85dBm/15kHz.													

The default signal level uncertainty is +/-3dB at each test port, for any level specified. If the uncertainty value is critical for the test purpose, a tighter uncertainty is specified for the related test case in Annex F

C.1 General

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

C.2 Setup

Table C.2-1 describes the downlink Physical Channels that are required for connection set up.

Table C.2-1: Downlink Physical Channels required for connection set-up

Physical Channel
PBCH
SSS
PSS
PDCCH
PDSCH
PBCH DMRS
PDCCH DMRS
PDSCH DMRS
CSI-RS

As common PDSCH and PDCCH configuration parameters the parameters in Table A.3.1-1, A.3.2.1-1, C.2-2, C.2-3, and C.2-4 shall be used to bring up the connection setup for FR1 NR cell.

Table C.2-2: PDSCH and PDCCH configuration

Parameter	Unit	Value
Number of HARQ processes		8 (TDD) 4 (FDD)
Aggregation level	CCE	4

Table C.2-3: TDD UL-DL pattern for SCS 15 KHz

Parameter		Unit	UL-DL pattern
TDD Slot Configuration pattern (Note 1)			DDDSU
Special Slot Configuration (Note 2)			10D+2G+2U
UL-DL configuration (*tdd-UL-DL-ConfigurationCommon*)	*referenceSubcarrierSpacing*	kHz	15
	dl-UL-TransmissionPeriodicity	ms	5
	nrofDownlinkSlots		3
	nrofDownlinkSymbols		10
	nrofUplinkSlot		1
	nrofUplinkSymbols		2
K1 value (PDSCH-to-HARQ-timing-indicator)			[4] if mod(I,5) = 0 [3] if mod(i,5) = 1 [2] if mod(i,5) = 2 [6] if mod(i,5) = 3
Note 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information. Note 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information. Note 3: i is the slot index per frame; i = {0,…,9}			

Table C.2-4: TDD UL-DL pattern for SCS 30 KHz

Parameter		Unit	UL-DL Pattern
TDD Slot Configuration pattern (Note 1)			7DS2U
Special Slot Configuration (Note 2)			6D+4G+4U
UL-DL configuration (*tdd-UL-DL-ConfigurationCommon*)	*referenceSubcarrierSpacing*	30	kHz
	dl-UL-TransmissionPeriodicity	5	
	nrofDownlinkSlots	7	
	nrofDownlinkSymbols	6	
	nrofUplinkSlot	2	
	nrofUplinkSymbols	4	
UL-DL configuration2 (*tdd-UL-DL-ConfigurationCommon2*)	*referenceSubcarrierSpacing*	N/A	
	dl-UL-TransmissionPeriodicity	N/A	
	nrofDownlinkSlots	N/A	
	nrofDownlinkSymbols	N/A	
	nrofUplinkSlot	N/A	
	nrofUplinkSymbols	N/A	

K1 value (PDSCH-to-HARQ-timing-indicator)		8 if mod(i,10) = 0 7 if mod(i,10) = 1 6 if mod(i,10) = 2 5 if mod(i,10) = 3 5 if mod(i,10) = 4 4 if mod(i,10) = 5 3 if mod(i,10) = 6 2 if mod(i,10) = 7
Note 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information. Note 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information. Note 3: i is the slot index per frame; i = {0,…,19}		

C.3 Connection

C.3.0 Measurement of Transmitter Characteristics

Unless otherwise stated, Table C.3.0-1 is applicable for measurements on the Transmitter Characteristics (clause 6).

Table C.3.0-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Parameter	Unit	Value
SSS transmit power	W	Test specific
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH to SSS	dB	0
EPRE ratio of PBCH to PBCH DMRS	dB	0
EPRE ratio of PDCCH to SSS	dB	0
EPRE ratio of PDCCH to PDCCH DMRS	dB	0
EPRE ratio of PDSCH to SSS	dB	0
EPRE ratio of PDSCH to PDSCH DMRS (Note 1)	dB	-3
EPRE ratio of CSI-RS to SSS	dB	0
EPRE ratio of PTRS to PDSCH	dB	Test specific
EPRE ratio of OCNG DMRS to SSS	dB	0
EPRE ratio of OCNG to OCNG DMRS (Note 1)	dB	0
Note 1: No boosting is applied to any of the channels except PDSCH DMRS. For PDSCH DMRS, 3 dB power boosting is applied assuming DMRS Type 1 configuration when DMRS and PDSCH are TDM'ed and only half of the DMRS REs are occupied. Note 2: Number of DMRS CDM groups without data for PDSCH DMRS configuration for OCNG is set to 1.		

C.3.1 Measurement of Receiver Characteristics

Unless otherwise stated, Table C.3.1-1 is applicable for measurements on the Receiver Characteristics (clause 7). For Adjacent channel selectivity testing, Table C.3.1-2 is applied.

Table C.3.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Parameter	Unit	Value
SSS transmit power	W	Test specific
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH to SSS	dB	0
EPRE ratio of PBCH to PBCH DMRS	dB	0
EPRE ratio of PDCCH to SSS	dB	0
EPRE ratio of PDCCH to PDCCH DMRS	dB	0
EPRE ratio of PDSCH to SSS	dB	0
EPRE ratio of PDSCH to PDSCH DMRS (Note 1)	dB	-3
EPRE ratio of CSI-RS to SSS	dB	0
EPRE ratio of PTRS to PDSCH	dB	Test specific
EPRE ratio of OCNG DMRS to SSS	dB	0
EPRE ratio of OCNG to OCNG DMRS (Note 1)	dB	0
Note 1: No boosting is applied to any of the channels except PDSCH DMRS. For PDSCH DMRS, 3 dB power boosting is applied assuming DMRS Type 1 configuration when DMRS and PDSCH are TDM'ed and only half of the DMRS REs are occupied. Note 2: Number of DMRS CDM groups without data for PDSCH DMRS configuration for OCNG is set to 1.		

Table C.3.1-2: PDCCH Aggregation Level for ACS testing

Parameter	Unit	Value	Comment
Aggregation level	CCE	1	CBW=10MHz when SCS=60kHz
		2	CBW=15MHz when SCS=60kHz
		4	CBW=5MHz when SCS=15kHz CBW=10,15MHz when SCS=30kHz CBW=20,25,30MHz when SCS=60kHz
		8	CBW=10,15MHz when SCS=15kHz CBW=20,25,30MHz when SCS=30kHz CBW=40,50,60,70MHz when SCS=60kHz
		16	CBW>15 MHz when SCS=15kHz CBW>30 MHz when SCS=30kHz CBW>70 MHz when SCS=60kHz

Annex D (normative): Characteristics of the Interfering Signal

D.1 General

Some RF performance requirements for the NR UE receiver are defined with interfering signals present in addition to the wanted signal.

For NR bands with F_{DL_high}< 2700 MHz and F_{UL_high}< 2700 MHz, a modulated 5MHz full bandwidth NR down link signal, and in some cases an additional CW signal, are used as interfering signal.

For NR bands with F_{DL_low}≥ 3300 MHz and F_{UL_low}≥ 3300 MHz, a modulated NR downlink signal which equals to channel bandwidth of the wanted signal for Single Carrier case and Inter-band CA case is used as interfering. For intra-band contiguous CA Bandwidth Class C case, a modulated NR downlink signal which equals to the aggregated channel bandwidth of the wanted signal is used. For intra-band contiguous CA Bandwidth Class D and E case, a modulated 50MHz NR downlink signal is used. And in some cases, an additional CW signal is used.

D.2 Interference signals

Table D.2-1 describes the modulated interferer for different channel bandwidth options for NR band lower than 2700MHz.

Table D.2-1: Description of modulated NR interferer for NR bands with F_{DL_high}< 2700 MHz and F_{UL_high}< 2700 MHz

	Channel bandwidth					
	5 MHz	10MHz	15 MHz	20 MHz	25 MHz	30 MHz
RB	NOTE1					
$BW_{Interferer}$	5 MHz					
	Channel bandwidth					
	40 MHz	**50 MHz**	**60 MHz**	**80 MHz**	**90 MHz**	**100 MHz**
RB	NOTE1					
$BW_{Interferer}$	5 MHz					
NOTE 1: The RB configured for interfering signal is the same as maximum RB number defined in Table 5.3.2-1 for each sub-carrier spacing.						

Table D.2-2 and Table D.2-3 describe the modulated interferer for different channel bandwidth options for NR band higher than 3300MHz.

Table D.2-2: Description of modulated NR interferer for NR bands with F_{DL_low}≥ 3300 MHz and F_{UL_low}≥ 3300 MHz

	Channel bandwidth								
	10 MHz	15 MHz	20 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
RB	NOTE1								
$BW_{Interferer}$	10 MHz	15 MHz	20 MHz	40 MHz	50 MHz	60 MHz	80 MHz	90 MHz	100 MHz
NOTE 1: The RB configured for interfering signal is the same as maximum RB number defined in Table 5.3.2-1 for each sub-carrier spacing.									

Table D.2-3: Description of modulated NR interferer for NR bands with F_{DL_low}≥ 3300 MHz and F_{UL_low}≥ 3300 MHz for Intra-band contiguous CA

	Aggregated Channel bandwidth of Bandwidth Class C								Bandwidth Class D/E
	110 MHz	120 MHz	130 MHz	140 MHz	150 MHz	160 MHz	180 MHz	200 MHz	
RB(SCS=30 kHz)	Note 1								133
RB(SCS=60 kHz)	Note 1								65
$BW_{Interferer}$	110 MHz	120 MHz	130 MHz	140 MHz	150 MHz	160 MHz	180 MHz	200 MHz	50MHz
NOTE 1: The interfering signal shall be configured in the same way as the aggregated bandwidth of the wanted signal. The RB configurations for each component carrier are defined in Table 5.3.2-1 for each sub-carrier spacing.									

Annex E (normative): Global In-Channel TX-Test

NOTE: Clauses E.2.2 to E.5.9.3 are descriptions, which assume no power ramping adjacent to the measurement period.

E.1 General

The global in-channel TX test enables the measurement of all relevant parameters that describe the in-channel quality of the output signal of the TX under test in a single measurement process.

The parameters describing the in-channel quality of a transmitter, however, are not necessarily independent. The algorithm chosen for description inside this annex places particular emphasis on the exclusion of all interdependencies among the parameters.

E.2 Signals and results

E.2.1 Basic principle

The process is based on the comparison of the actual **output signal of the TX under test**, received by an ideal receiver, with a **reference signal**, that is generated by the measuring equipment and represents an ideal error free received signal. All signals are represented as equivalent (generally complex) baseband signals.

The description below uses numbers as examples. These numbers are taken from FDD with normal CP length and 100 MHz bandwidth with 30 kHz SCS. The application of the text below, however, is not restricted to this frame structure and bandwidth.

E.2.2 Output signal of the TX under test

The output signal of the TX under test is acquired by the measuring equipment and stored for further processing. It is sampled at a sampling rate of 122.88 Mbps. In the time domain it comprises at least 10 uplink subframes. The measurement period is derived by concatenating the correct number of individual uplink slots until the correct measurement period is reached. The output signal is named z(ν). Each slot is modelled as a signal with the following parameters: demodulated data content, carrier frequency, amplitude and phase for each subcarrier, timing, carrier leakage.

NOTE 1: TDD

Since the uplink subframes are not continuous, *n* slots should be extracted from more than 1 continuous radio frame where

$$n = \begin{cases} 10, \text{ for 15 kHz SCS} \\ 20, \text{ for 30 kHz SCS} \\ 40, \text{ for 60 kHz SCS} \end{cases}$$

.

E.2.3 Reference signal

Two types of reference signal are defined:

The reference signal $i_1(\nu)$ is constructed by the measuring equipment according to the relevant TX specifications, using the following parameters: demodulated data content, nominal carrier frequency, nominal amplitude and phase for each subcarrier, nominal timing, no carrier leakage. It is represented as a sequence of samples at a sampling rate of 122.88 Msps in the time domain.

The reference signal $i_2(v)$ is constructed by the measuring equipment according to the relevant TX specifications, using the following parameters: restricted data content: nominal reference symbols, (all modulation symbols for user data symbols are set to 0V), nominal carrier frequency, nominal amplitude and phase for each applicable subcarrier, nominal timing, no carrier leakage. It is represented as a sequence of samples at a sampling rate of 122.88 Msps in the time domain.

NOTE: The PUCCH is off during the time under test.

E.2.4 Measurement results

The measurement results, achieved by the global in channel TX test are the following:

- Carrier Frequency error
- EVM (Error Vector Magnitude)
- Carrier leakage
- Unwanted emissions, falling into non allocated resource blocks.
- EVM equalizer spectrum flatness

E.2.5 Measurement points

The unwanted emission falling into non-allocated RB(s) is calculated directly after the FFT as described below. In contrast to this, the EVM for the allocated RB(s) is calculated after the IDFT for DFT-s-OFDM or after the Tx-Rx chain equalizer for CP-OFDM. The samples after the TX-RX chain equalizer are used to calculate EVM equalizer spectrum flatness. Carrier frequency error and carrier leakage is calculated in the block "RF correction".

In case the parameter 3300 or 3301 is reported from UE via *txDirectCurrentLocation* IE (as defined in TS 38.331 [6]), carrier leakage measurement in RF correction block shall be omitted. All statements from Annex E.3 onwards shall be read assuming that no carrier leakage has been measured.

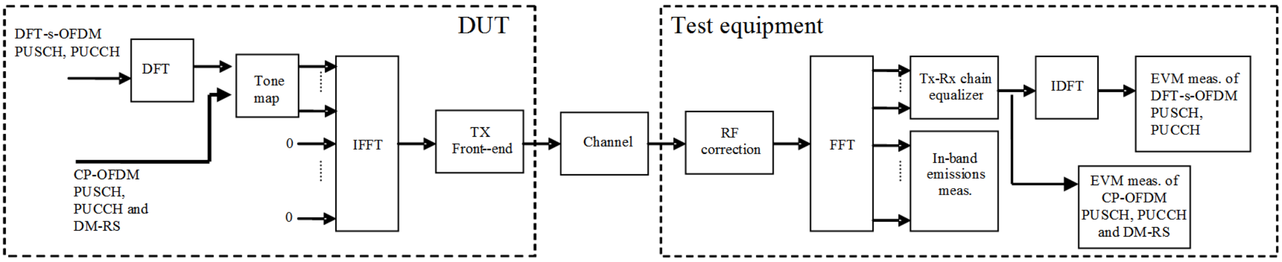

Figure E.2.5-1: EVM measurement points

E.3 Signal processing

E.3.1 Pre FFT minimization process

Before applying the pre-FFT minimization process, z(v) and i(v) are portioned into *n* pieces, comprising one slot each, where *n* is as defined in Annex E.2.2.

Each slot is processed separately. Sample timing, Carrier frequency and carrier leakage in z(ν) are jointly varied in order to minimise the difference between z(ν) and i(ν). Best fit (minimum difference) is achieved when the RMS difference value between z(ν) and i(ν) is an absolute minimum.

The carrier frequency variation and the IQ variation are the measurement results: Carrier Frequency Error and Carrier leakage.

From the acquired samples 10 carrier frequencies can be derived by averaging frequency errors for every 1, 2 or 4 slots for 15, 30 and 60 kHz SCS.

From the acquired samples *n* carrier frequencies and *n* carrier leakages can be derived.

NOTE 1: The minimisation process, to derive carrier leakage and RF error can be supported by Post FFT operations. However the minimisation process defined in the pre FFT domain comprises all acquired samples (i.e. it does not exclude the samples in between the FFT widths and it does not exclude the bandwidth outside the transmission bandwidth configuration

NOTE 2: The algorithm would allow deriving Carrier Frequency error and Sample Frequency error of the TX under test separately. However there are no requirements for Sample Frequency error. Hence the algorithm models the RF and the sample frequency commonly (not independently). It returns one error and does not distinguish between both.

After this process the samples z(ν) are called $z^0(\nu)$.

E.3.2 Timing of the FFT window

The FFT window length is 4096 samples per OFDM symbol. 14 FFTs (57344 samples) cover less than the acquired number of samples (61440 samples). The position in time for FFT must be determined.

In an ideal signal, the FFT may start at any instant within the cyclic prefix without causing an error. The TX filter, however, reduces the window. The EVM requirements shall be met within a window W<CP. There are three different instants for FFT:

Centre of the reduced window, called $\Delta\tilde{c}$, $\Delta\tilde{c}$ –W/2 and $\Delta\tilde{c}$ +W/2.

The timing of the measured signal is determined in the pre FFT domain as follows, using $z^0(\nu)$ and $i_2(\nu)$:

1. The measured signal is delay spread by the TX filter. Hence the distinct boarders between the OFDM symbols and between Data and CP are also spread and the timing is not obvious.

2. In the Reference Signal $i_2(\nu)$ the timing is known.

3. Correlation between (1.) and (2.) will result in a correlation peak. The meaning of the correlation peak is approx. the “impulse response” of the TX filter. The meaning of “impulse response” assumes that the autocorrelation of the reference signal $i_2(\nu)$ is a Dirac peak and that the correlation between the reference signal $i_2(\nu)$ and the data in the measured signal is 0. The correlation peak, (the highest, or in case of more than one, the earliest) indicates the timing in the measured signal.

From the acquired samples, *n* timings can be derived, where *n* is as defined in Annex E.2.2.

For all calculations, except EVM, the number of samples in $z^0(\nu)$ is reduced to 14 blocks of samples, comprising 4096 samples (FFT width) and starting with $\Delta\tilde{c}$ in each OFDM symbol including the demodulation reference signal.

For the EVM calculation the output signal under test is reduced to 28 blocks of samples, comprising 4096 samples (FFT width) and starting with $\Delta\tilde{c}$ –W/2 and $\Delta\tilde{c}$ +W/2 in each OFDM symbol including the demodulation reference signal.

The number of samples, used for FFT is reduced compared to $z^0(v)$. This subset of samples is called z'(v).

The timing of the centre $\Delta\tilde{c}$ with respect to the different CP length in a slot is as follows: (FDD, normal CP length)

$\Delta\tilde{c}$ is on T_f=144 (=CP/2) within the CP of length 288 FFT samples (in OFDM symbols except 0 and 14 (= $7 \cdot 2^{\mu} 7 \cdot 2^{\mu}$), where symbol 0 is the first symbol of each subframe) for 100 MHz channel bandwidth and SCS = 30 kHz.

$\Delta\tilde{c}$ is on T_f=208 (=352-144) within the CP of length 352 FFT samples (in OFDM symbol 0 and 14 (= $7 \cdot 2^{\mu} 7 \cdot 2^{\mu}$), where symbol 0 is the first symbol of each subframe) for 100 MHz channel bandwidth and SCS = 30 kHz.

E.3.3 Post FFT equalisation

Perform 14 FFTs on z'(v), one for each OFDM symbol in a slot using the timing $\Delta\tilde{c}$, including the demodulation reference symbol. The result is an array of samples, 14 in the time axis t times 4096 in the frequency axis f. The samples represent the data symbols (in OFDM-symbol 0,1,3,4,5,6,8,9,10,12,13 in each slot) and demodulation reference symbols (OFDM symbol 2, 7, 11 in each slot) in the allocated RBs and inband emissions in the non-allocated RBs within the transmission BW.

Only the allocated resource blocks in the frequency domain are used for equalisation.

The nominal demodulation reference symbols and nominal data symbols are used to equalize the measured data symbols. (Location for equalization see Figure E.2.5-1)

NOTE: The nomenclature inside this note is local and not valid outside.

The nominal data symbols are created by a demodulation process. The location to gain the demodulated data symbols is "EVM" in Figure E.2.5-1. For CP-OFDM, the process described in Annex E.5 can be applied. A demodulation process as follows is recommended for DFT-s-OFDM:

1. Equalize the measured data symbols using the reference symbols for equalisation. Result: Equalized data symbols
2. Only for DFT-s-OFDM, iDFT transform the equalized data symbols: Result: Equalized data symbols
3. Decide for the nearest constellation point: Result: Nominal data symbols
4. Only for DFT-s-OFDM, DFT transform the nominal data symbols: Result: Nominal data symbols

At this stage we have an array of Measured data-Symbols and reference-Symbols (MS(f,t))

versus an array of Nominal data-Symbols and reference Symbols (NS(f,t))

(complex, the arrays comprise 11 data symbols and 3 demodulation reference symbol in the time axis and the number of allocated subcarriers in the frequency axis.)

MS(f,t) and NS(f,t) are processed with a least square (LS) estimator, to derive one equalizer coefficient per time slot and per allocated subcarrier. EC(f) is defined as

$$EC(f) = \frac{\sum_{t=0}^{13} NS(f,t)^{*} NS(f,t)}{\sum_{t=0}^{13} NS(f,t)^{*} MS(f,t)}$$

.

With * denoting complex conjugation.

EC(f) are used to equalize the DFT-coded data symbols. The measured DFT-coded data and the references symbols are equalized by:

$$Z'(f,t) = MS(f,t) \cdot EC(f)$$

With · denoting multiplication.

Z'(f,t), restricted to the data symbol (excluding t=2,7,11) is used to calculate EVM, as described in E.4.1.

EC(f) is used in E.4.4.1 to calculate EVM equalizer spectral flatness.

NOTE: The post FFT minimisation process is done over 14 symbols (11 DFT-coded data symbols and 3 reference symbols).

The samples of the non-allocated resource blocks within the transmission bandwidth configuration in the post FFT domain are called Y(f,t) (f covering the non-allocated subcarriers within the transmission bandwidth configuration, t covering the OFDM symbols during 1 slot).

E.4 Derivation of the results

E.4.1 EVM

For EVM create two sets of Z'(f,t)., according to the timing " $\Delta\tilde{c}$ –W/2 and $\Delta\tilde{c}$ +W/2" using the equalizer coefficients from E.3.3.

Perform the iDFTs on Z'(f,t) in the case of DFT-s-OFDM waveform. The IDFT-decoding preserves the meaning of t but transforms the variable f (representing the allocated sub carriers) into another variable g, covering the same count and representing the demodulated symbols. The samples in the post IDFT domain are called iZ'(g, t). The equivalent ideal samples are called iI(g,t). Those samples of Z'(f,t), carrying the reference symbols (=symbol 2,7,11) are not iDFT processed.

The EVM is the difference between the ideal waveform and the measured and equalized waveform for the allocated RB(s)

$$EVM = \sqrt{\frac{\sum_{t \in T} \sum_{g \in G} \left| iZ'(g,t) - iI(g,t) \right|^{2}}{|G| \cdot |T| \cdot P_0}}$$

,

where

t covers the count of demodulated symbols with the considered modulation scheme being active within the measurement period, (i.e. symbol 0,1,3,4,5,6,8,9,10,12,13 in each slot, →|T|=11) g covers the count of demodulated symbols with the considered modulation scheme being active within the allocated bandwidth. (|G|=12* L_{CRBs} (with L_{CRBs} : number of allocated resource blocks)).

$iZ'(g,t)$ are the samples of the signal evaluated for the EVM.

$iI(g,t)$ is the ideal signal reconstructed by the measurement equipment, and

P_0 is the average power of the ideal signal. For normalized modulation symbols P_0 is equal to 1.

From the acquired samples *2n* EVM values can be derived, *n* values for the timing $\Delta\tilde{c}$ –W/2 and *n* values for the timing $\Delta\tilde{c}$ +W/2 where *n* is as defined in Annex E.2.2.

E.4.2 Averaged EVM

EVM is averaged over all basic EVM measurements.

The averaging comprises *n* UL slots

$$\overline{EVM} = \sqrt{\frac{1}{n}\sum_{i=1}^{n} EVM_i^2}$$

where *n* is as defined in Annex E.2.2for PUCCH, PUSCH.

The averaging is done separately for timing $\Delta\tilde{c}$ –W/2 and $\Delta\tilde{c}$ +W/2 leading to $\overline{\mathrm{EVM}}_l$ and $\overline{\mathrm{EVM}}_h$

$EVM_{\mathrm{final}} = \max(\overline{\mathrm{EVM}}_l, \overline{\mathrm{EVM}}_h)$ is compared against the test requirements.

E.4.3 In-band emissions measurement

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks.

Explanatory Note:

The inband emission measurement is only meaningful with allocated RB(s) next to non-allocated RB. The allocated RB(s) are necessary but not under test. The non-allocated RBs are under test. The RB allocation for this test is as follows: The allocated RB(s) are at one end of the channel BW, leaving the other end unallocated. The number of allocated RB(s) is smaller than half of the number of RBs, available in the channel BW. This means that the vicinity of the carrier in the centre is unallocated.

There are 3 types of inband emissions:

1. General
2. IQ image
3. Carrier leakage

Carrier leakage are inband emissions next to the carrier.

IQ image are inband emissions symmetrically (with respect to the carrier) on the other side of the allocated RBs.

General are applied to all unallocated RBs.

For each evaluated RB, the minimum requirement is calculated as the higher of P_{RB} - 30 dB and the power sum of all limit values (General, IQ Image or Carrier leakage) that apply.

In specific the following combinations:

- Power (General)
- Power (General + Carrier leakage)
- Power (General + IQ Image)

  1 and 2 is expressed in terms of power in one non allocated RB under test, normalized to the average power of an allocated RB (unit dB).

  3 is expressed in terms of power in one non allocated RB, normalized to the power of all allocated RBs. (unit dBc).

This is the reason for two formulas *Emissions* $_{relative}$.

Create one set of Y(t,f) per slot according to the timing "$\Delta\tilde{c}$"

For the non-allocated RBs below the in-band emissions are calculated as follows

$$Emissions_{absolute}(\Delta_{RB}) = \begin{cases} \dfrac{1}{|T_s|}\sum_{t\in T_s} \sum_{\max(f_{\min},(c_l+12\cdot\Delta_{RB}*\Delta f))}^{c_l+(12\cdot\Delta_{RB}+11)*\Delta f} |Y(t,f)|^2, & \Delta_{RB} < 0 \\ \dfrac{1}{|T_s|}\sum_{t\in T_s} \sum_{c_h+(12\cdot\Delta_{RB}-11)*\Delta f}^{\min(f_{\max},(c_h+12\cdot\Delta_{RB}*\Delta f))} |Y(t,f)|^2, & \Delta_{RB} > 0 \end{cases},$$

where

the upper formula represents the in band emissions below the allocated frequency block and the lower one the in band emissions above the allocated frequency block.

