# 3GPP TR 38.889 V16.0.0 (2018-12) Technical Report

**3rd Generation Partnership Project;** 

Technical Specification Group Radio Access Network; Study on NR-based access to unlicensed spectrum (Release 16)





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#### Keywords

NR, radio, unlicensed spectrum, physical layer

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## Foreword

This Technical Report has been produced by the 3<sup>rd</sup> Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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## Introduction

A study item, "Study on NR-based Access to Unlicensed Spectrum", was approved at 3GPP TSG RAN #77 [2] and revised in 3GPP TSG RAN #80 [30]. This study is to determine a single global solution for NR-based access to unlicensed spectrum, to be compatible with the NR concepts.

The objectives of the study include:

- Study NR-based operation in unlicensed spectrum (RAN1, RAN2, RAN4) including
  - Physical channels inheriting the choices of duplex mode, waveform, carrier bandwidth, subcarrier spacing, frame structure, and physical layer design made as part of the NR study and avoiding unnecessary divergence with decisions made in the NR WI
    - Consider unlicensed bands below 7GHz
    - Consider similar forward compatibility principles made in the NR WI
  - Initial access, channel access. Scheduling/HARQ, and mobility including connected/inactive/idle mode operation and radio-link monitoring/failure
  - Coexistence methods within NR-based and between NR-based operation in unlicensed and LTE-based LAA and with other incumbent RATs in accordance with regulatory requirements in e.g., 5GHz , 6GHz bands
    - Coexistence methods already defined for 5GHz band in LTE-based LAA context should be assumed as the baseline for 5GHz operation. Enhancements in 5GHz over these methods should not be precluded. NR-based operation in unlicensed spectrum should not impact deployed Wi-Fi services (data, video and voice services) more than an additional Wi-Fi network on the same carrier

The above study will address the following architectural scenarios (RAN2):

- An NR-based LAA cell(s) connects with an LTE or NR anchor cell operating in licensed spectrum
  - The study assumes the techniques for linking between Pcell (LTE or NR licensed CC) and Scell (NR unlicensed CCs) according to the NR WI
- An NR-based cell operating standalone in unlicensed spectrum, connected to a 5G-CN network, e.g., for private network deployments;
- Study how to ensure from a RAN level that connection and security management can be integrated with the E-UTRAN, NG RAN and 5G CN architecture, including service continuity requirements for users moving between cells of licensed and unlicensed frequency bands, liaising with SA2 as required

The results and findings of the study are documented in this technical report.

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# 1 Scope

The present document contains the results and findings from the study item, "Study on NR-based Access to Unlicensed Spectrum" [2]. The purpose of this TR is to document the identified NR enhancements and corresponding evaluations for a single global solution framework for NR based access to unlicensed spectrum.

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This document addresses evaluation methodology and possible scenarios for NR based unlicensed deployments.

This technical report documents the existing regulatory requirements for unlicensed spectrum deployment in the 5GHz bands, [and other bands]

This document identifies and captures coexistence evaluations of physical layer options and enhancements to NR and, if necessary, NR RAN protocols to meet the requirements and targets for unlicensed spectrum deployments.

This document contains an assessment of the feasibility of base station and terminal operation of 5GHz band (based on regulatory limits) in conjunction with relevant licensed frequency bands.

This document is a 'living' document, i.e. it is permanently updated and presented to TSG-RAN meetings.

## 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.
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# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

1x RTT	CDMA2000 1x Radio Transmission Technology
ACK	Acknowledgement
ACLR	Adjacent Channel Leakage Ratio
AP	Access Point
AUL-UCI	AUL uplink control information
BCH	Broadcast Channel
CA	Carrier Aggregation
CAT	Category
CBG	Code Block Group
CBGTI	Code block group transmission information
CCA	Clear Channel Assesment
CFI	Control Format Indicator
CG	Cell Group
CIF	Carrier Indicator Field
СР	Cyclic prefix
CPICH	Common Pilot Channel
CQI	Channel Quality Indicator
CRB	Common resource block
CRC	Cyclic Redundancy Check
CRI	CSI-RS resource indicator
CRS	Cell-specific Reference Signal
CSI	Channel-State Information
CSI-IM	CSI-interference measurement
CTS	Clear To Send
CWS	Contention Window Size
DAI	Downlink Assignment Index
DC	Dual Connectivity
DFI	Downlink Feedback Information
DFS	Dynamic Frequency Selection
DL-SCH	Downlink Shared Channel
DMRS	Dedicated demodulation reference signal
DM-RS	Demodulation reference signal
DMTC	DRS Measurement Timing Configuration
DRS	Discovery Reference Signal
DTX	Discontinuous Transmission
ECCE	Enhanced Control Channel Element
ED	Energy Detection
EDT	Early Data Transmission
EN-DC	E-UTRA NR dual connectivity with MCG using E-UTRA and SCG using NR
EPDCCH	Enhanced Physical Downlink Control CHannel
EPRE	Energy Per Resource Element
EREG	Enhanced Resource-Element Group
E-SMLC	Enhanced Serving Mobile Location Centre

	E-related LITD A
E-UTRA	Evolved UTRA
E-UTRAN	Evolved UTRAN
FBE	Frame Based Equipment
FDD	Frequency Division Duplex
FR1	Frequency range 1 as defined in [8, TS 38.104]
FR2	Frequency range 2 as defined in [8, TS 38.104]
FR	Frequency range
FWA	Fixed Wireless Access
GNSS	Global Navigation Satellite System
GSCN	Global synchronization channel number
GSM	Global System for Mobile communication
HARQ	Hybrid automatic repeat request
HI	HARQ indicator
HRPD	CDMA2000 High Rate Packet Data
IE	Information element
ISD	Inter Site Distance
LAA	Licensed-Assisted Access
LBE	Load Based Equipment
LBT	Listen Before Talk
LDPC	Low density parity check
LI	Layer indicator
LMU	Location Measurement Unit
MCG	Master Cell Group
MCH	Multicast channel
MCS	Modulation and Coding Scheme
MMSE	Minimum Mean Squared Error
MUST	Multiuser Superposition Transmission
MWUS	MTC Wake-Up Signal
NACK	Negative Acknowledgement
NCCE	Narrowband Control Channel Element
NDI	New Data Indication
NN-DC	NR NR dual connectivity
NPBCH	Narrowband Physical Broadcast channel
NPDCCH	Narrowband Physical Downlink Control channel
NPDSCH	
NPRACH	Narrowband Physical Downlink Shared channel
-	Narrowband Physical Random Access channel
NPRS	Narrowband Positioning Reference Signal
NPUSCH	Narrowband Physical Uplink Shared channel
NRS	Narrowband Reference Signal
NR-U	New Radio Unlicensed
NSSS	Narrowband Secondary Synchronization Signal
OCB	Occupied Channel Bandwidth
OFDM	Orthogonal frequency division multiplex
PBCH	Physical Broadcast Channel
P-CCPCH	Primary Common Control Physical Channel
PCell	Primary cell
PCFICH	Physical Control Format Indicator CHannel
PDCCH	Physical Downlink Control CHannel
PD	Packet Detection
PDSCH	Physical Downlink Shared CHannel
PHICH	Physical Hybrid-ARQ Indicator CHannel
РМСН	Physical Multicast CHannel
PMI	Precoding matrix indicator
PRACH	Physical Random Access CHannel
PRG	Precoding Resource Block Group
PSBCH	Physical Sidelink Broadcast CHannel
PSCCH	Physical Sidelink Control CHannel
PSCell	Primary Secondary cell
PSDCH	Physical Sidelink Discovery CHannel
PSD	Power Spectral Density
PSSCH	Physical Sidelink Shared CHannel

DCCC	Driver Cidelinh Construction Circal
PSSS	Primary Sidelink Synchronisation Signal
PTI	Precoding Type Indicator
PTRS	Phase-tracking reference signal
PUCCH	Physical Uplink Control CHannel
PUSCH	Physical Uplink Shared CHannel
QCL	Quasi-collocation
RACH	Random Access channel
RAT	Radio Access Technology
RBG	Resource Block Group
REG	Resource-Element Group
RE	Resource Element
RI	Rank indicator
RLAN	Radio Local Area Network
RLM	Radio link monitoring
RRM	Radio resource management
RSCP	Received Signal Code Power
RS	Reference Signal
RSRP	Reference Signal Received Power
RSRQ	Reference Signal Received Quality
RSTD	Reference Signal Time Difference
	8
RTS	Request To Send
RVID	Redundancy Version ID
SA	Stand Alone
SCCE	Short Control Channel Element
SCI	Sidelink Control Information
SCS	Subcarrier Spacing
SINR	Signal to Interference plus Noise Ratio
SL-BCH	Sidelink Broadcast Channel
SL-DCH	Sidelink Discovery Channel
SL-SCH	Sidelink Shared Channel
SPDCCH	Short Physical Downlink Control CHannel
SPS C-RNTI	Semi-Persistent Scheduling C-RNTI
SPUCCH	Short Physical Uplink Control CHannel
SREG	Short Resource-Element Group
SRI	SRS resource indicator
SRS	Sounding Reference Symbol
SSSS	Secondary Sidelink Synchronisation Signal
STA	Station or UE
SUL	Supplementary uplink
TAG	Timing Advance Group
TBS	Transport Block Size
TDD	Time Division Duplex
TPC	Transmit power control
TPMI	Transmitted Precoding Matrix Indicator
TrCH	
TRP	Transport channel Tx/Rx Point
UE	User Equipment
UL-SCH	Uplink Shared Channel
UMi	Urban Micro
UTRAN	Universal Terrestrial Radio Access Network
WAS	Wireless Access Systems
ZP CSI-RS	Zero power CSI-RS

# 4 Regulatory requirements

## 4.1 Regulatory requirements for 5GHz band

The range 5150-5925 MHz, or parts thereof, is potentially available for license-assisted access to unlicensed operation. This represents a significant amount of spectrum that can be used by operators to augment their service offerings in

licensed bands. The range above can be operated under a license-exempt regime or ISM but must be shared with existing mobile services and other incumbent services. The quality of service offered by a licensed regime can therefore not be matched. Hence, unlicensed access is viewed as complementary, and does not reduce the need for additional allocations for licensed operation in view of the increased demand for wireless broadband access.

It is relevant to consider the global (International) ITU-R allocations and technical provisions first. These could be basis for defining globally harmonised bands for LAA and starting points for requirements and limits before the local variations are considered.

#### 5150-5350 and 5470-5725 MHz

WRC 2003 allocated the bands 5 150-5 350 MHz and 5 470-5 725 MHz on a co-primary basis to the mobile service for the implementation of "wireless access systems (WAS), including radio local area networks (RLANs)". This was subject to technical and regulatory provisions included in the radio regulations given in Resolution 229 (WRC-03), which was subsequently revised at WRC-12 to Resolution 229 (Rev. WRC-12) [38]. These provisions are followed by many Administrations and resolves:

- 1) that the use of these bands by the mobile service will be for the implementation of WAS, including RLANs, as described in the most recent version of Recommendation ITU-R M.1450;
- 2) that in the band 5 150-5 250 MHz, stations in the mobile service shall be restricted to indoor use with a maximum mean e.i.r.p. of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band or equivalently 0.25 mW/25 kHz in any 25 kHz band;
- 3) that administrations may monitor whether the aggregate pfd levels given in Recommendation ITU-R S.1426 have been, or will be exceeded in the future, in order to enable a future competent conference to take appropriate action;
- 4) that in the band 5 250-5 350 MHz, stations in the mobile service shall be limited to a maximum mean e.i.r.p. of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band. Administrations are requested to take appropriate measures that will result in the predominant number of stations in the mobile service being operated in an indoor environment. Furthermore, stations in the mobile service that are permitted to be used either indoors or outdoors may operate up to a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band, and, when operating above a mean e.i.r.p. of 200 mW, these stations shall comply with the following e.i.r.p. elevation angle mask where θ is the angle above the local horizontal plane (of the Earth):

-13 dB(W/MHz) for  $0^{\circ} \le \theta < 8^{\circ}$ 

 $-13 - 0.716(\theta - 8) \text{ dB}(W/MHz) \text{ for } 8^{\circ} \le \theta < 40^{\circ}$ 

 $-35.9 - 1.22(\theta-40)$  dB(W/MHz) for  $40^{\circ} \le \theta \le 45^{\circ}$ 

-42 dB(W/MHz) for  $45^{\circ} < \theta$ ;

- 5) that administrations may exercise some flexibility in adopting other mitigation techniques, provided that they develop national regulations to meet their obligations to achieve an equivalent level of protection to the EESS (active) and the SRS (active) based on their system characteristics and interference criteria as stated in Recommendation ITU-R RS.1632;
- 6) that in the band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW<sup>3</sup> (administrations with existing regulations prior to WRC 03 may exercise some flexibility in determining transmitter power limits) with a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band;
- 7) that in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;
- 8) that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures found in Annex 1 to Recommendation ITU-R M.1652-1 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems,

This resolution makes DFS as described in the Annex 1 of ITU-R Recommendation M.1652-1 [39] mandatory, the basis for the DFS requirements developed e.g. in Europe and the US.

WAS is defined as end-user radio connections to public or private core networks, while primary allocation means that the services can claim protection from services of the secondary service. However, the WAS/RLAN services must protect the incumbent primary services.

Even if primary in the International table of allocations, this may not be the case in all countries. The bands are not allocated on a primary basis in the US allocation table, but to the Part 15 rules that provide for operation of low power radio transmitters without a license (secondary service operated on a non-interference basis).

### 5725-5850 MHz

The 5725-5875 MHz is allocated for ISM applications by means a footnote in the allocation table. Radiolocation is allocated on primary basis up to 5850 MHz so DFS is required up to this limit. Operation in 5725-5850 MHz is allowed in the US under the Part 15 rules (15.247 and 15.407).

#### 5850-5925 MHz

The band is allocated to the mobile service on a primary basis in all regions. In Europe it has been decided (2008) to harmonise the use of the 5875-5925 MHz frequency band for Intelligent Transport Systems (ITS). Similarly, according to the US allocation table, the use of the non-Federal mobile service in the band 5850-5925 MHz is limited to Dedicated Short Range Communications operating in the Intelligent Transportation System radio service.

## 4.1.1 ITU Region 1

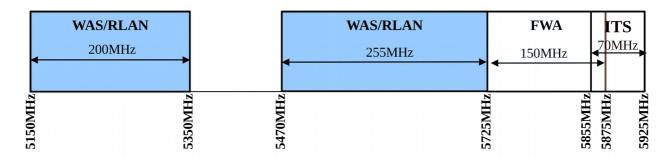
### 4.1.1.1 Europe

The European regulation is determined by the European Commission and the ECC. The relevant regulations for the 5 GHz bands are found in two Commission Decisions [8, 9] and one ECC Decision [10]. These are interpreted by ETSI and used as a basis for harmonized standards, which are used for conformance declaration when products are placed on the European market. Harmonized European standards have a higher regulatory relevance than other product standards, since they are produced based on a mandate from the Commission with reference to an EU directive. They also go through a public enquiry and voting process, and are cited by the Commission. The European requirements on 5 GHz unlicensed deployment are specified in three ETSI harmonized standards [5, 6, and 7]. Figure 4.1.1.1-1 summarizes the relevant parts of the 5 GHz band set aside for unlicensed spectrum usage. The 5150-5350 MHz and the 5470-5725 MHz bands are referred here as the broadband radio access networks (BRAN) bands where the wireless access systems (WAS) including RLAN equipment are operating in. Moreover, the 5725-5875 MHz band (in the BRAN domain) is used by the fixed wireless access (FWA) networks and finally the intelligent transport systems (ITS) utilize the 5855-5925 MHz band.

The BFWA and the ITS are designated by the ECC for use as parts of the 5 GHz band and the relevant regulations are found in:

- An ECC Recommendation for FBWA [14], and
- A Commission Decision [15], an ECC Decision [16] and an ECC Recommendation for ITS [17].

General purpose SRD devices can also operate in the band 5725-5875 MHz under the provisions of the ETSI harmonised standard EN 300 440 [18], but with reduced max EIRP of 25 mW.

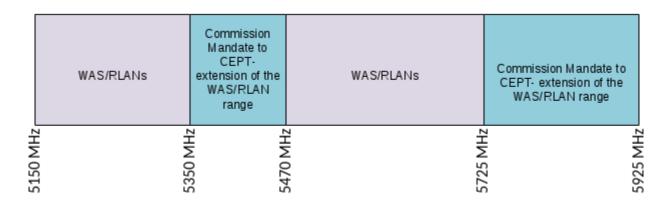


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Figure 4.1.1.1-1: 5 GHz spectrum allocations in Europe.

The European Commission has recently submitted to CEPT a mandate to study the conditions for the extension of the 5 GHz range designated for WAS/RLANs [19] in order to allow the use by WAS/RLANs of the whole 5150-5925 MHz band.

ECC approved CEPT Report 57 in March 2015 in response to the mandate based on the results of the Public Consultation. CEPT has carried out a significant amount of work but studies on mitigation techniques have not been completed in the timeframe and there are still a number of open issues ongoing.



### Figure 4.1.1.1-2: Summary of existing and proposed EU regulations for WAS/RLANs in the 5GHz band

In the rest of this section, the specified ETSI requirements for the WAS/RLAN and FWA bands are summarized. Table 4.1.1.1-1 provides the limits on the transmit power control (TPC), the RF output power and power density given by the mean EIRP and the mean EIRP density at the highest power level. Additionally the requirements on the transmitter out of band emissions are listed in Table 4.1.1.1-2, Figures 4.1.1.1-3a, and Figure 4.1.1.1-3b. Table 4.1.1.1-4 illustrates the DFS requirements for some of these bands in Europe. Moreover, the 5150-5350 MHz is restricted to indoor deployments.

Transmit Power Control (TPC) is a mechanism to be used by the RLAN device to ensure a mitigation factor of at least 3 dB on the aggregate power from a large number of devices. This requires the RLAN device with TPC to have a TPC range for which the lowest value is at least 6 dB below the values for mean EIRP given in Table 4.1.1.1-1.

In ETSI EN 301 893 [5], the requirements on the Nominal Channel Bandwidth and the Occupied Channel Bandwidth are defined for unlicensed spectrum in the 5 GHz region. The Nominal Channel Bandwidth, i.e., the widest band of frequencies inclusive of guard bands assigned to a single channel, shall be at least 5MHz at all times. The Occupied Channel Bandwidth, i.e., the bandwidth containing 99 % of the power of the signal, shall be between 80 % and 100 % of the declared Nominal Channel Bandwidth. During an established communication, a device is allowed to operate temporarily in a mode where its Occupied Channel Bandwidth may be reduced to as low as 40 % of its Nominal Channel Bandwidth with a minimum of 4 MHz. The Occupied Channel Bandwidth is determined by the test procedure defined in Section 5.3.3.2 in [5].

ETSI mandates the usage of DFS in some bands as shown in Table 4.1.1.1-4. Furthermore, a Listen-Before-Talk (LBT) mechanism is requested independently of whether the channel is occupied or not (Section 4.2.7 of [5]). Note that no LBT requirement is requested in [6] for the FWA band.

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	Freq. range (MHz)	Max Mean EIRP (dBm)	Max Mean EIRP density (dBm/MHz)	Comment
WAS/RLAN	5150-5350	23	10	20 MHz and 40 MHz
	5470-5725	30	17	channels
FWA	5725-5875	33	23	10 MHz channels
	5725-5875	36	23	20 MHz channels

#### Table 4.1.1.1-1: TPC, Transmit power and power spectral density requirements in Europe

Transmit Power Control (TPC):

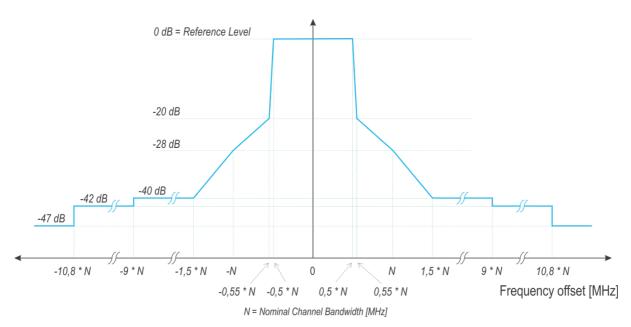
TPC ensures an average reduction in the aggregated transmission power by at least 3 dB (5 dB for FWA) compared with the maximum permitted transmission power.

TCP is not required for channels within the band 5150-5250 MHz.

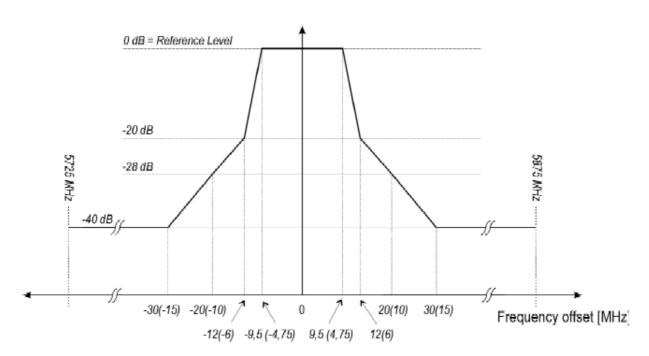
Without TPC, the highest permissible average EIRP (density) are reduced by 3 dB.

### Table 4.1.1.1- 2: Requirements on out of band emissions in Europe

	Frequency range	Max. power	Bandwidth
	30-47 MHz	-36 dBm	100 kHz
	47-74 MHz	-54 dBm	100 kHz
	75-87.5 MHz	-36 dBm	100 kHz
	87.5-118 MHz	-54 dBm	100 kHz
	118-174 MHz	-36 dBm	100 kHz
WAS/RLAN,	174-230 MHz	-54 dBm	100 kHz
FWA	230-470 MHz	-36 dBm	100 kHz
	470-862 MHz	-54 dBm	100 kHz
	0.862-1 GHz	-36 dBm	100 kHz
	1-5.15 GHz	-30 dBm	1 MHz
	5.35-5.5.47 GHz	-30 dBm	1 MHz
	5.725-26 GHz	-30 dBm	1 MHz



NOTE: dBc is the spectral density relative to the maximum spectral power density of the transmitted signal. Figure 4.1.1.1-3a: Transmit spectral power mask for RLAN equipment operating within the frequency bands 5150-5250 MHz; 5250-5350 MHz or 5470-5725 MHz



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NOTE1: 0 dB Reference Level is the spectral density relative to the maximum spectral power density of the transmitted signal.

NOTE2: On the Frequency Offset axis, the figures apply to ChS = 20 MHz whereas the figures in parentheses apply to ChS = 10 MHz.

NOTE3: Emissions that fall outside the lower and upper band frequency limits of 5 725 MHz and 5 875 MHz, respectively shall instead meet the unwanted emission limits of clause 4.3.1 [6].

Figure 4.1.1.1-3b: Transmit spectral power mask for FBWA equipment operating within the frequency band 5725-5875 MHz

FWA devices in the 5.8 GHz range are also subject to an additional requirement of EIRP spectral density limit in the elevation plane, see Table 5.

EIRP spectral density	Elevation angle	
For sectorised (e.g. P-MP Central or Base Station) and Omni-directional deployments:		
-7 dB(W/MHz)	$0^\circ \le \theta < 4^\circ$	
-2.2 - (1.2*θ) dB(W/MHz)	$4^\circ \le \theta \le 15^\circ$	
-18.4 - (0.15*θ) dB(W/MHz)	$\theta > 15^{\circ}$	
For P-MP Customer Terminal Station and P-P deployments:		
-7 dB(W/MHz)	for $0^\circ \le \theta < 8^\circ$	
-2.68 -(0.54*θ) dB(W/MHz)	8° ≤ θ < 32°	
-20 dB(W/MHz)	32° ≤ θ ≤50°	
-10 - (0.2*θ) dB(W/MHz)	θ > 50°	

Table 4.1.1.1-4: DFS req	uirements in Eu	rope
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Parameter

Requirement

Comments

DFS Threshold (dBm) for WAS/RLAN	-62(dBm) + 10(dBm/MHz) - EIRP Spectral density (dBm/MHz) + G(dBi)	*No DFS requirements on 5150 MHz – 5250 MHz *G denotes antenna gain			
DFS Threshold (dBm) for FWA	-69 (dBm) + 23(dBm/MHz) - EIRP Spectral density (dBm/MHz) + G(dBi)	*No DFS requirements on 5850 MHz – 5875 MHz *G denotes antenna gain			
Channel Availability check	60 seconds outside 5600-5650 MHz 10 minutes inside 5600-5650 MHz	Master mode			
Channel move time	10 seconds	Master and slave modes			
Non-occupancy time	30 minutes	After radar detection in either channel availability check or in-service monitoring			
Uniform Spreading is required across the frequency ranges 5150 -5350 MHz and 5470-5725 MHz. Uniform Spreading is not applicable for equipment that only operates in 5150-5250 MHz band.					

### **Interference to Weather Radars**

Interference to Weather Radars is also a hot topic in the EU. The two last versions of EN 301 893 (1.6.1 and 1.7.1) have included amendments to better protect these radars, like the prohibition to give the user access to the configuration control settings that would allow him to disconnect the DFS functionality.

The use of the band 5.60-5.65 GHz by WLANs is allowed in Europe, and a Market Surveillance campaign on WLANs 5 GHz has been led at EU level by the ADCO R&TTE Group. The report [20] of the campaign has proposed specific recommendations to improve the situation. These recommendations do not require amendments to the last version of EN 301 893.

### 4.1.1.2 Israel

In Israel the bands 5150-5250 MHz and 5250-5350 MHz are open to RLANs.

### 4.1.1.3 Russia

In the Russian Federation the bands 5150-5350 MHz, the band 5470-5725 MHz above 5650 MHz and the band 5725-5825 MHz [20] are allowed to RLANs. Use of DFS is not mandated.

### 4.1.1.4 South Africa

In South Africa the bands 5150-5250 MHz and 5250-5350 MHz are available to RLANs but restricted to indoor use. The band 5470-5725 MHz is also open to RLANs.

### 4.1.1.5 Turkey

In Turkey the bands 5150-5250 MHz and 5250-5350 MHz are restricted to indoor use. DFS and TPC are mandated in the band 5470-5725 MHz.

### 4.1.2 ITU Region 2

### 4.1.2.1 USA

The use of unlicensed 5 GHz spectrum in USA is governed by FCC part 15 regulations [3]. In Feb 2013, potential new rules were proposed in FCC 13-22 [4]. Figure 4.1.2.1-1 summarizes the relevant part 15 rules for 5GHz unlicensed spectrum usage:

U-NII-1 U-NII-2A	New Band	U-NII-2C	U-NII-3 (100 MHz)	New Band		
(100 MHz)	(100 MHz)	U-NII-2B (120 MHz)	(255 MHz)	Part 15.247 Ru (125 MHz)	les	U-NII-4 (75 MHz)
0GHz 5.25	)GHz 5.350	GHz 5.470GH	2	5.725GHz	5.85	0GHz 5.925

Figure 4.1.2.1-1 : Summary of existing and proposed new FCC part 15 rules for 5GHz unlicensed spectrum usage

In Figure 4.1.2.1-1, U-NII-x bands denote frequency bands for Unlicensed National Information Infrastructure devices usage that are governed by §15.407 [3]. As shown in the figure, there is also an overlapping ruling of §15.247 from 5.725 to 5.85 GHz. A device could choose to follow either U-NII rulings or §15.247 rulings when operating within the frequency range.

In the rest of this section, we summarize FCC paragraphs 15.407 and 15.247 rules. In general either frequency hopping or digital modulation techniques are permitted under part 15 rules. Since LTE is not designed as a frequency hopping system, the rest of the document will focus on regulations related to digital modulation.

Paragraph 15.247 rules relevant for LTE point to multi-point communications are summarized in 4 aspects:

- Transmission Bandwidth:
  - The minimum 6 dB bandwidth shall be at least 500 kHz.
- Maximum Transmit Power:
  - Peak conducted output power shall not exceed 1 W. An alternative to peak power measurements is maximum conducted output power, which is the total transmit power over all antennas and antenna elements when the transmitter is operating at its maximum power control level.
  - Note that, the conducted output power limit is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
- Out of Band Emission:
  - In any 100 kHz bandwidth outside the frequency band, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
- Power Spectrum Density:
  - The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. The same method of determining the conducted output power shall be used to determine the power spectral density.

Paragraph15.407 rules for UNII devices are summarized in following tables. In Table 4.1.2.1-1, the maximum transmit power, PSD and out of band emission requirements are listed for UNII-1/2/3 bands. In Table 4.1.2.1-2, the dynamic frequency selection requirements for radar detection are summarized for UNII-2 devices.

UNII-1	UNII-2A	UNII-2C	UNII-3	Comments

	1	5.15 - 5.25				1
Frequency Range (GHz)		5.15 - 5.25	5.25-5.35	5.47-5.725	5.725-5.85	
Max conducted output power <	а	eNB: 30 UE: 24	24	24	30	
min(a, b) (dBm)	b		11+10logB	11+10logB		B is the 26-dB emission bandwidth in MHz
Peak PSD (dBm/MHz)		eNB: 17 UE: 11	11	11	30dBm in 500kHz	
Assumed Antenna Gain (dBi)		6	6	6	6*	Peak power is reduced by G-6 dB for directional antennas with gain > 6 dBi; * UNII-3 fixed point to point operation power scaling threshold is 23 dBi
Out of band emission	Frequency Support (GHz)	Outside 5.15 – 5.35	Outside 5.15 – 5.35	Outside 5.47-5.725	Outside 5.715-5.865	
	EIRP (dBm/MHz)	-27	-27	-27	-27	Resolution bandwidth 1 MHz
	Frequency Support (GHz)				5.715-5.725 5.85-5.86	
	EIRP (dBm/MHz)				-17	Resolution bandwidth 1 MHz
Transmit Power Control		N/A	TPC to 6 dB b EIRP of 30 dB mean EIRP < 2	m. No TPC for	N/A	

### Table 4.1.2.1-2: DFS requirements for UNII-2 devices

	Levels	Comments
Max EIRP (dBm)	23 to 30	* DFS power is averaged in 1 micro-second for 0 dBi antenna.
DFS Threshold	-64	* Uniform spread over available channels.
(dBm)		
Max EIRP (dBm)	<23	
DFS Threshold	-62	
(dBm)		
Channel Availability	60 seconds	Master mode
check		
Channel move time	10 seconds	Master and slave modes
	200 ms normal	
	operation	
Non-occupancy time	30 minutes	After radar detection in either channel availability check or in-service
		monitoring

### **Interference to Weather Radars**

In order to resolve interference to Terminal Doppler Weather Radar (TDWR) the FCC has defined interim plans to approve UNII devices operating in the 5470-5725 MHz band [11]. These interim plans provide specific actions for equipment authorization and installation, as detailed below. The main elements in the interim plan are:

- Master devices shall not transmit on channels overlapping with the range 5600-5650 MHz band used by TDWRs;
- Professional installation of equipment operating within the band 5470-5720 MHz;
- Prohibition to include configuration controls (like country code settings) that would allow to change the frequency of operations to any frequency other than those specified on the grant of certification for US operation.

In parallel FCC is continuing its work to develop long-term equipment authorization test procedures that will ensure that the devices comply with the rules that protect the TDWR operations.

### 4.1.2.2 Canada

In Canada, the use of RLANs is forbidden in the band 5600-5650 MHz in order to protect the meteorological radars from interference caused by RLANs. The regulations for RLANs in the 5 GHz range in Canada are defined in RSS-210 Annex 9 [21]. Table 4.1.2.2-1 presents the transmit power requirements for RLAN devices while Table 4.1.2.2-1 provides the EIRP spectral density limits in the elevation plane required from RLAN devices operating with an EIRP level higher than 200 mW in the frequency range 5250-5350 MHz.

Frequency	ĺ	5.15 - 5.25	5.25-5.35	5.47-5.60	5.725-5.825	Ì
Range (GHz)				and 5.65-		
				5.725		
Max conducted	a		24	24	30	
output power <	b		11+10logB	11+10logB	17+10logB	B is the 26-dB
min(a, b)						emission bandwidth
(dBm)						in MHz
Peak PSD		4	11	11	17	Resolution
(dBm/MHz)						bandwidth 1 MHz
Max e.i.r.p. <	a	23	30	30	36	
min(a, b)	b	10+10logB	17+10logB	17+10logB	23+10logB	
(dBm)						
Max e.i.r.p		10				Resolution
density						bandwidth 1 MHz
(dBm/MHz)						
Out of band	Frequency	Outside 5.15	Outside 5.25	Outside	Outside	
emission	Support	– 5.25	– 5.35	5.47-5.725	5.725-5.825	
	(GHz)					
	EIRP	-27	-27	-27	-17 within	Resolution
	(dBm/MHz)				5.715-5.725	bandwidth 1 MHz
					and 5.825-	
					5.835; -27 outside	
					-27 Outside	
Transmit		N/A	TPC to 6 dB b			
Power Control			EIRP of 30 dB			
Power Control			mean EIRP < 2			
DFS		N/A	Required			
e.i.r.p.		N/A	If e.i.r.p. > 23	N/A	N/A	
elevation mask			dBm			
cievation maok			compliance			
			with e.i.r.p.			
			elevation			
			mask			
			required			

### Table 4.1.2.2-1: Transmit power requirements for RLAN devices in Canada

# Table 4.1.2.2-1: EIRP spectral density limits in the elevation plane for devices with EIRP > 200 mW(5.25-5.35 GHz frequency range)

EIRP spectral density	Elevation angle
-13 dB(W/MHz)	$0^{\circ} \le \theta < 8^{\circ}$
-13 - 0.716(θ-8) dB(W/MHz)	$8^\circ \le \theta < 40^\circ$
-35.9 - 1.22(θ-40) dB(W/MHz)	$40^\circ \le \theta < 45^\circ$
-42 dB(W/MHz)	$44^{\circ} \le \theta$

### 4.1.2.3 Brazil

In Brazil, nearly all the 5 GHz spectrum is allocated for Restricted Radiation, which means low-power unlicensed bands (i.e. any low-power-device can use it on a secondary basis). The bands 5250-5350 MHz, 5470-5650 MHz, 5650-5725 MHz and 5725-5850 MHz are allowed to RLANs [22]. Bands 5150-5250 MHz and 5250-5350 MHz are restricted to indoor use, and DFS is mandated in the bands 5250-5350 MHz and 5470-5725 MHz.

The relevant restrictions by band are as follows [23]:

From (MHz)	To (MHz)	Service	Restriction [insert reference]
5150	5350	Restricted radiation	Indoor use only, EIRP limited to 200mW, EIRP spectral power density limited to 10mW/MHz. DFS mandated between 5250-5350MHz.
5350	5470	Unregulated	
5470	5650	Restricted radiation	DFS mandated. Max transmitter output power limited to 250mW, EIRP limited to 1W, EIRP spectral power density limited to 50mW/MHz
5650	5725	Restricted radiation or amateur radio	DFS mandated. Max transmitter output power limited to 250mW, EIRP limited to 1W, EIRP spectral power density limited to 50mW/MHz
5725	5875	Restricted radiation (ISM Band)	Max transmitter output power limited to 1W, max EIRP EMF density of 50,000 microvolt per meter (measured at 3 meter distance)

NOTE: Note that the 5350-5470MHz band is not regulated.

### 4.1.2.4 Mexico

In Mexico, the bands 5150-5250 MHz, 5250-5350 MHz, 5470-5600 MHz, 5650-5725 MHz and 5725-5875 MHz are open to RLANs [22].

### 4.1.3 ITU Region 3

### 4.1.3.1 China

The 5150-5350 MHz frequency band is open to unlicensed WAS/RLANs indoor deployment in China. Furthermore, mandatory DFS / TPC (no less than 6 dB) or DFS only with a 3 dB backoff of the max mean EIRP, Power spectrum density and max emission is required for 5250-5350 MHz.

The key regulatory restrictions include:

- EIRP: ≤200mW
- Power Spectrum Density: ≤10dBm/MHz (EIPR)
- Max Emission at edges of the used frequency: <-80dBm/Hz (EIRP)
- Spurious Emission (corresponding to frequency range outside 2.5\*carrier bandwidth )
  - 30-1000MHz: -36dBm/100kHz
  - 48.5-72.5MHz, 76-118MHz, 167-223MHz, 470-798MHz: -54dBm/100kHz
  - 2400-2483.5MHz: -40dBm/1MHz
  - 5150-5350MHz: -33dBm/100kHz
  - 5470-5850MHz: -40dBm/1MHz
  - Other frequency in 1-40GHz: -30dBm/1MHz

The 5725-5850 MHz frequency band was assigned as light licensed in 2009, shared among operators and traffic control bureau, open for both WAS (wireless access system) and RLAN, for both indoor and outdoor deployment in China. The key regulatory restrictions as below:

- Transmit Power: ≤500mW and ≤27dBm;
- EIRP: ≤2W and ≤33dBm
- Power Spectrum Density: ≤13dBm/MHz and ≤19dBm/MHz(EIRP)
- Out of Band Emission:  $\leq$ -80dBm/Hz( $\leq$ 5725MHz and  $\geq$ 5850MHz)
- Spurious emission
  - $30-1000MHz: \le -36dBm/100kHz$
  - 2400-2483.5MHz: ≤-40dBm/1MHz
  - $3400-3530MHz: \le -40dBm/1MHz$
  - 5725-5850MHz: ≤-33dBm/100kHz
  - corresponding to frequency range outside 2.5\*carrier bandwidth
  - Other frequency in 1-40 GHz: -30dBm/1MHz

In the end of 2014, the regulation requirements of this band were adjusted from light license to fully unlicensed. Meanwhile, some restrictions for equipment were proposed to be updated such as spurious emission etc., which was publicly inquired on the website of ministry of industry and information technology of China without formal issued so far. The proposed key regulation restrictions update in 5725-5850MHz can be found in the table below.