T_s is a set of $|T_s|$ DFT-s-OFDM symbols with the considered modulation scheme being active within the measurement period,

Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB} = 1$ for the first upper or $\Delta_{RB} = -1$ for the first lower adjacent RB),

$f_{\min}$ and $f_{\max}$ are the lower and upper edge of the UL transmission BW configuration,

c_l and c_h are the lower and upper edge of the allocated BW,

Δf is the SCS, and

$Y(t, f)$ is the frequency domain signal evaluated for in-band emissions as defined in the clause E.3.3

The allocated RB power per RB and the total allocated RB power are given by:

$$P_{RB} = \frac{1}{|T_s| \cdot L_{CRBs}} \sum_{t \in T_S} \sum_{c_1}^{c_1 + (12 \cdot L_{CRBs} - 1) \cdot \Delta f} |\mathrm{MS}(t, f)|^2 [\mathrm{dBm}/(12\Delta f)]$$

$$P_{All-RBs} = \frac{1}{|T_s|} \sum_{t \in T_S} \sum_{c_l}^{c_l + (12 \cdot L_{CRBs} - 1) * \Delta f} |\mathrm{MS}(t, f)|^2 \ [\mathrm{dBm}]$$

The relative in-band emissions, applicable for General and IQ image, are given by:

$$Emissions_{relative}(\Delta_{RB}) = 10 \cdot \log_{10} \left(\frac{Emissions_{absolute}(\Delta_{RB})}{\frac{1}{|T_S| \cdot L_{CRBs}} \sum_{t \in T_S} \sum_{c_l}^{c_l + (12 \cdot L_{CRBs} - 1) \cdot \Delta f} |\mathrm{MS}(t, f)|^2} \right) [\mathrm{dB}] =$$

$$= Emissions_{absolute}(\Delta_{RB}) [\mathrm{dBm}/12\Delta f] - P_{RB}[dBm/12\Delta f]$$

where

L_{CRBs} is the number of allocated resource blocks,

and

$\mathrm{MS}(t, f)$ is the frequency domain samples for the allocated bandwidth, as defined in the clause E.3.3.

The relative in-band emissions, applicable for carrier leakage, is given by:

$$Emissions_{relative} = 10 \cdot \log_{10} \left(\frac{Emissions_{absolute}(DCRB)}{\frac{1}{|T_s|} \sum_{t \in T_s} \sum_{c_l}^{c_l + (12 \cdot L_{CRBs} - 1) \cdot \Delta f} |\mathrm{MS}(t, f)|^2} \right) [\mathrm{dBc}]$$

$$= Emissions_{absolute}(DCRB) \ [\mathrm{dBm}/12\Delta f] - P_{All-RBs} \ [\mathrm{dBm}]$$

where DCRB is one RB or one pair of RBs, depending whether the DC carrier is inside an RB or in-between two RBs.

Although an exclusion period may be applicable in the time domain, when evaluating EVM, the inband emissions measurement interval is defined over one complete slot in the time domain.

From the acquired samples *n* functions for general in band emissions and IQ image inband emissions can be derived, where *n* is as defined in Annex E.2.2. *n* values or *n* pairs of carrier leakage inband emissions can be derived. They are compared against different limits after the final averaging:

The in-band emissions are averaged over the *n* samples (equivalent to 10 UL subframes):

$$\overline{Emissions}_{absolute}(\Delta_{RB}) = \frac{1}{n}\sum_{i=1}^{n} Emissions_{absolute,i}(\Delta_{RB})$$

$$\overline{Emissions}_{relative}(\Delta_{RB}) = 10*\log_{10}\left(\frac{1}{n}\sum_{i=1}^{n}10^{Emissions_{relative,i}(\Delta_{RB})/10}\right)[dB]$$

$$\overline{Emissions}_{relative} = 10*\log_{10}\left(\frac{1}{n}\sum_{i=1}^{n}10^{Emissions_{relative,i}/10}\right)[dBc]$$

E.4.4 EVM equalizer

E.4.4.1 EVM equalizer spectrum flatness

For EVM equalizer spectrum flatness use EC(f) as defined in E.3.3. Note, EC(f) represents equalizer coefficient $f \in F$, f is the allocated subcarriers within the transmission bandwidth (($|F|=12*L_{CRBs}$)

From the acquired samples *n* functions EC(f) can be derived, where *n* is as defined in Annex E.2.2.

EC(f) is broken down to 2 functions:

$$\mathrm{EC}_1(f), f \in Range\ 1$$

$$\mathrm{EC}_2(f), f \in Range\ 2$$

Where Range 1 and Range 2 are as defined for Clause 6.4.2.4 in Table 6.4.2.4.5-1 for normal condition and Table 6.4.2.4.5-2 for extreme condition and for Clause 6.4.2.5 as in Table 6.4.2.5.5-1.

The following peak to peak ripple is calculated:

$\mathrm{RP}_1 = 20*\log\left(\max\left(|\mathrm{EC}_1(f)|\right)/\min\left(|\mathrm{EC}_1(f)|\right)\right)$,which denote the maximum ripple in Range 1

$\mathrm{RP}_2 = 20*\log\left(\max\left(|\mathrm{EC}_2(f)|\right)/\min\left(|\mathrm{EC}_2(f)|\right)\right)$,which denote the maximum ripple in Range 2

$\mathrm{RP}_{12} = 20*\log\left(\max\left(|\mathrm{EC}_1(f)|\right)/\min\left(|\mathrm{EC}_2(f)|\right)\right)$,which denote the maximum ripple between the upper side of Range 1 and lower side of Range 2

$\mathrm{RP}_{21} = 20*\log\left(\max\left(|\mathrm{EC}_2(f)|\right)/\min\left(|\mathrm{EC}_1(f)|\right)\right)$,which denote the maximum ripple between the upper side of Range 2 and lower side of Range 1

E.4.4.2 EVM equalizer spectral shaping filter

The calculation of the impulse response of the spectral shaping filter is based on EC(f) as defined in E.3.3. Note that EC(f) represents complex valued equalizer coefficient with $f \in F$, where f is the allocated subcarriers within the transmission bandwidth ($|F|$=12* L_{CRBs}).

EC'(f) is the corrected version of EC(f) by shifting by T_f. T_f is as defined in Clause E.3.2.

The impulse responses are the IDFT transformed equalizer coefficients:

$$a(\tau) = IDFT\left\{\frac{1}{EC'(f)}\right\}$$

, where *f* is the frequency of the *M* allocated subcarriers.

The impulse response is normalized to its first value.

$$\tilde{a}(\tau) = \frac{a(\tau)}{a(0)}$$

This is equivalent to defining the 0dB as $20log_{10}|\tilde{a}_t(0)|$.

From the acquired samples, *n* functions $\tilde{a}(\tau)$ can be derived, where *n* is as defined in Annex E.2.2.

Note, that this method provides reasonable results only in the case of full allocations.

E.4.5 Frequency error and Carrier leakage

See E.3.1.

E.4.6 EVM of Demodulation reference symbols (EVM_{DMRS})

For the purpose of EVM_{DMRS}, the steps E.2.2 to E.4.2 are repeated 6 times, constituting 6 EVM_{DMRS} sub-periods. The only purpose of the repetition is to cover the longer gross measurement period of EVM_{DMRS} ($6 \cdot n$ time slots) and to derive the FFT window timing per sub-period.

The bigger of the EVM results in one *n* TS period corresponding to the timing $\Delta\tilde{c}$ –W/2 or $\Delta\tilde{c}$ +W/2 is compared against the limit, where *n* is as defined in Annex E.2.2. (Clause E.4.2) This timing is re-used for EVM_{DMRS} in the equivalent EVM_{DMRS} sub-period.

For EVM the demodulation reference symbols are excluded, while the data symbols are used. For EVM_{DMRS} the data symbols are excluded, while the demodulation references symbols are used. This is illustrated in figure E.4.6-1

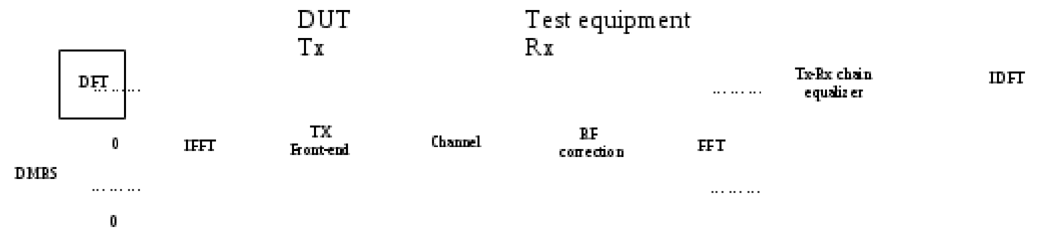

Figure E.4.6-1: EVM_{DMRS} measurement points

Re-use the following formula from E.3.3:

$$Z'(f,t) = MS(f,t) \cdot EC(f)$$

To calculate EVM_{DMRS} , the data symbol (t=0,1,3,4,5,6,8,9,10,12,13) in Z'(f,t) are excluded and only the reference symbols (t=2,7,11) is used.

The EVM_{DMRS} is the difference between the ideal waveform and the measured and equalized waveform for the allocated RB(s)

$$EVM_{DMRS} = \sqrt{\frac{\sum_{t \in T} \sum_{f \in F} |Z'(f,t) - I(f,t)|^2}{|T| ¿ P_0 ¿ |F|}}$$,

where

t covers the count of demodulation reference symbols (i.e. symbols 2,7,11 in each slot, so count=3)

f covers the count of demodulation reference symbols within the allocated bandwidth. (|F|=12* L_{CRBs} (with L_{CRBs} : number of allocated resource blocks)).

$Z'(f,t)$ are the samples of the signal evaluated for the EVM $_{DMRS}$

$I(f,t)$ is the ideal signal reconstructed by the measurement equipment, and

P_0 is the average power of the ideal signal. For normalized modulation symbols P_0 is equal to 1.

n such results are generated per measurement sub-period, where *n* is as defined in Annex E.2.2.

E.4.6.1 1st average for EVM $_{DMRS}$

EVM $_{DMRS}$ is averaged over all basic EVM $_{DMRS}$ measurements in one sub-period

The averaging comprises *n* UL slots

$$1stEVM_{DMRS} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(EVM_{DMRS,i}\right)^2},$$

where *n* is as defined in Annex E.2.2.

The timing is taken from the EVM for the data. 6 of those results are achieved from the samples. In general the timing is not the same for each result.

E.4.6.2 Final average for EVM $_{DMRS}$

$$finalEVM_{DMRS} = \sqrt{\frac{1}{6}\sum_{i=1}^{6}\left(1stEVM_{DMRS,i}\right)^2}$$

E.5 EVM and inband emissions for PUCCH

For the purpose of worst case testing, the PUCCH shall be located on the edges of the Transmission Bandwidth Configuration.

The EVM for PUCCH (EVM_{PUCCH}) is averaged over *n* slots, where *n* is as defined in Annex E.2.2.

At least *n* TSs shall be transmitted by the UE without power change. SRS multiplexing shall be avoided during this period. The following transition periods are applicable: One OFDM symbol on each side of the slot border (instant of band edge alternation).

The description below is generic in the sense that all 5 PUCCH formats are covered. Although the number of OFDM symbols in one slot can be different from 14 (depending on the format, configuration and cyclic prefix length), the text below uses 14 without excluding the others.

E.5.1 Basic principle

The basic principle is the same as described in E.2.1

E.5.2 Output signal of the TX under test

The output signal of the TX under test is processed same as described in E.2.2

E.5.3 Reference signal

The reference signal is defined same as in E.2.3. Same as in E.2.3, $i_1(\nu)$ is the ideal reference for EVM_{PUCCH} and $i_2(\nu)$ is used to estimate the FFT window timing.

Note PUSCH is off during the PUCCH measurement period.

E.5.4 Measurement results

The measurement results are:

- EVM_{PUCCH}
- Inband emissions with the sub-results: General in-band emission, IQ image (according to: 38.101. Annex F.4, Clause starting with: “At this stage the ….”)

E.5.5 Measurement points

The measurement points are illustrated in Figure E.2.5-1.

E.5.6 Pre FFT minimization process

The pre FFT minimisation process is the same as describes in clause E.3.1.

NOTE: although an exclusion period for EVM_{PUCCH} is applicable in E.5.9.1, the pre FFT minimisation process is done over the complete slot.

RF error, and carrier leakage are necessary for best fit of the measured signal towards the ideal signal in the pre FFT domain. However they are not used to compare them against the limits.

E.5.7 Timing of the FFT window

Timing of the FFT window is estimated with the same method as described in E.3.2.

E.5.8 Post FFT equalisation

The post FFT equalisation is described separately without reference to E.3.3:

Perform 14 FFTs on z’(ν), one for each OFDM symbol in a slot using the timing $\Delta\tilde{c}$, including the demodulation reference symbol. The result is an array of samples, 14 in the time axis t times 4096 in the frequency axis f. The samples represent the OFDM symbols (data and reference symbols) in the allocated RBs and inband emissions in the non-allocated RBs within the transmission BW.

Only the allocated resource blocks in the frequency domain are used for equalisation.

The nominal reference symbols and **nominal** OFDM data symbols are used to equalize the measured data symbols.

Note: (The nomenclature inside this note is local and not valid outside)

The nominal OFDM data symbols are created by a demodulation process. A demodulation process as follows is recommended:

1. Equalize the measured OFDM data symbols using the reference symbols for equalisation. Result: Equalized OFDM data symbols

2. Decide for the nearest constellation point, however not independent for each subcarrier in the RB. 12 constellation points are decided dependent, using the applicable CAZAC sequence. Result: Nominal OFDM data symbols

At this stage we have an array of Measured data-Symbols and reference-Symbols (MS(f,t))

versus an array of Nominal data-Symbols and reference Symbols (NS(f,t))

The arrays comprise in sum 14 data and reference symbols, depending on the PUCCH format, in the time axis and the number of allocated sub-carriers in the frequency axis.

MS(f,t) and NS(f,t) are processed with a least square (LS) estimator, to derive one equalizer coefficient per time slot and per allocated subcarrier. EC(f)

$$EC(f)=\frac{\sum_{t=0}^{13} NS(f,t)^{¿} NS(f,t)}{\sum_{t=0}^{13} MS(f,t)^{¿} NS(f,t)}$$

With * denoting complex conjugation.

EC(f) are used to equalize the OFDM data together with the demodulation reference symbols by:

$$Z'(f,t) = MS(f,t) \cdot EC(f)$$

With · denoting multiplication.

Z'(f,t) is used to calculate EVM_{PUCCH}, as described in E.5.9 1

NOTE: although an exclusion period for EVM_{PUCCH} is applicable in E.5.9.1, the post FFT minimisation process is done over 14 OFDM symbols.

The samples of the non-allocated resource blocks within the transmission bandwidth configuration in the post FFT domain are called Y(f,t) (f covering the non-allocated subcarriers within the transmission bandwidth configuration, t covering the OFDM symbols during 1 slot).

E.5.9 Derivation of the results

E.5.9.1 EVM_{PUCCH}

For EVM_{PUCCH} create two sets of Z'(f,t)., according to the timing " $\Delta\tilde{c}$ –W/2 and $\Delta\tilde{c}$ +W/2" using the equalizer coefficients from E.5.8

The EVM_{PUCCH} is the difference between the ideal waveform and the measured and equalized waveform for the allocated RB(s)

$$EVM_{PUCCH} = \sqrt{\frac{\sum_{t \in T} \sum_{f \in F} |Z'(f,t) - I(f,t)|^2}{|T| ¿ P_0 ¿ |F|}},$$

where

the OFDM symbols next to transition boarders (instant of PUCCH frequency hopping) are excluded:

t covers less than the count of demodulated symbols in the slot (|T|= 12)

f covers the count of subcarriers within the allocated bandwidth. (|F|=12)

$Z'(f,t)$ are the samples of the signal evaluated for the EVM_{PUCCH}

$I(f,t)$ is the ideal signal reconstructed by the measurement equipment, and

P_0 is the average power of the ideal signal. For normalized modulation symbols P_0 is equal to 1.

From the acquired samples 2*n* EVM_{PUCCH} value can be derived, *n* values for the timing $\Delta\tilde{c}$ –W/2 and *n* values for the timing $\Delta\tilde{c}$ +W/2, where *n* is as defined in Annex E.2.2.

E.5.9.2 Averaged EVM_{PUCCH}

EVM_{PUCCH} is averaged over all basic EVM_{PUCCH} measurements

The averaging comprises *n* UL slots

$$\overline{EVM}_{PUCCH} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}\left(EVM_{PUCCH,i}\right)^2},$$

where *n* is as defined in Annex E.2.2.

The averaging is done separately for timing $\Delta\tilde{c}$ –W/2 and $\Delta\tilde{c}$ +W/2 leading to $\overline{EVM}_{PUCCH,low}$ and $\overline{EVM}_{PUCCH,high}$

$EVM_{PUCCH,final} = \max\left(\overline{EVM}_{PUCCH,low}, \overline{EVM}_{PUCCH,high}\right)$ is compared against the test requirements.

E.5.9.3 In-band emissions measurement

The in-band emissions are a measure of the interference falling into the non-allocated resources blocks

Create one set of Y(t,f) per slot according to the timing “$\Delta\tilde{c}$”

For the non-allocated RBs the in-band emissions are calculated as follows

$$Emissions_{absolute}(\Delta_{RB}) = \begin{cases} \frac{1}{|T_s|}\sum_{t\in T_s} \sum_{\max(f_{\min},(c_l+12\cdot\Delta_{RB}*\Delta f))}^{c_l+(12\cdot\Delta_{RB}+11)*\Delta f} |Y(t,f)|^2, \Delta_{RB} < 0 \\ \frac{1}{|T_s|}\sum_{t\in T_s} \sum_{c_h+(12\cdot\Delta_{RB}-11)*\Delta f}^{\min(f_{\max},(c_h+12\cdot\Delta_{RB}*\Delta f))} |Y(t,f)|^2, \Delta_{RB} > 0 \end{cases},$$

where

the upper formula represents the inband emissions below the allocated frequency block and the lower one the inband emissions above the allocated frequency block.

T_s is a set of $|T_s|$ OFDM symbols in the measurement period,

Δ_{RB} is the starting frequency offset between the allocated RB and the measured non-allocated RB (e.g. $\Delta_{RB}=1$ for the first upper or $\Delta_{RB}=-1$ for the first lower adjacent RB),

$f_{\min}$ and $f_{\max}$ are the lower and upper edge of the UL UE channel bandwidth

c_l and c_h are the lower and upper edge of the allocated BW,

Δf is the SCS, and

$Y(t,f)$ is the frequency domain signal evaluated for in-band emissions as defined in the clause E.5.8.

The relative in-band emissions are, given by

$$Emissions_{relative}(\Delta_{RB}) = 10*\log_{10} \frac{Emissions_{absolute}(\Delta_{RB})}{\frac{1}{|T_s| \cdot L_{CRBs}} \sum_{t \in T_s} \sum_{c_l}^{c_l + (12 \cdot L_{CRBs} - 1) * \Delta f} |MS(t,f)|^2} [dB]$$

where

L_{CRBs} is the number of allocated RBs,

and $MS(t,f)$ is the frequency domain samples for the allocated bandwidth, as defined in the subsection E.5.8

Although an exclusion period for EVM is applicable in E.5.9.1, the inband emissions measurement interval is defined over one complete slot in the time domain.

From the acquired samples *n* functions for inband emissions can be derived, where *n* is as defined in Annex E.2.2.

The in-band emissions are averaged over the *n* samples (equivalent to 10 UL subframes) with the same PUCCH position to prevent averaging of allocated and non-allocated RBs due to PUCCH frequency hopping:

$$\overline{Emissions}_{absolute}(\Delta_{RB}) = \frac{1}{n} \sum_{i=1}^{n} Emissions_{absolute,i}(\Delta_{RB})$$

$$\overline{Emissions}_{relative}(\Delta_{RB}) = 10 * \log_{10} \left(\frac{1}{n} \sum_{i=1}^{n} 10^{Emissions_{relative,i}(\Delta_{RB})/10} \right) [dB]$$

Since the PUCCH allocation is always on the upper or lower band-edge, the opposite of the allocated one represents the IQ image, and the remaining inner RBs represent the general inband emissions. They are compared against different limits.

E.6 EVM for PRACH

The description below is generic in the sense that all PRACH formats are covered. The numbers, used in the text below are taken from PRACH format#0 without excluding the other formats. The sampling rate for PRACH is assumed as , 30.72 Msps in the time domain.

E.6.1 Basic principle

The basic principle is the same as described in E.2.1

E.6.2 Output signal of the TX under test

The output signal of the TX under test is processed same as described in E.2.2

The measurement period is different since 2 PRACH preambles are recorded for long preamble formats as defined in Table 6.3.3.1-1 in [8] and 10 preambles are recorded for short preamble formats as defined in Table 6.3.3.1-2 in [8].

E.6.3 Reference signal

The test description in 6.4.2.1.4.1 is based on non-contention based access:

- PRACH configuration index (responsible for Preamble format, System frame number and subframe number)
- Preamble ID
- Preamble power

signalled to the UE, defines the reference signal unambiguously, such that no demodulation process is necessary to gain the reference signal.

The reference signal i(v) is constructed by the measuring equipment according to the relevant TX specifications, using the following parameters: the applicable Zadoff Chu sequence, nominal carrier frequency, nominal amplitude and phase for each subcarrier, nominal timing, no carrier leakage. It is represented as a sequence of samples at a sampling rate of 122.88 Msps in the time domain.

E.6.4 Measurement results

The measurement result is:

- EVMPRACH

E.6.5 Measurement points

The measurement points are illustrated in the figure below:

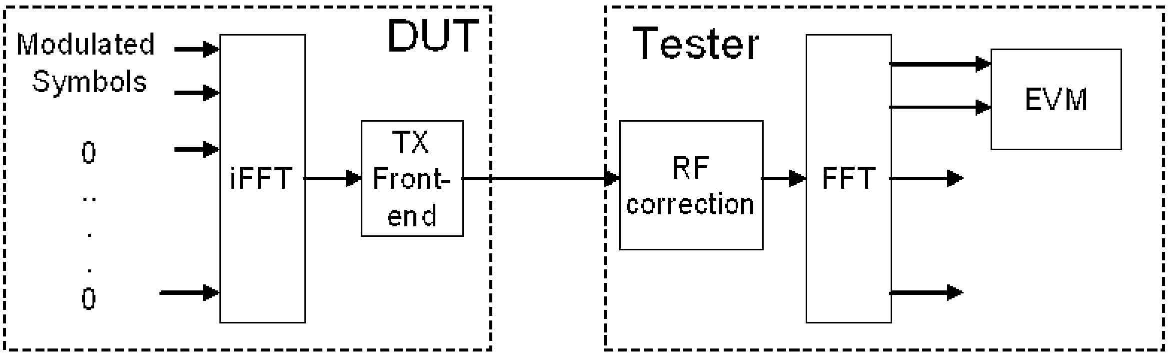

Figure E.6.5-1:Measurement points

E.6.6 Pre FFT minimization process

The pre-FFT minimization process is applied to each PRACH preamble separately. The time period for the pre- FFT minimisation process includes the complete CP and Zadoff-Chu sequence (in other words, the power transition period is per definition outside of this time period) Sample timing, Carrier frequency and carrier leakage in z(v) are jointly varied in order to minimise the difference between z(v) and i(v). Best fit (minimum difference) is achieved when the RMS difference value between z(v) and i(v) is an absolute minimum.

After this process the samples z(v) are called $z^0(v)$.

RF error, and carrier leakage are necessary for best fit of the measured signal towards the ideal signal in the pre FFT domain. However they are not used to compare them against the limits.

E.6.7 Timing of the FFT window

The FFT window length is 24576 samples for preamble format 0, however in the measurement period at least 27744 samples are taken. The position in time for FFT must be determined.

In an ideal signal, the FFT may start at any instant within the cyclic prefix without causing an error. The TX filter, however, reduces the window. The EVM requirements shall be met within a window W<CP.

The reference instant for the FFT start is the centre of the reduced window, called $\Delta\tilde{c}$,

EVM is measured at the following two instants: $\Delta\tilde{c}$ –W/2 and $\Delta\tilde{c}$ +W/2.

The timing of the measured signal $z^0(\nu)$ with respect to the ideal signal $i(\nu)$ is determined in the pre FFT domain as follows:

Correlation between $z^0(\nu)$ and $i(\nu)$ will result in a correlation peak. The meaning of the correlation peak is approx. the "impulse response" of the TX filter. The correlation peak, (the highest, or in case of more than one, the earliest) indicates the timing in the measured signal with respect to the ideal signal.

W is different for different preamble formats and shown in Table E.6.7-1 for $L_{\mathrm{RA}}=839$ and $\Delta f^{\mathrm{RA}}\in\{1.25,5\}$ kHz in Table E.6.7-2 for $L_{\mathrm{RA}}=139$ and $\Delta f^{\mathrm{RA}}=15\cdot 2^{\mu}$ kHz where $\mu\in\{0,1,2\}$.

Table E.6.7-1: EVM window length for PRACH formats for $L_{\mathrm{RA}}=839$

Preamble format	Cyclic prefix length N_{cp}	Nominal FFT size[1]	EVM window length *W* in FFT samples	Ratio of *W* to CP*
0	3168	24576	2307	72.8%
1	21024	24576	20163	95.9%
2	4688	24576	3827	81.6%
3	3168	6144	2952	93.2%
Note 1: The use of other FFT sizes is possible as long as appropriate scaling of the window length is applied Note 2: These percentages are informative				

Table E.6.7-2: EVM window length for PRACH formats for $L_{\mathrm{RA}} = 139$

Preamble format	Cyclic prefix length N_{cp}	Nominal FFT size[1]	EVM window length *W* in FFT samples	Ratio of *W* to CP*
A1	$288 \cdot 2^{-\mu}$	$2048 \cdot 2^{-\mu}$	$144 \cdot 2^{-\mu}$	50.0%
A2	$576 \cdot 2^{-\mu}$	$2048 \cdot 2^{-\mu}$	$432 \cdot 2^{-\mu}$	75.0%
A3	$864 \cdot 2^{-\mu}$	$2048 \cdot 2^{-\mu}$	$720 \cdot 2^{-\mu}$	83.3%
B1	$216 \cdot 2^{-\mu}$	$2048 \cdot 2^{-\mu}$	$72 \cdot 2^{-\mu}$	33.3%
B2	$360 \cdot 2^{-\mu}$	$2048 \cdot 2^{-\mu}$	$216 \cdot 2^{-\mu}$	60.0%
B3	$504 \cdot 2^{-\mu}$	$2048 \cdot 2^{-\mu}$	$360 \cdot 2^{-\mu}$	71.4%
B4	$936 \cdot 2^{-\mu}$	$2048 \cdot 2^{-\mu}$	$792 \cdot 2^{-\mu}$	84.6%
C0	$1240 \cdot 2^{-\mu}$	$2048 \cdot 2^{-\mu}$	$1096 \cdot 2^{-\mu}$	88.4%
C2	$2048 \cdot 2^{-\mu}$	$2048 \cdot 2^{-\mu}$	$1904 \cdot 2^{-\mu}$	93.0%
Note 1: The use of other FFT sizes is possible as long as appropriate scaling of the window length is applied Note 2: These percentages are informative				

The number of samples, used for FFT is reduced compared to $z^0(v)$. This subset of samples is called z' (v).

EVM is based on Nominal FFT size samples per PRACH preamble and demodulated symbol.

E.6.8 Post FFT equalisation

Equalisation is not applicable for the PRACH.

E.6.9 Derivation of the results

E.6.9.1 EVM$_{\mathrm{PRACH}}$

Perform FFT on z'(v) and i(v) using the FFT timing $\Delta\tilde{c}$ –W/2 and $\Delta\tilde{c}$ +W/2.

For format 2 and 3 the first and the repeated preamble sequence are FFT-converted separately. using the standard FFT length of 2048.

The EVM$_{\mathrm{PRACH}}$ is the difference between the ideal waveform and the measured and equalized waveform for the allocated RB(s).

$$EVM_{PRACH} = \sqrt{\frac{\sum_{t \in T} \sum_{f \in F} \left| Z'(f,t) - I(f,t) \right|^2}{|T| \cdot P_0 \cdot |F|}}$$

,

where

t covers the count of demodulated symbols in the slot.

f covers the count of demodulated symbols within the allocated bandwidth.

$Z'(f,t)$ are the samples of the signal evaluated for the EVM_{PRACH}

$I(f,t)$ is the ideal signal reconstructed by the measurement equipment, and

P_0 is the average power of the ideal signal. For normalized modulation symbols P_0 is equal to 1.

From the acquired samples 2*m* EVM_{PRACH} values can be derived, *m* values for the timing $\Delta\tilde{c}$ –W/2 and *m* values for the timing $\Delta\tilde{c}$ +W/2, where *m* is the number of recorded preambles as defined in Annex E.6.2.

E.6.9.2 Averaged EVM_{PRACH}

The PRACH EVM, EVM_{PRACH}, is averaged over *m* preamble sequence measurements.

$$\overline{EVM}_{\text{PRACH}} = \sqrt{\frac{1}{m}\sum_{i=1}^{m}\left(EVM_{\text{PRACH},i}\right)^2},$$

where *m* is the number of recorded preambles as defined in Annex E.6.2.The averaging is done separately for timing $\Delta\tilde{c}$ –W/2 and $\Delta\tilde{c}$ +W/2 leading to $\overline{EVM}_{PRACH,low}$ and $\overline{EVM}_{PRACH,high}$

$EVM_{PRACH,final} = \max\left(\overline{EVM}_{PRACH,low}, \overline{EVM}_{PRACH,high}\right)$ is compared against the test requirements.

Annex F (normative): Measurement uncertainties and Test Tolerances

F.1 Acceptable uncertainty of Test System (normative)

The maximum acceptable uncertainty of the Test System is specified below for each test, where appropriate. The Test System shall enable the stimulus signals in the test case to be adjusted to within the specified range, and the equipment under test to be measured with an uncertainty not exceeding the specified values. All ranges and uncertainties are absolute values, and are valid for a confidence level of 95 %, unless otherwise stated.

A confidence level of 95 % is the measurement uncertainty tolerance interval for a specific measurement that contains 95 % of the performance of a population of test equipment.

For RF tests it should be noted that the uncertainties in clause F.1 apply to the Test System operating into a nominal 50 ohm load and do not include system effects due to mismatch between the DUT and the Test System.

The downlink signal uncertainties apply at each receiver antenna connector.

F.1.1 Measurement of test environments

The measurement accuracy of the UE test environments defined in TS 38.508-1 [5] subclause 4.1, Test environments shall be

- Pressure ±5 kPa.
- Temperature ±2 degrees.
- Relative Humidity ±5 %.
- DC Voltage ±1,0 %.
- AC Voltage ±1,5 %.
- Vibration 10 %.
- Vibration frequency 0,1 Hz.

The above values shall apply unless the test environment is otherwise controlled and the specification for the control of the test environment specifies the uncertainty for the parameter.

F.1.2 Measurement of transmitter

Table F.1.2-1: Maximum Test System Uncertainty for transmitter tests

Subclause	Maximum Test System Uncertainty	Derivation of Test System Uncertainty
6.2.1 UE maximum output power	f ≤ 3.0GHz ±0.7 dB, BW ≤ 40MHz ±1.4 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.0 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±1.3 dB, BW ≤ 20MHz ±1.5 dB, 20MHz < BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz	
6.2.2 Maximum Power Reduction (MPR)	f ≤ 3.0GHz ±0.7 dB, BW ≤ 40MHz ±1.4 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.0 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±1.3 dB, BW ≤ 20MHz ±1.5 dB, 20MHz < BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz	
6.2.3 UE additional maximum output power reduction	f ≤ 3.0GHz ±0.7 dB, BW ≤ 40MHz ±1.4 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.0 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±1.3 dB, BW ≤ 20MHz ±1.5 dB, 20MHz < BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz	
6.2.4 Configured transmitted power	f ≤ 3.0GHz ±0.7 dB, BW ≤ 40MHz ±1.4 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.0 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±1.3 dB, BW ≤ 20MHz ±1.5 dB, 20MHz < BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz	
6.2A.1.1 UE maximum output power for CA (2UL CA)	For Inter-band CA MAX (MU_{CC1}, MU_{CC2})	MU_{CCX} is MU of each UL CC specified in single UL case 6.2.1.

6.2A.2.1 UE maximum output power reduction for CA (2UL CA)	For Inter-band CA MAX (MU_{CC1}, MU_{CC2}) For intra-band contiguous CA Aggregated BW ≤ 100M: same as 6.2.2 for sum of powers of all CCs Aggregated BW > 100M: TBD	MU_{CCX} is MU of each UL CC specified in single UL case 6.2.2.
6.2A.3.1 UE additional maximum output power reduction CA (2UL CA)	For Inter-band CA MAX (MU_{CC1}, MU_{CC2})	MU_{CCX} is MU of each UL CC specified in single UL case 6.2.3.
6.2A.4.1 Configured transmitted power for CA (2UL CA)	For Inter-band CA MAX (MU_{CC1}, MU_{CC2}) For intra-band contiguous CA Aggregated BW ≤ 100M: same as 6.2.2 for sum of powers of all CCs Aggregated BW > 100M: TBD	MU_{CCX} is MU of each UL CC specified in single UL case 6.2.4.
6.2C.1 Configured transmitted power for SUL	Same as 6.2.4	
6.2C.3 UE maximum output power for SUL	Same as 6.2.1	
6.2C.4 UE maximum output power reduction for SUL	Same as 6.2.2	
6.2C.5 UE additional maximum output power reduction for SUL	Same as 6.2.3	
6.2D.1 UE maximum output power for UL MIMO	Same as 6.2.1 for the sum of power at each of UE antenna connector	MU is for the sum of power at each of UE antenna connector, and is the same as the MU of single antenna port in 6.2.1 with SNR assumption reduced by 3dB compared to the single antenna case.
6.2D.2 UE maximum output power reduction for UL MIMO	Same as 6.2.2 for the sum of power at each of UE antenna connector	MU is for the sum of power at each of UE antenna connector, and is the same as the MU of single antenna port in 6.2.2 with SNR assumption reduced by 3dB compared to the single antenna case.
6.2D.3 UE additional maximum output power reduction for UL MIMO	Same as 6.2.3 for the sum of power at each of UE antenna connector	MU is for the sum of power at each of UE antenna connector, and is the same as the MU of single antenna port in 6.2.3 with SNR assumption reduced by 3dB compared to the single antenna case.
6.2D.4 Configured transmitted power for UL MIMO	Same as 6.2.4 for the sum of power at each of UE antenna connector	MU is for the sum of power at each of UE antenna connector, and is the same as the MU of single antenna port in 6.2.4 with SNR assumption reduced by 3dB compared to the single antenna case.

6.3.1 Minimum output power	f ≤ 3.0GHz ±1.0 dB, BW ≤ 40MHz ±1.4 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.3 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±1.5 dB, BW ≤ 40MHz ±1.8 dB, 40MHz < BW ≤ 100MHz	
6.3.2 Transmit OFF power	f ≤ 3.0GHz ±1.5 dB, BW ≤ 40MHz ±1.7 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.8 dB, BW ≤ 40MHz ±1.9 dB, 40MHz < BW ≤ 80MHz ±2.2 dB, 80MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±2.0 dB, BW ≤ 20MHz ±2.1 dB, 20MHz < BW ≤ 80MHz ±2.2 dB, 80MHz < BW ≤ 100MHz	
6.3.3.2 General ON/OFF time mask	f ≤ 3.0GHz ±1.5 dB, BW ≤ 40MHz ±1.7 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.8 dB, BW ≤ 40MHz ±1.9 dB, 40MHz < BW ≤ 80MHz ±2.2 dB, 80MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±2.0 dB, BW ≤ 20MHz ±2.1 dB, 20MHz < BW ≤ 80MHz ±2.2 dB, 80MHz < BW ≤ 100MHz	
6.3.3.4 PRACH time mask	f ≤ 3.0GHz ±1.5 dB, BW ≤ 40MHz ±1.7 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.8 dB, BW ≤ 40MHz ±1.9 dB, 40MHz < BW ≤ 80MHz ±2.2 dB, 80MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±2.0 dB, BW ≤ 20MHz ±2.1 dB, 20MHz < BW ≤ 80MHz ±2.2 dB, 80MHz < BW ≤ 100MHz	

6.3.3.6 SRS time mask	f ≤ 3.0GHz ±1.5 dB, BW ≤ 40MHz ±1.7 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.8 dB, BW ≤ 40MHz ±1.9 dB, 40MHz < BW ≤ 80MHz ±2.2 dB, 80MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±2.0 dB, BW ≤ 20MHz ±2.1 dB, 20MHz < BW ≤ 80MHz ±2.2 dB, 80MHz < BW ≤ 100MHz	
6.3.4.2 Absolute power tolerance	f ≤ 3.0GHz ±1.0 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±1.4 dB, BW ≤ 40MHz ±1.9 dB, 40MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±2.0 dB, BW ≤ 20MHz ±2.1 dB, 20MHz < BW ≤ 40MHz ±2.2 dB, 80MHz < BW ≤ 100MHz	Test System uncertainty = SQRT (UL Meas Uncer^2 + DL Meas Uncer^2)
6.3.4.3 Power Control Relative power tolerance	±0.7 dB, BW ≤ 40MHz ±1.0 dB, 40MHz < f ≤ 100MHz	
6.3.4.4 Aggregate power tolerance	±0.7 dB, BW ≤ 40MHz ±1.0 dB, 40MHz < f ≤ 100MHz	
6.3A.1.1 Minimum output power for CA (2UL CA)	Same as 6.3.1 for each CC	
6.3A.3.1 Transmit ON/OFF time mask for CA (2UL CA)	Same as 6.3.3.2 for each CC	
6.3D.1 Minimum output power for UL MIMO	Same as 6.3.1 for the sum of power at each of UE antenna connector	MU is for the sum of power at each of UE antenna connector, and is the same as the MU of single antenna port in 6.3.1 with SNR assumption reduced by 3dB compared to the single antenna case.
6.3D.2 Transmit OFF power for UL MIMO	Same as 6.3.2 for each antenna	
6.3D.3 Transmit ON/OFF time mask for UL MIMO	Same as 6.3.3.2 for each antenna	
6.3D.4.1 Absolute Power tolerance	Same as 6.3.4.2 for the sum of power at each of UE antenna connector	MU is for the sum of power at each of UE antenna connector, and is the same as the MU of single antenna port in 6.3.4.2 with SNR assumption reduced by 3dB compared to the single antenna case.
6.3D.4.2 Relative Power tolerance	±0.9 dB, BW ≤ 40MHz ±1.4 dB, 40MHz < f ≤ 100MHz	MU is for the sum of power at each of UE antenna connector
6.3D.4.3 Aggregate Power tolerance	Same as 6.3.4.4 for the sum of power at each of UE antenna connector	MU is for the sum of power at each of UE antenna connector, and is the same as the MU of single antenna port in 6.3.4.4 with SNR assumption reduced by 3dB compared to the single antenna case.

6.4.1 Frequency Error	±15 Hz, f ≤ 3.0GHz ±36 Hz, f > 3.0GHz DL Signal level: ±0.7 dB, f ≤ 3.0GHz ±1.0 dB, 3.0GHz < f ≤ 4.2GHz ±1.5 dB, 4.2GHz < f ≤ 6.0GHz	
6.4.2.1 Error Vector Magnitude	For up to 256QAM: f ≤ 6.0GHz, BW ≤ 100MHz 15 dBm < P_{UL} PUSCH, PUCCH, PRACH: ±1.5 % -25 dBm < P_{UL} ≤ 15 dBm PUSCH, PUCCH, PRACH: ±2.5 % -40dBm ≤ P_{UL} ≤ -25dBm PUSCH, PUCCH, PRACH: ±3.0 % Absolute Uplink power measurement same as 6.3.1. Relative Uplink power measurement same as 6.3.4.3.	
6.4.2.2 Carrier Leakage	f ≤ 3.0GHz ±0.8 dB, BW ≤ 40MHz ±1.5 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±0.8 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±1.0 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz Absolute Uplink power measurement for step 2 and step 4 same as 6.2.1. Absolute Uplink power measurement for step 6 and step 8 same as 6.3.1. Relative Uplink power measurement same as 6.3.4.3.	
6.4.2.3 In-band emissions	f ≤ 3.0GHz ±0.8 dB, BW ≤ 40MHz ±1.5 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±0.8 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±1.0 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz Absolute Uplink power measurement for steps 1.2, 1.4, 2.2, and 2.4 same as 6.2.1. Absolute Uplink power measurement for steps 1.6, 1.8, 2.6, and 2.8 same as 6.3.1. Relative Uplink power measurement same as 6.3.4.3.	
6.4.2.4 EVM equalizer spectrum flatness	±1.4 dB, BW ≤ 40MHz ±1.6 dB, 40MHz < BW ≤ 100MHz	
6.4.2.5 EVM equalizer spectrum flatness for Pi/2 BPSK	Same as 6.4.2.4	
6.4A.1 Frequency error for CA	For inter-band CA: same as 6.4.1 for each CC	

6.4A.2.1 Error Vector Magnitude for CA	For inter-band CA: same as 6.4.2.1 for each CC Absolute Uplink power measurement same as 6.3A.1.1. Relative Uplink power measurement same as 6.3.4.3.	
6.4A.2.2 Carrier leakage for CA	For inter-band CA: same as 6.4.2.2 for each CC Uplink power measurement for step 5 and step 7 same as 6.2A.1.1. Absolute Uplink power measurement for step 9 and step 11 same as 6.3A.1.1] Relative Uplink power measurement same as 6.3.4.3.	
6.4A.2.3 In-band emission for CA	For inter-band CA: same as 6.4.2.3 for each CC Absolute Uplink power measurement for step 5 and step 7 same as 6.2A.1.1. Absolute Uplink power measurement for step 9 and step 11 same as 6.3A.1.1. Relative Uplink power measurement same as 6.3.4.3.	
6.4C.1 Frequency error for SUL	Same as 6.4.1	
6.4C.2.1 Error Vector Magnitude for SUL	Same as 6.4.2.1	
6.4C.2.2 Carrier leakage for SUL	Same as 6.4.2.2	
6.4C.2.3 In-band emissions for SUL	Same as 6.4.2.3	
6.4C.2.4 EVM equalizer spectrum flatness for SUL	Same as 6.4.2.4	
6.4D.1 Frequency error for UL MIMO	Same as 6.4.1 for each antenna	
6.4D.2.1 Error Vector Magnitude for UL MIMO	Same as 6.4.2.1 for each antenna Absolute Uplink power measurement same as 6.3D.1. Relative Uplink power measurement same as 6.3.4.3.	
6.4D.2.2 Carrier leakage for UL MIMO	Same as 6.4.2.2 for each antenna Absolute Uplink power measurement for step 2 and step 4 same as 6.2D.1. Absolute Uplink power measurement for step 6 and step 8 same as 6.3D.1. Relative Uplink power measurement same as 6.3.4.3.	
6.4D.2.3 In-band emissions for UL MIMO	Same as 6.4.2.3 for each antenna Absolute Uplink power measurement for steps 1.2 and 1.4 same as 6.2D.1. Absolute Uplink power measurement for steps 1.6 and 1.8 same as 6.3D.1. Relative Uplink power measurement same as 6.3.4.3.	
6.4D.2.4 EVM equalizer spectrum flatness for UL MIMO	Same as 6.4.2.4 for each antenna	
6.4D.3 Time alignment error for UL MIMO	±25ns	
6.4D.4 Requirements for Coherent UL MIMO	FFS	
6.5.1 Occupied bandwidth	1.5% of channel bandwidth	
6.5.2.2 Spectrum Emission Mask	±1.5 dB, f ≤ 3.0GHz ±1.8 dB, 3.0GHz < f ≤ 4.2GHz ±2.0 dB, 4.2GHz < f ≤ 6.0GHz	
6.5.2.3 Additional spectrum emission mask	±1.5 dB, f ≤ 3.0GHz ±1.8 dB, 3.0GHz < f ≤ 4.2GHz ±2.0 dB, 4.2GHz < f ≤ 6.0GHz	

6.5.2.4.1 NR ACLR	±0.8 dB, f ≤ 4.0GHz ±1.0 dB, 4.0GHz < f ≤ 6.0GHz	
6.5.2.4.2 UTRA ACLR	±0.8 dB, f ≤ 4.0GHz ±1.0 dB, 4.0GHz < f ≤ 6.0GHz	
6.5.3.1 General spurious emissions	for results > -60 dBm: ±2.0 dB, 9kHz < f ≤ 3GHz ±2.5 dB, 3GHz < f ≤ 4GHz ±4.0 dB, 4GHz < f ≤ 19GHz ±6.0 dB, 19GHz < f ≤ 26GHz	
6.5.3.2 Spurious emission for UE co-existence	for results > -60 dBm: ±2.0 dB, 9kHz < f ≤ 3GHz ±2.5 dB, 3GHz < f ≤ 4GHz ±4.0 dB, 4GHz < f ≤ 19GHz ±6.0 dB, 19GHz < f ≤ 26GHz	
6.5.3.3 Additional spurious emissions	for results > -60 dBm: ±2.0 dB, 9kHz < f ≤ 3GHz ±2.5 dB, 3GHz < f ≤ 4GHz ±4.0 dB, 4GHz < f ≤ 19GHz ±6.0 dB, 19GHz < f ≤ 26GHz	
6.5.4 Transmit intermodulation	f ≤ 3.0GHz ±2.7 dB, BW ≤ 40MHz ±3.1 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 4.2GHz ±3.7 dB, BW ≤ 40MHz ±4.0 dB, 40MHz < BW ≤ 100MHz 4.2GHz < f ≤ 6.0GHz ±5.1 dB, BW ≤ 40MHz ±5.3 dB, 40MHz < BW ≤ 100MHz	Overall system uncertainty comprises four quantities: 1. Wanted signal setting error 2. CW Interferer level error 3. Wanted signal meas. error 4. Intermodulation product measurement error The relative level of the wanted signal and the CW interferer has 2 x effect on the intermodulation product. Items 1, 2, 3 and 4 are assumed to be uncorrelated so can be root sum squared to provide the combined effect. Test System uncertainty = SQRT [(2 x SQRT (Wanted setting_error^2 + CW_level_error^2)) ^{2} + Wanted_level_meas error^2 + Intermodulation product measurement error^2]
6.5A.1 Occupied bandwidth for CA	For inter-band CA: same as 6.5.1 for each CC	
6.5A.2.2 Spectrum emission mask	For inter-band CA: same as 6.5.2.2 for each CC	
6.5A.2.4.1 NR ACLR	For inter-band CA: same as 6.5.2.4.1 for each CC	
6.5A.2.4.2 URTA ACLR	For inter-band CA: same as 6.5.2.4.2 for each CC	
6.5A.3.1 General spurious emissions for CA	For inter-band CA: same as 6.5.3.1 for each CC	
6.5A.3.2 Spurious emission for UE co-existence	For inter-band CA: same as 6.5.3.2 for each CC	
6.5A.4 Transmit intermodulation for CA	For inter-band CA: same as 6.5.2.4.2, at each antenna used for transmission	
6.5C.1 Occupied bandwidth for SUL	Same as 6.5.1	
6.5C.2.2 Spectrum Emission Mask for SUL	Same as 6.5.2.2	

6.5C.2.3 Additional spectrum emission mask for SUL	Same as 6.5.2.3	
6.5C.2.4.1 NR ACLR for SUL	Same 6.5.2.4.1	
6.5C.2.4.2 UTRA ACLR for SUL	Same as 6.5.2.4.2	
6.5C.3.1 General spurious emissions for SUL	Same as 6.5.3.1	
6.5C.3.2 Spurious emission for UE co-existence for SUL	Same as 6.5.3.2	
6.5C.3.3 Additional spurious emissions for SUL	Same as 6.5.3.3	
6.5C.4 Transmit intermodulation for SUL	Same as 6.5.4	
6.5D.1 Occupied bandwidth for UL MIMO	Same as 6.5.1 for each antenna	
6.5D.2.2 Spectrum emission mask for UL MIMO	Same as 6.5.2.2 for each antenna	
6.5D.2.3 Additional spectrum emission mask for UL MIMO	Same as 6.5.2.3 for each antenna	
6.5D.2.4.1 NR ACLR for UL MIMO	Same as 6.5.2.4.1 for each antenna	
6.5D.2.4.2 UTRA ACLR for UL MIMO	Same as 6.5.2.4.2 for each antenna	
6.5D.3.1 General spurious emissions for UL MIMO	Same as 6.5.3.1 for each antenna	
6.5D.3.2 Spurious emissions for UE co-existence for UL MIMO	Same as 6.5.3.2 for each antenna	
6.5D.3.3 Additional spurious emissions for UL MIMO	Same as 6.5.3.3 for each antenna	
6.5D.4 Transmit intermodulation for UL MIMO	Same as 6.5.4 for each antenna	

F.1.3 Measurement of receiver

Table F.1.3-1: Maximum Test System Uncertainty for receiver tests

Subclause	Maximum Test System Uncertainty	Derivation of Test System Uncertainty
7.3.2 Reference sensitivity power level	±0.7 dB, f ≤ 3.0GHz ±1.0 dB, 3.0GHz < f ≤ 4.2GHz ±1.5 dB, 4.2GHz < f ≤ 6GHz	
7.3A Reference sensitivity for CA (Same MU apply to all subsections including 7.3A.1, 7.3A.2, 7.3A.3, 7.3A.4, etc.)	Same as 7.3.2 for each component carrier	
7.3C.2 Reference sensitivity power level	Same as 7.3.2	
7.3D Reference sensitivity for MIMO	Same as 7.3.2	
7.4 Maximum input level	Downlink power ±0.7 dB, f ≤ 3.0GHz ±1.0 dB, 3.0GHz < f ≤ 4.2GHz ±1.5 dB, 4.2GHz < f ≤ 6GHz Uplink power measurement same as 6.2.1	
7.4A Maximum input level for CA (Same MU apply to all subsections including 7.4A.1, 7.4A.2, 7.4A.3, 7.4A.4, etc.)	Same as 7.4 for each component carrier	
7.4D Maximum input level for UL MIMO	Downlink power same as 7.4 Uplink power measurement same as 6.2D.1	The overall UL power is the linear sum of the output powers over all Tx antenna connectors
7.5 Adjacent channel selectivity	ACS value ±1.6 dB, f ≤ 3.0GHz ±2.3 dB, 3.0GHz < f ≤ 4.2GHz ±3.0 dB, 4.2GHz < f ≤ 6.0GHz Uplink power measurement same as 6.2.1	Overall ACS uncertainty comprises three quantities: 1. Wanted signal level error 2. Interferer signal level error 3. Additional impact of interferer ACLR Items 1 and 2 are assumed to be uncorrelated so can be root sum squared to provide the ratio error of the two signals. The interferer ACLR effect is systematic, and is added arithmetically. Test System uncertainty = [SQRT (wanted_level_error^2 + interferer_level_error^2)] + ACLR effect.