Parameter	Requirement
EIRP	≤25mW for Micro power(short range) station
	≤2W for others
Power Spectrum Density(EIRP)	≤19dBm/MHz (other than ITS system)
Max Emission at edges of the used frequency	≤-80dBm/Hz(EIRP)
Spurious Emission (corresponding to frequency	-36dBm/100kHz (30-1000MHz)
range outside 2.5*carrier bandwidth)	-54dBm/100kHz (48.5-72.5MHz, 76-118MHz, 167-
	223MHz, 470-798MHz)
	-40dBm/1MHz (2400-2483.5MHz, 5150-5350MHz)
	-33dBm/100kHz (5470-5850MHz)
	-30dBm/1MHz(Other frequency in 1-40GHz)

Table 4.1.3.1-1 Proposed key regulatory restrictions update in 5725-5850MHz

The band 5470-5725 MHz has not yet been officially open for WAS/RLAN (is put on hold). However, this band as a potential WAS/RLAN frequency band has been widely discussed, while the related regulation restrictions are also publicly inquired on the website of ministry of industry and information technology of China in the year of 2014. In order to protect the incumbent services (such as radio-determination service), DFS and TPC (no less than 6dB) are strictly required and DFS function can not be closed. The details of the proposed key regulation restrictions in 5470-5725MHz are listed as table below.

Table 4.1.3.1-2 Proposed key regulatory restrictions in 5470-5725MHz

Parameter	Requirement
EIRP	≤1W
Power Spectrum Density(EIRP)	≤50mW/MHz
Max Emission at edges of the used frequency	≤-80dBm/Hz(EIRP)
Spurious Emission (corresponding to frequency range outside 2.5*carrier bandwidth)	-36dBm/100kHz (30-1000MHz) -54dBm/100kHz (48.5-72.5MHz, 76-118MHz, 167- 223MHz, 470-798MHz) -40dBm/1MHz (2400-2483.5MHz) -33dBm/100kHz (5470-5850MHz) -30dBm/1MHz (Other frequency in 1-40GHz)

### 4.1.3.2 Japan

With regard to the use of 5 GHz spectrum for RLAN in Japan, the following frequency bands are available:

- 5150-5250 MHz;
- 5250-5350 MHz;
- 5470-5725 MHz.

Table 4.1.3.2-1 summarizes overview of technical regulatory requirements in Japan based on those for IEEE 802.11a/n/ac. As shown in the table, it should be noted that "Max Burst Length" is specified as less than 4 msec for RLAN systems in Japan.

			1			
Frequency		5.15-5.25 GHz	5.25-5.35 GHz	5.47~5.725 GHz		
Location		Limited to indoor Indoor a		Indoor and outdoor		
Channel bandwidth			20/40/80/160 MHz			
Modulation	20/40/80/160 MHz		OFDM			
Maximum output	20/40/80/160 MHz		10/5/2.5/1.25 mW/MHz			
power						
Maximum antenna ga	ain	Any				
Maximum e.i.r.p	20/40/80/160 MHz	10/5/2.5/1.25 mW/MHz 50/25/		50/25/12.5/6.25		
		mW/MHz				
Carrier sense	20/40/80/160 MHz		Required			
Max Burst Length		< 4 ms				
DFS, TPC (Note 1)		Not required	Required (only for master control station)			
Connection topology		Any	Any (connection between the stations not			
			controlled by master control station is not			
			allowed)			
NOTE 1: DFS ( Dynamic Frequency Selection ) , TPC ( Transmitter Power Control)						

 Table 4.1.3.2-1: Summary of basic regulatory requirements

Figure 4.1.3.2-1 indicates the spectrum and channelling arrangements available for different channel bandwidth. This figure also provides information on incumbent systems to be coexisting with RLAN systems in Japan.

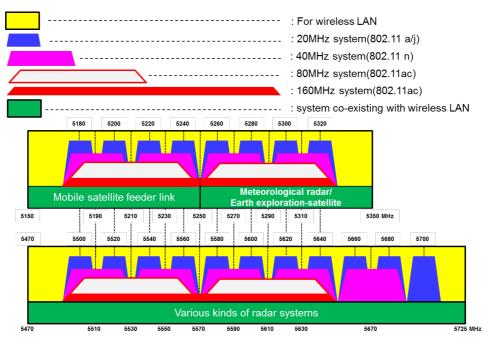


Figure 4.1.3.2-1: Spectrum and channel arrangement

Further detailed regulatory requirements, such as ACLR, SEM and peak data rate for the respective frequency bands are provided in the following sub-sections. Note that for "78 MHz < Occupied bandwidth  $\leq$  158 MHz" (covers the 160 MHz system), there are no ACLR1 and ACLR2 requirements specified.

### 4.1.3.2.1 5150-5250 and 5250-5350 MHz

Occupied bandwidth	≤ 18MHz	> 18MHz and ≤ 19MHz	> 19MHz and ≤ 38MHz	> 38MHz and ≤ 78MHz
ACLR 1	≥ 25 dB	≥ 25 dB	≥ 25 dB	≥ 25 dB
Measurement bandwidth	18 MHz	19 MHz	38 MHz	78 MHz
Adjacent channel	+20	+20	+40	+80
centre frequency	1	/	1	
offset [MHz]	-20	-20	-40	-80

## Table 4.1.3.2.1-1: Adjacent Channel Leakage Ratio (ACLR) 1

### Table 4.1.3.2.1-2: Adjacent Channel Leakage Ratio (ACLR) 2

Occupied bandwidth	≤ 18MHz	> 18MHz and ≤ 19MHz	> 19MHz and ≤ 38MHz	> 38MHz and ≤ 78MHz
ACLR 2	≥ 40 dB	≥ 40 dB	≥ 40 dB	-
Measurement bandwidth	18 MHz	19 MHz	38 MHz	-
Adjacent channel	+40	+40	+80	
centre frequency	/	/	/	-
offset [MHz]	-40	-40	-80	

Occupied bandwidth  $\leq$  18 MHz:

Centre Frequency (MHz)	Frequency range(f) (MHz)	Frequency difference between centre frequency – the edges of frequency range(MHz)	e.i.r.p/MHz
	5140 ≤ f ≤ 5142	≥ 98 and ≤ 100	≤ 2.5 μW
	5142 < f ≤ 5150	≥ 90 and < 98	≤ 15 μW
	5250 ≤ f < 5251	≥ 10 and < 11	$\leq 10^{1-(f-9)}$ mW
5240	5251 ≤ f < 5260	≥ 11 and < 20	$\leq 10^{-1-(\frac{8}{90})(f-11)}$ mW
	5260 ≤ f < 5266.7	≥ 20 and < 26.7	$\leq 10^{-1.8 - (\frac{6}{50})(f-20)}$ mW
	5266.7 ≤ f ≤ 5360	$\geq$ 26.7 and $\leq$ 120	≤ 2.5 μW
	5140 ≤ f ≤ 5233.3	≥ 26.7 and ≤ 120	≤ 2.5 μW
	5233.3 < f ≤ 5240	≥ 20 and < 26.7	$\leq 10^{-1.8 - (\frac{6}{50})(f-20)}$ mW
5260	5240 < f ≤ 5249	≥ 11 and < 20	$\leq 10^{-1-(\frac{8}{90})(f-11)}$ mW
	5249 < f ≤ 5250	≥ 10 and < 11	$\leq 10^{1-(f-9)}$ mW
	5350 ≤ f ≤ 5360	≥ 90 and ≤ 100	≤ 2.5 μW

18 MHz < Occupied bandwidth ≤ 19 MHz:

Centre	Frequency range(f)	Frequency difference between	e.i.r.p/MHz
Frequency	(MHz)	centre frequency – the edges of	
(MHz)		frequency range(MHz)	

5135 ≤ f ≤ 5142	$\geq$ 38 and $\leq$ 45	≤ 2.5 μW
5142 < f ≤ 5150	≥ 30 and < 38	≤ 15 μW
5250 ≤ f < 5251	≥ 10 and < 11	$\leq 10^{1-(f-9)}$ mW
5251 ≤ f < 5260	≥ 11 and < 20	$\leq 10^{-1 - (\frac{8}{90})(f - 11)} \text{mW}$
5260 ≤ f < 5266.7	≥ 20 and < 26.7	$\leq 10^{-1.8 - (\frac{6}{50})(f-20)} \text{mW}$
5266.7 ≤ f ≤ 5365	$\geq$ 26.7 and $\leq$ 125	≤2.5 μW
5135 ≤ f ≤ 5233.3	$\geq$ 26.7 and $\leq$ 125	≤2.5 μW
5233.3 < f ≤ 5240	≥ 20 and < 26.7	$\leq 10^{-1.8 - (\frac{6}{50})(f-20)} \text{mW}$
5240 < f ≤ 5249	≥ 11 and < 20	$\leq 10^{-1-(\frac{8}{90})(f-11)}$ mW
5249 < f ≤ 5250	≥ 10 and < 11	$\leq 10^{1-(f-9)}$ mW
5350 ≤ f ≤ 5365	$\geq$ 30 and $\leq$ 45	≤ 2.5 μW
	$5142 < f \le 5150$ $5250 \le f < 5251$ $5251 \le f < 5260$ $5260 \le f < 5266.7$ $5266.7 \le f \le 5365$ $5135 \le f \le 5233.3$ $5233.3 < f \le 5240$ $5240 < f \le 5249$ $5249 < f \le 5250$	$5142 < f \le 5150$ $\ge 30 \text{ and } < 38$ $5250 \le f < 5251$ $\ge 10 \text{ and } < 11$ $5251 \le f < 5260$ $\ge 11 \text{ and } < 20$ $5260 \le f < 5266.7$ $\ge 20 \text{ and } < 26.7$ $5266.7 \le f \le 5365$ $\ge 26.7 \text{ and } \le 125$ $5135 \le f \le 5233.3$ $\ge 26.7 \text{ and } \le 125$ $5233.3 < f \le 5240$ $\ge 20 \text{ and } < 26.7$ $5240 < f \le 5249$ $\ge 11 \text{ and } < 20$ $5249 < f \le 5250$ $\ge 10 \text{ and } < 11$

19 MHz < Occupied bandwidth  $\leq$  38 MHz:

Table 4.1.3.2.1-5: SEM: 19 MHz < C	Occupied bandwidth $\leq$ 38 MHz
------------------------------------	----------------------------------

Centre Frequency	Frequency range(f) (MHz)	Frequency difference between centre frequency – the edges of	e.i.r.p/MHz
(MHz)	()	frequency range(MHz)	
5190	5100 ≤ f ≤ 5141.6	≥ 48.4 and ≤ 90	≤ 2.5 μW
2130	5141.6 < f ≤ 5150	≥ 40 and < 48.4	≤ 15 μW
	5250 ≤ f < 5251	≥ 20 and < 21	$\leq 10^{-(f-20)+\log(1/2)}$ mW
	5251 ≤ f < 5270	≥ 21 and < 40	$\leq 10^{-\left(\frac{8}{190}\right)(f-21)-1+\log(1/2)} \text{ mW}$
5230	5270 ≤ f < 5278.4	≥ 40 and < 48.4	$ \frac{mW}{\leq -\left(\frac{3}{50}\right)(f-40)-1.8+\log(1/2)} mW $
	5278.4 ≤ f ≤ 5400	≥ 48.4 and ≤ 170	≤ 2.5 μW
	5100 ≤ f ≤ 5210	≥ 60 and ≤ 170	≤ 2.5 μW
	5210 < f ≤ 5221.6	≥ 48.4 and < 60	≤ 2.5 μW
	5221.6 < f ≤ 5230	≥ 40 and < 48.4	$\leq 2.5 \mu \text{W} \\ \leq 10^{-\left(\frac{3}{50}\right)(f-40)-1.8 + \log(1/2)}$
5270			mW
	5230 < f ≤ 5249	≥ 21 and < 40	$10^{-\left(\frac{8}{190}\right)(f-21)-1+\log(1/2)}mW$
	5249 < f ≤ 5250	≥ 20 and < 21	$\leq 10^{-(f-20)+\log(1/2)}$ mW
5210	5350 ≤ f < 5358.4	≥ 40 and < 48.4	≤ 15 μW
5310	5358.4 ≤ f ≤ 5400	≥ 48.4 and ≤ 90	≤ 2.5 μW

38 MHz < Occupied bandwidth ≤ 78 MHz:

Table 4.1.3.2.1-6: SEM: 38 MHz < Occupied bandwidth ≤ 78 MHz

Centre	Frequency range(f)	Frequency difference between	e.i.r.p/MHz
Frequency	(MHz)	centre frequency – the edges of	
(MHz)		frequency range(MHz)	

	5020 ≤ f ≤ 5123.2	$\geq$ 86.8 and $\leq$ 190	≤ 2.5 μW
	5123.2 < f ≤ 5150	$\ge$ 60 and < 86.8	≤ 15 μW
	5250 ≤ f < 5251	≥ 40 and < 41	$\leq 10^{-(f-40)+\log(1/4)}$ mW
5210	5251 ≤ f < 5290	≥ 41 and < 80	$ \leq 10^{-\left(\frac{8}{390}\right)(f-41)-1+\log(1/4)} $ mW
	5290 ≤ f < 5296.7	≥ 80 and < 86.7	$10^{-\left(\frac{3}{100}\right)(f-80)-1.8+\log(1/4)}$ mW
	5296.7 ≤ f ≤ 5480	≥ 86.7 and ≤ 270	≤ 2.5 μW
	5020 ≤ f ≤ 5203.3	$\geq$ 86.7 and $\leq$ 270	≤ 2.5 μW
5290	5203.3 < f ≤ 5210	≥ 80 and < 86.7	$10^{-\left(\frac{3}{100}\right)(f-80)-1.8+\log(1/4)}$ mW
	5210 < f ≤ 5249	≥ 41 and < 80	$\leq 10^{-\left(\frac{8}{390}\right)(f-41)-1+\log(1/4)} \text{mW}$
	5249 < f ≤ 5250	≥ 40 and < 41	$\leq 10^{-(f-40)+\log(1/4)}$ mW
	5350 ≤ f < 5376.8	≥ 60 and < 86.8	≤ 15 μW
	5376.8 ≤ f ≤ 5480	$\geq$ 86.8 and $\leq$ 190	≤ 2.5 μW

78 MHz < Occupied bandwidth ≤ 158 MHz:

Table 4.1.3.2.1-7: SEM: 78 MHz < Occupied bandwidth ≤ 158 MHz

Centre Frequency (MHz)	Frequency range(f) (MHz)	Frequency difference between centre frequency – the edges of frequency range(MHz)	e.i.r.p/MHz
5250	4916 ≤ f ≤ 5099.6	≥ 150.4 and ≤ 334	≤ 2.5 μW
	5099.6 < f ≤ 5150	≥ 100 and < 150.4	≤ 15 μW
	5350 ≤ f < 5400.4	≥ 100 and < 150.4	≤ 15 μW
	5400.4 ≤ f ≤ 5584	$\geq$ 150.4 and $\leq$ 334	≤ 2.5 μW

### Table 4.1.3.2.1-8: Peak data rate

Occupied bandwidth(MHz)	Peak data rate (Mbps)
≤ 19	≥ 20
> 19 and ≤ 38	≥ 40
> 38 and ≤ 78	≥ 80
> 78 and ≤ 158	≥ 160

### 4.1.3.2.2 5470-5725 MHz

### Table 4.1.3.2.2-1: Adjacent Channel Leakage Ratio (ACLR) 1

Occupied bandwidth	≤ <b>19.7MHz</b>	> 19.7MHz and ≤ 38MHz	> 38MHz and ≤ 78MHz
ACLR 1	≥ 25 dB	≥ 25 dB	≥ 25 dB
Measurement bandwidth	19 MHz	38 MHz	78 MHz
Adjacent channel centre frequency offset [MHz]	+20 / -20	+40 / -40	+80 / -80

### Table 4.1.3.2.2-2: Adjacent Channel Leakage Ratio (ACLR) 2

0	ccupied bandwidth	≤19.7MHz	> 19.7MHz and ≤ 38MHz	> 38MHz and ≤	
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			78MHz
ACLR 2	≥ 40 dB	≥ 40 dB	-
Measurement bandwidth	19 MHz	38 MHz	-
Adjacent channel centre frequency offset [MHz]	+40 / -40	+80 / -80	-

Occupied bandwidth  $\leq$  19.7 MHz:

Frequency range(f) (MHz)	e.i.r.p/MHz
5455 ≤ f ≤ 5460	≤ 2.5 μW
5460 < f ≤ 5470	≤ 12.5 μW
5725 ≤ f < 5740	≤ 12.5 μW
5740 ≤ f ≤ 5745	≤ 2.5 μW

19.7 MHz < Occupied bandwidth ≤ 38 MHz:

Table 4.1.3.2.2-4: SEM: 19	9.7 MHz < Occupied	bandwidth ≤ 38 MHz
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Frequency range(f) (MHz)	e.i.r.p/MHz
5420 ≤ f ≤ 5460	≤ 12.5 μW
5460 < f ≤ 5470	≤ 50 μW
5725 ≤ f ≤ 5760	≤ 12.5 μW

38 MHz < Occupied bandwidth ≤ 78 MHz:

Frequency range(f) (MHz)	e.i.r.p/MHz
5340 ≤ f ≤ 5460	≤ 12.5 μW
5460 < f ≤ 5469.5	≤ 50 μW
5469.5 < f ≤ 5470	≤ 51.2 μW
5725 ≤ f ≤ 5800	≤ 12.5 μW

78 MHz < Occupied bandwidth ≤ 158 MHz:

### Table 4.1.3.2.2-6: SEM: 78 MHz < Occupied bandwidth $\leq$ 158 MHz

Frequency range(f) (MHz)	e.i.r.p/MHz	
5236 ≤ f ≤ 5419.6	≤ 12.5 μW	
5419.6 < f ≤ 5470	≤ 50 μW	
5725 ≤ f ≤ 5904	≤ 12.5 μW	

Table	4.1.3.2.2-7	: Peak	data rate
Tuble	TITIOICIC /	. i can	uutu rute

Occupied bandwidth(MHz)	Peak data rate (Mbps)
≤ 19.7	≥ 20
> 19.7 and ≤ 38	≥ 40
> 38 and ≤ 78	≥ 80
> 78 and ≤ 158	≥ 160

# 4.1.3.2.3 Simultaneous use of 5150-5250 and 5470-5725 MHz / 5250-5350 and 5470-5725 MHz

When simultaneous use of non-contiguous two channels in 5150-5250 and 5470-5725 MHz or that in 5250-5350 and 5470-5725MHz is employed, the following regulatory requirements are also applied. It should be note that total channel bandwidth is less and equal to 160 MHz in these usages.

Casa	Combination of simultaneous transmission Centre Frequencies					
Case	Centre Frequency 1 (MHz)	Centre Frequency 2 (MHz)				
1	5210	5530				
2	5210	5610				
3	5290	5530				
4	5290	5610				

Side conditions

- Occupied bandwidth for respective Carrier for Centre frequency is > 38 MHz and ≤ 78 MHz.
- Maximum Output power ≤ 1.25 mW
- e.i.r.p.≤ 1.25 mW

Table 4.1.3.2.3-2: Ad	jacent Channel Leakage Ratio (	ACLR)

Occupied bandwidth	> 38MHz and ≤ 78MHz			
ACLR	≥ 25 dB			
Measurement bandwidth	78 MHz			
Adjacent channel centre frequency offset [MHz]	+80 / -80			
Note: Applicable to respective carrier				

### Table 4.1.3.2.3-3: SEM: Case 1 and 2

Centre Frequency (MHz)	Frequency range(f) (MHz)	Frequency difference between centre frequency – the edges of frequency range(MHz)	e.i.r.p/MHz
	5,020 ≤ f ≤ 5,134.8	$\geq$ 75.2 and $\leq$ 190	≤ 2.5 □W
	$5,134.8 < f \le 5,150$	≥ 75.2 and ≤ 190 ≥ 60 and < 75.2	≤ 12.5 IW
	5,250 ≤ f < 5,251	≥ 40 and < 41	$\leq 10^{-(f-40)+\log(1/8)}$ mW
5,210	5,251 ≤ f < 5,285.2	≥ 41 and < 75.2	$\leq 10^{-\left(\frac{8}{390}\right)(f-41)-1+\log(1/8)}$
	5,285.2 ≤ f < 5,370	≥ 75.2 and < 160	mW ≤ 2.5 IW
= = = = = =	$5,285.2 \le 1 \le 5,370$ $5,370 \le f \le 5,454.8$	≥ 75.2 and < 100	≤ 2.5 IW
5,530	5,454.8 < f ≤ 5,470	≥ 60 and < 75.2	≤ 15 IW
5,610	5,725 ≤ f ≤ 5,800	≥ 115 and ≤ 190	≤ 15 □W

### Table 4.1.3.2.3-4: SEM: Case 3 and 4

Centre	Frequency range(f)	Frequency difference between	e.i.r.p/MHz
Frequency	(MHz)	centre frequency – the edges of	
(MHz)		frequency range(MHz)	

	5,020 ≤ f ≤ 5,214.8	≥ 75.2 and ≤ 270	≤ 2.5 IW
E 200	5,214.8 < f ≤ 5,249	≥ 41 and < 75.2	$\leq \frac{-\left(\frac{8}{390}\right)(f-41)-1+\log(1/8)}{10}$
5,290	5,249 < f ≤ 5,250	≥ 40 and < 41	$\leq 10^{-(f-40)+\log(1/8)}$ mW
	5,350 ≤ f < 5,365.2	≥ 60 and < 75.2	≤ 15 □W
	5,365.2 ≤ f < 5,410	≥ 75.2 and < 120	≤ 2.5 IW
5,530	5,410 ≤ f ≤ 5,454.8	$\geq$ 75.2 and $\leq$ 120	≤ 2.5 □W
5,550	5,454.8 < f ≤ 5,470	≥ 60 and < 75.2	≤ 15 □W
5,610	5,725 ≤ f ≤ 5,800	≥ 115 and ≤ 190	≤ 15 □W

### Table 4.1.3.2.3-5: Peak data rate

Peak data rate (Mbps)
≥ 160

### 4.1.3.3 Korea

## Table 4.1.3.3-1: Transmit power requirements for 5GHz Devices

Frequency Range(MHz)	5100-5250					5470-5650		5725-5825, 2400~2483.5 (Note 7)	
	BW(MHz)	PSD	BW(MHz)	PSD	BW(MHz)	PSD	BW(MHz)	PSD	
Average PSD	0.5-20	≤2.5	0.5-20	≤10	0.5-20	≤10	0.5-26	≤10	
requirement	20-40	≤1.25	20-40	≤5	20-40	≤5	26-40	≤5	
(mW/MHz)							40-80	≤2.5	
(111 VV / 1V1112)	40-80	≤0.625	40-80	≤2.5	40-80	≤2.5	40-60 (Note 1)	≤0.1 (Note 1)	
Assumed antenna gain G (dBi) (Note 4)	6		7		7		6, 20 (PTP) (	Notes 2, 3)	
Out of band emission, EIRP (dBm/MHz)	-27		-27		-27		For any 100kH band, les -30dBm(2400- -27dBm/MH 5825M	ss than 2483.5MHz) Iz (5725-	
DFS (Note 5)	No		Yes		Yes		No		
TPC (Note 6)	No		Yes		Yes		No		
IPC (Note 6)NoYesYesNoNOTE 1:2400-2483.5MHz devicesNOTE 2:Fixed point to point operation power scaling threshold is 20 dBiNOTE 3:PTP: Point to Point communicationNOTE 4:Peak power is reduced by G-THR dB for directional antennas with gain > THR dBi (THR = 6 dBi for 51005250MHz and 5725-5825MHz or 7dBi for 5250-5350MHz and 5470-5650MHz)NOTE 5:DFS: Dynamic Frequency SelectionNOTE 6:TPC: Transmit Power ControlNOTE 7:5725-5825MHz, 2400-2483.5MHz are not allowed to be used for point-to-multipoint service for the same information and omni-directional electro-magnetic wave transmission									

### Table 4.1.3.3-2: DFS requirements for 5GHz Devices

	Levels	Comments
DFS Threshold (dBm) for	-62dBm	Average power considering antenna gain: <10mW/MHz
interference detection	-64dBm	Average power considering antenna gain: 10mW/MHz ~50mW/MHz
Channel availability check time	> 60 seconds	
Channel move time	< 10 seconds	
Non-occupancy time	> 30 minutes	After radar detection in either channel availability

check or in-service monitoring

Korean regulatory requirements are summarized as follows:

- Average PSD requirement (mW/MHz)
  - It covers both power spectral density and Max transmission power
  - The maximum PSD is defined for a given spectrum range
  - Maximum transmission power :
    - 50mW, 200mW, 200mW and 200/260mW for 5150-5250, 5250-5350, 5470-5650, and 5725-5825 MHz band respectively
- Antenna gain assumed:
  - 6 dBi for 5150-5250 and 5725-5825MHz band
  - 7 dBi for 52505350 and 5470-5650MHz band
- Out of Band Emission (EIRP (dBm/MHz))
  - <-27 dBm/MHz
- DFS & TPC
  - DFS is defined for 5250-5350MHz and 5470-5650MHz
  - TPC is defined for 5250-5350MHz and 5470-5650MHz
    - TPC ensures wireless devices with average Tx power including antenna gain larger than 25mW/MHz can reduce its average Tx power by at least 3dB (below 12.5mW/MHz)
- Maximum bandwidth occupancy
  - < 80MHz for 5GHz
- Maximum power spectral density for bandwidth aggregation (contiguous or non-contiguous)
  - Among 5150-5250, 5250-5350, 5470-5650, and 5725-5825 MHz bands, multiple of 80MHz bandwidth can be aggregated in contiguous or non-contiguous manner to form 160MHz bandwidth
  - In this case, maximum power spectral density for 5150-5250MHz should be lower than 0.625mW/MHz while it should be lower than 1.25mW/Hz in the other bands
- Modulation scheme
  - Digital modulation for 5GHz
- Difference from FCC regulation
  - Maximum transmission power in case of 5725 to 5825MHz is still 200mW for 20MHz bandwidth (a bit lower compared to 1W power in UNII-3)
  - 5825-5850MHz is not for WAS (Wireless Access System)

### 4.1.3.4 India

In India the bands 5150-5250 MHz, 5250-5350 MHz, 5570-5725 MHz and 5725-5875 MHz are open to RLANs [22], [35], [36], [37]. Table 4.1.3.4-1 and Table 4.1.3.4-2 summarize regulatory requirements in India for indoor and outdoor deployments respectively. Some parts of the 5 GHz band shall follow usage "on non-interference, non-protection and shared (non-exclusive) basis". These are the 5725-5825 MHz band open to licensed WAS including RLANs, and the 5150-5350 MHz and 5725-5875 MHz bands open for unlicensed WAS including RLANs for indoor deployment.

Regulation code	NFAP2011-IND 67, GSR No 46E, 37E	NFAP2011-IND 69
Band (MHz)	5150-5350, 5725-5875	5570-5725
License Type	Unlicensed	Licensed
Maximum mean EIRP	200mW (23dBm)	1W (30dBm)
Maximum mean EIRP density	10 mW/MHz	50 mW/MHz
Band usage	Low power WAS including RLAN	Low power WAS
		including RLAN

Table 4.1.3.4-1: Summary of regulatory requirements for indoor deployment in India

### Table 4.1.3.4-2: Summary of regulatory requirements for outdoor deployment in India

Regulation code	NFAP2011-IND 68	NFAP2011-IND 69	NFAP2011-IND 71	NFAP2011-IND 72, GSR No 38E
Band (MHz)	5150-5250	5570-5725	5725-5825	5825-5875
License Type	Licensed	Licensed	Licensed	Unlicensed
Maximum transmitter output power			1 W (30dBm) in spread of 10 MHz or higher	1 W (30dBm) in spread of 10 MHz or higher
Maximum mean EIRP	200mW (23dBm)	1W (30dBm)	4W (36dBm)	4W (36dBm)
Maximum mean EIRP density	10 mW/MHz	50 mW/MHz		
Band usage	Low power WAS including RLAN	Low power WAS including RLAN	Low power WAS including RLAN and Dedicated Short Range Communications (DSRC) for Intelligent Transport Networks	Low power WAS including RLAN

### 4.1.3.5 Taiwan

In Taiwan the bands 5250-5350 MHz, 5470-5600 MHz, 5650-5725 MHz and 5725-5850 MHz are allocated to RLANs [22][40]. Table 4.1.3.5-1 and Table 4.1.3.5-2 summarize the current regulatory requirements for transmit power and DFS in Taiwan [40]. DFS is mandate for 5470-5725 MHz [41]. Recently, work for specifying requirements for allowing RLANs in 5150-5250 MHz and 5600-5650 MHz has started but the detailed regulatory requirements for this has not yet been specified. Additionally specification work for allowing 5250-5350 MHz outdoor has started, this assumes that DFS will be performed, but detailed requirements are not yet defined.

			E 47 E 00 I	5 705 5 005	the second second second
Frequency		5.25-5.35 *	5.47-5.60 and	5.725-5.825	*For indoor use
Range (GHz)		47	5.65-5.725		only
Peak transmit	A	17	24	30	
power < min(a, b) (dBm)	В	4+10logB	11+10logB	17+10logB	B is the 26-dB emission bandwidth in MHz
Peak PSD (dBm/MHz)		4	11	17	Resolution bandwidth 1 MHz
Assumed Antenna Gain (dBi)		6	6	6**	Peak power is reduced by G-6 dB for directional antennas with gain > 6 dBi; ** Fixed point to point operation power scaling threshold is 23 dBi
Out of band emission	Frequency Support (GHz)	Outside 5.25 – 5.35	Outside 5.47- 5.725	Outside 5.715- 5.835	
CINISSION	EIRP (dBm/MHz)	-27	-27	-27	Resolution bandwidth 1 MHz
	Frequency Support (GHz)			5.715-5.725 5.825-5.835	
	EIRP (dBm/MHz)			-17	Resolution bandwidth 1 MHz
Transmit Power Control		N/A	TPC to 6 dB below a mean EIRP of 30 dBm. No TPC for mean EIRP < 27 dBm	N/A	
DFS		Required	Required	N/A	

Table 4.1.3.5-1 Transmit power requirements	for 5GHz band in Taiwan
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		Commonto
	Levels	Comments
DFS Detection	-64 for EIRP between	DFS power is averaged in 1 micro-second for 0 dBi
Threshold (dBm)	200mW and 1W	antenna.
		Uniform spread over available channels.
	-62 for EIRP < 200mW	
Channel availability	60 seconds	Master mode
check time		
Channel move time	<10 seconds	Master and slave mode
		After detection of radar signal:
		at most 200ms for normal communication
		manage and control signals can be transmitted
		discontinuously in the remaining time within 10 seconds
Non-occupancy	>30 minutes	After radar detection in either channel availability check or
time		in-service monitoring

Table 4.1.3.5-2 DFS requirements for 5.470-5.725GHz band in Taiwan

### 4.1.3.6 Singapore

In Singapore the bands 5150-5250 MHz, 5250-5350 MHz, 5470-5725MHz and 5725-5850 MHz are open to RLANs.

### 4.1.3.7 Australia

In Australia the band bands 5150-5250 MHz, 5250-5350 MHz and 5470-5725 MHz, except the sub-band 5600-5650 MHz, are open to RLANs. DFS and TPC are mandatory in the bands 5250-5350 MHz and 5470-5725 MHz.

## 4.1.4 Applicability of DFS requirements

The concept surfaced around 2001 in the ECC for handling uniform spread of WLAN interference into satellite and radar services, but was soon extended to include methods for discovery and avoidance of frequencies used by the radar service in the preparation work for WRC 2003.

Use of DFS in accordance with Annex 1 of ITU-R Recommendation M.1652 [39] is mandated as per Resolution 229 [38]. The 5 GHz Harmonized European Standard developed by ETSI TC BRAN was the first to include these DFS rules (EN 301 893 V1.2.3 in 2003), the DFS test specification included in this standard therefore became the basis for the development of the FCC DFS test specification and other test specifications in other countries.

For NR-U, it appears that conformance testing would only have to be performed for the BS. Already at the outset in ITU-R M.1652 it was made clear that full DFS functionality may not have to be implemented in all devices, only those controlling the transmission [39]:

### 2.1 Detection requirements

The DFS mechanism should be able to detect interference signals above a minimum DFS detection threshold of -62 dBm for devices with a maximum e.i.r.p. of < 200 mW and -64 dBm for devices with a maximum e.i.r.p. of 200 mW to  $1 \text{ W}^3$  averaged over  $1 \mu s$ .

This is defined as the received signal strength (RSS) (dBm), normalized to the output of a 0 dBi receive antenna, that is required to be detected within the WAS channel bandwidth.

### 2.2 Operational

with the footnote 3 stating:

In practice, it may not be necessary for each device to implement full DFS functionality, provided that such devices are only able to transmit under the control of a device that ensures that all DFS requirements are fulfilled.

This is reflected in both regulation for Europe and the Part 15 rules by the FCC. The harmonized ETSI BRAN standard cited in the EC commission rules is also followed by many other countries outside Europe.

### 4.1.4.1 DFS according to ECC

In accordance with the ECC Decision [10], "Every Master Device will use the Radar Interference Detection function in order to check for any co-channel radar signal prior to use a channel but also during normal operation. In addition to this Radar Interference Detection function, every Master Device shall also implement a channel selection mechanism to ensure a near uniform spread of the loading of available spectrum." In the latest version of the EN 301 893 [5], the applicability of the DFS requirements is listed as follows:

Table 5 lists the DFS related technical requirements and their applicability for every operational mode. If the RLAN device is capable of operating in more than one operational mode then every operating mode shall be assessed separately.

Requirement	DFS Operational mode		
	Master	Slave without radar detection (see table D.2, note 2)	Slave with radar detection (see table D.2, note 2)
Channel Availability Check		Not required	[](see note 2)
Off-Channel CAC (see note 1)		Not required	□□(see note 2)
In-Service Monitoring		Not required	
Channel Shutdown			
Non-Occupancy Period		Not required	
Uniform Spreading		Not required	Not required
NOTE 1: Where implemented by NOTE 2: A slave with radar dete use of the channel but <i>Channel</i> by <i>In-Service</i>	ction is not only after t	required to perform a CAC or C he slave has detected a radar si	

#### Table 5 (from EN 301 893): Applicability of DFS requirements

The radar detection requirements specified in clauses 4.7.2.2 to 4.7.2.4 assume that the centre frequencies of the radar signals fall within the central 80 % of the *Occupied Channel Bandwidth* of the RLAN channel (see clause 4.3).

Notice also the assumption that the radar signal falls within 80% of the occupied bandwidth, which is linked to the requirements on occupied emission bandwidth in EN 801 893 (clause 4.7).

### 4.1.4.2 DFS in the Part 15 rules

The rules with regard to implementation of DFS functionality are similar in the Part 15 rules [3]; the required functionality is limited for the slave,

(2) Radar Detection Function of Dynamic Frequency Selection (DFS). U-NII devices operating with any part of its 26 dB emission bandwidth in the 5.25-5.35 GHz and 5.47-5.725 GHz bands shall employ a DFS radar detection mechanism to detect the presence of radar systems and to avoid co-channel operation with radar systems. Operators shall only use equipment with a DFS mechanism that is turned on when operating in these bands. The device must sense for radar signals at 100 percent of its emission bandwidth. The minimum DFS detection threshold for devices with a maximum e.i.r.p. [...]

(i) Operational Modes. The DFS requirement applies to the following operational modes:

(A) The requirement for channel availability check time applies in the master operational mode.

(B) The requirement for channel move time applies in both the master and slave operational modes.

(ii) Channel Availability Check Time. A U-NII device shall check if there is a radar system already operating on the channel before it can initiate a transmission on a channel and when it has to move to a new channel. The U-NII device may start using the channel if no radar signal with a power level greater than the interference threshold values listed in paragraph (h)(2) of this section, is detected within 60 seconds.

(iii) Channel Move Time. After a radar's presence is detected, all transmissions shall cease on the operating channel within 10 seconds. Transmissions during this period shall consist of normal traffic for a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel.

Similar to the ETSI BRAN harmonized standard, there is also a requirement that "the device must sense for radar signals at 100 percent of its emission bandwidth". In deriving the minimum DFS detection threshold for the WAS receiver, it was assumed that above this threshold the emissions within the RLAN bandwidth would desensitize the radar receiver. Reciprocity was thus assumed, the WAS should be able to detect a radar within its emission bandwidth. The bandwidth of the WAS affects the probability of detecting a radar signal and its side lobes and the probability of causing interference (the WAS emissions).

## 4.2 Regulatory requirements for 6GHz band

Currently, CEPT and FCC have started initiatives to investigate potentialities for deployment of IMT services in the 5.925-7.125 GHz frequency range (e.g. US 5925 – 7125 MHz, or European 5925 – 6425 MHz, or parts thereof), with considerations for all or part of this range being made available for unlicensed operation [32].

# 5 Spectrum considerations

For the NR-U study item, different unlicensed bands or shared bands have been discussed, such as 2.4 GHz band, 3.5 GHz band, 5 GHz band, and 6 GHz band. Some bands are available globally and some bands are only available in some specific regions, and some bands may be made available after the completion of this study [32].

Follow the NR design principles, from RAN1 design perspective, this NR-U study is not limited to a particular unlicensed band. Instead, the target NR-U design is applicable to a set of frequency ranges to be further defined. There is no prioritization between unlicensed bands. On the other hand, the NR-U study does not target sub-1 GHz unlicensed bands, due to the lack of spectrum in the band to support efficient NR-U operation.

# 6 Deployment scenarios

This section describes possible deployment scenarios for NR-U.