7.5A Adjacent channel selectivity for CA (Same MU apply to all subsections including 7.5A.1, 7.5A.2, 7.5A.3, 7.5A.4, etc.)	Same as 7.5 for each component carrier	Same as 7.5 The wanted signal level uncertainty applies for each CC. Overall ACS uncertainty calculation includes the uncertainty for wanted level error only once, as the uncertainty of other CCs is not expected to have any significant effect.
7.5D Adjacent channel selectivity for UL MIMO	ACS value same as 7.5 Uplink power measurement same as 6.2D.1	The overall UL power is the linear sum of the output powers over all Tx antenna connectors
7.6.2 Inband Blocking	Blocking ±1.6 dB, f ≤ 3.0GHz ±2.3 dB, 3.0GHz < f ≤ 4.2GHz ±3.0 dB, 4.2GHz < f ≤ 6.0GHz Uplink power measurement same as 6.2.1	Overall blocking uncertainty can have these contributions: 1. Wanted signal level error 2. Interferer signal level error 3. Interferer ACLR 4. Interferer broadband noise Items 1 and 2 are assumed to be uncorrelated so can be root sum squared to provide the ratio error of the two signals. The Interferer ACLR or Broadband noise effect is systematic, and is added arithmetically. Test System uncertainty = [SQRT (wanted_level_error^2 + interferer_level_error^2)] + ACLR effect + Broadband noise effect. In-band blocking, using modulated interferer: Broadband noise not applicable
7.6.3 Out-of-band blocking	Wanted signal, f ≤ 3.0GHz ±2.0 dB, Blocking, 1MHz < $f_{interferer}$ ≤ 3GHz ±3.9 dB, Blocking, 3GHz < $f_{interferer}$ ≤ 12.75GHz Wanted signal, 3.0GHz < f ≤ 4.2GHz ±2.2 dB, Blocking, 1MHz < $f_{interferer}$ ≤ 3GHz ±4.0 dB, Blocking, 3GHz < $f_{interferer}$ ≤ 12.75GHz Wanted signal, 4.2GHz < f ≤ 6GHz ±2.6 dB, Blocking, 1MHz < $f_{interferer}$ ≤ 3GHz ±4.2 dB, Blocking, 3GHz < $f_{interferer}$ ≤ 12.75GHz Uplink power measurement same as 6.2.1	Out of band blocking, using CW interferer: Interferer ACLR not applicable Impact of interferer Broadband noise 0.8dB Figures are combined to give Test System uncertainty, using formula given for 7.6.2
7.6.4 Narrow band blocking	Blocking ± 2.0dB, f ≤ 3.0GHz ± 2.4dB, 3.0GHz < f ≤ 4.2GHz ± 3.1dB, 4.2GHz < f ≤ 6.0GHz Uplink power measurement same as 6.2.1	Narrow band blocking, using CW interferer: Interferer ACLR not applicable Impact of interferer Broadband noise 0.8dB Figures are combined to give Test System uncertainty, using formula given for 7.6.2

7.6A.2 Inband Blocking for CA (Same MU apply to all subsections including 7.6A.2.1, 7.6A.2.2, 7.6A.2.3, 7.6A.2.4, etc.)	Same as 7.6.2 for each component carrier	Same as 7.6.2 The wanted signal level uncertainty applies for each CC. Overall blocking uncertainty calculation includes the uncertainty for wanted level error only once, as the uncertainty of other CCs is not expected to have any significant effect.
7.6A.3 Out-of-band Blocking for CA (Same MU apply to all subsections including 7.6A.3.1, 7.6A.3.2, 7.6A.3.3, 7.6A.3.4, etc.)	Same as 7.6.3 for each component carrier	Same as 7.6.3 The wanted signal level uncertainty applies for each CC. Overall blocking uncertainty calculation includes the uncertainty for wanted level error only once, as the uncertainty of other CCs is not expected to have any significant effect.
7.6A.4 Narrow band Blocking for CA (Same MU apply to all subsections including 7.6A.4.1, 7.6A.4.2, 7.6A.4.3, 7.6A.4.4, etc.)	Same as 7.6.4 for each component carrier	Same as 7.6.4 The wanted signal level uncertainty applies for each CC. Overall blocking uncertainty calculation includes the uncertainty for wanted level error only once, as the uncertainty of other CCs is not expected to have any significant effect.
7.6D.2 Inband blocking for UL MIMO	Blocking same as 7.6.2 Uplink power measurement same as 6.2D.1	The overall UL power is the linear sum of the output powers over all Tx antenna connectors
7.6D.3 Out-of-band blocking for UL MIMO	Wanted signal same as 7.6.3 Uplink power measurement same as 6.2D.1	The overall UL power is the linear sum of the output powers over all Tx antenna connectors
7.6D.4 Narrow-band blocking for UL MIMO	Blocking same as 7.6.4 Uplink power measurement same as 6.2D.1	The overall UL power is the linear sum of the output powers over all Tx antenna connectors
7.7 Spurious response	Same as 7.6.3	Same as 7.6.3
7.7A Spurious response for CA (Same MU apply to all subsections including 7.7A.1, 7.7A.2, 7.7A.3, etc.)	Same as 7.6A.3	Same as 7.6A.3
7.7D Spurious response for UL MIMO	Same as 7.7 Uplink power measurement same as 6.2D.1	The overall UL power is the linear sum of the output powers over all Tx antenna connectors

7.8.2 Wide band Intermodulation	Intermodulation ± 2.3dB, f ≤ 3.0GHz ± 3.1dB, 3.0GHz < f ≤ 4.2GHz ± 4.3dB, 4.2GHz < f ≤ 6.0GHz Uplink power measurement same as 6.2.1	Overall intermodulation uncertainty comprises three quantities: 1. Wanted signal level error 2. CW Interferer level error 3. Modulated Interferer level error Effect of interferer ACLR has not been included as modulated interferer has larger frequency offset The effect of the closer CW signal has twice the effect. Items 1, 2 and 3 are assumed to be uncorrelated so can be root sum squared to provide the combined effect of the three signals. Test System uncertainty = SQRT [(2 x CW_level_error)^2 + (mod interferer_level_error)^2 + (wanted signal_level_error)^2]
7.8A.2 Wide band Intermodulation for CA (Same MU apply to all subsections including 7.8A.1, 7.8A.2, 7.8A.3, etc.)	Same as 7.8.2 for each component carrier	Same as 7.8.2 The wanted signal level uncertainty applies for each CC. Overall intermodulation uncertainty calculation includes the uncertainty for wanted level error only once, as the uncertainty of other CCs is not expected to have any significant effect.
7.8D Intermodulation characteristics for UL MIMO	Intermodulation same as 7.8.2 Uplink power measurement same as 6.2D.1	The overall UL power is the linear sum of the output powers over all Tx antenna connectors
7.9 Spurious emissions	for results > -60 dBm: ±2.0 dB, 9kHz < f ≤ 3GHz ±2.5 dB, 3GHz < f ≤ 4GHz ±4.0 dB, 4GHz < f ≤ 19GHz ±6.0 dB, 19GHz < f ≤ 26GHz	
7.9A.1 Spurious emissions for CA (2DL CA)	Same as 7.9	

F.2 Interpretation of measurement results (normative)

The measurement results returned by the Test System are compared – without any modification – against the Test Requirements. The Test Requirement is defined as a threshold considered in a test to assess compliance of the device; it might be either equal (“Shared Risk” principle) or relaxed (“Never fail a good DUT” principle) compared to the corresponding core specification value by an amount defined in Annex F.3 as Test Tolerance.

The “Shared Risk” and the “Never fail a good DUT” principles are defined in Rec. ITU-R M.1545.

The actual measurement uncertainty of the Test System for the measurement of each parameter shall be included in the test report.

The recorded value for the Test System uncertainty shall be, for each measurement, equal to or lower than the appropriate figure in clause F.1 of the present document.

If the Test System for a test is known to have a measurement uncertainty greater than that specified in clause F.1, it is still permitted to use this apparatus provided that an adjustment is made value as follows:

Any additional uncertainty in the Test System over and above that specified in clause F.1 shall be used to tighten the Test Requirement, making the test harder to pass. For some tests, for example receiver tests, this may require modification of stimulus signals. This procedure will ensure that a Test System not compliant with clause F.1does not increase the chance of passing a device under test where that device would otherwise have failed the test if a Test System compliant with clause F.1 had been used.

F.3 Test Tolerance and Derivation of Test Requirements (informative)

The Test Requirements in the present document have been calculated by relaxing the Minimum Requirements of the core specification using the Test Tolerances defined in this clause. When the Test Tolerance is zero, the Test Requirement will be the same as the Minimum Requirement. When the Test Tolerance is non-zero, the Test Requirements will differ from the Minimum Requirements, and the formula used for the relaxation is given in this clause.

The Test Tolerances are derived from Test System uncertainties, regulatory requirements and criticality to system performance. As a result, the Test Tolerances may sometimes be set to zero.

The test tolerances should not be modified for any reason e.g. to take account of commonly known test system errors (such as mismatch, cable loss, etc.).

The downlink Test Tolerances apply at each receiver antenna connector.

F.3.1 Measurement of test environments

The UE test environments are set to the values defined in TS 38.508-1 subclause 4.1, without any relaxation. The applied Test Tolerance is therefore zero.

F.3.2 Measurement of transmitter

Table F.3.2-1: Derivation of Test Requirements (Transmitter tests)

Sub clause	Test Tolerance (TT)	Formula for test requirement
6.2.1 UE maximum output power	f ≤ 3.0GHz 0.7 dB, BW ≤ 40MHz 1.0 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 6.0GHz 1.0 dB, BW ≤ 100MHz	Upper limit + TT, Lower limit - TT
6.2.2 Maximum Power Reduction (MPR)	f ≤ 3.0GHz 0.7 dB, BW ≤ 40MHz 1.0 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 6.0GHz 1.0 dB, BW ≤ 100MHz	Upper limit + TT, Lower limit - TT
6.2.3 UE additional maximum output power reduction	f ≤ 3.0GHz 0.7 dB, BW ≤ 40MHz 1.0 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 6.0GHz 1.0 dB, BW ≤ 100MHz	Upper limit + TT, Lower limit - TT
6.2.4 Configured transmitted power	f ≤ 3.0GHz 0.7 dB, BW ≤ 40MHz 1.0 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 6.0GHz 1.0 dB, BW ≤ 100MHz	Upper limit + TT, Lower limit - TT
6.2A.1.1 UE maximum output power for CA (2UL CA)	For Inter-band CA MAX (TT_{CC1}, TT_{CC2})	TT_{CCX} is TT of each UL CC specified in single UL case 6.2.1.
6.2A.2.1 UE maximum output power reduction for CA (2UL CA)	For Inter-band CA MAX (TT_{CC1}, TT_{CC2}) For intra-band contiguous CA Aggregated BW ≤ 100M: same as 6.2.2 for sum of powers of all CCs Aggregated BW > 100M: TBD	TT_{CCX} is TT of each UL CC specified in single UL case 6.2.2.
6.2A.3.1 UE additional maximum output power reduction CA (2UL CA)	For Inter-band CA MAX (TT_{CC1}, TT_{CC2})	TT_{CCX} is TT of each UL CC specified in single UL case 6.2.3.
6.2A.4.1 Configured transmitted power for CA (2UL CA)	For Inter-band CA MAX (TT_{CC1}, TT_{CC2}) For intra-band contiguous CA Aggregated BW ≤ 100M: same as 6.2.4 for sum of powers of all CCs Aggregated BW > 100M: TBD	TT_{CCX} is TT of each UL CC specified in single UL case 6.2.4.
6.2C.1 Configured transmitted power for SUL	Same as 6.2.4	Same as 6.2.4
6.2C.3 UE maximum output power for SUL	Same as 6.2.1	Same as 6.2.1
6.2C.4 UE maximum output power reduction for SUL	Same as 6.2.2	Same as 6.2.2
6.2C.5 UE additional maximum output power reduction for SUL	Same as 6.2.3	Same as 6.2.3

6.2D.1 UE maximum output power for UL MIMO	Same as 6.2.1 for the sum of power at each of UE antenna connector	Same as 6.2.1 Uplink power measurement applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.2D.2 UE maximum output power reduction for UL MIMO	Same as 6.2.2 for the sum of power at each of UE antenna connector	Same as 6.2.2 Uplink power measurement applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.2D.3 UE additional maximum output power reduction for UL MIMO	Same as 6.2.3 for the sum of power at each of UE antenna connector	Same as 6.2.3 Uplink power measurement applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.2D.4 Configured transmitted power for UL MIMO	Same as 6.2.4 for the sum of power at each of UE antenna connector	Same as 6.2.4 Uplink power measurement applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.3.1 Minimum output power	<u>f ≤ 3.0GHz</u> 1.0 dB, BW ≤ 40MHz 1.3 dB, 40MHz < BW ≤ 100MHz <u>3.0GHz < f ≤ 6.0GHz</u> 1.3 dB, BW ≤ 100MHz	Minimum requirement + TT
6.3.2 Transmit OFF power	<u>f ≤ 3.0GHz</u> 1.5 dB, BW ≤ 40MHz 1.7 dB, 40MHz < BW ≤ 100MHz <u>3.0GHz < f ≤ 6.0GHz</u> 1.8 dB, BW ≤ 100MHz	Minimum requirement + TT
6.3.3.2 General ON/OFF time mask	<u>f ≤ 3.0GHz</u> 1.5 dB, BW ≤ 40MHz 1.7 dB, 40MHz < BW ≤ 100MHz <u>3.0GHz < f ≤ 6.0GHz</u> 1.8 dB, BW ≤ 100MHz	<u>OFF Power:</u> Minimum requirement + TT <u>ON Power:</u> Upper limit + TT, Lower limit - TT
6.3.3.4 PRACH time mask	<u>f ≤ 3.0GHz</u> 1.5 dB, BW ≤ 40MHz 1.7 dB, 40MHz < BW ≤ 100MHz <u>3.0GHz < f ≤ 6.0GHz</u> 1.8 dB, BW ≤ 100MHz	<u>OFF Power:</u> Minimum requirement + TT <u>ON Power:</u> Upper limit + TT, Lower limit - TT
6.3.3.6 SRS time mask	<u>f ≤ 3.0GHz</u> 1.5 dB, BW ≤ 40MHz 1.7 dB, 40MHz < BW ≤ 100MHz <u>3.0GHz < f ≤ 6.0GHz</u> 1.8 dB, BW ≤ 100MHz	<u>OFF Power:</u> Minimum requirement + TT <u>ON Power:</u> Upper limit + TT, Lower limit - TT
6.3.4.2 Absolute power tolerance	<u>UL Power ≥ 0dBm</u> <u>f ≤ 3.0GHz</u> 1.0 dB, BW ≤ 40MHz 1.4 dB, 40MHz < BW ≤ 100MHz	Upper limit + TT, Lower limit – TT

	3.0GHz < f ≤ 6.0GHz 1.4 dB, BW ≤ 100MHz	

6.3.4.3 Power Control Relative power tolerance	0.7 dB, BW ≤ 100MHz	Upper limit + TT, Lower limit – TT
6.3.4.4 Aggregate power tolerance	0.7 dB, BW ≤ 100MHz	Upper limit + TT, Lower limit – TT
6.3A.1.1 Minimum output power for CA (2UL CA)	Same as 6.3.1	Minimum requirement + TT
6.3A.3.1 Transmit ON/OFF time mask for CA (2UL CA)	Same as 6.3.3.2	Minimum requirement + TT
6.3C.1 Minimum output power for SUL	Same as 6.3.1	Same as 6.3.1
6.3C.2 Transmit OFF power for SUL	Same as 6.3.2	Same as 6.3.2
6.3C.3 Transmit ON/OFF time mask for SUL	Same as 6.3.3.2	Same as 6.3.3.2
6.3C.4.1 Absolute power tolerance for SUL	Same as 6.3.4.2	Same as 6.3.4.2
6.3C.4.2 Power Control Relative power tolerance for SUL	Same as 6.3.4.3	Same as 6.3.4.3
6.3C.4.3 Aggregate power tolerance for SUL	Same as 6.3.4.4	Same as 6.3.4.4
6.3D.1 Minimum output power for UL MIMO	Same as 6.3.1 for the sum of power at each of UE antenna connector	Same as 6.3.1 Uplink power measurement applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.3D.2 Transmit OFF power for UL MIMO	Same as 6.3.2 for each antenna	Same as 6.3.2 Uplink power measurement applies to each Tx antenna connector
6.3D.3 Transmit ON/OFF time mask for UL MIMO	Same as 6.3.3.2 for each antenna	Same as 6.3.3 Uplink power measurement applies to each Tx antenna connector
6.3D.4.1 Absolute Power tolerance	Same as 6.3.4.2 for the sum of power at each of UE antenna connector	Same as 6.3.4.2 Uplink power measurement applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.3D.4.2 Relative Power tolerance	Same as 6.3.4.3 for the sum of power at each of UE antenna connector	Same as 6.3.4.3 Uplink power measurement applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.3D.4.3 Aggregate Power tolerance	Same as 6.3.4.4 for the sum of power at each of UE antenna connector	Same as 6.3.4.4 Uplink power measurement applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.4.1 Frequency Error	15 Hz	Modulated carrier frequency: Upper limit + TT, Lower limit – TT DL power: REFSENS + TT
6.4.2.1 Error Vector Magnitude	For up to 64QAM 0%	Minimum requirement + TT

	For 256QAM f ≤ 6.0GHz, BW ≤ 100MHz 0.3%, 15dBm < P_{UL} 0.8%, -25dBm < P_{UL} ≤ 15dBm, 1.1%, -40dBm ≤ P_{UL} ≤ -25dBm	

6.4.2.2 Carrier Leakage	0.8 dB, BW ≤ 100MHz	Minimum requirement + TT
6.4.2.3 In-band emissions	0.8 dB, BW ≤ 100MHz	Minimum requirement + TT
6.4.2.4 EVM equalizer spectrum flatness	1.4 dB, BW ≤ 100MHz	Minimum requirement + TT
6.4.2.5 EVM equalizer spectrum flatness for Pi/2 BPSK	Same as 6.4.2.4	Minimum requirement + TT
6.4A.1.1 Frequency error for CA (2UL CA)	For inter-band CA: same as 6.4.1 for each CC	Modulated carrier frequency: Upper limit + TT, Lower limit – TT
6.4A.2.1.1 Error Vector Magnitude for CA (2UL CA)	For up to 64QAM 0% For 256QAM For inter-band CA: same as 6.4.2.1 for each CC	Minimum requirement + TT
6.4A.2.2.1 Carrier leakage for CA (2UL CA)	For inter-band CA: same as 6.4.2.2 for each CC	Minimum requirement + TT
6.4A.2.3.1 In-band emissions for CA (2UL CA)	For inter-band CA: same as 6.4.2.3 for each CC	Minimum requirement + TT
6.4C.1 Frequency error for SUL	Same as 6.4.1	Minimum requirement + TT
6.4C.2.1 Error Vector Magnitude for SUL	Same as 6.4.2.1	Minimum requirement + TT
6.4C.2.2 Carrier leakage for SUL	Same as 6.4.2.2	Minimum requirement + TT
6.4C.2.3 In-band emissions for SUL	Same as 6.4.2.3	Minimum requirement + TT
6.4C.2.4 EVM equalizer spectrum flatness for SUL	Same as 6.4.2.4	Minimum requirement + TT
6.4D.1 Frequency error for UL MIMO	Same as 6.4.1 for each antenna	Same as 6.4.1
6.4D.2.1 Error Vector Magnitude for UL MIMO	Same as 6.4.2.1 for each antenna	Same as 6.4.2.1 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.4D.2.2 Carrier leakage for UL MIMO	Same as 6.4.2.2 for each antenna	Same as 6.4.2.2 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.4D.2.3 In-band emissions for UL MIMO	Same as 6.4.2.3 for each antenna	Same as 6.4.2.3 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
6.4D.2.4 EVM equalizer spectrum flatness for UL MIMO	Same as 6.4.2.4 for each antenna	Same as 6.4.2.4
6.4D.3 Time alignment error for UL MIMO	25ns	Minimum Requirement + TT
6.4D.4 Requirements for Ccoherent UL MIMO	FFS	FFS
6.5.1 Occupied bandwidth	0 kHz	Minimum requirement + TT
6.5.2.2 Spectrum Emission Mask	1.5 dB, f ≤ 3.0GHz 1.8 dB, 3.0GHz < f ≤ 6.0GHz	Minimum requirement + TT
6.5.2.3 Additional spectrum emission mask	1.5 dB, f ≤ 3.0GHz 1.8 dB, 3.0GHz < f ≤ 6.0GHz	Minimum requirement + TT

6.5.2.4.1 NR ACLR	Absolute requirement 0 dB Relative requirement 0.8 dB	Absolute requirement ACLR Minimum Requirement + TT Relative requirement ACLR Minimum Requirement - TT
6.5.2.4.2 UTRA ACLR	Same as 6.5.2.4.1	Same as 6.5.2.4.1
6.5.3.1 General spurious emissions	0 dB	Minimum requirement + TT
6.5.3.2 Spurious emission for UE co-existence	0 dB	Minimum requirement + TT
6.5.3.3 Additional spurious emissions	0 dB	Minimum requirement + TT
6.5.4 Transmit intermodulation	0 dB	CW interferer Minimum Requirement - TT
6.5A.1 Occupied bandwidth for CA	For inter-band CA: same as 6.5.1 for each CC	
6.5A.2.2.1 Spectrum emission mask for CA (2UL CA)	For inter-band CA: same as 6.5.2.2 for each CC	Minimum requirement + TT
6.5A.2.4.1.1 NR ACLR for CA (2UL CA)	For inter-band CA: same as 6.5.2.4.1 for each CC	Same as 6.5.2.4.1
6.5A.2.4.2.1 UTRA ACLR for CA (2UL CA)	For inter-band CA: same as 6.5.2.4.2 for each CC	Same as 6.5.2.4.2
6.5A.3.1.1 General spurious emissions for CA (2UL CA)	0 dB	Minimum requirement + TT
6.5A.3.2.1 Spurious emissions for UE co-existence for CA (2UL CA)	0 dB	Minimum requirement + TT
6.5A.4.1 Transmit intermodulation for CA (2UL CA)	0 dB	CW interferer Minimum Requirement - TT
6.5C.1 Occupied bandwidth for SUL	Same as 6.5.1	Same as 6.5.1
6.5C.2.2 Spectrum Emission Mask for SUL	Same as 6.5.2.2	Same as 6.5.2.2
6.5C.2.3 Additional spectrum emission mask for SUL	Same as 6.5.2.3	Same as 6.5.2.3
6.5C.2.4.1 NR ACLR for SUL	Same as 6.5.2.4.1	Same as 6.5.2.4.1
6.5C.2.4.2 UTRA ACLR for SUL	Same as 6.5.2.4.2	Same as 6.5.2.4.2
6.5C.3.1 General spurious emissions for SUL	Same as 6.5.3.1	Same as 6.5.3.1
6.5C.3.2 Spurious emission for UE co-existence for SUL	Same as 6.5.3.2	Same as 6.5.3.2
6.5C.3.3 Additional spurious emissions for SUL	Same as 6.5.3.3	Same as 6.5.3.3
6.5C.4 Transmit intermodulation for SUL	Same as 6.5.4	Same as 6.5.4
6.5D.1 Occupied bandwidth for UL MIMO	Same as 6.5.1 for each antenna	Same as 6.5.1
6.5D.2.2 Spectrum emission mask for UL MIMO	Same as 6.5.2.2 for each antenna	Same as 6.5.2.2
6.5D.2.3 Additional spectrum emission mask for UL MIMO	Same as 6.5.2.3 for each antenna	Same as 6.5.2.3
6.5D.2.4.1 NR ACLR for UL	Same as 6.5.2.4.1 for each antenna	Same as 6.5.2.4.1

MIMO		
6.5D.2.4.2 UTRA ACLR for UL MIMO	Same as 6.5.2.4.2 for each antenna	Same as 6.5.2.4.2
6.5D.3.1 General spurious emissions for UL MIMO	Same as 6.5.3.1 for each antenna	Same as 6.5.3.1
6.5D.3.2 Spurious emissions for UE co-existence for UL MIMO	Same as 6.5.3.2 for each antenna	Same as 6.5.3.2
6.5D.3.3 Additional spurious emissions for UL MIMO	Same as 6.5.3.3 for each antenna	Same as 6.5.3.3
6.5D.4 Transmit intermodulation for UL MIMO	Same as 6.5.4 for each antenna	Same as 6.5.4

F.3.3 Measurement of receiver

Table F.3.3-1: Derivation of Test Requirements (Receiver tests)

Sub clause	Test Tolerance (TT)	Formula for test requirement
7.3.2 Reference sensitivity power level	0.7 dB, f ≤ 3.0GHz 1.0 dB, 3.0GHz < f ≤ 6.0GHz	Reference sensitivity power level + TT T-put limit unchanged
7.3A Reference sensitivity for CA (Same TT apply to all subsections including 7.3A.1, 7.3A.2, 7.3A.3, 7.3A.4, etc.)	Same as 7.3.2 for each component carrier	Same as 7.3.2 for each component carrier
7.3C.2 Reference sensitivity power level	Same as 7.3.2	Same as 7.3.2
7.3D Reference sensitivity for MIMO	Same as 7.3.2	Same as 7.3.2
7.4 Maximum input level	0.7 dB, f ≤ 3.0GHz 1.0 dB, 3.0GHz < f ≤ 6.0GHz	Maximum input level - TT
7.4A Maximum input level for CA (Same TT apply to all subsections including 7.4A.1, 7.4A.2, 7.4A.3, 7.4A.4, etc.)	Same as 7.4 for each component carrier	Same as 7.4 for each component carrier
7.4D Maximum input level for UL MIMO	Same as 7.4	Same as 7.4 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
7.5 Adjacent channel selectivity	0 dB <u>Uplink power</u> <u>f ≤ 3.0GHz</u> 0.7 dB, BW ≤ 40MHz 1.0 dB, 40MHz < BW ≤ 100MHz <u>3.0GHz < f ≤ 6.0GHz</u> 1.0 dB, BW ≤ 100MHz	Wanted signal power + TT Interferer signal power unchanged T-put limit unchanged
7.5A Adjacent channel selectivity for CA (Same TT apply to all subsections including 7.4A.1, 7.4A.2, 7.4A.3, 7.4A.4, etc.)	Same as 7.5 for each component carrier	Same as 7.5 for each component carrier
7.5D Adjacent channel selectivity for UL MIMO	Same as 7.5	Same as 7.5 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors

7.6.2 Inband Blocking	0 dB Uplink power f ≤ 3.0GHz 0.7 dB, BW ≤ 40MHz 1.0 dB, 40MHz < BW ≤ 100MHz 3.0GHz < f ≤ 6.0GHz 1.0 dB, BW ≤ 100MHz	Wanted signal power + TT Interferer signal power unchanged T-put limit unchanged
7.6.3 Out-of-band blocking	0 dB	Wanted signal power + TT Interferer signal power unchanged T-put limit unchanged
7.6.4 Narrow band blocking	0 dB	Wanted signal power + TT Interferer signal power unchanged T-put limit unchanged
7.6A.2 Inband Blocking for CA (Same TT apply to all subsections including 7.6A.2.1, 7.6A.2.2, 7.6A.2.3, 7.6A.2.4, etc.)	Same as 7.6.2 for each component carrier	Same as 7.6.2 for each component carrier
7.6A.3 Out-of-band Blocking for CA (Same TT apply to all subsections including 7.6A.3.1, 7.6A.3.2, 7.6A.3.3, 7.6A.3.4, etc.)	Same as 7.6.3 for each component carrier	Same as 7.6.3 for each component carrier
7.6A.4 Narrow band Blocking for CA (Same TT apply to all subsections including 7.6A.4.1, 7.6A.4.2, 7.6A.4.3, 7.6A.4.4, etc.)	Same as 7.6.4 for each component carrier	Same as 7.6.4 for each component carrier
7.6C.2 Inband Blocking for SUL	Same as 7.6.2	Same as 7.6.2
7.6C.3 Out-of-band blocking for SUL	Same as 7.6.3	Same as 7.6.3
7.6D.2 Inband blocking for UL MIMO	Same as 7.6.2	Same as 7.6.2 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
7.6D.3 Out-of-band blocking for UL MIMO	Same as 7.6.3	Same as 7.6.3 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
7.6D.4 Narrow-band blocking for UL MIMO	Same as 7.6.4	Same as 7.6.4 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
7.7 Spurious response	0 dB	Wanted signal power + TT Interferer signal power unchanged

		T-put limit unchanged
7.7A Spurious response for CA (Same TT apply to all subsections including 7.7A.1, 7.7A.2, 7.7A.3, etc.)	Same as 7.7 for each component carrier	Same as 7.7 for each component carrier
7.7D Spurious response for UL MIMO	Same as 7.7	Same as 7.7 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
7.8.2 Wide band Intermodulation	0 dB	Wanted signal power +TT CW Interferer signal power unchanged Modulated Interferer signal power unchanged T-put limit unchanged
7.8A.2 Wide band Intermodulation for CA (Same TT apply to all subsections including 7.8A.1, 7.8A.2, 7.8A.3, etc.)	Same as 7.8.2 for each component carrier	Same as 7.8.2 for each component carrier
7.8D Intermodulation characteristics for UL MIMO	Same as 7.8.2	Same as 7.8.2 Uplink power measurement window applies to overall UL power, which is the linear sum of the output powers over all Tx antenna connectors
7.9 Spurious emissions	0 dB	Minimum requirement + TT
7.9A.1 Spurious emissions for CA (2DL CA)	Same as 7.9	Same as 7.9

F.4 Uplink power window

F.4.1 Introduction

A number of Tx and Rx Test cases set the UE uplink power to be within a defined window to ensure the test is carried out in the intended conditions. This clause gives the method for calculating the uplink power window used in Tx test cases and Rx Test cases.