Five deployment scenarios have been identified:

- Scenario A: Carrier aggregation between licensed band NR (PCell) and NR-U (SCell)
  - NR-U SCell may have both DL and UL, or DL-only.
- Scenario B: Dual connectivity between licensed band LTE (PCell) and NR-U (PSCell)
- Scenario C: Stand-alone NR-U
- Scenario D: An NR cell with DL in unlicensed band and UL in licensed band
- Scenario E: Dual connectivity between licensed band NR (PCell) and NR-U (PSCell)

# 7 Design targets, functionalities and solutions

In the discussions in the NR-U study item, references to sub-7 GHz are intended to include unlicensed bands in the 6 GHz region that are being discussed in regulatory discussions which may have some region exceeding 7 GHz (e.g., 7.125 GHz).

## 7.1 Design targets and functionalities

The NR-U study targets identification of additional functionality needed for a PHY layer design (except channel access procedures) for operation in unlicensed spectrum that may be applicable over a particular frequency range (e.g., sub-7 GHz, 7-52.6 GHz, > 52.6 GHz). The definition of the frequency ranges is to be further defined. On the other hand, the optimizations for a particular frequency band may be necessary due to different requirements, such as PSD limitation or OCB requirement, for each band. Channel bandwidths below 5 MHz are not targeted in this study.

The study targets the design of channel access procedures for frequency bands based on coexistence and regulatory considerations applicable to the band. The study includes identification of procedures for technology neutral channel access for frequency bands that may become available subject to regulations. The study assumes regulation will provide the framework concerning the protection for the technologies not using unlicensed access in those bands.

### 7.2 Solutions for operation in unlicensed spectrum

### 7.2.1 Physical layer aspects

According to the study item description [30], physical channels inheriting the choices of duplex mode, waveform, carrier bandwidth, subcarrier spacing, frame structure, and physical layer design made as part of the NR study and avoiding unnecessary divergence with decisions made in the NR WI.

NR-U supports both Type-A and Type-B mapping already supported in NR.

Initial active DL/UL BWP is approximately 20MHz for 5GHz band, though the final value will be quantized to number of PRBs. Initial active DL/UL BWP is approximately 20MHz for 6GHz band if similar channelization as 5GHz band is used for 6GHz band.

### 7.2.1.1 Frame structure

Single and multiple DL to UL and UL to DL switching points within a shared gNB COT is identified to be beneficial and can be supported. LBT requirements to support single or multiple switching points has been identified (Section 7.2.1.3.1).

For NR-U DL operation, it is identified that being able to operate all DL signal/channels with the same numerology for a carrier and at least for intra-band CA on serving cells on unlicensed bands has at least the following benefits (at least for standalone operation)

- Lower implementation complexity (e.g., a single FFT, no switching gaps)
- Lower specification impact
- No need for gaps for measurements on frequencies with a configured serving cell in unlicensed bands

For NR-U UL operation, it is identified that being able to operate all UL signal/channels (except PRACH) with the same numerology for a carrier and at least for intra-band CA on serving cells on unlicensed bands has at least the following benefits:

- Lower implementation complexity (e.g., a single FFT, no switching gaps)
- Lower specification impact
- Common interlace structure
- No need for gaps for transmission of SRS on a configured serving cell in unlicensed bands

For unlicensed PCell, the UE assumes single SSB numerology per band.

It has been identified to be beneficial for the NR-U design to not require the gNB to change a pre-determined TBS for a PDSCH transmission depending on the LBT outcome, at least when the PDSCH is transmitted at the beginning of the gNB's COT.

The following options have been identified as possible candidates for PDSCH transmission in the partial slot at least for the first PDSCH(s) transmitted in the DL transmission burst. The options are not mutually exclusive.

- Option 1: PDSCH(s) as in Rel-15 NR
- Option 2: Punctured PDSCH depending on LBT outcome
- Option 3: PDSCH mapping type B with durations other than 2/4/7 symbols
- Option 4: PDSCH across slot boundary

In addition to the functionalities provided by DCI format 2\_0 in Rel-15 NR, indication of the COT structure in the time domain has been identified as being beneficial.

It has been identified to be beneficial for the NR-U design to not require the UE to change a granted TBS for a PUSCH transmission depending on the LBT outcome.

The following options have been identified as possible candidate at least for the first PUSCH(s) transmitted in the UL transmission burst.

- Option 1: PUSCH(s) as in Rel-15 NR
- Option 2: Multiple starting positions in one or multiple slot(s) are allowed for PUSCH(s) scheduled by a single UL grant (i.e., not a configured grant) and one of the multiple PUSCH starting positions can be decided depending on LBT outcome.

It is noted that for above options, the ending position of the PUSCH is fixed as indicated by the UL grant.

It is noted that above options are not mutually exclusive.

It has been identified that FBE operation for the scenario where it is guaranteed that LBE nodes are absent on a long term basis (e.g., by level of regulation) and FBE gNBs are synchronized can achieve the following: Ability to use frequency reuse factor 1; Lower complexity for channel access due to lack of necessity to perform random backoff. It is noted that this does not imply that LBE does not have benefits in similar scenarios although there are differences between the two modes of operation. It is also noted that FBE may also have some disadvantages compared to other modes of operation such as LBE, e.g., a fixed overhead for idle time during a frame.

For wideband operation for both DL and UL,

- Bandwidth larger than 20 MHz can be supported with multiple serving cells.
- NR-U should support that a serving cell can be configured with bandwidth larger than 20 MHz.

For DL operation, the following options for BWP-based operation within a carrier with bandwidth larger than 20 MHz can be considered.

- Option 1a: Multiple BWPs configured, multiple BWPs activated, transmission of PDSCH on one or more BWPs
- Option 1b: Multiple BWPs configured, multiple BWPs activated, transmission of PDSCH on single BWP
- Option 2: Multiple BWPs can be configured, single BWP activated, gNB transmits PDSCH on a single BWP if CCA is successful at gNB for the whole BWP
- Option 3: Multiple BWPs can be configured, single BWP activated, gNB transmits PDSCH on parts or whole of single BWP where CCA is successful at gNB

For UL operation, the following options for BWP-based operation within a carrier with bandwidth larger than 20 MHz can be considered.

- Option 1a: Multiple BWPs configured, multiple BWPs activated, transmission of PUSCH on one or more BWPs

- Option 1b: Multiple BWPs configured, multiple BWPs activated, transmission of PUSCH on single BWP
- Option 2: Multiple BWPs can be configured, single BWP activated, UE transmits PUSCH on a single BWP if CCA is successful at UE for the whole BWP
- Option 3: Multiple BWPs can be configured, single BWP activated, UE transmits PUSCH on parts or whole of single BWP where CCA is successful at UE

It is noted that CCA is declared to be successful or not in multiples of 20 MHz.

Detailed design and potential selection from the above options can be further discussed when specifications are developed considering protocol and RF aspects.

### 7.2.1.2 Physical layer channel designs

For physical layer channel design, NR design will be used as baseline, and the following potential design changes are to be studied to support the following channels/signals in NR-U.

- PDCCH/PDSCH
- PUCCH/PUSCH
- PSS/SSS/PBCH
- PRACH
- DL and UL reference signals applicable to the operational frequency range

For SS/PBCH block transmission, extended CP is not supported for NR-U operation.

For PSS/SSS/PBCH transmission, NR-U should have a signal that contains at least SS/PBCH block burst set transmission. The design of this signal should consider the following characteristics specific to unlicensed band operation:

- There are no gaps within the time span the signal is transmitted at least within a beam
- The occupied channel bandwidth is satisfied (although this may not be a requirement)
- Strive to minimize the channel occupancy time of the signal
- Characteristics that may facilitate fast channel access

Inclusion of the CSI-RS and RMSI-CORESET(s)+PDSCH(s) (carrying RMSI) associated with SS/PBCH block(s) in addition to the SS/PBCH burst set in one contiguous burst (referred to as the NR-U DRS) can be beneficial for

- Meeting OCB requirement
- Compacting signals in time domain to limit the required number of channel access and for short channel occupancy
- Support of stand-alone NR-U deployments
- Support of automatic neighbour relations (ANR) functionality in an NR-U deployment
- Resolution of PCI confusion in an NR-U deployment

The transmission of additional signals such as OSI and paging within the NR-U DRS is allowed and can be beneficial.

Support of Pattern 1 is recommended for multiplexing of SS/PBCH block(s) and CORESET(s)#0 in NR-U, where Pattern 1 is understood as CORESET#0 and an SS/PBCH block occuring in different time instances, and the CORESET#0 bandwidth overlaping with the transmission bandwidth of the SS/PBCH block.

As one element to facilitate a NR-U DRS design without gaps in the time domain, the CORESET#0 configuration(s) and/or Type0-PDCCH common search space configuration(s) may need enhancements compared to NR Rel-15, such as additional time domain configurations of the common search space(s).

The detection of a gNB's transmission burst by the UE has been studied, and concerns on the UE power consumption required for Tx burst detection e.g. if the UE needs to frequently detect/monitor the PDCCH have been raised. The proposals that have been made by contributions regarding these topics include existing NR signal(s) with potential enhancement(s), a channel such as PDCCH with potential enhancement(s), and the 802.11a/802.11ax preamble with potential enhancement(s); consensus was not achieved on any of these proposals. The detection/decoding reliability of each of the proposals has not been sufficiently evaluated for a complete evaluation of the proposals against each other. The power consumption and detection/decoding complexity of each of the proposals have not been sufficiently evaluated for a complete evaluation of a proposal with C-DRX and/or measurement gap(s) may need further consideration when specifications are being developed.

Compared to NR Rel-15, it has been identified to be beneficial if the time domain instances in which the UE is expected to receive PDCCH can change dynamically, e.g. by implicit determination related to the gNB's COT, or explicitly signalled by the gNB.

For UL waveform for PUSCH, PUCCH, and PRACH, it has been identified that an interlaced waveform can have benefits in some scenarios including link budget limited cases with given PSD constraint, and as one option to efficiently meet the occupied channel bandwidth requirement.

On the other hand, it is RAN1's understanding that the temporal allowance of not meeting occupied channel bandwidth by regulation can be exploited if the minimum bandwidth requirement, e.g., 2 MHz, is satisfied. Therefore, a waveform contiguous in frequency may be adequate in some scenarios, which implies that Release 15 NR contiguous allocation designs can be used for NR-U as well.

Support for Rel-15 NR PUSCH can be considered. However, it has been identified that block-interlaced based PUSCH can be beneficial.

Support for Rel-15 NR PUCCH formats can be considered, however, not necessarily all Release 15 NR PUCCH formats are applicable to NR-U. It has been identified that legacy PUCCH formats PF2 and PF3 are beneficial for NR-U for the scenario of contiguous allocations due to the fact that they may be configured with bandwidth that meets the minimum temporal allowance of 2 MHz (12/6/3 PRBs for 15/30/60 kHz SCS). It has been identified that legacy PUCCH formats PF0/1/4 are not well-suited for NR-U for the scenario of contiguous allocations since they support only single PRB.

When new block interlace waveform for PUCCH is to be defined, it is beneficial to use the same block interlace structure for PUCCH and PUSCH.

It has been identified that enhancement of one or more legacy PUCCH formats is feasible to support block interlaced PUCCH transmission. There is consensus that enhanced PUCCH with both short and long duration is beneficial for NR-U; however, no consensus has been achieved about which legacy PUCCH format(s) should be the starting point for an enhanced PUCCH design. Some sources suggest introducing just one or two new enhanced PUCCH formats, while other sources suggest enhancing all or almost all legacy PUCCH formats (PF0,1,2,3,4). Regardless of which format(s) is(are) chosen as a starting point for enhancement, the following common aspects have been identified as important to consider in the detailed design of the enhanced PUCCH format(s) when specifications are developed:

- Flexible number of OFDM symbols
  - Short duration, e.g., 1 or 2 OFDM symbols
  - Long duration, e.g., 4 14 OFDM symbols
- Flexible UCI payload
  - Small payload, e.g., 1 or 2 bit
  - Larger payloads, e.g., > 2 bits
- Coding of UCI payload, e.g.,
  - Extend legacy (NR Rel-15) PUCCH encoder to handle small payloads
  - Repetition of coded UCI bits across PRBs of an interlace
  - UCI Codebits over all PRBs, i.e. no repetition coding.
- Number of supported PUCCH formats

- Support for user multiplexing of both UCI payload and DMRS on an interlace, e.g.,
  - OCCs
  - Cyclic shifts
  - FDM within an interlace
- Multiplexing method of UCI payload and DMRS, e.g,
  - TDM
  - FDM
- Mechanism to control PAPR, e.g.,
  - OCC cycling
  - Bit level processing
  - PRB level processing
  - Sequence hopping
- PUCCH waveform, e.g.,
  - CP-OFDM
  - DFT-s-OFDM
- Performance, e.g.,
  - Required SNR to achieve a target BLER
  - Required SNR to achieve target ACK to NACK rate, NACK to ACK rate and DTX to ACK rate
  - Coverage considering CM/PAPR

Support for Rel-15 NR PRACH formats can be considered, however, not necessarily all Release 15 NR PRACH formats are applicable to NR-U. It is RAN1's understanding that certain formats do not meet the minimum bandwidth requirement by regulation. Exclusion of the support of certain formats is to be identified.

It is identified that interlaced based PRACH can be beneficial.

It has been identified that enhancement of one or more legacy PRACH formats is feasible for NR-U. Four potential design alternatives, including no interlacing, have been identified for the frequency mapping of PRACH sequences for NR-U, where consensus on which one(s) to support for NR-U has not yet been achieved:

- Alt-1: Uniform PRB-level interlace mapping
  - In this approach a PRACH sequence for a particular PRACH occasion is mapped to all of the PRBs of one or more of the interlaces in the PRB-based block interlace structure. Within a PRB, either all or a subset of REs are used. Different PRACH occasions are defined using an orthogonal set of PRBs, or an orthogonal set of REs within the PRBs, from one or more same/different interlaces.
  - It has been identified that a uniform mapping (equal spacing of PRBs) in the frequency domain produces a zero-autocorrelation zone, of which the duration is inversely proportional to the frequency spacing between the PRBs.
- Alt-2: Non-uniform PRB-level interlace mapping
  - In this approach a PRACH sequence for a particular PRACH occasion is mapped to some or all of the PRBs of one or more of the interlaces in the same PRB-based block interlace structure used for PUSCH/PUCCH. Within a PRB, either all or a subset of REs are used. Different PRACH occasions are defined using an orthogonal set of PRBs, or an orthogonal set of REs within the PRBs, from one or more same/different interlaces.

- It has been identified that an irregular mapping (non-equal spacing of PRBs/REs) in the frequency domain reduces the false peaks in the PRACH preamble auto-correlation function.
- Alt-3: Uniform RE-level interlace mapping
  - In this approach, a PRACH sequence for a particular PRACH occasion consists of a "comb-like" mapping in the frequency domain with equal spacing between all used REs. Different PRACH occasions are defined by way of different comb offsets.
  - Since this approach does not fit with the common PUSCH/PUCCH interlace structure, one source suggests that only TDM multiplexing of PUSCH/PUCCH and PRACH should be supported. Another source suggests that puncturing/rate matching PUSCH/PUCCH around the used PRACH REs may be used.
- Alt-4: Non-interlaced mapping
  - In this approach, a PRACH sequence for a particular PRACH occasion is mapped to a number of contiguous PRBs, same or similar to NR Rel-15.
  - Some sources propose that to fulfill the minimum OCB requirement, that the PRACH sequence is mapped to a set of contiguous PRBs, and the PRACH sequence mapping is repeated across the frequency domain, potentially with guard RE(s)/PRB(s) between repetitions. For each repetition, a different cyclic shift or different base sequence may or may not be applied.

It has been identified that the long PRACH sequence length defined in NR Rel-15 (L = 839) is not beneficial for NR-U, since PRACH formats based on this length are tailored toward large cells not expected in an NR-U deployment. However, when it comes to shorter sequence lengths, some sources propose reusing the short sequence length (L = 139) defined in NR-Rel-15, whereas other sources propose defining new sequence lengths depending on which of the 4 alternatives above is supported.

It has been identified that the following common design attributes need to be considered in the detailed design of an interlaced PRACH waveform for 4-step random access for NR-U when specifications are developed:

- Multiplexing of PRACH and PUSCH/PUCCH, considering block interlaced structure used for PUSCH/PUCCH, e.g.,
  - FDM
  - TDM
- Supported PRACH sequence and PRACH sequence length(s)
- PRACH capacity
  - Number of PRACH preambles per cell
  - Number of root sequences
  - Number of cyclic shifts
  - Number of PRACH occasions
- Maximum supported Tx power
- PAPR/CM
- Number of PRACH formats
- Simulation assumptions for evaluation of performance, e.g.,
  - Single vs. multi-cell assumptions
- Performance metrics
  - Timing estimation error
  - Miss-detection probability

- False-detection probability
- False-alarm probability

For scenarios in which a block-interlaced waveform is used for PUCCH/PUSCH, it has been identified that from FDMbased user-multiplexing standpoint it can be beneficial to have UL channels on a common interlace structure, at least for PUSCH, PUCCH, associated DMRS, and potentially PRACH

On the other hand, for scenarios in which a contiguous allocation for PUSCH and PUCCH is used, it is beneficial to use contiguous resource allocation for PRACH

For scenarios in which a block-interlaced waveform is used for UL transmission, a PRB-based block-interlace design has been identified as beneficial at least for 15 and 30 kHz SCS, and potentially for 60 kHz SCS. One identified benefit is better link budget with given PSD constraint. However, it has been observed that power boosting gains decrease with increasing SCS. Another identified benefit is as one option to efficiently meet the occupied channel bandwidth requirement. Compared with sub-PRB interlace design, the PRB-based block-interlace design has comparatively less specification impact.

For sub-PRB block interlace designs, in some scenarios, sub-PRB block interlacing can be beneficial in terms of power boosting. However, the sub-PRB block interlace design has at least the following specification impacts: Reference signal design (e.g., DMRS); Channel estimation aspects; Resource allocation.

Both PRB and sub-PRB interlacing for 60 kHz have been studied. For sub-PRB interlacing the following aspects have been considered:

- Power boosting potential depending on resource allocation size
- PUSCH DMRS configuration aspects
- Channel estimation performance
- Number of REs per interlace unit

It has been identified as beneficial to support a block-interlaced structure in which the number of interlaces (M) decreases with increasing SCS, and the nominal number of PRBs per interlace (N) is similar for each SCS (in a given bandwidth) at least for 15 and 30 kHz SCS, and potentially 60 kHz depending on supported interlace design.

From a RAN1 perspective it has been identified that supporting a non-uniform interlace structure in which the number of PRBs per interlace is allowed to be different for different interlaces is beneficial from a spectrum utilization point of view. It is up to RAN4 to investigate whether or not the non-uniform interlace structure has an impact on MPR/A-MPR requirements for PUSCH.

Within a 20 MHz bandwidth, the following candidate PRB-based interlace designs have been identified where M is the number of interlaces and N is the number of PRBs per interlace in a 20 MHz bandwidth. Where two values are listed for N, it means that some interlaces have one more PRB than others (non-uniform interlace design)

SCS	M	Ν
15 kHz	12	8 or 9
	10	10 or 11
	8	13 or 14
30 kHz	6	8 or 9
	5	10 or 11
	4	12 or 13
60 kHz	4	6
	3	8
	2	12
60 kHz (if 26 PRBs is	4	6 or 7
supported in a 20 MHz	2	13
bandwidth)	3	8 or 9

For carriers with bandwidth larger than 20 MHz, two candidate interlace designs have been identified:

- Alt-1: Same interlace spacing for all interlaces regardless of carrier BW. This alternative uses Point A as a reference for the interlace definition
- Alt-2: Interlacing defined on a sub-band (20 MHz) basis. (Note: Possible interlace spacing discontinuity at edges of sub-band).

Additional candidates have been identified, but consensus has not been achieved, e.g., (1) for carriers with bandwidth larger than 20 MHz, retain the same number of PRBs per interlace (N) for all interlaces regardless of carrier BW; (2) Partial interlace allocation. Detailed design can be further discussed when specifications are developed taking RF aspects into account.

It has been identified that support of different numerology candidates at least has the following specification impacts:

- For PRB-based block-interlace design for 15, 30, and 60 kHz SCS, the following spec impacts have been identified: Number of interlaces and number of PRBs per interlace need to be defined; the resource allocation mechanism needs to be defined; channel estimation aspects need to be considered, such as impact on PRG. In addition to the above impact, for sub-PRB-based block-interlace design for 60 kHz SCS, reference signal design (such as DMRS) needs to be revisited and alternative resource allocation mechanism is needed.
- For NR-U DRS design for 15 and 30 kHz SCS, the SS/PBCH block time domain pattern is already supported in Rel-15. For 60 kHz SCS, there is no SS/PBCH block time domain pattern defined in Rel-15. SS/PBCH block to CORESET configuration tables (38.213 Section 13) need to be defined as well.
- For PRACH design for 15, 30, and 60 kHz SCS, signalling mechanism of RACH configuration indicating PRACH numerology may need modification to support more than two numerologies for PRACH for NR-U.

It has been identified as beneficial for NR-U to introduce additional flexibility in configuring/triggering SRS compared to NR Rel-15. The following candidate enhancements have been discussed; design details can be further discussed when specifications are developed:

- Additional OFDM symbol locations for an SRS resource within a slot other than the last 6 symbols
- Interlaced waveform
- Additional flexibility in frequency domain configuration

It may be beneficial to apply restrictions on the use of DFT-s-OFDM in NR-U to avoid significant design efforts specific to operation in unlicensed spectrum.

### 7.2.1.3 Physical layer procedure designs

#### 7.2.1.3.1 Channel access procedures

If absence of Wi-Fi cannot be guaranteed (e.g. by regulation) in the band (sub-7 GHz) where NR-U is operating, the baseline assumption is, the NR-U operating bandwidth is an integer multiple of 20MHz.

Channel access mechanisms need to comply with regulations and may therefore need to be adapted for particular frequency ranges.

For channel access mechanism, LTE-LAA LBT mechanism is adopted as baseline for 5GHz band and adopted as the starting point of the design for 6GHz band. At least for band where absence of Wi-Fi cannot be guaranteed (e.g. by regulation), LBT can be performed in units of 20 MHz.

For 5GHz band, having a 16 µs gap to accommodate for the transceiver turnaround before the immediate transmission of the responding node is beneficial for NR-U, such as for supporting fast A/N feedback, and is permitted per regulation. Restrictions/conditions on when this option can be used will be further identified, e.g., in consideration of fair coexistence.

A 16 µs gap to accommodate for the transceiver turnaround before the immediate transmission of the responding node can also be applied to 6GHz band if allowed by regulation, and restrictions/conditions on when this option can be used will be further identified, if fair coexistence criterion is defined for 6GHz band.

For CWS adjustment procedure in NR-U, in addition to aspects considered in LTE LAA, NR-U may additionally consider at least the following aspects: CBG based HARQ-ACK operation, NR scheduling and HARQ-feedback delays

and processing times, wideband (>20 MHz) operation including BWPs, Configured grant operation. For initiation of a COT by the gNB (operating as an LBE device), the channel access schemes in Table 7.2.1.3.1-1 are used.

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	Cat 2 LBT	Cat 4 LBT
DRS alone or multiplexed with non-unicast data (e.g. OSI, paging, RAR)	When the DRS duty cycle ≤1/20, and the total duration is up to 1 ms: 25 µs Cat 2 LBT is used (as in LAA)	When DRS duty cycle is > 1/20, or total duration > 1 ms
DRS multiplexed with unicast data	N/A except for the cases discussed in the Note below	Channel access priority class is selected according to the multiplexed data
PDCCH and PDSCH	N/A except for the cases discussed in the Note below	Channel access priority class is selected according to the multiplexed data

Note: Applicability of an LBT scheme other than Cat 4 LBT for control messages related to initial/random access, mobility, paging, reference signals only, and PDCCH-only transmissions, e.g. "RACH message 4", handover command, GC-PDCCH, or short message paging transmitted either alone or when multiplexed with DRS have been discussed. Further details related to exceptions in this note can be determined when specifications are developed.

At least for the case where a DL burst follows a UL burst within a gNB-initiated COT and there is no gap larger than 25 µs between any two transmissions in the COT, the channel access schemes in Table 7.2.1.3.1-2 apply for the DL burst following a UL burst.

# Table 7.2.1.3.1-2: Channel access schemes for a DL burst follows a UL burst within a gNB-initiated COT as LBE device

Cat 1 Immediate transmission	Cat 2 LBT
When the gap from the end of the	When the gap from the end of the scheduled UL
scheduled UL transmission to the	transmission to the beginning of the DL burst is larger
beginning of the DL burst is up to 16 $\mu sec$	than 16 $\mu sec$ but not more than 25 $\mu sec$

Note: a DL burst is defined as a set of transmissions from a given gNB having no gaps or gaps of no more than 16 µs. Transmissions from a gNB having a gap of more than 16 µs are considered as separate DL bursts.

Within a gNB-initiated COT, an UL burst for a UE consisting of one or more of PUSCH, PUCCH, PRACH, and SRS follows the channel access schemes in Table 7.2.1.3.1-3.

Cat 1 Immediate transmission	Cat 2 LBT	Cat 4 LBT
When the gap from the end of the DL transmission to the beginning of the UL burst is not more than 16 µsec. Note: Maximum limits of the duration of the UL burst other than those already derived from MCOT duration limits should be further discussed when specifications are developed.	<ul> <li>For any of the following cases: <ul> <li>When the gap between any two successive scheduled/granted transmissions in the COT is not greater than 25 μsec</li> </ul> </li> <li>For the case where a UL transmission in the gNB initiated COT is not followed by a DL transmission in the same COT <ul> <li>Note: the duration from the start of the first transmission within the channel occupancy until the end of the last transmission in the same channel occupancy shall not exceed 20 ms.</li> </ul> </li> </ul>	N/A

Note: An UL burst is defined as a set of transmissions from a given UE having no gaps or gaps of no more than 16 µs. Transmissions from a UE having a gap of more than 16 µs are considered as separate UL bursts. The number of LBT attempts within a COT should be determined when specifications are developed.

For initiation of a COT by the UE, the channel access schemes in Table 7.2.1.3.1-4 are used.

	Cat 2 LBT	Cat 4 LBT
PUSCH (including at least UL-	N/A except for the	Channel access priority class is
SCH with user plane data)	cases discussed in	selected according to the data
	Note 2 below	
SRS-only	N/A	Cat4 with lowest channel access priority class value (as in LTE eLAA)
RACH-only	(see Note 2)	Cat4 with lowest channel access priority class value
PUCCH-only	(see Note 2)	Cat4 with lowest channel access priority class value

#### Table 7.2.1.3.1-4: Channel access schemes for initiating a COT by UE as LBE device

Note 1: If the COT includes multiple signals/channels with different channel access categories / priority classes, the highest channel access priority class value and highest channel access category among the channel access priority classes and channel access categories corresponding to the multiple signals/channels applies.

Note 2: Applicability of a channel access scheme other than Cat 4 for the following signals / channels have been discussed and details are to be determined when the specifications are developed:

- UL control information including UCI only on PUSCH, e.g. HARQ-ACK, Scheduling Request, and Channel State Information
- Random Access

For FBE mode of operation, gNB acquires COT with Cat2 immediately prior to the fixed frame period. Within the gNB acquired COT, if a gap is  $\leq 16 \mu$ s, Cat 1 channel access scheme can be used by the gNB and associated UEs. Within the gNB acquired COT, if a gap is  $\geq 16 \mu$ s, Cat 2 channel access scheme should be used by the gNB and associated UEs. Note this channel access mechanisms are intended to be aligned with any regulations for FBE operation.

Means to reduce or mitigate the impact of interference e.g. from hidden nodes with UE assistance have been studied. Possible mechanisms include at least enhancements to L1 measurement and reporting of interference observed by a UE, and handshaking procedures between transmitter and the receiver. Further consideration is required regarding the detailed solutions and their benefits for mitigation of impact of interference on NR-U when the specifications are to be developed.

Means to facilitate spatial reuse, or frequency reuse 1 operation of NR-U have been studied. Possible mechanisms include at least: alignment of starting points for transmission (and consequently time instances for at least the last CCA); exchange and coordination of LBT related parameters amongst different NR-U gNBs or UEs; means to determine whether interference originates from other NR-U nodes; enhancements to L1 measurement and reporting of interference observed by a UE; and adjustment of energy/signal detection thresholds. Further consideration is required regarding the detailed solutions and their benefits for facilitating spatial reuse in NR-U when the specifications are to be developed, taking into account regulations.

Channel access mechanisms for beamformed transmissions have been studied. It has been identified that omnidirectional LBT should be supported. Using directional LBT for beamformed transmissions, i.e. LBT performed in the direction of the transmitted beam has also been studied. Further consideration is required regarding directional LBT and its benefits for beamformed transmissions when the specifications are to be developed, taking into account regulations and fair co-existence with other technologies.

#### 7.2.1.3.2 Initial access and mobility

For initial access and mobility procedures, the main issue identified for NR operation in unlicensed band is the reduced transmission opportunities for different signals and channels due to LBT failure.

The following modifications to initial access procedures have been identified as beneficial:

- Modifications to initial access procedures considering limitations on access to the channel based on LBT. NR-U
  needs to develop techniques to handle reduced SS/PBCH block and RMSI transmission opportunities due to
  LBT failure.
- Enhancement to 4-step RACH, including developing mechanisms to handle reduced msg 1/2/3/4 transmission opportunities due to LBT failure.

It is also identified that a 2-step RACH procedure potentially has benefit for channel access.

For SS/PBCH block transmission, it is recommended to define a mechanism to transmit SS/PBCH blocks dropped due to LBT failure. It is also recommended to define a mechanism when specifications are developed for UE(s) to determine the frame timing and QCL assumptions from the detected SS/PBCH block. The feasibility and benefits of beam repetition for soft combining reception of SSBs within the same DRS transmission may be further considered.

For SS/PBCH block transmissions as part of DRS, it is considered beneficial to expand the maximum number of candidate SS/PBCH block positions within the DRS transmission window to Y, for e.g.,  $Y \le 64$ , where the choice of Y may depend on the numerology of the SS/PBCH blocks. The transmitted SS/PBCH blocks do not overlap and the maximum number of transmitted SS/PBCH blocks is X within DRS transmission window with  $X \le 8$ . The time-domain positions of the actually transmitted SS/PBCH blocks are selected from a set of Y candidate SS/PBCH block positions. Proposals for shift granularity between candidate time domain SSB positions/candidate groups of SSBs, duration of DRS transmission window, and duration of the transmitted DRS within the window including SSBs and other multiplexed signals/channels, were discussed without reaching consensus, and can be considered further when specifications are developed.

Modifications to paging procedures due to reduced transmission opportunities for paging due to LBT failure are beneficial and have been identified and studied. It is therefore considered beneficial to enhance paging opportunities using the following mechanism:

- Increased time-domain paging occasions or paging monitoring occasions.
  - This can enable additional paging occasions outside of DRS.

Note: Parts or all of the above enhancement may fall under the purview of higher-layer enhancements and may not require any further study from a L1 perspective

For potential RACH resource enhancements, the following options have been identified for NR-U, beyond the flexibility already available in Rel-15, but consensus was not achieved. These options may be further considered when specifications are developed:

- Frequency-domain enhancement: Multiple PRACH resources across multiple LBT sub-bands/carriers for both contention-free and contention-based RA
- Time-domain enhancements:
  - For connected mode UE, scheduling of PRACH resources via DCI.
    - Triggered PRACH within gNB acquired COT can use a new resource indicated by the DCI
  - For idle mode UE, scheduling of PRACH resources via paging
    - Note: potential inefficiency in network resource due to paging across multiple cells
  - Additional, new RACH resources are used immediately following detection of DRS transmission
  - Multiple PRACH transmissions before Msg2 reception in RAR window for initial access
    - Number of allowed transmissions is pre-defined or indicated, e.g., in RMSI
  - Group wise SSB-to-RO mapping by frequency first-time second manner, where grouping is in time domain

For msg1 transmission of 4-step RACH procedure, if preamble transmissions are dropped due to LBT failure, then from RAN1 perspective, it is recommended that preamble power ramping is not performed and that the preamble transmission counter is not incremented.

For msg 2 transmission in the 4-step RACH procedure, in some scenarios it is beneficial for the maximum RAR window size to be extended beyond 10 ms to improve robustness to DL LBT failure for RAR transmission. Other candidate mechanisms that were identified without reaching consensus include preconfigured/pre-indicated/scheduled multiple opportunities in time and/or frequency domain in different LBT subbands for message 2/3/4 transmissions and/or reducing the latency of the RACH procedure and can be considered further when specifications are to be developed.

Potential modifications to RLM/RRM procedures due to reduced transmission opportunities for DL signals and channels due to LBT failure have been identified and studied.

For RLM on an unlicensed SpCell and RRM, it is considered beneficial to configure DMTCs (DRS Measurement Time Configuration) in which UEs can perform measurements. It is considered beneficial that these time-domain measurement windows for RRM measurements and RLM can be different. RLM DMTC may coincide with DRS transmission window. For RLM, the following recommendations are considered beneficial for further design when the specifications are developed:

- Identifying a set of RLM-RS, e.g., DRS, SS/PBCH blocks, CSI-RS. The transmission of the RS in a COT may be subject to LBT.
- Identifying which set(s) of RLM-RS are used for in-sync and out-of-sync evaluations. For example, determining which RLM-RS within or outside the RLM measurement window can be utilized for in-sync and out-of-sync evaluations.
- Potential definition of a metric, e.g., Rel-15 out-of-sync indication or new metric, to accurately identify instances of unsuccessful detection of RLM-RS. Whether/how to report such a metric to higher layers is determined when the specifications are developed.

It is beneficial to support reporting of RSSI. Furthermore, it is considered beneficial to report a metric to represent channel occupancy or medium contention in addition to RSSI, as also noted from a higher-layer perspective in Section 7.2.2.3.1. The exact definition of the metric(s) can be considered when specifications are developed.

### 7.2.1.3.3 Potential HARQ enhancements

NR-U uses NR HARQ feedback mechanisms as baseline, and enhancements can be identified.

Transmission of HARQ A/N for the corresponding data in the same shared COT is identified as beneficial. For NR-U, the design strives to support transmitting all HARQ A/N for the corresponding data in the same shared COT, if possible, considering the current NR UE processing time required. A gap of up to 16 µs should be allowed between the end of the DL transmission and the immediate transmission of feedback to accommodate for the hardware turnaround time. It is beneficial to be able to support transmissions (e.g. CSI reporting or SRS, or other PUSCH, or CSI-RS, or other PDSCH) in the time between one DL data transmission for a UE and the corresponding UL transmission of DL HARQ feedback for the same UE within a shared COT. Potential enhancements for such type of operation, e.g. by possibly preconfigured or pre-determined uplink transmissions for reducing signaling overhead for these transmissions, may be beneficial.

However, it is understood in some cases, the HARQ A/N has to be transmitted in a separate COT from the one the corresponding data was transmitted. Introduce signaling a value of the PDSCH-to-HARQ-timing-indicator in the DCI scheduling the PDSCH that tells the UE that the timing and resource for HARQ-ACK feedback for the corresponding PDSCH will be determined later.

Techniques to handle reduced HARQ A/N transmission opportunities for a given HARQ process due to LBT failure are identified as beneficial. Potential techniques include mechanisms to provide multiple and/or supplemental time and/or frequency domain transmission opportunities.

When UL HARQ feedback is transmitted on unlicensed band, NR-U considers mechanisms to support flexible triggering and multiplexing of HARQ feedback for one or more DL HARQ processes

NR-U should support both the HARQ feedback corresponding to some or all the PDSCHs of a channel occupancy can be reported in the same channel occupancy and HARQ feedback corresponding to PDSCHs of a channel occupancy can be reported outside of that channel occupancy.

To support the HARQ feedback corresponding to some or all the PDSCHs of a channel occupancy to be reported in the same channel occupancy, it is found beneficial to extend the PDSCH-to-HARQ-timing to support indicating timings up to the end of the longest COT allowed by regulations. One or more of the following would be needed: Allow values larger than 15 by RRC signalling; Allow more bits for the PDSCH-to-HARQ-timing-indicator.

To support HARQ feedback corresponding to PDSCHs of a channel occupancy can be reported outside of that channel occupancy, the following possible candidate solutions can be considered:

- Alt1: gNB requests/triggers feedback for PDSCH from earlier COT(s)
- Alt2: UE is configured to report HARQ feedback for PDSCH from earlier COT(s) without an explicit request/trigger

- Alt3: by PDSCH-to-HARQ-timing-indicator in the DCI scheduling the PDSCH

The alternatives above are at least applicable for the case where there is no HARQ feedback expected in the same channel occupancy as the PDSCH.

Further details on potential solutions to allow cross-COT HARQ-ACK feedback and multiple opportunities for HARQ-ACK feedback are provided in Table 7.2.1.3.3-1.