F.4.2 Setting the power window above a requirement

F.4.2.1 NR FR1

The method used to derive the uplink power window is defined in TS 38.521-3 [14] clause F.4.2.1.

F.4.3 Setting the power window below a requirement

F.4.3.1 NR FR1

The method used to derive the uplink power window is defined in TS 38.521-3 [14] clause F.4.3.1.

F.4.4 Setting the power window centred on a target value

F.4.4.1 NR FR1

The method used to derive the uplink power window is defined in TS 38.521-3 [14] clause F.4.4.1.

Annex G (normative): Uplink Physical Channels

G.0 Uplink Signal Levels

Uplink signal power is a UE figure, which is configured by the Test System by means of:

RRC messages (IE-s), such as:

- PUSCH-PowerControl
- PUCCH-PowerControl
- RACH-ConfigGeneric
- SRS-Config

and L1/2 Power control commands (TPC).

The uplink power settings are specified in the test case.

Otherwise, the uplink power settings result from the default RRC messages described in TS 38.508 [5], and appropriate TPC-s, which are sent to the UE to transmit with an UL power level necessary for maintaining the call during the test.

G.1 General

This annex specifies the uplink physical channels that are needed for setting a connection and channels that are needed during a connection. Table G.1-1 describes the mapping of uplink physical channels and signals to physical resources

Table G.1-1: Mapping of uplink physical channels and signals to physical resources

Physical channel	Time Domain Location	Frequency Domain Location	Note
PRACH	Allowed by the parameter prach-ConfigurationIndex provided by higher layers	Allowed by the parameter msg1-FrequencyStart provided by higher layers	Mapping rule is specified in TS 38.211 [8] Section 6.3.3
DMRS	For DMRS on PUCCH format 1: Every other symbols i.e., 0, 2, 4... For DMRS on PUCCH format 2: All the PUCCH symbols For DMRS on PUCCH format 3,4: PUCCH length dependent For One symbol DMRS on PUSCH: Symbol 2,7 and 11 of each slot	DMRS on CP-OFDM PUSCH: Specified by the parameters *dmrs-Type* provided by higher layers. DMRS on DFT-OFDM PUSCH: Allowed for DMRS configuration type1 DMRS on PUCCH: PUCCH bandwidth dependent.	Mapping rule of DMRS for PUCCH is specified in TS 38.211 [8] Section 6.4.1.3 Mapping rule of DMRS for PUSCH is specified in TS 38.211 [8] Sections 6.4.1.1, 6.4.1.2
PUCCH	For PUCCH Format 0: 1 ~ 2 symbols each slot, specified by the parameters of nrofSymbols and startingSymbolIndex in PUCCH-format0 provided by the higher layer. For PUCCH Format 1: 4 ~ 14 symbols each slot, specified by the parameters of nrofSymbols and those of startingSymbolIndex of PUCCH-format1 provided by the higher layer. For PUCCH Format 2, 1 ~ 2 symbols each slot, specified by the parameters of nrofSymbols and startingSymbolIndex in PUCCH-format2 provided by the higher layer. For PUCCH Format 3: 4 ~ 14 symbols each slot, allowed by the parameters of nrofSymbols and startingSymbolIndex in PUCCH-format3, provided by the higher layer. For PUCCH Format 4: 4 ~ 14 symbols each slot, specified by the parameters of nrofSymbols and startingSymbolIndex in PUCCH-format4, provided by higher layer.	For PUCCH Format 0, 1 1 RB, the position specified by the parameters of startingPRB and intraSlotFrequencyHopping in the corresponding PUCCH-Resource provided by the higher layer. For PUCCH Format 2, 3: 1~16 RBs, specified by the parameter of nrofPRBs in PUCCH-format2 and PUCCH-format3 respectively; additionally the position specified by the parameters of startingPRB and intraSlotFrequencyHopping in the corresponding PUCCH-Resource provided by the higher layer. For PUCCH Format 4 1 RB, the position specified by the parameters of startingPRB and intraSlotFrequencyHopping in the corresponding PUCCH-Resource provided by the higher layer	Mapping rule is specified in TS 38.211 [8] Section 6.3.2 and 38.213 [9] Section 9.2
PUSCH	All remaining uplink symbols of each slot not allocated to DMRS	RBs allocated according to Reference Measurement channel in Annex A.2	Mapping rule is specified in TS 38.211 [8] Section 6.3 and 38.214 [12] Section 6.1

SRS	1, 2, or 4 symbols among the last 6 symbols in each SRS transmission slot specified by the parameters of resourceMapping, and resourceType in SRS-Config provided by the higher layer.	RBs specified by the ue-specific parameters of freqDomainPosition, freqDomainShift and freqHopping in SRS-Config provided by the higher layer.	Mapping rule is specified in TS 38.211 [8] Section 6.4.1.4.3

G.2 Set-up

Table G.2-1 describes the uplink physical channels that are required for connection set up.

Table G.2-1: Uplink Physical Channels required for connection set-up

Physical Channel
PRACH
PUCCH
PUSCH
PUCCH DMRS
PUSCH DMRS
SRS

In case of supplementary test, Table G.2-2 describes the supplementary uplink physical channels that are required for connection set-up, and unless stated otherwise, there is no other uplink physical channels configured on the NON-SUL carrier except PRACH.

Table G.2-2: Supplementary Uplink Physical Channels required for connection set-up

Physical Channel
PRACH
DMRS
PUCCH
PUSCH

G.3 Connection

The following clauses describes the uplink physical channels that are transmitted during a connection i.e., when measurements are done.

G.3.0 Measurement of Transmitter Characteristics

As specified in the test case. Otherwise:

- PUSCH + DMRS for PUSCH (and DMRS) measurements.
- PUCCH + DMRS for PUCCH (and DMRS) measurements.
- PRACH for PRACH measurements.

SRS for SRS measurements.

G.3.1 Measurement of Receiver Characteristics

As specified in the test case. Otherwise:

- PUSCH + DMRS for measurements with uplink interference configured.
- PUCCH + DMRS for measurements without uplink interference configured.

G.3.2 Measurement of Performance Requirements

As specified in the test case. Otherwise:

PUCCH + DMRS for measurements without CSI feedback, or with CSI feedback in PUCCH mode.

PUSCH + DMRS for measurements with CSI feedback in PUSCH mode.

Annex H (normative): Statistical Testing

H.1 General

This annex specifies mapping throughput to error ratio, pass fail limits and pass fail decision rules that are needed for measuring average throughput for a duration sufficient to achieve statistical significance for testing receiver characteristics.

H.2 Statistical testing of receiver characteristics

H.2.1 General

The test of receiver characteristics is twofold.

1. A signal or a combination of signals is offered to the RX port(s) of the receiver.
2. The ability of the receiver to demodulate /decode this signal is verified by measuring the throughput.

In (2) is the statistical aspect of the test and is treated here.

The minimum requirement for all receiver tests is >95% of the maximum throughput.

All receiver tests are performed in static propagation conditions. No fading conditions are applied.

H.2.2 Mapping throughput to error ratio

a) The measured information bit throughput R is defined as the sum (in kilobits) of the information bit payloads successfully received during the test interval, divided by the duration of the test interval (in seconds).

b) In measurement practice the UE indicates successfully received information bit payload by signalling an ACK to the SS.
If payload is received, but damaged and cannot be decoded, the UE signals a NACK.

c) Only the ACK and NACK signals, not the data bits received, are accessible to the SS.
The number of bits is known in the SS from knowledge of what payload was sent.

d) For the reference measurement channel, applied for testing, the number of bits is different in different subframes, however in a radio frame it is fixed during one test.

e) The time in the measurement interval is composed of successfully received subframes (ACK), unsuccessfully received subframes (NACK) and no reception at all (DTX-subframes).

f) DTX-subframes may occur regularly according the applicable reference measurement channel (regDTX).
In real live networks this is the time when other UEs are served. In TDD these are the UL and special subframes.
regDTX vary from test to test but are fixed within the test.

g) Additional DTX-subframes occur statistically when the UE is not responding ACK or NACK where it should. (statDTX)
This may happen when the UE was not expecting data or decided that the data were not intended for it.

The pass / fail decision is done by observing the:

- number of NACKs
- number of ACKs and
- number of statDTXs (regDTX is implicitly known to the SS)

The ratio (NACK + statDTX)/(NACK+ statDTX + ACK)is the Error Ratio (ER). Taking into account the time consumed by the ACK, NACK, and DTX-TTIs (regular and statistical), ER can be mapped unambiguously to throughput for any single reference measurement channel test.

H.2.3 Design of the test

The test is defined by the following design principles (see clause H.x, Theory….):

1. The early decision concept is applied.
2. A second limit is introduced: Bad DUT factor M>1
3. To decide the test pass:

    Supplier risk is applied based on the Bad DUT quality

    To decide the test fail

    Customer Risk is applied based on the specified DUT quality

The test is defined by the following parameters:

1. Limit ER = 0.05 (Throughput limit = 95%)
2. Bad DUT factor M=1.5 (selectivity)
3. Confidence level CL = 95% (for specified DUT and Bad DUT-quality)

H.2.4 Numerical definition of the pass fail limits

Table H.2.4-1: pass fail limits

ne	ns_p	ns_f	ne	ns_p	ns_f	ne	ns_p	ns_f	ne	ns_p	ns_f
0	67	NA	39	763	500	78	1366	1148	117	1951	1828
1	95	NA	40	778	516	79	1381	1166	118	1965	1845
2	119	NA	41	794	532	80	1396	1183	119	1980	1863
3	141	NA	42	810	548	81	1412	1200	120	1995	1881
4	162	NA	43	826	564	82	1427	1217	121	2010	1899
5	183	NA	44	842	580	83	1442	1234	122	2025	1916
6	202	NA	45	858	596	84	1457	1252	123	2039	1934
7	222	NA	46	873	612	85	1472	1269	124	2054	1952
8	241	NA	47	889	629	86	1487	1286	125	2069	1969
9	259	NA	48	905	645	87	1502	1303	126	2084	1987
10	278	76	49	920	661	88	1517	1321	127	2099	2005
11	296	88	50	936	678	89	1532	1338	128	2113	2023
12	314	100	51	952	694	90	1547	1355	129	2128	2040
13	332	113	52	967	711	91	1562	1373	130	2143	2058
14	349	126	53	983	727	92	1577	1390	131	2158	2076
15	367	140	54	998	744	93	1592	1407	132	2172	2094
16	384	153	55	1014	760	94	1607	1425	133	2187	2111
17	401	167	56	1029	777	95	1623	1442	134	2202	2129
18	418	181	57	1045	793	96	1637	1459	135	2217	2147
19	435	195	58	1060	810	97	1652	1477	136	2231	2165
20	452	209	59	1076	827	98	1667	1494	137	2246	2183
21	469	224	60	1091	844	99	1682	1512	138	2261	2201
22	486	238	61	1106	860	100	1697	1529	139	2275	2218
23	503	253	62	1122	877	101	1712	1547	140	2290	2236
24	519	268	63	1137	894	102	1727	1564	141	2305	2254
25	536	283	64	1153	911	103	1742	1582	142	2320	2272
26	552	298	65	1168	928	104	1757	1599	143	2334	2290
27	569	313	66	1183	944	105	1772	1617	144	2349	2308

28	585	328	67	1199	961	106	1787	1634	145	2364	2326
29	602	343	68	1214	978	107	1802	1652	146	2378	2344
30	618	359	69	1229	995	108	1817	1669	147	2393	2361
31	634	374	70	1244	1012	109	1832	1687	148	2408	2379
32	650	389	71	1260	1029	110	1847	1704	149	2422	2397
33	667	405	72	1275	1046	111	1861	1722	150	2437	2415
34	683	421	73	1290	1063	112	1876	1740	151	2452	2433
35	699	436	74	1305	1080	113	1891	1757	152	2466	2451
36	715	452	75	1321	1097	114	1906	1775	153*)	NA	2469
37	731	468	76	1336	1114	115	1921	1793			
38	747	484	77	1351	1131	116	1936	1810	*) note 2 in H.2.5		

NOTE 1: The first column is the number of errors (ne = number of NACK + statDTX)

NOTE 2: The second column is the number of samples for the pass limit (ns_p, ns=Number of Samples= number of NACK + statDTX + ACK)

NOTE 3: The third column is the number of samples for the fail limit (ns_f)

H.2.5 Pass fail decision rules

The pass fail decision rules apply for a single measurement. A test case is passed only when all the measurements in the test case are passed.

Having observed 0 errors, pass the test at 67+ samples, otherwise continue

Having observed 1 error, pass the test at 95+ otherwise continue

Having observed 2 errors, pass the test at 119+ samples, otherwise continue

Etc. etc.

Having observed 151 errors, pass the test at 2452+ samples, fail the test at 2433- samples, otherwise continue

Having observed 152 errors, pass the test at 2466+ samples, fail the test at 2451- samples.

Where x+ means: x or more, x- means x or less

NOTE 1: an ideal DUT passes after 67 samples. The maximum test time is 2466 samples.

NOTE 2: It is allowed to deviate from the early decision concept by postponing the decision (pass/fail or continue). Postponing the decision to or beyond the end of Table H.2.4-1 requires a pass fail decision against the test limit: pass the DUT for ER<0.0618, otherwise fail.

H.2A Statistical testing of receiver characteristics with CA

H.2A.1 General

H.2.1 applies.

H.2A.2 Mapping throughput to error ratio

H.2.2 applies for each component carrier.

H.2A.3 Design of the test

The test is defined by the following design principles (see clause H.x, Theory….):

1. The standard concept is applied. (not the early decision concept).
2. A second limit is introduced, defining the Bad DUT.
3. To decide the test pass:
    - Supplier risk is applied based on the Bad DUT quality.
    - To decide the test fail.
    - Customer Risk is applied based on the specified DUT quality.

The test is defined by the following parameters:

1) Limit Error Ratio = 0.05 (95% throughput is tested).

2) Bad DUT factor M=1.5 (selectivity).

3) Confidence level CL = 95% (for specified DUT and Bad DUT-quality).

H.2A.4 Pass fail decision rules

Apply 1003 samples to the DUT per CC.

Decide pass per CC in case of ≤ 62 errors, otherwise fail.

NOTE 1: The pass fail decision is done individually for each CC. The pass fail decision for one measurement is as follows: pass if all CCs or SCC only according to the test cases pass, otherwise fail. A test case is passed only when all the measurements in the test case are passed.

NOTE 2: It is allowed to apply more samples to the DUT, common for all CCs, (e.g. up to an integer number of frames). Use the ratio (62/1003) for the pass fail decision.

NOTE 3: 62/1003 = 0.0618, the same test limit is used at the end of Table H.2.4-1

Annex I (informative): Change history

Change history
Date
Meeting
TDoc
CR
Rev
Cat
Subject/Comment
New version
2017-08
RAN5#76
R5-175705
-
-
-
Draft skeleton
0.0.1
2018-01
RAN5#1-5G-NR Adhoc
R5-180068
R5-180069
R5-180070
R5-180071
R5-180072
R5-180073
R5-180075
R5-180076
R5-180077
R5-180078
R5-180079
-
-
-
Implementation of pCRs to TS 38.521-1 V0.1.0
0.1.0
2018-01
RAN5#78
R5-181506
R5-181507
R5-181670
R5-181671
R5-181672
R5-181676
R5-181677
R5-181678
R5-181679 R5-181685
R5-181686
R5-181698
R5-181699
R5-181700
-
-
-
Implementation of pCRs to TS 38.521-1 V0.2.0
0.2.0
2018-03
RAN5#2-5G-NR Adhoc
R5-181759
-
-
-
Update TS 38.521-1 to align with new structure of TS 38.101-1 based on endorsed CR R4-1802403

0.3.0
2018-04
RAN5#2-5G-NR Adhoc
R5-81976
-
-
-
3GU mismatch
0.3.1
2018-04
RAN5#2-5G-NR Adhoc
R5-181771
R5-181833
R5-181842
R5-182000
R5-182002
R5-182003
R5-182004
R5-182005
R5-182020
R5-182021
R5-182026
-
-
-
Implementation of pCRs to TS 38.521-1 V0.4.0
Add clause 4.4 Test point analysis
0.4.0
2018-07
RAN5#79
R5-182768
R5-182973
R5-183702
R5-183703
R5-183704
R5-183705
R5-183906
R5-183936
R5-183280
R5-183923
R5-183953
R5-183954
R5-183955
R5-183956
R5-183957
R5-183958
R5-183959
R5-183960
-
-
-
Implementation of pCRs to TS 38.521-1 V0.5.0
0.5.0
2018-07
RAN5#79
R5-183960
R5-183279
-
-
-
Corrected Table numbering issues in subclause 6.5.2.4.1.4.2 Test procedure to capture R5-183960 changes into draft TS 38.521-1 v0.5.1
0.5.1
2018-07
RAN5#79
R5-182363
-

-
-
withdrawn
1.0.0
2018-08
RAN5#80
R5-185321
R5-184298
R5-185305
R5-185322
R5-185323
R5-185495
R5-185444
R5-185565
R5-185445
R5-185524
R5-184572
R5-185390
R5-184574
R5-185521
R5-185408
R5-184822
R5-185446
R5-185324
R5-185447
R5-185411
R5-185413
R5-185496
R5-185414
R5-185415
R5-185325
R5-185500
R5-185501
R5-185312
R5-185326
R5-185315
R5-185317
R5-185327
R5-185320
-
-
-
Implementation of pCRs to TS 38.521-1 V1.0.1
1.0.1
2018-09
RAN#81
-
-
-
-
raised to v15.0.0 with editorial changes only
15.0.0
2018-12
RAN#82
R5-186604
0072
-
F
5G_FR1 Text update for 7.3 Reference sensitivity
15.1.0
2018-12
RAN#82
R5-186605
0073
-
F
5R_FR1 Text Update for 6.5.3.1_General spurious emissions

15.1.0
2018-12
RAN#82
R5-186606
0074
-
F
5R FR1 Text Update for 6.5.3.2 Spurious emission for UE co-existence
15.1.0
2018-12
RAN#82
R5-186670
0078
-
F
Updating test case 6.2.3 UE additional maximum output power reduction
15.1.0
2018-12
RAN#82
R5-186671
0079
-
F
Updating test case 6.5.2.3 Additional spectrum emission mask
15.1.0
2018-12
RAN#82
R5-186680
0080
-
F
Update of test case 6.5.2.4.2, UTRA ACLR in 38.521-1
15.1.0
2018-12
RAN#82
R5-186736
0084
-
F
Update of FR1 Transmit OFF power
15.1.0
2018-12
RAN#82
R5-186774
0088
-
F
Addition of 6.3D.1 Minimum output power for UL-MIMO
15.1.0
2018-12
RAN#82
R5-186776
0089
-
F
Addition of 6.3D.2 Transmit OFF power for UL-MIMO
15.1.0
2018-12
RAN#82
R5-186781
0090
-
F
Addition of 6.3D.3 Transmit ON/OFF time mask for UL-MIMO
15.1.0
2018-12
RAN#82

R5-186901
0091
-
F
Update SEM requirements to TS 38.101-1 v15.3.0
15.1.0
2018-12
RAN#82
R5-186902
0092
-
F
Update ACS and inband blocking test cases in TS 38.521-1
15.1.0
2018-12
RAN#82
R5-187034
0107
-
F
Adding edge allocation into common uplink configuration in 6.1
15.1.0
2018-12
RAN#82
R5-187038
0109
-
F
Update test points for multiple FR1 test cases
15.1.0
2018-12
RAN#82
R5-187149
0111
-
F
Updated to Annexes for FR1 tests
15.1.0
2018-12
RAN#82
R5-187150
0112
-
F
General clauses updated for TS38.521-1
15.1.0
2018-12
RAN#82
R5-187376
0120
-
F
Update of 6.2.1 MOP
15.1.0
2018-12
RAN#82
R5-187378
0122
-
F
Update of 6.3.1 Minimum Output Power
15.1.0
2018-12
RAN#82
R5-187379
0123
-

F
Update of 6.3.3.2 General ON/OFF time mask
15.1.0
2018-12
RAN#82
R5-187380
0124
-
F
Addition of 6.2D.1 MOP for MIMO
15.1.0
2018-12
RAN#82
R5-187381
0125
-
F
Addition of 6.2D.2 MPR for MIMO
15.1.0
2018-12
RAN#82
R5-187382
0126
-
F
Addition of 6.2D.4 Configured Output Power for MIMO
15.1.0
2018-12
RAN#82
R5-187383
0127
-
F
Addition of 6.4D.1 Frequency error for MIMO
15.1.0
2018-12
RAN#82
R5-187384
0128
-
F
Addition of 6.4D.2.1 EVM for MIMO
15.1.0
2018-12
RAN#82
R5-187385
0129
-
F
Addition of 6.4D.2.2 Carrier Leakage for MIMO
15.1.0
2018-12
RAN#82
R5-187386
0130
-
F
Addition of 6.4D.2.3 In-band emissions for MIMO
15.1.0
2018-12
RAN#82
R5-187387
0131
-
F
Addition of 6.4D.2.4 EVM equalizer spectrum flatness for MIMO
15.1.0

2018-12
RAN#82
R5-187395
0132
-
F
Update of test case 6.2.3 UE A-MPR, general
15.1.0
2018-12
RAN#82
R5-187397
0133
-
F
Update of test case 6.2.3 UE A-MPR, NS_04
15.1.0
2018-12
RAN#82
R5-187399
0134
-
F
Update of test case test case 6.5.2.3 Additional spectrum emission mask, NS_04
15.1.0
2018-12
RAN#82
R5-187421
0136
-
F
Introduction of TC 6.5D.1 Occupied bandwidth for UL MIMO
15.1.0
2018-12
RAN#82
R5-187422
0137
-
F
Introduction of TC 6.5D.2.2 Spectrum Emission Mask for UL MIMO
15.1.0
2018-12
RAN#82
R5-187423
0138
-
F
Introduction of TC 6.5D.2.3 Additional Spectrum Emission Mask for UL MIMO
15.1.0
2018-12
RAN#82
R5-187424
0139
-
F
Introduction of TC 6.5D.2.4.1 NR ACLR for UL MIMO
15.1.0
2018-12
RAN#82
R5-187425
0140
-
F
Introduction of TC 6.5D.2.4.2 UTRA ACLR for UL MIMO
15.1.0
2018-12
RAN#82
R5-187429

0144
-
F
Introduction of TC 6.5D.4 Transmit intermodulation for UL MIMO
15.1.0
2018-12
RAN#82
R5-187431
0146
-
F
Introduction of TC 7.4D Maximum input level for UL-MIMO
15.1.0
2018-12
RAN#82
R5-187432
0147
-
F
Updating of 6.2C.1 Configured transmitted power for SUL
15.1.0
2018-12
RAN#82
R5-187433
0148
-
F
Introduction of TC 6.5C.1 Occupied bandwidth for SUL
15.1.0
2018-12
RAN#82
R5-187434
0149
-
F
Introduction of TC 6.5C.2.2 Spectrum Emission Mask for SUL
15.1.0
2018-12
RAN#82
R5-187435
0150
-
F
Introduction of TC 6.5C.2.3 Additional Spectrum Emission Mask for SUL
15.1.0
2018-12
RAN#82
R5-187436
0151
-
F
Introduction of TC 6.5C.2.4.1 NR ACLR for SUL
15.1.0
2018-12
RAN#82
R5-187437
0152
-
F
Introduction of TC 6.5C.2.4.2 UTRA ACLR for SUL
15.1.0
2018-12
RAN#82
R5-187438
0153
-
F

Introduction of TC 6.5C.3.2 General spurious emissions for SUL
15.1.0
2018-12
RAN#82
R5-187439
0154
-
F
Introduction of TC 6.5C.3.3 Spurious Emission for UE co-existence for SUL
15.1.0
2018-12
RAN#82
R5-187440
0155
-
F
Introduction of TC 6.5C.3.4 Additional Spurious Emission for SUL
15.1.0
2018-12
RAN#82
R5-187455
0158
-
F
Updating test case 6.3.4.2 Absolute Power Tolerance
15.1.0
2018-12
RAN#82
R5-187456
0159
-
F
Updating test case 6.3.4.4 Aggregate Power Tolerance
15.1.0
2018-12
RAN#82
R5-187560
0162
-
F
Update to Table 5.3.5-1 in TS 38.521-1
15.1.0
2018-12
RAN#82
R5-187585
0164
-
F
Update of transmit signal quality test cases in 38.521-1
15.1.0
2018-12
RAN#82
R5-187615
0167
-
F
Introduction of TC 6.5D.3.1 General spurious emissions for UL MIMO
15.1.0
2018-12
RAN#82
R5-187616
0168
-
F
Introduction of TC 6.5D.3.2 Spurious Emission for UE co-existence for UL MIMO
15.1.0
2018-12

RAN#82
R5-187617
0169
-
F
Introduction of TC 6.5D.3.3 Additional Spurious Emission for UL MIMO
15.1.0
2018-12
RAN#82
R5-187618
0170
-
F
Updating of Uplink channel for SUL in Annex G
15.1.0
2018-12
RAN#82
R5-187804
0069
1
F
Editorial Cleaning up for description of test requirement in clause 6
15.1.0
2018-12
RAN#82
R5-187805
0063
1
F
Introduction of TC 7.7D Spurious response for UL-MIMO
15.1.0
2018-12
RAN#82
R5-187807
0113
1
F
Introduction of receiver spurious emission tests for FR1 SA
15.1.0
2018-12
RAN#82
R5-187810
0114
1
F
Introduction of wideband intermodulation tests for FR1 SA
15.1.0
2018-12
RAN#82
R5-187811
0145
1
F
Introduction of TC 7.3D Reference sensitivity for UL-MIMO
15.1.0
2018-12
RAN#82
R5-187812
0085
1
F
Update of operating bands and channel arrangement to TS 38.521-1
15.1.0
2018-12
RAN#82
R5-187888
0121

1
F
Update of 6.2.4 Configured Output Power
15.1.0
2018-12
RAN#82
R5-187890
0156
1
F
Introduction of TC 6.5C.4 Transmit intermodulation for SUL
15.1.0
2018-12
RAN#82
R5-187892
0108
1
F
Removing the Editor's notes of SA messages and procedures for all FR1 test cases
15.1.0
2018-12
RAN#82
R5-187893
0083
1
F
Update of FR1 6.2.2 MPR
15.1.0
2018-12
RAN#82
R5-187894
0086
1
F
Addition of Time alignment error for UL-MIMO to TS38.521-1
15.1.0
2018-12
RAN#82
R5-187895
0115
1
F
Introduction of New FR1 test case 6.3.3.6 SRS time mask
15.1.0
2018-12
RAN#82
R5-187896
0116
1
F
5G_FR1 Text update for 6.5.3.3 Additional Spurious emission
15.1.0
2018-12
RAN#82
R5-187897
0161
1
F
Update of test case 6.3.4.3, Power Control Relative power tolerance in 38.521-1
15.1.0
2018-12
RAN#82
R5-187898
0165
1
F
Addition of EVM equalizer spectral flatness test case 6.4.2.5 to TS 38.521-1

15.1.0
2018-12
RAN#82
R5-187899
0099
1
F
Introduction of test case for Frequency error for CA
15.1.0
2018-12
RAN#82
R5-187900
0100
1
F
Introduction of test cases for Transmit modulation quality for CA
15.1.0
2018-12
RAN#82
R5-187901
0101
1
F
Introduction of test case for Spectrum emission mask for Inter-band CA
15.1.0
2018-12
RAN#82
R5-187902
0102
1
F
Introduction of test case for NR ACLR for Inter-band CA
15.1.0
2018-12
RAN#82
R5-187903
0103
1
F
Introduction of test case for UTRA ACLR for Inter-band CA
15.1.0
2018-12
RAN#82
R5-187904
0104
1
F
Introduction of test case for General spurious emissions for Inter-band CA
15.1.0
2018-12
RAN#82
R5-187905
0105
1
F
Introduction of test case for Spurious emission for UE co-existence for CA
15.1.0
2018-12
RAN#82
R5-187906
0106
1
F
Introduction of test case for Transmit intermodulation for Inter-band CA
15.1.0
2018-12
RAN#82

R5-187911
0118
1
F
Addition of notes to clarify test point selection into general section of TS 38.521-1
15.1.0
2018-12
RAN#82
R5-187914
0163
1
F
Update of Global In-channel Tx Test Annex in 38.521-1
15.1.0
2018-12
RAN#82
R5-187915
0082
1
F
Introduction of FR1 7.4 Maximum input level
15.1.0
2018-12
RAN#82
R5-188032
0075
1
F
Addition of 6.3D.4.1 Absolute Power tolerance for UL-MIMO
15.1.0
2018-12
RAN#82
R5-188033
0076
1
F
Addition of 6.3D.4.2 Relative Power Tolerance for UL-MIMO
15.1.0
2018-12
RAN#82
R5-188034
0077
1
F
Addition of 6.3D.4.3 Aggregate Power tolerance for UL-MIMO
15.1.0
2018-12
RAN#82
R5-188035
0110
1
F
Update to FR1 test case 6.3.3.4 PRACH time mask
15.1.0
2018-12
RAN#82
R5-188206
0117
1
F
Introduction of New FR1 test case 6.3.3.7 PUSCH-PUCCH and PUSCH-SRS time masks
15.1.0
2018-12
RAN#82
R5-188207
0071
1

F
5G_FR1 Text update for 7.3A Reference sensitivity for CA
15.1.0
2018-12
RAN#82
R5-188208
0067
2
F
Updates of MU in TS 38.521-1 Annex F during RAN5#81
15.1.0
2018-12
RAN#82
R5-188209
0068
2
F
Updates of TT in TS 38.521-1 Annex F during RAN5#81
15.1.0
2018-12
RAN#82
R5-188210
0097
1
F
TDD configuration for UE Tx test in FR1
15.1.0
2018-12
RAN#82
R5-188211
0119
1
F
Core alignment CR to capture TS 38.101-1 updates during RAN4#89
15.1.0
2019-03
RAN#83
R5-191034
0228
-
F
Update Clause 2 of TS 38.521-1
15.2.0
2019-03
RAN#83
R5-191035
0229
-
F
Update Clause 3.2 of TS 38.521-1
15.2.0
2019-03
RAN#83
R5-191039
0232
-
F
Correction to TC 6.4A.2.1.1 Error Vector Magnitude for CA (2UL CA)
15.2.0
2019-03
RAN#83
R5-191088
0244
-
F
Editorial cleaning up of test configuration tables in TS 38.521-1
15.2.0

2019-03
RAN#83
R5-191089
0245
-
F
Editorial correction of core alignment in TS 38.521-1
15.2.0
2019-03
RAN#83
R5-191090
0246
-
F
Updates of TT in TS38.521-1 Annex F during RAN5#NR4
15.2.0
2019-03
RAN#83
R5-191156
0247
-
F
General clauses updated for TS38.521-1
15.2.0
2019-03
RAN#83
R5-191244
0249
-
F
Editorial change in 6.5.2.1 general section
15.2.0
2019-03
RAN#83
R5-191245
0250
-
F
Update ACS and Inband Blocking test cases in TS38.521-1
15.2.0
2019-03
RAN#83
R5-191258
0251
-
F
Update to FR1 test case 6.5.4 Transmit intermodulation
15.2.0
2019-03
RAN#83
R5-191262
0252
-
F
Update of TC 7.6.3_Out-of-band blocking
15.2.0
2019-03
RAN#83
R5-191264
0253
-
F
Introduction of TC 7.6.4 Narrow-band blocking
15.2.0
2019-03
RAN#83
R5-191265

0254
-
F
Introduction of TC 7.7 Spurious response
15.2.0
2019-03
RAN#83
R5-191338
0256
-
F
Update of test case 6.3.4.3, Power Control Relative power tolerance in 38.521-1
15.2.0
2019-03
RAN#83
R5-191465
0257
-
F
Correction of FR1 6.2.2 Maximum Power Reduction (MPR)
15.2.0
2019-03
RAN#83
R5-191506
0262
-
F
Shared Risk clarification in TS 38.521-1
15.2.0
2019-03
RAN#83
R5-191526
0263
-
F
Update to FR1 test case 6.3.3.6 SRS time mask
15.2.0
2019-03
RAN#83
R5-191675
0267
-
F
Addition of MU and TT for NR FR1 UL-MIMO test cases
15.2.0
2019-03
RAN#83
R5-191815
0272
-
F
OBW test procedure update for 38.521-1
15.2.0
2019-03
RAN#83
R5-191846
0277
-
F
FR1 Text update for 6.5.3.1 General spurious emission
15.2.0
2019-03
RAN#83
R5-191848
0278
-
F

Correction of errors in Table 6.1-1 of 38.521-1
15.2.0
2019-03
RAN#83
R5-191849
0279
-
F
FR1 Text update for 7.3C Reference sensitivity power level for SUL
15.2.0
2019-03
RAN#83
R5-191852
0280
-
F
FR1 Text update for 6.5.3.2 Spurious emission for UE co-existence
15.2.0
2019-03
RAN#83
R5-191854
0281
-
F
FR1 Text update for 7.3.2 Reference sensitivity power level
15.2.0
2019-03
RAN#83
R5-192088
0317
-
F
Test mode and test loop function activation in SA Tx RF test cases in TS 38.521-1
15.2.0
2019-03
RAN#83
R5-192089
0318
-
F
Test mode and test loop function activation in SA Rx RF test cases in TS 38.521-1
15.2.0
2019-03
RAN#83
R5-192121
0320
-
F
Update of Global In-channel Tx Test Annex for FR1
15.2.0
2019-03
RAN#83
R5-192402
0266
1
F
Update of FR1 6.2.4 Configured transmitted power
15.2.0
2019-03
RAN#83
R5-192407
0294
1
F
Update of time alignment error for UL MIMO FR1 6.4D.3
15.2.0
2019-03

RAN#83
R5-192408
0295
1
F
Introduction of TC 6.4D.4
15.2.0
2019-03
RAN#83
R5-192409
0309
1
F
Update of FR1 6.2.1 MOP
15.2.0
2019-03
RAN#83
R5-192411
0310
1
F
Update of FR1 6.3.1 Minimum Output Power
15.2.0
2019-03
RAN#83
R5-192412
0311
1
F
Addition of FR1 6.3A.1 minimum output power for CA
15.2.0
2019-03
RAN#83
R5-192413
0321
1
F
Update of transmit signal quality test cases for FR1
15.2.0
2019-03
RAN#83
R5-192414
0231
1
F
Introduction of TC 7.7A.0 Minimum conformance requirements
15.2.0
2019-03
RAN#83
R5-192416
0240
1
F
Update to Wideband Intermodulation for SA FR1
15.2.0
2019-03
RAN#83
R5-192417
0241
1
F
Updates to 7.9 spurious emission for SA in FR1
15.2.0
2019-03
RAN#83
R5-192418
0259

1
F
Introduction of FR1 7.6D.3 Out-of-band blocking for UL-MIMO
15.2.0
2019-03
RAN#83
R5-192419
0260
1
F
Introduction of FR1 7.6D.4 Narrow band blocking for UL-MIMO
15.2.0
2019-03
RAN#83
R5-192420
0261
1
F
Introduction of FR1 7.8D.2 Wide band Intermodulation for UL-MIMO
15.2.0
2019-03
RAN#83
R5-192421
0276
1
F
Correction of FR1 7.4 Maximum input level
15.2.0
2019-03
RAN#83
R5-192510
0322
1
F
Asymmetric CH BWs test configuration for Reference Sensitivity
15.2.0
2019-03
RAN#83
R5-192544
0230
1
F
Correction to TC 6.4A.2.2 Carrier leakage for CA
15.2.0
2019-03
RAN#83
R5-192545
0248
1
F
Update of test case 6.5.2.4.2, UTRA ACLR in 38.521-1
15.2.0
2019-03
RAN#83
R5-192547
0273
1
F
Update of FR1 6.2D.1 MOP for MIMO
15.2.0
2019-03
RAN#83
R5-192548
0275
1
F
Update of 6.2D.4 Configured Output Power for MIMO

15.2.0
2019-03
RAN#83
R5-192549
0284
1
F
Update of FR1 test case 6.3D.1 Minimum output power for UL-MIMO
15.2.0
2019-03
RAN#83
R5-192550
0296
1
F
Update of TC 6.5D.1
15.2.0
2019-03
RAN#83
R5-192551
0297
1
F
Update of TC 6.5D.2.2
15.2.0
2019-03
RAN#83
R5-192553
0298
1
F
Introduction of TC 6.5D.2.3
15.2.0
2019-03
RAN#83
R5-192554
0299
1
F
Update of TC 6.5D.2.4.1
15.2.0
2019-03
RAN#83
R5-192555
0300
1
F
Update of TC 6.5D.2.4.2
15.2.0
2019-03
RAN#83
R5-192556
0301
1
F
Update of 6.5D.3.1
15.2.0
2019-03
RAN#83
R5-192557
0302
1
F
Update of 6.5D.3.2
15.2.0
2019-03
RAN#83

R5-192558
0303
1
F
Update of 6.5D.3.3
15.2.0
2019-03
RAN#83
R5-192559
0304
1
F
Update of 6.5D.4
15.2.0
2019-03
RAN#83
R5-192561
0313
1
F
Addition of FR1 6.3A.3 Transmit ON/OFF time mask for CA
15.2.0
2019-03
RAN#83
R5-192562
0325
1
F
Update of FR1 6.2D.2 MPR for MIMO
15.2.0
2019-03
RAN#83
R5-192563
0233
1
F
Introduction of TC 7.7A.1 Spurious response for 2DL CA
15.2.0
2019-03
RAN#83
R5-192564
0234
1
F
Introduction of TC 7.7A.2 Spurious response for 3DL CA
15.2.0
2019-03
RAN#83
R5-192565
0235
1
F
Introduction of TC 7.7A.3 Spurious response for 4DL CA
15.2.0
2019-03
RAN#83
R5-192566
0258
1
F
Introduction of FR1 7.6D.2 Inband blocking for UL-MIMO
15.2.0
2019-03
RAN#83
R5-192567
0285
1

F
Update on TC 6.4A.1.1 Frequency error for CA
15.2.0
2019-03
RAN#83
R5-192570
0286
1
F
Update on TCs in section 6.4A.2 Transmit modulation quality for CA
15.2.0
2019-03
RAN#83
R5-192576
0287
1
F
Update on TC 6.5A.2.2.1 Spectrum emission mask for CA
15.2.0
2019-03
RAN#83
R5-192577
0288
1
F
Update on TC 6.5A.2.4.1.1 NR ACLR for CA
15.2.0
2019-03
RAN#83
R5-192578
0289
1
F
Update on TC 6.5A.2.4.2.1 UTRA ACLR for CA
15.2.0
2019-03
RAN#83
R5-192579
0290
1
F
Update on TC 6.5A.3.1.1 General spurious emissions for CA
15.2.0
2019-03
RAN#83
R5-192580
0291
1
F
Update on TC 6.5A.3.2.1 Spurious emissions for UE co-existence for CA
15.2.0
2019-03
RAN#83
R5-192581
0292
1
F
Update on TC 6.5A.4.1 TX IM for CA
15.2.0
2019-03
RAN#83
R5-192583
0268
1
F
Addition of 7.5A.0 Minimum conformance requirements
15.2.0

2019-03
RAN#83
R5-192584
0269
1
F
Addition of 7.5A.1 Adjacent channel selectivity for 2DL CA
15.2.0
2019-03
RAN#83
R5-192585
0270
1
F
Addition of 7.5A.2 Adjacent channel selectivity for 3DL CA
15.2.0
2019-03
RAN#83
R5-192586
0271
1
F
Addition of 7.5A.3 Adjacent channel selectivity for 4DL CA
15.2.0
2019-03
RAN#83
R5-192587
0282
1
F
FR1 Text update for 7.3A.2 Reference sensitivity power level for CA
15.2.0
2019-03
RAN#83
R5-192588
0283
1
F
FR1 Text update for 7.3.2_1 Reference sensitivity level with 4 Rx antenna ports
15.2.0
2019-03
RAN#83
R5-192589
0305
1
F
Update of 7.3D.2
15.2.0
2019-03
RAN#83
R5-192590
0306
1
F
Update of TC 7.4D
15.2.0
2019-03
RAN#83
R5-192591
0307
1
F
Introduction of TC 7.5D
15.2.0
2019-03
RAN#83
R5-192592

0324
1
F
Update of TC 7.7D Spurious response for UL-MIMO
15.2.0
2019-03
RAN#83
R5-192593
0243
1
F
Updates of TT in TS38.521-1 Annex F during RAN5#82
15.2.0
2019-03
RAN#83
R5-192594
0265
1
F
Correction of HARQ-ACK transmission timing for DL RMC for FR1 TDD SCS=60kHz
15.2.0
2019-03
RAN#83
R5-192597
0319
1
F
Updating test case 7.3.2 Reference sensitivity power level Table 7.3.2.4.1-3
15.2.0
2019-03
RAN#83
R5-192598
0323
1
F
Update OBW, SEM and ACLR in TS 38.521-1
15.2.0
2019-03
RAN#83
R5-192682
0236
1
F
Introduction of TC 7.9A.0 Minimum conformance requirements
15.2.0
2019-03
RAN#83
R5-192683
0237
1
F
Introduction of TC 7.9A.1 Spurious emission for 2DL CA
15.2.0
2019-03
RAN#83
R5-192685
0312
2
F
Addition of FR1 6.3A.2 Transmit OFF power for CA
15.2.0
2019-03
RAN#83
R5-192693
0293
1
F

Introduction of Annex on Characteristics of the Interfering Signal FR1
15.2.0
2019-03
RAN#83
R5-192837
0326
1
F
Update of operating bands and channel arrangement to TS 38.521-1
15.2.0
2019-03
RAN#83
-
-
-
-
Editorial correction of references to TS 38.508-1 clause 4.6 tables
15.2.0
2019-06
RAN#84
R5-193535
0389
-
F
Update of test case 6.5.2.4.2, UTRA ACLR in 38.521-1
15.3.0
2019-06
RAN#84
R5-193536
0390
-
F
Update of test case 6.3.4.3, Power Control Relative power tolerance
15.3.0

2019-06
RAN#84
R5-193567
0394
-
F
Correction of 38.521-1 7.6D.2
15.3.0
2019-06
RAN#84
R5-193569
0395
-
F
Correction of 38.521-1 7.6D.3
15.3.0
2019-06
RAN#84
R5-193571
0396
-
F
Correction of 38.521-1 7.6D.4
15.3.0
2019-06

RAN#84
R5-193573
0397
-
F
Correction of 38.521-1 7.8D.2
15.3.0
2019-06
RAN#84
R5-193574
0398
-
F
Correction of 38.521-1 6.2.2
15.3.0
2019-06
RAN#84
R5-193585
0400
-
F
Update of TC 7.7A.0 Spurious response for CA
15.3.0
2019-06
RAN#84
R5-193586
0401
-
F
Correction of section number for UE diagram in Initial conditions of 38.521-1 Clause 6
15.3.0
2019-06
RAN#84
R5-193589
0404
-
F
Correction of section number for UE diagram in Initial conditions of 38.521-1 Clause 7
15.3.0
2019-06
RAN#84
R5-193593
0405
-
F
Unify Outer_1RB and Edge_1RB in Test Configuration Table of 38.521-1
15.3.0
2019-06
RAN#84
R5-193753
0413
-
F
Update of 6.3D Output power dynamics for UL-MIMO
15.3.0
2019-06
RAN#84
R5-193915
0417
-
F
Update of NR FR1 6.2.3 A-MPR NS_04
15.3.0
2019-06
RAN#84
R5-193917
0418

-
F
Update of SA FR1 RF 6.5D.2.3
15.3.0
2019-06
RAN#84
R5-193918
0419
-
F
Update of SA FR1 RF 6.5D.2.4.2
15.3.0
2019-06
RAN#84
R5-193920
0420
-
F
Update of SA FR1 RF 6.5D.3.3
15.3.0
2019-06
RAN#84
R5-193930
0421
-
F
Addition of NR FR1 6.2D.3 A-MPR for UL-MIMO
15.3.0
2019-06
RAN#84
R5-193955
0423
-
F
Update of clause 5 to TS 38.521-1
15.3.0
2019-06
RAN#84
R5-194125
0425
-
F
Update Out of band emission test cases in TS 38.521-1
15.3.0
2019-06
RAN#84
R5-194126
0426
-
F
Update ACS and Inbanblocking interferer definition in TS 38.521-1
15.3.0
2019-06
RAN#84
R5-194161
0428
-
F
Update of test case 6.2.3 UE A-MPR, NS_35
15.3.0
2019-06
RAN#84
R5-194162
0429
-
F
Update of test case 6.5.2.3; Additional spectrum emission mask

15.3.0
2019-06
RAN#84
R5-194226
0435
-
F
Correction to In-band emission test case
15.3.0
2019-06
RAN#84
R5-194228
0437
-
F
Correction to PRACH configurations
15.3.0
2019-06
RAN#84
R5-194256
0439
-
F
Correction to FR1 Reference Sensitivity
15.3.0
2019-06
RAN#84
R5-194268
0440
-
F
Update of 7.5A.0 Minimum conformance requirements
15.3.0
2019-06
RAN#84
R5-194304
0442
-
F
Correction to time domain allocation of DMRS
15.3.0
2019-06
RAN#84
R5-194305
0443
-
F
Updating 7.8.2 Wide band Intermodulation
15.3.0
2019-06
RAN#84
R5-194307
0445
-
F
Correction to ON/OFF time mask test
15.3.0
2019-06
RAN#84
R5-194308
0446
-
F
Correction to carrier leakage and in-band emission tests
15.3.0
2019-06
RAN#84

R5-194312
0447
-
F
FR1 Update for 7.3A Reference sensitivity for CA
15.3.0
2019-06
RAN#84
R5-194313
0448
-
F
FR1 Update for 7.3.2 Reference sensitivity power level
15.3.0
2019-06
RAN#84
R5-194314
0449
-
F
FR1 Update for 7.3.3 Ref sensitivity ?RIB,c
15.3.0
2019-06
RAN#84
R5-194315
0450
-
F
FR1 Update for 7.3C Reference sensitivity for SUL
15.3.0
2019-06
RAN#84
R5-194316
0451
-
F
FR1 Update for 6.5.3.2 Spurious emission for UE co-existence
15.3.0
2019-06
RAN#84
R5-194377
0454
-
F
FR1 Update for 6.5.3.3 Additional spurious emissions
15.3.0
2019-06
RAN#84
R5-194383
0455
-
F
Update of 7.5A.2 Adjacent channel selectivity for 3DL CA
15.3.0
2019-06
RAN#84
R5-194905
0414
1
F
Update of 6.3D.4.1 Absolute Power tolerance for UL-MIMO
15.3.0
2019-06
RAN#84
R5-194906
0415
1

F
Update of 6.3D.4.2 Relative Power Tolerance for UL-MIMO
15.3.0
2019-06
RAN#84
R5-194908
0465
1
F
Update of TC 6.3A.3 Transmit ON/OFF time mask for CA
15.3.0
2019-06
RAN#84
R5-194910
0463
1
F
Update of TC 6.3A.1 Minimum output power for CA FR1
15.3.0
2019-06
RAN#84
R5-194911
0434
1
F
Update of 6.2.3 for UE additional maximum output power reduction
15.3.0
2019-06
RAN#84
R5-194912
0430
1
F
Update of test case 6.2.3 UE A-MPR FR1, general part and minimum requirements
15.3.0
2019-06
RAN#84
R5-194915
0438
1
F
Correction to SRS time mask test
15.3.0
2019-06
RAN#84
R5-194916
0444
1
F
Correction to transmit signal quality test cases
15.3.0
2019-06
RAN#84
R5-194917
0461
1
F
Introduction of 6.2A.4.0.2 TIB for CA into Rel-15
15.3.0
2019-06
RAN#84
R5-194918
0468
1
F
Update of transmit signal quality test cases for FR1
15.3.0

2019-06
RAN#84
R5-194919
0407
1
F
Update of TC 7.9A.1 Spurious emissions for 2DL CA
15.3.0
2019-06
RAN#84
R5-194920
0456
1
F
Update of 7.5A.3 Adjacent channel selectivity for 4DL CA
15.3.0
2019-06
RAN#84
R5-194921
0469
1
F
Correction to FR1 Reference Sensitivity test configurations with n70
15.3.0
2019-06
RAN#84
R5-194922
0431
1
F
Update of clause 3 to TS 38.521-1
15.3.0
2019-06
RAN#84
R5-194923
0432
1
F
Update of clause 4 to TS 38.521-1
15.3.0
2019-06
RAN#84
R5-194924
0433
1
F
Update of clause 5 for operating bands and channel arrangement
15.3.0
2019-06
RAN#84
R5-194925
0452
1
F
General clause updated for FR1 spec
15.3.0
2019-06
RAN#84
R5-194926
0467
1
F
Update of Global In-channel Tx Test Annex for FR1
15.3.0
2019-06
RAN#84
R5-194957

0392
1
F
Updates of MU and TT in TS 38.521-1 Annex F during RAN5#NR5
15.3.0
2019-06
RAN#84
R5-194973
0402
1
F
Update of TC 7.9A.0 Spurious emissions for CA
15.3.0
2019-06
RAN#84
R5-194974
0403
1
F
Update of TC 7.7D Spurious response for UL-MIMO
15.3.0
2019-06
RAN#84
R5-195090
0470
1
F
Update of FR1 ON_ON time mask test cases
15.3.0
2019-06
RAN#84
R5-195092
0441
1
F
Update of 7.5A.1 Adjacent channel selectivity for 2DL CA
15.3.0
2019-06
RAN#84
R5-195140
0416
1
F
Update of 6.3D.4.3 Aggregate Power tolerance for UL-MIMO
15.3.0
2019-06
RAN#84
R5-195142
0422
1
F
Addition of TT values for NR FR1 UL-MIMO test cases
15.3.0
2019-06
RAN#84
R5-195143
0457
1
F
Introduction of Occupied bandwidth for Inter-band CA in NR SA FR1
15.3.0
2019-06
RAN#84
R5-195144
0458
1
F

Update of 6.4D.3 Time alignment error for UL-MIMO FR1
15.3.0
2019-06
RAN#84
R5-195145
0464
1
F
Update of TC 6.3A.2 Transmit OFF power for CA FR1
15.3.0
2019-06
RAN#84
R5-195198
0436
1
F
Correction to power control test cases
15.3.0
2019-06
RAN#84
R5-195403
0459
1
F
Addition of 6.2A.1.3 FR1 MOP for inter-band CA
15.3.0
2019-06
RAN#84
R5-195430
0393
1
F
Updates of MU and TT in TS 38.521-1
15.3.0
2019-06
RAN#84
R5-195431
0424
1
F
Core alignment with TS 38.101-1
15.3.0
2019-06
RAN#84
R5-193550
0391
-
F
Introduction of CA_n41A-n79A into Rel-16
16.0.0
2019-06
RAN#84
R5-195053
0462
1
F
Introduction of 6.2A.4.0.2 TIB for CA into Rel-16
16.0.0
2019-06
RAN#84
R5-195056
0399
1
F
Introduction of CA_n41 into Rel-16 TS 38.521-1
16.0.0
2019-06