	Cross-COT HARQ-ACK	Multiple opportunities for
	feedback	HARQ-ACK feedback
Alt1: gNB requests/triggers feedback for PDSCH from earlier COT(s) or additional reporting of earlier HARQ feedback, where the exact HARQ feedback timing and resource is provided to the UE in another DCI (in the same or in another COT)	Alt1a: request/trigger reporting of HARQ feedback for earlier COT(s) or additional reporting of earlier HARQ feedback without explicit signaling of HARQ process ID, possibly along with other HARQ feedback reports (e.g. for the current COT) Alt1b: request/trigger reporting for a set of HARQ processes, either for all configured HARQ processes (e.g. group feedback), or for a set of HARQ process IDs or HARQ process ID groups	
Alt2: UE is configured/allowed to report HARQ feedback for PDSCH from earlier COT(s) without an explicit request/trigger	UE autonomously reports UCI with ac processes - e.g. corresponding to PD reported in PUSCH [or PUCCH] along	SCH from earlier COT(s) - that are
Alt3: gNB requests feedback outside the COT by PDSCH-to- HARQ-timing-indicator in the DCI scheduling the PDSCH	The UE will attempt reporting at the indicated time and resource (e.g. in a UE-initiated channel occupancy), even if the PDSCH-to-HARQ- timing-indicator indicates a slot that falls outside the gNB-initiated COT.	Not a solution if PDSCH-to-HARQ- timing-indicator can only indicate a single value
Alt4: preconfigured/pre-indicated multiple opportunities in frequency domain in different LBT subbands	Possible if this is combined with Alt1 or Alt2 or Alt3	Possible for indicating multiple candidate PUCCH or PUSCH carrying HARQ-ACK feedback
Alt5: preconfigured/pre-indicated multiple opportunities in time domain	The UE will attempt reporting at the preconfigured/pre-indicated times and resources (e.g. in a UE- initiated channel occupancy)	Alt5a: Multiple candidate opportunities by providing multiple timings in PDSCH-to-HARQ-timing- indicator and/or other DCI fields Alt5b: Multiple candidate slots in a window with size configured by RRC. There could be some activation/deactivation by DCI

A possible enhancement for dynamic HARQ codebook is to support a larger DAI field to accommodate for possibly missing more than 4 PDSCH transmissions, which is more likely to occur on unlicensed spectrum. Enhancements are necessary for aligning the dynamic HARQ codebook between UE and gNB. Alt. 1 in Table 7.2.1.3.3-1 allows triggering/requesting a report for missed or unreported HARQ-ACK feedback in case of LBT failure for PUCCH/PUSCH transmission, or in case of PUCCH/PUSCH detection failure at gNB, or in case of PDCCH detection failure at UE, or in case of HARQ-ACK feedback pending from earlier COT(s). Alt. 2 in the table allows reporting unreported HARQ-ACK feedback in case of LBT failure for PUCCH/PUSCH transmission, or in case of LBT failure for PUCCH/PUSCH transmission, or in case of HARQ-ACK feedback pending from earlier COT(s). Alt. 2 in the table allows reporting unreported HARQ-ACK feedback in case of LBT failure for PUCCH/PUSCH transmission, or in case of HARQ-ACK feedback pending from earlier COT(s).

Scheduling multiple TTIs for PUSCH each using a separate UL grant in the same PDCCH monitoring occasion is identified as beneficial. Scheduling multiple TTIs for PUSCH, i.e., scheduling multiple TBs with different HARQ process IDs over multiple slots, using a single UL grant, is identified as beneficial and should be supported in NR-U.

In case of CBG-based HARQ and LBT category 4, enhancements for defining how to adjust the contention window size (CWS) based on TB-level HARQ-ACK and CBG-level HARQ-ACK would be beneficial.

### 7.2.1.3.4 Potential enhancements to configured grant

NR already defined Type-1 and Type-2 configured grant mechanism. For NR-U, there is no necessity to exclude Type-1 or Type-2 configured grant mechanism for operation of NR in unlicensed spectrum.

The following modifications to the configured grant procedures are beneficial.

- Removing dependencies of HARQ process information to the timing. This can be achieved by introducing UCI on PUSCH to carry HARQ process ID, NDI, RVID
  - Additional information fields can be considered to be included in the UCI, e.g. UE-ID, COT sharing information, PUSCH duration, etc.
  - It was identified that the resources utilized by the UCI, and multiplexing of UCI and data information of PUSCH require consideration of DMRS placement and starting and ending symbols of the configured grant based transmissions. Details on multiplexing UCI and data information of configured grant PUSCH can be determined when specifications are developed.
- Introducing Downlink Feedback Information (DFI) including HARQ feedback for configured grant transmission
- Increased flexibility on time domain resource allocation for the configured grant transmissions
- As for potential solutions to providing flexibility on time domain resource allocation, bitmap based approach and NR Rel-15 based time domain resource allocation approach, which includes {periodicity, offset in the frame, start symbol and length of PUSCH and K-repetition signaling}, are identified as potential candidates. Additional aspects such as finer granularity of resource allocation, and multiple resources within a period may be considered for enhancing flexibility on time domain resource allocation.- Supporting retransmissions without explicit UL grant

Allowing consecutive configured grant resources in time without any gaps in between the resources and nonconsecutive configured grant resources (not necessarily periodic) with gaps in between the resources is beneficial and should be considered for NR in unlicensed spectrum

UE selects the HARQ process ID from an RRC configured set of HARQ IDs for NR-unlicensed configured grant transmission.

It is identified to be beneficial to support DFI to include pending HARQ ACK feedback for prior configured grant transmissions from the same UE.

It was identified that it is problematic for the UE to assume ACK in absence of reception of feedback, which may include explicit feedback or feedback in the form of uplink grants. It was additionally identified that assuming NACK upon timer expiration can be a candidate solution to avoid LBT impact on reception of feedback. It was also identified that possible conflicts, with respect to NDI and RNTI for the same HARQ process, between configured grant transmission and scheduled grant transmission may have to be addressed. Details can be determined when specifications are developed.

For the retransmission of a HARQ process that was initially transmitted via configured grant resource, both retransmission via same configured grant resource and retransmission via resource scheduled by UL grant are supported.

UE may autonomously initiate retransmission for a HARQ process that was initially transmitted via configured grant mechanism for NR-unlicensed when it receives NACK feedback via DFI for the corresponding HARQ process.

It is identified to be beneficial to consider UE multiplexing and collision avoidance mechanisms between configured grant transmissions and between configured grant and scheduled grant transmissions.

NR-unlicensed configured grant transmission is not allowed during the time when it overlaps with occasions configured for potential NR-U DRS of the serving cell irrespective of the configured time domain resource for configured grant transmission.

It was identified that CBG based retransmissions for configured grant based transmissions is beneficial. Details on which CBG related control information is transmitted as part of DFI and UCI, and how such control information is conveyed through DFI and UCI can be determined when specifications are developed.

It was identified that collision avoidance between configured grant and scheduled grant based transmission can be achieved by management of starting point of the transmission for configured grant and scheduled grant based transmission. Further details on the management of the starting point of the transmission can be determined when specifications are developed.

It was identified that sharing resources with gNB within COT(s) that is acquired by UE(s) as part of configured grant based transmissions should be supported. It was also identified that allowing configured grant based transmissions within a gNB acquired COT should be supported. Details of identification of situations when COT(s) sharing is possible and the details of potential resource sharing mechanisms and rules can be determined when specifications are developed.

### 7.2.2 Higher layer aspects

### 7.2.2.1 Inactive and Idle procedures (38.304 related)

For Inactive and Idle mode procedures, Rel-15 NR design is considered as the baseline. As such, NR licensed measurement framework (cell and beam quality derivation for RSRP, RSRQ, and SINR, filtering and combining multiple beams) is also used as the baseline.

The UE measurements in Idle/Inactive mode will assume recurring transmissions of SSB/PBCH and RMSI but possibly with reduced opportunities due to LBT. The impact of LBT on Idle/Inactive measurement is not captured in RAN2 specifications.

In unlicensed bands, multiple PLMNs can use the same carriers without any coordination. Therefore, the best cell found by a UE on a frequency may not belong the registered PLMN. In this case, the UE should be enabled to camp on a non-best cell on a carrier if the best cell does not belong to the registered PLMN (or E-PLMN), where the non-best cell would still be the best cell of the registered PLMN.

For paging, it may be beneficial to introduce more opportunities per DRX cycle for the UE to receive the page. The additional locations can be provided in time domain by configuring an extended paging occasion (i.e. a paging window) or configuring multiple paging occasions to a UE. In any specified solution(s) based on additional paging opportunities, the UE power consumption should also be taken into account; to this end, it is beneficial that the paging occasions are transmitted in close time to or overlap with the reference signals.

### 7.2.2.2 L2 impacts

### 7.2.2.2.1 RACH (4-step, 2-step)

Both 4-step and 2-step RACH will be supported for NR-U. Here 2-step RACH refers to the procedure which can complete contention-based RACH (CBRA) in two steps as explained below. One additional benefit of 2-step RACH is due to less LBT impact with the reduced number of messages. However, in order to alleviate the impact of LBT failures further, additional opportunities for the RACH messages may be introduced, e.g. in time or frequency domain, for both 4-step and 2-step RACH. The additional opportunities for 4-step RACH will be applicable to both msg1 and msg3.

NR-U will support contention-free RACH (CFRA) and CBRA for both 2-step and 4-step RACH. On SCells, CFRA is supported as a baseline while both CBRA and CFRA are supported on SpCells.

For 4-step RACH, the messages in time order are named as msg1, msg2, msg3, msg4 and for 2-step RACH, they are named msgA and msgB.

A single RACH procedure i will be used and thus multiple RACH procedures in parallel will not be supported for NR-U.As a baseline, the random-access response to msg1 will be on SpCell and msg3 is assumed to use a predetermined HARQ ID.

In legacy RACH, the counters for preamble transmission and power ramping are increased with every attempt. In NR-U, power ramping is not applied when preamble is not transmitted due to LBT failure. This will require an indication from the physical layer to the MAC. In addition, ra-ResponseWindow is not started when the preamble is not transmitted due to LBT failure.

It is assumed that ra-ContentionResolutionTimer may need to be extended with larger values to overcome the LBT impact.

For 2-step RACH, the msgA is a signal to detect the UE and a payload while the second message is for contention resolution for CBRA with a possible payload. msgA will at least include the equivalent information which is transmitted in msg3 for 4-step RACH.

NOTE: Further input from RAN1 will be needed for the payload size of msgA.

As a baseline, all the triggers for 4-step RACH are also applicable to 2-step RACH; however further analysis is needed on SI request and BFR as well as how timing advance and grants can be obtained for msgA.

The contention resolution in 2-step RACH will be performed by including a UE identifier in the first message which is echoed in the second message. The type of UE identifier(s) is FFS.

Fall-back from 2-step RACH to 4-step RACH will be supported. The fallback after msgA transmission is feasible only if detection of the UE without the decoding of the payload is possible and thus relies on such support at the physical layer.

If 2-step RACH is used for initial access, the parameters for 2-step RACH procedure including resources for msgA will be broadcasted.

NOTE: 2-step RACH if applied to licensed operation would not take into account LBT.

#### 7.2.2.2.2 MAC (except RACH)

For scheduling request (SR), a prohibit timer as in NR licensed can be used. However, this should not prevent the UE from attempting to transmit an SR again if the triggered SR was not transmitted due to LBT failure.

#### 7.2.2.2.3 Other

For channel access and transmissions in NR-U the mechanisms and associated signaling adopted by LTE LAA (e.g. standardized QCI to access priority mapping for DL and UL, how access priority per logical channel is determined for scheduled UL and AUL transmissions etc) are used as the baseline. Any changes due to new physical layer design and channel access mechanisms for NR-U (e.g. introduction of PRACH, support of FBE) can also be introduced.

In addition, access priority for control signaling (transmissions over SRBs) over unlicensed carriers should be introduced for stand-alone and DC NR-U. In this case, it is assumed that control signaling will have the highest access priority.

### 7.2.2.3 Control plane impacts

#### 7.2.2.3.1 RLM/RLF and mobility (conn mode)

For non-standalone NR-U deployments, connected mode mobility is supported on licensed spectrum using the baseline mobility procedure specified for the concerned licensed radio access technology (LTE or NR).

For standalone NR-U deployments, the following mobility scenarios shall be supported:

- Inter-cell handover between NR-U and NR-U;
- Inter-cell handover between NR-U and NR.

In addition, the following mobility scenarios shall be supported based on the mobility between NR-U and NR and and the mobility between NR and (e)LTE, however further optimizations to this scenarios will be considered possibly with lower priority:

- Inter-RAT handover between NR-U and LTE connected to EPC;
- Inter-RAT handover between NR-U and LTE connected to 5GC.

For connected mode mobility, the main issue identified for NR operation in unlicensed band is the reduced transmission opportunities for different signalings due to LBT failure.

The following modifications to mobility-related procedures have been identified as beneficial to study:

- Modifications to mobility-related measurements considering limitations to the transmission of reference signals due to LBT. NR-U needs to consider techniques to handle reduced RS (e.g. SS/PBCH block and CSI-RS) transmission opportunities due to LBT failure.
- Modifications to mobility-related measurements and/or triggers considering limitations related to high channel occupancy. NR-U needs to consider techniques to handle increased interference levels in the unlicensed channel for mobility-related decisions.

- Modifications to mobility-related procedures and/or triggers considering limitations related to the transmission of control plane signalling due to LBT. NR-U needs to consider whether NR-U specific techniques to handle additional signaling delays due to LBT failure are required, if not resolved by general mobility enhancement solutions [RP-181433].

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Potential modifications to the measurement reporting quantities, to the measurement reporting triggers and to the condition used by the UE when delaying the time at which it applies a reconfiguration for mobility that are based at least on channel occupancy and RSSI should be studied.

For RRM, RLM, and mobility procedures, NR licensed specification in Rel-15 are considered as a baseline for NR-U. However, changes to these due to new physical layer design and LBT for the unlicensed operation can be introduced. These will support both synchronous and, except for LAA case, asynchronous deployments.

The RRM and RLM framework for NR-U will also support multiple beam operation. The measurement of multiple beams in NR-U will use the framework in TS 38.300 Section 9.2.4 as a baseline and the measurement model captured in Figure 9.2.4-1 is also applicable for NR-U.

For UE measurements, it is assumed that recurring transmissions of SSB/PBCH and RMSI will be available with possibly reduced opportunities due to LBT. The NR licensed measurement framework (cell and beam quality derivation for RSRP, RSRQ, and SINR, filtering and combining multiple beams) is used as a baseline. The handling of missing measurements due to LBT are expected to be captured at physical layer specifications.

In addition to the existing measurement quantities, channel occupancy and RSSI, similar to adopted for LTE LAA, are considered useful.

In unlicensed spectrum, multiple PLMNs from different operators can share the same channel and coordination between different operators may not happen. This may cause PCI collisions or confusion. As one possible solution, the gNBs can scan different frequencies to identify the PCIs of neighbour cells and use this information in setting the PCIs of their own cells in order to avoid PCI collisions. In addition, ANR can be used, as in NR licensed, to detect and solve PCI collision and confusion.

#### 7.2.2.3.2 Other

Since System Information (SI) transmissions will be subject to LBT, it is beneficial to add more transmission opportunities in time domain for SI transmission, e.g. by configuring a longer SI window.

If there is need to have multiple SI messages then with existing NR design, different SI messages require separate LBT procedures. It may be beneficial not to require multiple LBTs for different SI messages to increase the success probability of the transmission.

In response to a RAN2 LS requesting study of system level aspects of NR-U, SA2 has discussed this topic and concluded as follows:

- Based on SA2 analysis, only system impact identified specifically for NR-U is the need for introducing RAT type for NR-U, if desired, for "subscription based access restriction", policy and charging purpose.
- If a non-public network operator wants to leverage NR-U, Network Identification & Network selection aspects for operators with no globally unique PLMN ID are already being addressed within FS\_Vertical\_LAN study ongoing in SA2. Thus NR-U is not resulting in additional system impacts work.
- The same impact identified for 5GS applies also for EPS. SA2 understanding is that for NR-U in EPS it is only for NR-U as secondary RAT (ENDC case) following similar approach in terms of subscription based access restriction, policy and charging as LAA/LWA. As such, similar solution can be adopted as the one that already exists in EPS.

Based on the SA2 analysis and response, there is no impact to RAN for the possible changes to 5GS and EPS for NR-U. The support for "subscription based access restriction", policy and charging is contained to CN signalling and the support for non-public operator network identification will not result in additional work specific to NR-U.

# 8 Performance evaluations

For performance evaluation, coexistence with other networks will be evaluation, such as Wi-Fi, LTE-LAA, or other NR-U network.

When coexistence with Wi-Fi is evaluated, following the study item description [2], NR-based operation in unlicensed spectrum should not impact deployed Wi-Fi services (data, video and voice services) more than an additional Wi-Fi network on the same carrier, where the deployed Wi-Fi includes 11ac in 5GHz band.

For sub-7 GHz bands other than 5GHz band, though it is not in the scope of this study to define a fairness criterion with other RATs, a fairness criterion for coexistence has been discussed but no conclusions were reached. Coexistence simulations with other RATs have been performed using technology neutral assumptions (eg. channel access mechanism) at an arbitrary carrier frequency in 5GHz band for application to bands other than 5GHz which may become available subject to regulations. The study assumes regulation will provide the framework concerning the protection for the technologies not using unlicensed access in those bands. For this coexistence evaluation, as the regulations on channel access is not yet available, companies have provided description on the assumptions used for technology neutral channel access mechanism when providing simulation results.

## 8.1 Scenarios and methodology

For the NR-U study evaluation, to reuse the simulation platform already developed for NR study, the 5GCM in [29] is used for NR-U simulation evaluation. The evaluation deployment scenarios are derived from NR evaluation deployment scenarios as defined in [28] with proper modifications to introduce the second operator. For coexistence evaluations below 7GHz, for parameters not provided in this section, the evaluations assumptions specified for LTE (e)LAA coexistence evaluations [31] apply. The base metrics for NR-U evaluation are the same as in LTE-LAA in [31].

NR-U simulation evaluation considers the following layout scenarios:

- Indoor sub-7GHz, 2 operators
- Outdoor Sub-7 GHz, 2 operators
- Stadium scenario for sub-7GHz, 2 operators, can be optionally considered by interested companies.

The following deployment scenarios for simulation are identified:

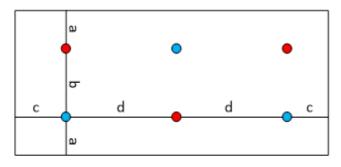
- CA between NR licensed cell and NR unlicensed cell
- DC (with LTE and with NR)
- SA
- An NR cell with DL in unlicensed band and UL in licensed band

In the simulations, only unlicensed cell(s) is to be simulated. The licensed cell may not be explicitly modelled in the simulation. Necessary assumptions regarding the presence of the licensed carriers can be made and provided.

It was also noted that a single set of evaluations may be applicable to multiple deployment scenarios. For example, DC and SA deployment scenarios can share the same set of simulations, possibly with some minor differences on how the overhead (say for system information delivery) is captured in the result.

### 8.1.1 Sub7 GHz indoor scenario

For sub7 GHz indoor simulation evaluation, two operators each with 3 gNBs are deployed in a room of size 120 meters by 80 meters as shown in Figure 1. In the figure, the gNB of the same color belongs to the same operator. The parameters are of value a=20 meters, b=40 meters, c=20 meters, and d=40 meters. The deployment scenario is selected to achieve a target serving link RSSI distribution with 10%-15% serving link below -72dBm.



#### Figure 1: Indoor sub7 simulation office layout

Additional evaluation parameters are provided in Annex A.1.1.

### 8.1.2 Sub7GHz outdoor scenario

For sub 7 GHz outdoor simulation evaluation, two scenarios are considered. The two scenarios differ in the inter-gNB distance within the same macro cell.

- Scenario 1: Within each macro cell coverage, two operators each drop one micro gNB with a maximum distance of 30 meters between the gNBs
- Scenario 2: Within each macro cell coverage, two operators each drop one micro gNB with no limitation on the inter-gNB distance.