RAN#84
R5-195405
0460
1
F
Introduction of 6.2A.1.3 FR1 MOP for inter-band CA into Rel-16
16.0.0
2019-09
RAN#85
R5-195732
0472
-
F
Update Clause 6.2A.4.0.2 TIB for CA

16.1.0
2019-09
RAN#85
R5-195804

0474

-

F
Update of UE A_MPR test case in 6.2.3

16.1.0
2019-09
RAN#85
R5-196191

0477

-

F
Update of Minimum conformance requirements and addition of test points in TC 6.2.2

16.1.0
2019-09
RAN#85
R5-196231

0483

-

F
Correction to 6.5.2.3 Additional spectrum emission mask

16.1.0
2019-09
RAN#85
R5-196233

0485

-

F
Correction to 6.3.4.3 Power Control Relative power tolerance

16.1.0
2019-09
RAN#85
R5-196234

0486

-

F
Correction to PUCCH format in EVM and In-band emissions test

16.1.0
2019-09
RAN#85
R5-196291

0488

-

F
Add Annex F.4 Uplink Power window explanation for SA test cases

16.1.0
2019-09
RAN#85
R5-196396

0489

-

F
Update of Minimum output power for CA FR1

16.1.0
2019-09
RAN#85
R5-196402

0492

-

F
Update of NR test case 6.2A.1-UE maximum output power for CA

16.1.0
2019-09
RAN#85
R5-196413

0498

-

F
Update of FR1 6.4D.1 Frequency error for UL MIMO

16.1.0
2019-09
RAN#85
R5-196421

0502

-

F
Update of FR1 6.4D.2.4 EVM equalizer spectrum flatness for UL MIMO

16.1.0
2019-09
RAN#85
R5-196425

0504

-

F
Update of DL RB allocation in Annex C

16.1.0
2019-09
RAN#85
R5-196481

0514

-

F
Remove references to 4Rx Reference Sensitivity test case 7.3.2_1 from Annex F

16.1.0
2019-09
RAN#85
R5-196499

0517

-

F
Updated to Annex A for RF FR1 tests

16.1.0
2019-09
RAN#85
R5-196500

0518

-

F
General clause updated for FR1 spec

16.1.0
2019-09
RAN#85
R5-196653

0521

-

F
Update TT for 6.3D.4.1

16.1.0
2019-09
RAN#85
R5-196696

0523

-

F
Update of Minimum conformance requirements and Test requirement in TC 7.4

16.1.0
2019-09
RAN#85
R5-196699

0524

-

F
Update of Minimum conformance requirements in TC 6.3.2

16.1.0
2019-09
RAN#85
R5-196711

0525

-

F
Addition of TT for 6.3D.4.2

16.1.0
2019-09
RAN#85
R5-196726

0526

-

F
Addition of TT for 6.3D.4.3

16.1.0
2019-09
RAN#85
R5-197307

0476

1

F
Update UL-MIMO to UL MIMO to align with RAN4 terminology in FR1

16.1.0
2019-09
RAN#85
R5-197308

0506

1

F
Update for 6.5.3.1 General spurious emissions

16.1.0
2019-09
RAN#85
R5-197309

0508

1

F
Update for 6.5.3.3 Additional spurious emissions

16.1.0
2019-09
RAN#85
R5-197312

0473

1

F
Update of Additional spectrum emission mask test case 6.5.2.3

16.1.0
2019-09
RAN#85
R5-197313

0480

1

F
Add TT to 6.3D.1 Minimum output power for UL-MIMO

16.1.0
2019-09
RAN#85
R5-197314

0484

1

F
Correction to PRACH configurations

16.1.0
2019-09
RAN#85
R5-197316

0494

1

F
Addition of NR test case 6.2A.3-UE additional maximum output power reduction for CA

16.1.0
2019-09
RAN#85
R5-197318

0495

1

F
Addition of NR test case 6.2A.4-Configured output power for CA

16.1.0
2019-09
RAN#85
R5-197319

0499

1

F
Update of FR1 6.4D.2.1 EVM for UL MIMO

16.1.0
2019-09
RAN#85
R5-197321

0500

1

F
Update of FR1 6.4D.2.2 Carrier leakage for UL MIMO

16.1.0
2019-09
RAN#85
R5-197324

0501

1

F
Update of FR1 6.4D.2.3 Inband emission for UL MIMO

16.1.0
2019-09
RAN#85
R5-197327

0511

1

F
Update for 7.3C.0 Minimum conformance requirements for SUL

16.1.0
2019-09
RAN#85
R5-197328

0512

1

F
Update for 7.3A.0 Minimum conformance requirements for CA

16.1.0
2019-09
RAN#85
R5-197329

0522

1

F
Update of Minimum conformance requirements and Test requirement in TCs 7.6.3 7.6.4 and 7.7

16.1.0
2019-09
RAN#85
R5-197330

0527

1

F
Update of 7.5A.0

16.1.0
2019-09
RAN#85
R5-197492

0503

1

F
Update of UL power configuration for ON/OFF and Absolute power tolerance

16.1.0
2019-09
RAN#85
R5-197514

0478

1

F
Correction of uplink power setting for SA FR1 transmitter test cases

16.1.0
2019-09
RAN#85
R5-197515

0479

1

F
Correction of uplink power setting for SA FR1 receiver test cases

16.1.0
2019-09
RAN#85
R5-197519

0493

1

F
Addition of NR test case 6.2A.2-UE maximum output power reduction for CA

16.1.0
2019-09
RAN#85
R5-197520

0497

1

F
Update of FR1 6.2D.1 MOP for UL MIMO

16.1.0
2019-09
RAN#85
R5-197521

0507

1

F
Update for 6.5.3.2 Spurious emission for UE co-existence

16.1.0
2019-09
RAN#85
R5-197522

0515

1

F
Update to Occupied bandwidth for CA in NR SA FR1

16.1.0
2019-09
RAN#85
R5-197523

0496

1

F
Addition of FR1 7.4A Maximum input level for CA

16.1.0
2019-09
RAN#85
R5-197608

0510

1

F
Update for 7.3C.2 Reference sensitivity power level for SUL

16.1.0
2019-09
RAN#85
R5-197609

0513

1

F
Update for 7.3.2 Reference sensitivity power level

16.1.0
2019-09
RAN#85
R5-197610

0471

1

F
Updates of MU and TT in TS 38.521-1

16.1.0
2019-09
RAN#85
R5-197634

0475

2

F
Update of operating bands and channel arrangement to TS38.521-1 g00

16.1.0
2019-09
RAN#85
R5-197635

0491

2

F
Update of Transmit ON/OFF time mask for CA FR1

16.1.0
2019-09
RAN#85
R5-197639

0482

2

F
Correction to power control TC 6.3.4.2 and 6.3.4.4

16.1.0
2019-09
RAN#85
R5-197640

0509

2

F
Update for 7.3A Reference sensitivity for CA

16.1.0
2019-09
RAN#85
R5-197641

0528

2

F
Addition of the connection setup in TS 38.521-1

16.1.0
2019-10
RAN#85
-

-

-

-
Deletion of R5-197560 which was added by mistake but was withdrawn and belonged to another spec

16.1.1
2019-12
RAN#86
R5-197917

0705

-

F
Addition of FR1 SUL test case 6.2C.5

16.2.0
2019-12
RAN#86
R5-197923

0711

-

F
Editorial update of test case 6.4D.2.1

16.2.0
2019-12
RAN#86
R5-198044

0714

-

F
Update of Clause 7.9A.1 Spurious emission for 2DL CA

16.2.0
2019-12
RAN#86
R5-198103

0715

-

F
Correction of Clause 7.9 Spurious emissions

16.2.0
2019-12
RAN#86
R5-198134

0716

-

F
Updating incorrect note in test procedure

16.2.0
2019-12
RAN#86
R5-198237

0723

-

F
Alignment with core specification for test case 6.3.4.3

16.2.0
2019-12
RAN#86
R5-198397

0739

-

F
Correction to Test Configuration for In-band emissions

16.2.0
2019-12
RAN#86
R5-198398

0740

-

F
Editorial correction to test configuration table in MPR test

16.2.0
2019-12
RAN#86
R5-198399

0741

-

F
Correction to the test procedure for frequency error

16.2.0
2019-12
RAN#86
R5-198401

0743

-

F
Correction to Common Uplink Configuration

16.2.0
2019-12
RAN#86
R5-198479

0747

-

F
Correction of UL RMCs

16.2.0
2019-12
RAN#86
R5-198526

0753

-

F
Update of test case 6.2.3 UE A_MPR NS_43

16.2.0
2019-12
RAN#86
R5-198546

0760

-

F
Message Contents Update for TC 6.2.4 and 6.2D.4 of TS 38.521-1

16.2.0
2019-12
RAN#86
R5-198547

0761

-

F
Addition of NR FR1 intraband non-contiguous 2CA tests to 7.4A.1 and 7.5A.1 and updating 7.5A.1 to 38.521-1 to enable testing of CA combinations involving bands n66, n70 and n71

16.2.0
2019-12
RAN#86
R5-198635

0764

-

F
Updated to Annex A for RF FR1 tests

16.2.0
2019-12
RAN#86
R5-198747

0774

-

F
Update for 7.3.3

16.2.0
2019-12
RAN#86
R5-198755

0777

-

F
Introduction of n65 to 38.521-1 Chapter 7

16.2.0
2019-12
RAN#86
R5-199085

0701

1

F
Updates of MU and TT in TS 38.521-1

16.2.0
2019-12
RAN#86
R5-199308

0724

1

F
Correction of 6.3D.3 Transmit ONOFF time mask for UL-MIMO

16.2.0
2019-12
RAN#86
R5-199309

0725

1

F
Correction of 6.3D.4.1

16.2.0
2019-12
RAN#86
R5-199310

0727

1

F
Correction of 6.3D.4.2 Relative power tolerance for UL-MIMO

16.2.0
2019-12
RAN#86
R5-199311

0731

1

F
Corrections to 6.3A.1.1 Minimum output power for CA 2UL CA FR1

16.2.0
2019-12
RAN#86
R5-199313

0702

1

F
Update of FR1 SUL test case 6.2C.1

16.2.0
2019-12
RAN#86
R5-199314

0703

1

F
Addition of FR1 SUL test case 6.2C.3

16.2.0
2019-12
RAN#86
R5-199315

0704

1

F
Addition of FR1 SUL test case 6.2C.4

16.2.0
2019-12
RAN#86
R5-199316

0706

1

F
Addition of FR1 SUL test case 6.4C.1

16.2.0
2019-12
RAN#86
R5-199317

0707

1

F
Addition of FR1 SUL test case 6.4C.2.1

16.2.0
2019-12
RAN#86
R5-199318

0708

1

F
Addition of FR1 SUL test case 6.4C.2.2

16.2.0
2019-12
RAN#86
R5-199319

0709

1

F
Addition of FR1 SUL test case 6.4C.2.3

16.2.0
2019-12
RAN#86
R5-199320

0710

1

F
Addition of FR1 SUL test case 6.4C.2.4

16.2.0
2019-12
RAN#86
R5-199321

0712

1

F
Update test points in transmit quality to replace -40dBm by minimum output power

16.2.0
2019-12
RAN#86
R5-199322

0746

1

F
Correction to UL Power Control Window in FR1

16.2.0
2019-12
RAN#86
R5-199323

0749

1

F
Corrections on A-MPR requirements in 38.521-1

16.2.0
2019-12
RAN#86
R5-199324

0750

1

F
Update of UE A_MPR Minimum Conformance requirements in 6.2.3

16.2.0
2019-12
RAN#86
R5-199325

0751

1

F
Update of test case 6.2.3 for UE A_MPR, NS_03 and NS_03U

16.2.0
2019-12
RAN#86
R5-199329

0752

1

F
Update of test case 6.2.3 UE A_MPR, NS_05 and NS_05U

16.2.0
2019-12
RAN#86
R5-199330

0754

1

F
Update of test case 6.2.3 UE A_MPR NS_43U

16.2.0
2019-12
RAN#86
R5-199331

0755

1

F
Adding of test requirements for UE A_MPR NS_100

16.2.0
2019-12
RAN#86
R5-199332

0756

1

F
Adding of test requirements for UE A_MPR NS_18

16.2.0
2019-12
RAN#86
R5-199333

0758

1

F
Update of Additional spectrum emission mask test case in 6.5.2.3

16.2.0
2019-12
RAN#86
R5-199334

0775

1

F
Update for 6.5.3.3 Additional spurious emissions

16.2.0
2019-12
RAN#86
R5-199335

0718

1

F
Correction of test applicability and minimum conformance requirements for SA FR1 7.6.4

16.2.0
2019-12
RAN#86
R5-199336

0719

1

F
Correction of minimum conformance requirements for SA FR1 7.6.3 7.7 and 7.9

16.2.0
2019-12
RAN#86
R5-199337

0717

1

F
Correction and addition of uplink power measurement MUs for SA FR1 TCs

16.2.0
2019-12
RAN#86
R5-199338

0728

1

F
Update of Operating bands and Channel arrangement to TS 38.521-1 R15

16.2.0
2019-12
RAN#86
R5-199339

0766

1

F
Update of Annex C.3.1

16.2.0
2019-12
RAN#86
R5-199412

0765

1

F
Update of clause 5 for R16 CA configurations in 38.521-1

16.2.0
2019-12
RAN#86
R5-199433

0736

1

F
Addition of reference sensitivity test for NR CA combination n29-n66

16.2.0
2019-12
RAN#86
R5-199434

0729

1

F
Update of Operating bands and Channel arrangement to TS 38.521-1 R16

16.2.0
2019-12
RAN#86
R5-199435

0767

1

F
Introduction of n29 and n65 to 38.521-1 Chapter 5 and 6.2.1

16.2.0
2019-12
RAN#86
R5-199484

0720

1

F
Correction of test procedure of SA FR1 6.5.3.1

16.2.0
2019-12
RAN#86
R5-199485

0768

1

F
Update to ACLR test case

16.2.0
2019-12
RAN#86
R5-199486

0776

1

F
Update for 6.5.3.2 Spurious emission for UE co-existence

16.2.0
2019-12
RAN#86
R5-199490

0748

1

F
update of 7.5A.2

16.2.0
2019-12
RAN#86
R5-199491

0773

1

F
Update for 7.3C.0 Minimum conformance requirements for SUL

16.2.0
2019-12
RAN#86
R5-199493

0770

1

F
Add section 4.5 Applicability and test coverage rules

16.2.0
2019-12
RAN#86
R5-199502

0721

1

F
Correction of test description for SA FR1 6.5.2.4.2

16.2.0
2019-12
RAN#86
R5-199503

0730

1

F
Addition of almost contiguous allocation test points and update of minimum conformance requirements for SA FR1 6.2.2

16.2.0
2019-12
RAN#86
R5-199556

0735

1

F
Introduction of 3CA reference sensitivity case 7.3A.2 for NR and addition of reference sensitivity test for many combinations involving bands n66, n70 and n71 to 38.521-1

16.2.0
2019-12
RAN#86
R5-199557

0762

1

F
Introduction of CA blocking case 7.6A to 38.521-1

16.2.0
2019-12
RAN#86
R5-199563

0732

1

F
Addition of 7.6A.3.1 Out-of-band blocking for CA (2DL CA) for SA FR1

16.2.0
2019-12
RAN#86
R5-199564

0733

1

F
Addition of 7.6A.4.1 Narrow band blocking for CA (2DL CA) for SA FR1

16.2.0
2019-12
RAN#86
R5-199565

0734

1

F
Addition of 7.8A.2.1 Wide band Intermodulation for CA (2DL CA) for SA FR1

16.2.0
2020-03
RAN#87
R5-200393

0789

F
Adding MU and TT for FR1 Rx CA test cases

16.3.0
2020-03
RAN#87
R5-200397

0791

F
Updating power configuration for PRACH time mask

16.3.0
2020-03
RAN#87
R5-200438

0792

F
Clarification of measurement interval of frequency error in FR1

16.3.0
2020-03
RAN#87
R5-200440

0794

F
Correction to 6.3.4.3 Power Control Relative power tolerance

16.3.0
2020-03
RAN#87
R5-200441

0795

F
Correction to SEM and ACLR test cases

16.3.0
2020-03
RAN#87
R5-200443

0797

F
Correction to UL power window description for 6.3.4.4

16.3.0
2020-03
RAN#87
R5-200461

0798

F
Update of 7.6A.3.1 Out-of-band blocking for 2DL CA

16.3.0
2020-03
RAN#87
R5-200462

0799

F
Update of 7.6A.4.1 Narrow band blocking for 2DL CA

16.3.0
2020-03
RAN#87
R5-200463

0800

F
Update of 7.8A.2.1 Wide band Intermodulation for 2DL CA

16.3.0
2020-03
RAN#87
R5-200570

0804

F
Update of NR test case 6.5.3.2-Spurious emission for UE co-existence

16.3.0
2020-03
RAN#87
R5-200640

0808

F
Update of Minimum requirements of 6.2.2 UE maximum output power reduction

16.3.0
2020-03
RAN#87
R5-200658

0810

F
Update of 6.1 common part of Tx in TS38.521-1

16.3.0
2020-03
RAN#87
R5-200659

0811

F
Core spec alignment for test case 6.3.4.3 Relative power tolerance

16.3.0
2020-03
RAN#87
R5-200664

0812

F
Correction of UL configuration for almost contiguous allocation in 6.2.2

16.3.0
2020-03
RAN#87
R5-200666

0813

F
Update measurement bandwidth references in 6.5.4

16.3.0
2020-03
RAN#87
R5-200693

0814

F
Update for 6.5.3.2 Spurious emission for UE co-existence

16.3.0
2020-03
RAN#87
R5-200700

0817

F
Removal of square brackets for DCI format for test cases in 7.6 and 7.7 of SA FR1

16.3.0
2020-03
RAN#87
R5-200721

0818

F
Addition of new Rel-16 70MHz CBW for 6.3.2 and 7.4 of SA FR1

16.3.0
2020-03
RAN#87
R5-200725

0819

F
Correction of A-SE for NS_04

16.3.0
2020-03
RAN#87
R5-200755

0823

F
Removing text from a Void clause

16.3.0
2020-03
RAN#87
R5-200757

0825

F
Correction of A_MPR test for NS_05 and NS_05U

16.3.0
2020-03
RAN#87
R5-200759

0826

F
Update of test case 6.2.3 UE A_MPR, NS_37

16.3.0
2020-03
RAN#87
R5-200761

0827

F
Update of test case 6.2.3 UE A_MPR, NS_38

16.3.0
2020-03
RAN#87
R5-200763

0828

F
Update of test case 6.2.3 UE A_MPR, NS_39

16.3.0
2020-03
RAN#87
R5-200765

0829

F
Corrections of NS_43 in 38.521-1 section 6

16.3.0
2020-03
RAN#87
R5-200767

0830

F
Corrections of NS_43U in 38.521-1 section 6

16.3.0
2020-03
RAN#87
R5-200892

0815

1

F
Update for 6.5.3.3 Additional spurious emissions

16.3.0
2020-03
RAN#87
R5-200893

0809

1

F
Core spec alignment for 7.6.3 and 7.8

16.3.0
2020-03
RAN#87
R5-200895

0787

1

F
Introduction of n95 SUL band test cases

16.3.0
2020-03
RAN#87
R5-200906

0824

1

F
Aligning A-MPR clause with TS 38.101-1 Rel-15

16.3.0
2020-03
RAN#87
R5-200907

0781

1

F
Update of TC 7.7A.1

16.3.0
2020-03
RAN#87
R5-200908

0782

1

F
Update of Clause 4 in TS 38.521-1

16.3.0
2020-03
RAN#87
R5-200909

0783

1

F
Update of clause 5 to TS 38.521-1 in R15

16.3.0
2020-03
RAN#87
R5-200922

0822

1

F
Introduction of Rel-16 spurious emissions co-existence requirements for bands n48, n65 and n95

16.3.0
2020-03
RAN#87
R5-200924

0788

1

F
Adding statistical testing condition in Annex H for CA testing

16.3.0
2020-03
RAN#87
R5-200962

0786

1

F
Corrections to TC 6.3A.3 transmit On OFF time mask for CA FR1

16.3.0
2020-03
RAN#87
R5-200971

0780

1

F
Correction of reference numbers in TS 38.521-1

16.3.0
2020-03
RAN#87
R5-200972

0793

1

F
Correction to 6.2.3 A-MPR test case

16.3.0
2020-03
RAN#87
R5-200974

0802

1

F
Update of test requirements for NR test case 6.5D.2.2 and 6.5D.2.4

16.3.0
2020-03
RAN#87
R5-200975

0803

1

F
Update of NR SUL test cases

16.3.0
2020-03
RAN#87
R5-200976

0820

1

F
Update of NR test case 6.2.4-ConfigTP

16.3.0
2020-03
RAN#87
R5-200977

0805

1

F
Update of NR test case 7.4A Maximum input level for CA

16.3.0
2020-03
RAN#87
R5-200978

0806

1

F
Update of NR test case 7.6A.2 Inband Blocking for CA

16.3.0
2020-03
RAN#87
R5-200979

0821

1

F
Cleaning up of Rx 2DL CA test cases in FR1

16.3.0
2020-03
RAN#87
R5-201054

0785

1

F
Update of R16 new bands and CBWs to TS 38.521-1 clause 5

16.3.0
2020-03
RAN#87
R5-201069

0832

1

F
Adding n65 A-MPR and Emission Requirements

16.3.0
2020-03
RAN#87
R5-201247

0790

2

F
Cleaning up of power class 2 test cases in FR1

16.3.0
2020-03
RAN#87
R5-201238

0831

1

F
Corrections of NS_18 in 38.521-1 section 6

16.3.0
2020-06
RAN#88
R5-201597

0835

-

F
Correction of 4RX Reference requirement for n77 high range in 7.3.2

16.4.0
2020-06
RAN#88
R5-201598

0836

-

F
Correction of lower limit for test ID 55 in test 6.2.3

16.4.0
2020-06
RAN#88
R5-201734

0841

-

F
Addition of NR test case 6.3C.1 Minimum output power for SUL

16.4.0
2020-06
RAN#88
R5-201735

0842

-

F
Addition of NR test case 6.3C.2 Transmit OFF power for SUL

16.4.0
2020-06
RAN#88
R5-201736

0843

-

F
Addition of NR test case 6.3C.3 Transmit ON/OFF time mask for SUL

16.4.0
2020-06
RAN#88
R5-201739

0846

-

F
Addition of NR test case 6.3C.4.3 Aggregate power tolerance for SUL

16.4.0
2020-06
RAN#88
R5-201741

0848

-

F
Update of NR test case 6.5C.3.3-Additional spurious emissions for SUL

16.4.0
2020-06
RAN#88
R5-201742

0849

-

F
Update test description of NR test case 7.6.3-Out-of-band blocking

16.4.0
2020-06
RAN#88
R5-201744

0851

-

F
Addition of NR test case 7.6C.3 Out-of-band blocking for SUL

16.4.0
2020-06
RAN#88
R5-201745

0852

-

F
Update of Annex F.3.2 and F.3.3

16.4.0
2020-06
RAN#88
R5-201749

0854

-

F
Update of NR test case 7.4A.1 Maximum input level for 2DL CA

16.4.0
2020-06
RAN#88
R5-201750

0855

-

F
Addition of NR test case 7.4A.2 Maximum input level for 3DL CA

16.4.0
2020-06
RAN#88
R5-201752

0857

-

F
Addition of NR test case 7.6A.2.2 IBB for 3DL CA

16.4.0
2020-06
RAN#88
R5-201764

0861

-

F
Adding NS_27 A_MPR and Emission Requirements for band n48

16.4.0
2020-06
RAN#88
R5-201772

0865

-

F
Adding NS_47 A_MPR and Emission Requirements for band n41

16.4.0
2020-06
RAN#88
R5-201801

0866

-

F
Update of clause 5 to TS 38.521-1 in R15

16.4.0
2020-06
RAN#88
R5-201833

0867

-

F
Update of Refsense requirements for n79

16.4.0
2020-06
RAN#88
R5-201834

0868

-

F
Correction of FR1 PUCCH EVM definition

16.4.0
2020-06
RAN#88
R5-201845

0871

-

F
Editorial correction of 6.2.1 test requirements

16.4.0
2020-06
RAN#88
R5-201847

0873

-

F
Updating 6.3.4.3 alternating sub-test

16.4.0
2020-06
RAN#88
R5-201861

0875

-

F
Addition of asymmetric BW combination set 1 of n66

16.4.0
2020-06
RAN#88
R5-201934

0877

-

F
Update of Operating bands and Channel arrangement to TS 38.521-1 for R16 CADC configurations

16.4.0
2020-06
RAN#88
R5-202034

0883

-

F
Addition of new test case 7.6A.3.2 Out-of-band blocking for CA 3DL CA R16

16.4.0
2020-06
RAN#88
R5-202035

0884

-

F
Addition of new test case 7.6A.3.3 Out-of-band blocking for CA 4DL CA R16

16.4.0
2020-06
RAN#88
R5-202036

0885

-

F
Addition of new test case 7.6A.4.2 Narrow band blocking for CA 3DL CA R16

16.4.0
2020-06
RAN#88
R5-202037

0886

-

F
Addition of new test case 7.6A.4.3 Narrow band blocking for CA 4DL CA R16

16.4.0
2020-06
RAN#88
R5-202039

0888

-

F
Addition of new test case 7.8A.2.3 Wide band Intermodulation for CA 4DL CA R16

16.4.0
2020-06
RAN#88
R5-202041

0890

-

F
Correction of test procedure and some typos in 7.6A.4.1 Narrow band blocking for CA 2DL CA R16

16.4.0
2020-06
RAN#88
R5-202042

0891

-

F
Correction of test procedure and test requirement in 7.8A.2.1 R16

16.4.0
2020-06
RAN#88
R5-202109

0893

-

F
Correction to n70 asymmetric test points in Rx tests

16.4.0
2020-06
RAN#88
R5-202217

0899

-

F
Corrections on transmitter power for CA in 38.521-1

16.4.0
2020-06
RAN#88
R5-202422

0906

-

F
Update F.1.2 with Relative Uplink power measurement uncertainty as 6.3.4.3

16.4.0
2020-06
RAN#88
R5-202430

0909

-

F
Add Reference sensitivity requirement for n48

16.4.0
2020-06
RAN#88
R5-202484

0913

-

F
Update of Reference sensitivity power level for R16 new CBW of n1

16.4.0
2020-06
RAN#88
R5-202503

0914

-

F
CR on EVM Window Centre Timing Definition in FR1

16.4.0
2020-06
RAN#88
R5-202710

0840

1

F
Update of NR test case 6.2A.3 AMPR for CA

16.4.0
2020-06
RAN#88
R5-202711

0844

1

F
Addition of NR test case 6.3C.4.1-Absolute power tolerance for SUL

16.4.0
2020-06
RAN#88
R5-202712

0845

1

F
Addition of NR test case 6.3C.4.2 Power Control Relative power tolerance for SUL

16.4.0
2020-06
RAN#88
R5-202713

0847

1

F
Update of NR test case 6.5.2.4 ACLR

16.4.0
2020-06
RAN#88
R5-202714

0864

1

F
Update of test case 6.2.3 UE A_MPR, NS_42

16.4.0
2020-06
RAN#88
R5-202715

0905

1

F
Update Uplink power control window size for SA TX TCs

16.4.0
2020-06
RAN#88
R5-202716

0910

1

F
Update for 6.5.3.1 General spurious emissions

16.4.0
2020-06
RAN#88
R5-202717

0850

1

F
Addition of NR test case 7.6C.2-Inband Blocking for SUL

16.4.0
2020-06
RAN#88
R5-202718

0902

1

F
Update of UL configuration in REFSENS

16.4.0
2020-06
RAN#88
R5-202719

0903

1

F
Diversity Characteristics requirements alignment

16.4.0
2020-06
RAN#88
R5-202765

0880

1

F
Updates to test case 6.5.2.2, Spectrum Emission Mask

16.4.0
2020-06
RAN#88
R5-202781

0859

1

F
Adding several new 2CA and 3CA combinations to 7.3A and corrections to 7.3A.1

16.4.0
2020-06
RAN#88
R5-202783

0881

1

F
Adding REFSENS requirements for 30 MHz channel bandwidth in band n41

16.4.0
2020-06
RAN#88
R5-202791

0869

1

F
Update of general clause 7.1

16.4.0
2020-06
RAN#88
R5-202807

0904

1

F
Receiver characteristics testing update to 38.521-1

16.4.0
2020-06
RAN#88
R5-202821

0862

1

F
Update of test case 6.2.3 UE A_MPR, NS_40

16.4.0
2020-06
RAN#88
R5-202822

0863

1

F
Update of test case 6.2.3 UE A_MPR, NS_41

16.4.0
2020-06
RAN#88
R5-202823

0908

1

F
Update for 6.5.3.3 Additional spurious emissions

16.4.0
2020-06
RAN#88
R5-202860

0912

1

F
Update of Spurious emission for UE co-existence for CA_n1-n78

16.4.0
2020-06
RAN#88
R5-202886

0860

1

F
Aligning A-MPR clause with TS 38.101-1 Rel-15

16.4.0
2020-06
RAN#88
R5-202887

0894

1

F
NS_05 corrections related to n65

16.4.0
2020-06
RAN#88
R5-202888

0896

1

F
Corrections on network signalling value abbreviation in 38.521-1

16.4.0
2020-06
RAN#88
R5-202889

0897

1

F
Corrections on NS signalling label for band n39 in 38.521-1

16.4.0
2020-06
RAN#88
R5-202890

0900

1

F
Correction on txDirectCurrentLocation in FR1 SA tests

16.4.0
2020-06
RAN#88
R5-202891

0911

1

F
Updated MOP UL MIMO test case to include steps for per port testing

16.4.0
2020-06
RAN#88
R5-202892

0834

1

F
Correction and clarifications of default DL physical channels power in annex C

16.4.0
2020-06
RAN#88
R5-202927

0876

1

F
Update of Operating bands and Channel arrangement to TS 38.521-1 for R16 new bands and CBWs

16.4.0
2020-06
RAN#88
R5-202928

0856

1

F
Update for NR test case 7.6A.2.1 Inband Blocking for 2DL CA

16.4.0
2020-06
RAN#88
R5-202929

0887

1

F
Addition of new test case 7.8A.2.2 Wide band Intermodulation for CA 3DL CA R16

16.4.0
2020-06
RAN#88
R5-202930

0889

1

F
Correction of CW interference setting for OOBB Inter-band 2DL CA in TC 7.6A.3.1 R16

16.4.0
2020-06
RAN#88
R5-202931

0892

1

F
Alignment of minimum conformance requirements in 7.6A.3.0 and 7.8A.2.0 with core spec R16

16.4.0
2020-06
RAN#88
R5-202940

0879

1

F
Updates to test case 6.5.2.4.1, NR ACLR

16.4.0
2020-06
RAN#88
R5-202941

0870

1

F
Skipping 2Rx testing on bands where UE support 4Rx for SA test cases

16.4.0
2020-06
RAN#88
R5-202942

0901

1

F
Re-organization of CA refsens test cases

16.4.0
2020-06
RAN#88
R5-202957

0853

1

F
Update of NR test case 6.2.2 UE maximum output power reduction

16.4.0
2020-09
RAN#89
R5-203260

0917

-

F
Adding NS_47 to Additional spurious emissions test case

16.5.0
2020-09
RAN#89
R5-203261

0918

-

F
Adding UL MIMO additional spurious emissions test for NS_47

16.5.0
2020-09
RAN#89
R5-203290

0926

-

F
Clarification of Interferer frequency selection in FR1 IBB test case 7.6.2

16.5.0
2020-09
RAN#89
R5-203291

0927

-

F
Correction of K1 to achieve PUCCH Format 3 in FDD in EVM and in-band emission

16.5.0
2020-09
RAN#89
R5-203572

0932

-

F
Corrected test config for NS_24 in additional spurious emission test 6.5.3.3

16.5.0
2020-09
RAN#89
R5-203678

0935

-

F
Adding MU and TTs for Inter-band UL CA test cases

16.5.0
2020-09
RAN#89
R5-203679

0936

-

F
Updating message content in SUL test cases

16.5.0
2020-09
RAN#89
R5-203682

0937

-

F
Updating test case 6.5A.2.4.1-NR ACLR for CA

16.5.0
2020-09
RAN#89
R5-203687

0939

-

F
Updating channel configurations for Intra-band UL contiguous CA

16.5.0
2020-09
RAN#89
R5-203688

0940

-

F
Updating intra-band CA UL and DL configurations

16.5.0
2020-09
RAN#89
R5-203689

0941

-

F
Adding MU and TTs for Intra-band UL CA test cases

16.5.0
2020-09
RAN#89
R5-203690

0942

-

F
Introduce general requirement for UL CA test cases

16.5.0
2020-09
RAN#89
R5-203691

0943

-

F
Updating NR test case 6.2A.1- MOP for CA

16.5.0
2020-09
RAN#89
R5-203696

0946

-

F
Addition of general clause 7.1A

16.5.0
2020-09
RAN#89
R5-203697

0947

-

F
Updating REFSENS minimum requirements for Intra-band non-contiguous CA

16.5.0
2020-09
RAN#89
R5-203698

0948

-

F
Update of 7.4A.2-Maximum input level for 3DL CA

16.5.0
2020-09
RAN#89
R5-203700

0950

-

F
Update of test case 7.6A.2-Inband blocking for CA

16.5.0
2020-09
RAN#89
R5-203701

0951

-

F
Update of test case 7.6A.2.2 Inband blocking for 3DL CA

16.5.0
2020-09
RAN#89
R5-203735

0956

-

F
Add intra-band contiguous CA to 6.3A.2

16.5.0
2020-09
RAN#89
R5-203748

0958

-

F
Change of RB allocation start for test case 6.3.4.3

16.5.0
2020-09
RAN#89
R5-203777

0960

-

F
Update of NR test case 6.2.1 UE MOP for n30

16.5.0
2020-09
RAN#89
R5-203778

0961

-

F
Update of NR test case 6.2.2 UE MPR for n30

16.5.0
2020-09
RAN#89
R5-203780

0962

-

F
Update of NR test case 6.2D.1 UE MOP for UL MIMO for n30

16.5.0
2020-09
RAN#89
R5-203783

0964

-

F
Update of NR test case 6.5.3.2 Spurious Emissions for UE Co-Ex for n30

16.5.0
2020-09
RAN#89
R5-203786

0965

-

F
Update of NR test case 7.3 UE Ref Sens for n30

16.5.0
2020-09
RAN#89
R5-203788

0967

-

F
Update of NR test case 7.6.3 UE OBB for n30

16.5.0
2020-09
RAN#89
R5-203789

0968

-

F
Update of NR test case 7.6.4 UE NBB for n30

16.5.0
2020-09
RAN#89
R5-203879

0972

-

F
Correction of diversity characteristics requirement in section 7.2

16.5.0
2020-09
RAN#89
R5-203880

0973

-

F
Correction of UE mean power requirements Table numbers in SEM and ACLR test cases for SA FR1

16.5.0
2020-09
RAN#89
R5-203881

0974

-

F
Adding NOTEs to the test requirement tables in 6.2D.2

16.5.0
2020-09
RAN#89
R5-203885

0978

-

F
Correction of test requirement for 6.2.1

16.5.0
2020-09
RAN#89
R5-203967

0983

-

F
Editorial correction of 6.2.4

16.5.0
2020-09
RAN#89
R5-204010

0986

-

F
Correction to target power level Pmin for SA UL MIMO TCs

16.5.0
2020-09
RAN#89
R5-204035

0987

-

F
Updating NR test case 7.6A.3 for n48

16.5.0
2020-09
RAN#89
R5-204040

0989

-

F
Update of NR test case 7.7A Spurious response for CA

16.5.0
2020-09
RAN#89
R5-204054

0990

-

F
Correction to test Configuration of flatness for Pi/2 BPSK

16.5.0
2020-09
RAN#89
R5-204103

0991

-

F
Correction of QPSK UL RMC

16.5.0
2020-09
RAN#89
R5-204195

0996

-

F
Update 6.5.3.2 Spurious emission for UE co-existence

16.5.0
2020-09
RAN#89
R5-204202

0997

-

F
Update for 7.3A.0 Minimum conformance requirements for CA

16.5.0
2020-09
RAN#89
R5-204263

1001

-

F
Update of CSI-RS definition for DL RMCs in TS 38.521-1

16.5.0
2020-09
RAN#89
R5-204711

0933

1

F
Updating 6.2A.3-AMPR for CA for NS_43 and NS_01,NS_43U and NS_01

16.5.0
2020-09
RAN#89
R5-204760

0934

1

F
Cleaning up of Tx inter-band CA test cases

16.5.0
2020-09
RAN#89
R5-204761

1000

1

F
Editorial correction to FR1 co-existence requirements

16.5.0
2020-09
RAN#89
R5-204762

0923

1

F
Update of clause5 into TS 38.521-1 R15

16.5.0
2020-09
RAN#89
R5-204807

0993

1

F
Update of UE co-existence for CA_n1-n78

16.5.0
2020-09
RAN#89
R5-204808

0925

1

F
Update of R16 CADC combos in TS 38.521-1

16.5.0
2020-09
RAN#89
R5-204823

0916

1

F
Correction of test frequencies for NS_47

16.5.0
2020-09
RAN#89
R5-204824

0919

1

F
Adding band n48 to maximum output power and maximum output power reduction tests

16.5.0
2020-09
RAN#89
R5-204825

0984

1

F
Addition of 25MHz for NR band n1

16.5.0
2020-09
RAN#89
R5-204826

0985

1

F
Addition of AMPR NS_48 for NR band n1

16.5.0
2020-09
RAN#89
R5-204827

0992

1

F
Addition of n1 R16 new CBW into 38.521-1 Refsense test

16.5.0
2020-09
RAN#89
R5-204828

0924

1

F
Update of R16 new bands and CBWs in 38.521-1

16.5.0
2020-09
RAN#89
R5-204832

0952

1

F
Introduce of new TC 6.3A.4.1

16.5.0
2020-09
RAN#89
R5-204833

0953

1

F
Introduce of new TC 6.3A.4.2

16.5.0
2020-09
RAN#89
R5-204834

0954

1

F
Introduce of new TC 6.3A.4.3

16.5.0
2020-09
RAN#89
R5-204835

0955

1

F
Add intra-band contiguous CA to 6.3A.1

16.5.0
2020-09
RAN#89
R5-204836

0957

1

F
Add intra-band contiguous CA to 6.3A.3

16.5.0
2020-09
RAN#89
R5-204837

0949

1

F
Adding band n48 for Blocking characteristics testing

16.5.0
2020-09
RAN#89
R5-204839

0995

1

F
Updated to FR1 general clauses for NRSL eV2X

16.5.0
2020-09
RAN#89
R5-204854

0959

1

F
Correct UE output power configuration to some UL MIMO cases

16.5.0
2020-09
RAN#89
R5-204855

0969

1

F
Removal of editor's note about missing of Rel-15 In-gap OOB blocking requirement in RAN4 spec

16.5.0
2020-09
RAN#89
R5-204897

0929

1

F
Update to 7.5A.2 ACS for 3DL CA

16.5.0
2020-09
RAN#89
R5-204898

0988

1

F
Update of NR test case 7.5A Adjacent Channel selectivity for CA

16.5.0
2020-09
RAN#89
R5-204905

0975

1

F
Correction of 6.2D.1 and Test applicability of 6.5.2.4.2

16.5.0
2020-09
RAN#89
R5-204906

0976

1

F
Correction of test requirement for 6.2.4

16.5.0
2020-09
RAN#89
R5-204907

0977

1

F
Addition of test procedure and test requirement for PC2 fallback to PC3 for network signalling value NS_04

16.5.0
2020-09
RAN#89
R5-204908

0979

1

F
Adding additional tolerance to test requirement of 6.2.1, 6.2.2, 6.2.3 and 6.2.4

16.5.0
2020-09
RAN#89
R5-204909

0980

1

F
Update of 6.2.3 for minimum conformance requirements for A-MPR

16.5.0
2020-09
RAN#89
R5-204910

0970

1

F
Alignment of requirements in 7.6.3 and 7.6A.3 with the core spec

16.5.0
2020-09
RAN#89
R5-204911

0971

1

F
Removal of SDL bands from single carrier Rx TCs 7.6.2, 7.6.3 and 7.6.4

16.5.0
2020-09
RAN#89
R5-204912

0981

1

F
Update of SA Rx test cases for 4Rx UEs

16.5.0
2020-09
RAN#89
R5-204913

0998

1

F
Update Uplink power control window size for SA RX TCs

16.5.0
2020-09
RAN#89
R5-204960

0928

1

F
Addition of test cases for n28 with CBW of 30MHz

16.5.0
2020-09
RAN#89
R5-204961

0922

1

F
n26 Rx requirements in 38.521-1

16.5.0
2020-09
RAN#89
R5-204962

0966

1

F
Update of NR test case 7.6.2 UE IBB for n30

16.5.0
2020-09
RAN#89
R5-204974

0945

1

F
Updating of NR test case 6.2A.4-Configured output power for CA

16.5.0
2020-09
RAN#89
R5-204980

0930

2

F
Corrections and additions to 7.3A

16.5.0
2020-09
RAN#89
R5-204981

0931

2

F
Completing 3CA Rx cases 7.5A.2 and 7.7A.2

16.5.0
2020-09
RAN#89
R5-204984

0944

1

F
Update of NR test case 6.2A.2-MPR for CA

16.5.0
2020-09
RAN#89
RP-201670

1002

-

F
Adding FR1 PDCCH Aggregation Level in Annex C.3

16.5.0
2020-12
RAN#90
R5-205252

1005

-

F
Adding NR Band n53 to UE maximum output power and MPR test cases

16.6.0
2020-12
RAN#90
R5-205254

1007

-

F
Adding NR Band n53 into Spurious emission for UE co-existence

16.6.0
2020-12
RAN#90
R5-205299

1011

-

F
Update of clause 5 in TS 38.521-1 R15

16.6.0
2020-12
RAN#90
R5-205490

1014

-

F
Update of Reference sensitivity power level for R16 new CBW of n3

16.6.0
2020-12
RAN#90
R5-205493

1015

-

F
Correction of diversity characteristics requirement in section 7.2

16.6.0
2020-12
RAN#90
R5-205494

1016

-

F
Correction of minimum conformance requirements and test requirement for narrow band blocking for Intra-band contiguous CA

16.6.0
2020-12
RAN#90
R5-205495

1017

-

F
Correction of Allocated slots per Frame for DL reference measurement channels

16.6.0
2020-12
RAN#90
R5-205535

1018

-

F
Correcting RB start for test case 6.3C.4.2

16.6.0
2020-12
RAN#90
R5-205537

1019

-

F
Update of NR test case 6.2.1 UE MOP for n14

16.6.0
2020-12
RAN#90
R5-205550

1023

-

F
Update of NR test case 7.3 UE Ref Sens for n14

16.6.0
2020-12
RAN#90
R5-205551

1024

-

F
Update of NR test case 7.6.2 UE IBB for n14

16.6.0
2020-12
RAN#90
R5-205552

1025

-

F
Update of NR test case 7.6.3 UE OBB for n14

16.6.0
2020-12
RAN#90
R5-205553

1026

-

F
Update of NR test case 7.6.4 UE NBB for n14

16.6.0
2020-12
RAN#90
R5-205557

1028

-

F
Updating abbreviation list

16.6.0
2020-12
RAN#90
R5-205569

1031

-

F
Adding 30 MHz channel bandwidth to test requirements for UL MIMO Spurious

16.6.0
2020-12
RAN#90
R5-205574

1032

-

F
Co-existence Table corrections related to n65

16.6.0
2020-12
RAN#90
R5-205700

1043

-

F
Addition of V2X reference measurement channels

16.6.0
2020-12
RAN#90
R5-205731

1045

-

F
Introduce General requirement for CA configurations

16.6.0
2020-12
RAN#90
R5-205732

1046

-

F
Adding RB allocation for channel BW 70MHz

16.6.0
2020-12
RAN#90
R5-205733

1047

-

F
Updating test configuration tables for intra-band UL CA test cases

16.6.0
2020-12
RAN#90
R5-205734

1048

-

F
Updating NR test case MOP for MIMO for several NR bands

16.6.0
2020-12
RAN#90
R5-205735

1049

-

F
Updating NR test case MPR for MIMO for several NR bands

16.6.0
2020-12
RAN#90
R5-205736

1050

-

F
Updating minimum requirement for OBW for inter-band CA

16.6.0
2020-12
RAN#90
R5-205737

1051

-

F
Update OBW testing for intra-band UL CA

16.6.0
2020-12
RAN#90
R5-205743

1055

-

F
Updating NR test case 7.4A.2-Maximum input level for 3 DL CA

16.6.0
2020-12
RAN#90
R5-205745

1056

-

F
Updating NR test case 7.5A.2- Adjacent channel selectivity for 3DL CA

16.6.0
2020-12
RAN#90
R5-205746

1057

-

F
Updating NR test case 7.6A.2.2- In-band Blocking for 3DL CA

16.6.0
2020-12
RAN#90
R5-205748

1058

-

F
Updating Narrow band blocking for CA for band n48

16.6.0
2020-12
RAN#90
R5-205790

1061

-

F
Removing the highest SCS from test configuration for Tx spurious emissions for UL MIMO

16.6.0
2020-12
RAN#90
R5-205791

1062

-

F
Update of MPR for PC3 half Pi BPSK DMRS in 6.2.2

16.6.0
2020-12
RAN#90
R5-205796

1066

-

F
Update of MOP for UL MIMO with ULFPTx in 6.2D.1

16.6.0
2020-12
RAN#90
R5-205799

1068

-

F
Addition of new test case 6.5D.3_1.2 UE co-existence spurious emissions for Rel-16 UL MIMO

16.6.0
2020-12
RAN#90
R5-205800

1069

-

F
Addition of new test case 6.5D.3_1.3 additional spurious emissions for Rel-16 UL MIMO

16.6.0
2020-12
RAN#90
R5-205852

1070

-

F
Correction of RAR timing for PRACH TC 6.3.3.4 and EVM TC 6.4.2.1

16.6.0
2020-12
RAN#90
R5-205872

1073

-

F
Editorial correction to minimum requirements of REFSENS for CA

16.6.0
2020-12
RAN#90
R5-205879

1075

-

F
Update of Rx test cases to add 40MHz for NR band n38

16.6.0
2020-12
RAN#90
R5-205882

1076

-

F
Update of A-MPR for NS_18

16.6.0
2020-12
RAN#90
R5-206022

1082

-

F
Update of 6.3.1 for UE minimum output power test

16.6.0
2020-12
RAN#90
R5-206088

1088

-

F
Correction to ASEM for NS_27

16.6.0
2020-12
RAN#90
R5-206160

1102

-

F
Correction of Test Message Table 6.3.3.4.4.3-2 in section 6.3.3.4

16.6.0
2020-12
RAN#90
R5-206638

1071

1

F
Handling of delta Tib for UE supporting multiple band combinations

16.6.0
2020-12
RAN#90
R5-206639

1077

1

F
Update of A-MPR for NS_46

16.6.0
2020-12
RAN#90
R5-206640

1090

1

F
Update for 6.5.3.2 Spurious emission for UE co-existence

16.6.0
2020-12
RAN#90
R5-206641

1092

1

F
Correction for 6.3.3.6 SRS time mask

16.6.0
2020-12
RAN#90
R5-206642

1098

1

F
Correction to spurious co-existence requirements for n28 and n83

16.6.0
2020-12
RAN#90
R5-206643

1044

1

F
CR to update DMRS position in UL RMC for FR1

16.6.0
2020-12
RAN#90
R5-206718

1037

1

F
Addition of UL CA combinations to maximum output power for Inter-band CA

16.6.0
2020-12
RAN#90
R5-206719

1035

1

F
Update of 7.5A.3 Adjacent channel selectivity for 4DL CA

16.6.0
2020-12
RAN#90
R5-206740

1006

1

F
Adding NR Band n53 to UE additional maximum output power reduction test cases

16.6.0
2020-12
RAN#90
R5-206741

1008

1

F
Adding NS_45 to Additional spurious emissions test case for NR Band n53

16.6.0
2020-12
RAN#90
R5-206742

1020

1

F
Update of NR test case 6.2.2 UE MPR for n14

16.6.0
2020-12
RAN#90
R5-206743

1021

1

F
Update of NR test case 6.2.3 UE A-MPR for n14

16.6.0
2020-12
RAN#90
R5-206744

1022

1

F
Update of NR test case 6.5.3.2 Spurious Emissions for UE Co-Ex for n14

16.6.0
2020-12
RAN#90
R5-206745

1029

1

F
Adding A-MPR test for band n30 with NS_21

16.6.0
2020-12
RAN#90
R5-206746

1030

1

F
Adding additional Spectrum emission test for band n30 with NS_21

16.6.0
2020-12
RAN#90
R5-206747

1041

1

F
Update of NR test case 6.5.2.3 Additional Spectrum Emission Mask for n30

16.6.0
2020-12
RAN#90
R5-206748

1074

1

F
Update of Tx test cases to add 40MHz for NR band n38

16.6.0
2020-12
RAN#90
R5-206749

1080

1

F
Correction of 6.3.2 for UE transmit OFF power test

16.6.0
2020-12
RAN#90
R5-206750

1096

1

F
Adding n26 Tx requirements

16.6.0
2020-12
RAN#90
R5-206751

1009

1

F
Adding NR Band n53 Receiver requirements

16.6.0
2020-12
RAN#90
R5-206761

1010

1

F
Update of Test case 6.3A.4.1

16.6.0
2020-12
RAN#90
R5-206762

1034

1

F
Update of Test case 6.3A.4.3

16.6.0
2020-12
RAN#90
R5-206763

1059

1

F
Updating NR test case 7.8A.2.2-Wide band Intermodulation for 3DL CA

16.6.0
2020-12
RAN#90
R5-206764

1078

1

F
Addition of 6.2E.1.1 V2X MOP for non-concurrent

16.6.0
2020-12
RAN#90
R5-206765

1079

1

F
Addition of 7.3E.2 V2X REFSENS for non-concurrent

16.6.0
2020-12
RAN#90
R5-206766

1063

1

F
Update of SEM for PC3 half Pi BPSK DMRS in 6.5.2.2

16.6.0
2020-12
RAN#90
R5-206767

1064

1

F
Update of NR ACLR for PC3 half Pi BPSK DMRS in 6.5.2.4.1

16.6.0
2020-12
RAN#90
R5-206768

1067

1

F
Addition of new test case 6.5D.3_1.1 general spurious emissions for Rel-16 UL MIMO

16.6.0
2020-12
RAN#90
R5-206863

1060

1

F
Update of signalling configuration for almost contiguous allocation across clause 6

16.6.0
2020-12
RAN#90
R5-206864

1053

1

F
Updating NR test case REFSENS for 2DL CA

16.6.0
2020-12
RAN#90
R5-206879

1036

1

F
Addition of 2UL CA exception to reference sensitivity test case

16.6.0
2020-12
RAN#90
R5-206880

1039

1

F
Update of Refsense test case for CA_n1A-n78A into 38.521-1

16.6.0
2020-12
RAN#90
R5-206881

1040

1

F
Update of Refsense test case for CA_n1A-n77A into 38.521-1

16.6.0
2020-12
RAN#90
R5-206882

1042

1

F
Update of R16 CADC configurations into 38.521-1 clause 5

16.6.0
2020-12
RAN#90
R5-206888

1089

1

F
Update for 6.5D.3.3 Additional spurious emissions for UL MIMO

16.6.0
2020-12
RAN#90
R5-206889

1094

1

F
Update for 6.5.3.3 Additional spurious emission

16.6.0
2020-12
RAN#90
R5-206890

1012

1

F
Update of R16 new band and CBWs into TS 38.521-1 clause 5

16.6.0
2020-12
RAN#90
R5-206891

1033

1

F
Update of Test case 6.3A.4.2

16.6.0
2020-12
RAN#90
R5-206892

1054

1

F
Updating NR test case REFSENS for 3DL CA

16.6.0
2020-12
RAN#90
R5-206894

1027

1

F
Addition of test case 6.5D.1_1, Occupied bandwidth for UL MIMO (Rel-16 onward)

16.6.0
2020-12
RAN#90
R5-206901

1093

1

F
Update for 6.5A.3.2 Spurious emission for UE co-existence

16.6.0
2020-12
RAN#90
R5-206912

1091

1

F
Update for 6.5A.3.1 General spurious emissions for CA

16.6.0