The layout of the gNBs are defined as follows:

- Macro deployment with ISD=200×A meters
  - A=1.0 for scenario 1
- A=1.5 for scenario 2- Each operator randomly drops 1 micro-layer TRP within each macro cell sector with minimum distance between micro-layer TRPs equals 57.9×A meters
- Independent dropping between two operators
  - Use 10 meters as the inter-operator micro-layer TRP minimum distance
  - For the inter-operator micro-layer TRP maximum distance
    - Outdoor scenario 1: 30
    - Outdoor scenario 2: No limit as long as the TRP is within the macro cell

The layout of UEs are defined as follows:

- UE randomly dropped within macro cell sector with a minimum serving cell RSSI of -82dBm
- All UEs dropped outdoor

Additional evaluation parameters are provided in Annex A.1.2.

### 8.2 Channel access schemes

The channel access schemes for NR-based access for unlicensed spectrum can be classified into the following categories:

- Category 1: Immediate transmission after a short switching gap
  - This is used for a transmitter to immediately transmit after a switching gap inside a COT.

- The switching gap from reception to transmission is to accommodate the transceiver turnaround time and is no longer than 16 μs.
- Category 2: LBT without random back-off
  - The duration of time that the channel is sensed to be idle before the transmitting entity transmits is deterministic.
- Category 3: LBT with random back-off with a contention window of fixed size
  - The LBT procedure has the following procedure as one of its components. The transmitting entity draws a random number N within a contention window. The size of the contention window is specified by the minimum and maximum value of N. The size of the contention window is fixed. The random number N is used in the LBT procedure to determine the duration of time that the channel is sensed to be idle before the transmitting entity transmits on the channel.
- Category 4: LBT with random back-off with a contention window of variable size
  - The LBT procedure has the following as one of its components. The transmitting entity draws a random number N within a contention window. The size of contention window is specified by the minimum and maximum value of N. The transmitting entity can vary the size of the contention window when drawing the random number N. The random number N is used in the LBT procedure to determine the duration of time that the channel is sensed to be idle before the transmitting entity transmits on the channel.

For different transmissions in a COT and different channels/signals to be transmitted, different categories of channel access schemes can be used.

### 8.3 Evaluation results

For coexistence evaluation, WiFi+WiFi, WiFi+NR-U and NR-U+NR-U evaluations are baseline with equal priority.

When submitting coexistence evaluation results, the following information should be reported

- The COT assumptions of Wi-Fi and NR-U
- Is RTS/CTS enabled for Wi-Fi
- PD/ED threshold assumptions
- Max modulation order supported in each technology
- MIMO scheme and number of MIMO layers used for both technologies
- Wi-Fi MAC layer A-MPDU/A-MSDU aggregation level, MPDU size
- NR-U SCS,
- Wi-Fi guard interval
- NR UE processing time capability (#1 or #2)
- NR PDSCH/PUSCH mapping type, PDCCH monitoring configuration
- Link adaptation assumptions
- NR assumption on self scheduling or using cross carrier scheduling

Evaluation results are included in Annex B.

### 8.3.1 Coexistence evaluation results for 5GHz

Key findings of the evaluation results in Annex B.1 for 5GHz band are discussed in this section. The single carrier scenario with stand-alone deployment and LAA deployment for NR-U were both evaluated.

### 8.3.1.1 Detailed findings for indoor scenarios

Key findings from Tables in Annex B.1, which captured the results for an indoor deployment with one shared unlicensed carrier and FTP traffic are summarized below.

- Nine sources evaluated NR-U with a category 4 LBT scheme with CCA-ED threshold of -72dBm for NR-U.
  - Five sources evaluated licensed assisted access scheme.
    - One source provided results for two subcarrier spacing settings and reported an improvement in all measured metrics for the non-replaced Wi-Fi operator.
    - Two sources reported an improvement in all measured metrics for the non-replaced Wi-Fi operator while one source reported an improvement in 44 of the 48 metrics for the non-replaced Wi-Fi operator.
    - One source also provided results for DL only traffic and UL only traffic on the unlicensed carrier and reported an improvement in all measured metrics for the non-replaced Wi-Fi operator.
    - One source also provided results with mixed traffic for Wi-Fi operator and reported an improvement in all measured metrics for the non-replaced Wi-Fi operator. The source also reported improvement in VoIP performance for the non-replaced Wi-Fi operator.
    - One source also provided results comparing coexistence performance for three cases, NR-U node using CCA-ED threshold of -72, -82 and third case where NR-U node enables Wi-Fi preamble detection and reported that all 3 schemes co-exist fairly with Wi-Fi and that using ED threshold of -82dBm provides better coexistence performance for both NR-U and Wi-Fi nodes than enabling Wi-Fi preamble detection.
    - One source provided results for mixed traffic with two LBT modes (category 1 immediate transmission and category 2) for scheduled UL in gNB acquired COT. The source provided results only for high buffer occupancy and reported a degradation in most metrics for the non-replaced Wi-Fi operator for both cases. The source also provided results with Wi-Fi preamble detection enabled a the NR-U node and reported an improvement in 15 out of the16 metrics (only high buffer occupancy metrics) for the non-replaced Wi-Fi operator for a degradation in VoIP performance for the non-replaced Wi-Fi operator for all three cases.
- Four sources evaluated for a stand-alone NR-U deployment on an unlicensed carrier.
  - One source reported an improvement in 47 of the 48 measured metrics for the non-replaced Wi-Fi operator with a maximum degradation under 5%.
  - One source reported an improvement in 35 of the 48 measured metrics for the non-replaced Wi-Fi operator.
  - One source provided results with RTS/CTS enabled for Wi-Fi operator, DRS modelled with DRS using category 2 LBT for channel access in the DMTC window for the NR-U operator and reported an improvement in 40 of the 48 measured metrics for the non-replaced Wi-Fi operator with a maximum degradation under 10%. The source also provided results for the case where HARQ-ACK feedback is sent within a gap of 16us after the end of DL transmission and showed improvements in the coexistence performance compared to the case where the HARQ-ACK feedback is sent at a gap of 24us after the end of DL transmission using category 2 LBT.
  - One source provided results with RTS/CTS enabled, DRS modelled with DRS using category 2 LBT for channel access in the DMTC window, and with multiple switching points with switching gaps no longer than 16 µs in the COT used for control information transmission and reported an improvement in all of the measured metrics for the non-replaced Wi-Fi operator. The source also provided results with RTS/CTS enabled and DRS modelling enabled for a second COT structure that utilized a preparation stage for fast CSI exchange and reported an improvement in all of the measured metrics for the non-replaced Wi-Fi operator.
  - One source also provided results comparing NRU-WiFi coexistence performance for two cases, NR-U node using CCA-ED threshold of -77, and second case where NR-U node enables Wi-Fi preamble detection and reported that enabling Wi-Fi preamble detection degrades the coexistence performance as compared to using ED threshold of -77dBm
  - One source also provided results comparing NRU-NRU coexistence performance for two cases, NR-U node using CCA-ED threshold of -72, and second case where NR-U node enables Wi-Fi preamble detection and

reported that enabling Wi-Fi preamble detection degrades the coexistence performance as compared to using ED threshold of -72dBm.

- One source provided results with DRS with transmit duration of 1ms using category 2 LBT for channel access in the 6ms DRS transmission window for the NR-U operator and reported an improvement in 47 of the 48 measured metrics for the non-replaced Wi-Fi operator.
- One source provided results for the case where NR-U follows COT sharing procedure as permitted by EN 301 893 (category 1 LBT for gaps <=16us, for gap of above 16us but does not exceed 25us, and gaps that exceed 25us category LBT is used) and showed improvement in all measured metrics and in VoIP performance for the non-replaced Wi-Fi operator.</li>
- One source provided results where it is assumed that 20% of the UL transmissions are UL RACH transmissions with category 2 LBT and reported an improvement in 47 of the 48 measured metrics for the non-replaced Wi-Fi operator.

### 8.3.1.2 Detailed findings for outdoor scenario 1

Key findings from Tables in Annex B.2, which captured the results for an outdoor deployment scenario 1 with one shared unlicensed carrier and FTP traffic are summarized below.

- Three sources evaluated NR-U with a category 4 LBT scheme with CCA-ED threshold of -72dBm for a standalone NR-U deployment on an unlicensed carrier.
  - One source provided results with RTS/CTS enabled, DRS modelled with DRS using category 2 LBT for channel access in the DMTC window, and with multiple switching points with switching gaps no longer than 16 µs in the COT used for control information transmission and reported an improvement in all of the measured metrics for the non-replaced Wi-Fi operator. The source also provided results with RTS/CTS enabled and DRS modelling enabled for a second COT structure that utilized a preparation stage for fast CSI exchange and reported an improvement in 45 of the 48 measured metrics for the non-replaced Wi-Fi operator.
  - One source reported an improvement in 45 of the 48 measured metrics for the non-replaced Wi-Fi operator.
  - One source reported an improvement in 47 of the 48 measured metrics for the non-replaced Wi-Fi operator with a maximum degradation under 0.3%.
  - One source also provided results comparing NRU-WiFi coexistence performance for two cases, NR-U node using CCA-ED threshold of -72, and second case where NR-U node enables Wi-Fi preamble detection and reported that enabling Wi-Fi preamble detection degrades the coexistence performance as compared to using ED threshold of -72dBm.
  - One source also provided results comparing NRU-NRU coexistence performance for two cases, NR-U node using CCA-ED threshold of -72, and second case where NR-U node enables Wi-Fi preamble detection and reported that enabling Wi-Fi preamble detection degrades the coexistence performance as compared to using ED threshold of -72dBm
- Two sources evaluated NR-U with a category 4 LBT scheme with CCA-ED threshold of -72dBm for an LAA NR-U deployment on an unlicensed carrier.
  - One source provided results for two subcarrier spacing settings and reported an improvement in all measured metrics for the non-replaced Wi-Fi operator.
  - One source provided coexistence results when both Wi-Fi and NR-U have DL only traffic. The source reported an improvement in 23 of the 24 metrics for the non-replaced Wi-Fi operator, with the maximum degradation under 5%.

### 8.3.1.3 Detailed findings for outdoor scenario 2

Key findings from Tables in Annex B.3 which captured the results for an outdoor deployment scenario 2 with one shared unlicensed carrier and FTP traffic are summarized below.

- Three sources evaluated NR-U with a category 4 LBT scheme with CCA-ED threshold of -72dBm for a standalone NR-U deployment on an unlicensed carrier.
  - One source reported an improvement in all measured metrics for the non-replaced Wi-Fi operator.

- One source reported an improvement in 47 of the 48 measured metrics for the non-replaced Wi-Fi operator with a maximum degradation under 3%.
- One source provided results with RTS/CTS enabled, DRS modelled with DRS using category 2 LBT for channel access in the DMTC window, and with multiple switching points with gaps no longer than 16 µs in the COT used for control information transmission and reported an improvement in all of the measured metrics for the non-replaced Wi-Fi operator. The source also provided results with RTS/CTS enabled and DRS modelling enabled for a second COT structure that utilized a preparation stage for fast CSI exchange and reported an improvement in all of the measured metrics for the non-replaced Wi-Fi operator.
- Two sources evaluated NR-U with a category 4 LBT scheme with CCA-ED threshold of -72dBm for an LAA NR-U deployment on an unlicensed carrier.
  - One source provided results for two subcarrier spacing settings and reported an improvement in all measured metrics for the non-replaced Wi-Fi operator.
  - One source provided coexistence results when both Wi-Fi and NR-U have DL only traffic. The source reported an improvement in 22 of the 24 metrics for the non-replaced Wi-Fi operator, with the maximum degradation under 5%.

#### 8.3.1.4 Summary of observations

In all evaluation results submitted, category 4 LBT with -72 dBm ED threshold was the primary scheme used in the evaluations for obtaining the COT. In all simulation when a Wi-Fi preamble was used, a fixed CCA-PD threshold of -82dBm was assumed. Other LBT schemes used in the evaluations include immediate transmission for switching of transmission direction with switching gap < 16us and category 2 LBT for switching of transmission direction with gap > 16us, for scheduled UL in gNB acquired COT, for DRS transmission, and for PRACH transmission. Companies evaluated the three agreed scenarios defined in Section 8.1. The parameters listed in Section 8.3 were left for companies to choose, and are provided together with the evaluation results in Annex B.

Eight out of nine sources showed combinations of DL and UL LBT schemes for NR-U with CCA-ED of -72dBm and no CCA-PD do not impact Wi-Fi more than another Wi-Fi network in any of the measured performance metrics in all three evaluated scenarios. One of nine sources indicated degradation of Wi-Fi performance when coexist with NR-U in some scenarios (Section 8.3.1.1).

Three sources submitted results with NR-U transmitting and receiving Wi-Fi 802.11a preamble and showed combinations of DL and UL LBT schemes for NR-U with CCA-ED of -62dBm and CCA-PD of -82dBm do not impact Wi-Fi more than another Wi-Fi network in any of the measured performance metrics in all evaluated scenarios.

Three sources submitted results with NR-U transmitting and receiving Wi-Fi 802.11a preamble. For indoor scenario, two sources indicated fair coexistence with mostly improved performance for both Wi-Fi and NR-U when NR-U with CCA-ED of -62dBm and CCA-PD of -82dBm compared with NR-U with CCA-ED of -72dBm and no Wi-Fi 802.11a preamble. For outdoor scenario 1, one source indicated fair coexistence with mostly degraded performance for both Wi-Fi and NR-U with CCA-ED of -62dBm and CCA-ED of -62dBm and CCA-PD of -62dBm and CCA-PD of -82dBm compared with NR-U with CCA-ED of -72dBm and no Wi-Fi 802.11a preamble.

Two sources submitted results for indoor scenario and one source submitted results for outdoor scenario 1 with NR-U transmitting and receiving Wi-Fi 802.11a preamble for NR-U and NR-U coexistence in the absence of Wi-Fi, and showed combinations of DL and UL LBT schemes for NR-U with CCA-ED of -62dBm and CCA-PD of -82dBm degrades NR-U performance compared with NR-U with CCA-ED of -72dBm and no Wi-Fi 802.11a preamble.

Two sources submitted results for indoor scenario with NR-U with CCA-ED reduced below -72dBm for all NR-U devices. The sources indicated fair coexistence with mostly improved performance for both Wi-Fi and NR-U when NR-U with CCA-ED reduced below -72dBm compared with NR-U with CCA-ED of -62dBm and CCA-PD of -82dBm Wi-Fi 802.11a preamble.

For the case where an NR-U network coexists with an 802.11ac network in the indoor scenario and a NR-U DL/UL switching gap less than 16 µs, and NR-U UL data transmission after the gap with Category 1 channel access without any additional restrictions on duration other than the MCOT limits, one source has shown that there is a degradation to the throughput and VoIP outage performance of 802.11ac, while another source has shown that the throughput and VoIP outage performance of 802.11ac improves, when compared to the case where two 802.11ac networks coexist.

### 8.3.2 Coexistence evaluation results for 6GHz

Key findings of the evaluation results in Annex B.1 for 6GHz band are discussed in this section. Due to its greenfield nature, coexistence evaluations were performed using technology neutral assumptions (eg. channel access mechanism) and the companies provided simulation results along with their assumptions on technology neutral channel access schemes and coexistence performance metrics.

### 8.3.2.1 Detailed findings for indoor scenarios

Key findings from Tables in Annex B.1 which captured the results for an indoor deployment with one shared unlicensed carrier and FTP traffic are summarized below.

- Two sources provided evaluation results for a stand-alone NR-U deployment on an unlicensed carrier specifically for 6GHz.
  - One source provided results of Wi-Fi operator with RTS/CTS disabled using CCA-ED of -72dBm and PD of -82dBm and reported an improvement in 37 of the 48 metrics (agreed to be used for the 5GHz bands) for the non-replaced Wi-Fi operator with the maximum degradation being < 4% compared to the case where the Wi-Fi operator was using CCA-ED of -62dBm and PD of -82dBm. In both these cases, all reported metrics for the non-replaced Wi-Fi operator are better with NR-U network as neighbour than Wi-Fi network as neighbour.
  - One source also provided results comparing NRU-WiFi coexistence performance for two cases: (Case 1) Wi-Fi node using CCA-ED threshold of -72 and PD of -82dBm; and NR-U node using CCA-ED threshold of -72 dBm, and (Case 2) Wi-Fi node using CCA-ED threshold of -62 and PD of -82dBm; and NR-U node using CCA-ED threshold of -72 dBm and reported that Case 1 provides better coexistence performance than Case 2 for both NRU and Wi-Fi nodes.
- One source provided evaluation results for a non-stand-alone NR-U deployment on an unlicensed carrier specifically for 6GHz.
  - One source provided results for CCA-ED threshold varying between -62dBm to -82dBm for case when Wi-Fi operator uses the same CCA-ED and CCA-PD threshold and the NR-U operator uses the same CCA-ED threshold as the Wi-Fi operator and observed that the higher ED threshold of -62dBm provides the best performance. The results showed that Wi-Fi operator using CCA-ED -72 dBm and CCA-PD of -72 dBm gives better Wi-Fi UPT performance than Wi-Fi using CCA-ED -62 dBm and CCA-PD of -82 dBm for the Wi-Fi operator, while NR-U operator uses CCA-ED -72 dBm. The results showed that Wi-Fi operator using CCA-ED -72 dBm and CCA-PD of -72 dBm while NR-U operator uses CCA-ED -72 dBm gives better Wi-Fi UPT performance than Wi-Fi using CCA-ED -82 dBm and CCA-PD of -82 dBm for the Wi-Fi operator while NR-U operator uses CCA-ED -82 dBm. The results showed that Wi-Fi operator using CCA-ED -72 dBm and CCA-PD of -72 dBm gives better Wi-Fi UPT performance than Wi-Fi using CCA-ED -62 dBm and CCA-PD of -82 dBm for the Wi-Fi operator, while NR-U operator uses CCA-ED of -62dBm and CCA-NRU-PD of -82dBm. The results showed that Wi-Fi operator using CCA-PD of -82dBm and CCA-ED of -62dBm while NRU operator using CCA-ED of -62dBm gives better UPT performance for both Wi-Fi and NRU operator than Wi-Fi operator using CCA-PD of -82dBm and CCA-ED of -72dBm while NRU operator using CCA-ED of -72dBm. In all these cases, all reported metrics for the non-replaced Wi-Fi operator are better with NR-U network as neighbour than Wi-Fi network as neighbour.

### 8.3.2.2 Detailed findings for outdoor scenario 1

Key findings from Tables in Annex B.2 which captured the results for an indoor deployment with one shared unlicensed carrier and FTP traffic are summarized below.

- One source provided evaluation results for a stand-alone NR-U deployment on an unlicensed carrier specifically for 6GHz.
  - One source provided results of Wi-Fi operator with RTS/CTS disabled using CCA-ED of -72dBm and PD of -82dBm and reported an improvement in 47 of the 48 metrics (agreed to be used for the 5GHz bands) for the non-replaced Wi-Fi operator with the maximum degradation being < 0.2% compared to the case where the Wi-Fi operator was using CCA-ED of -62dBm and PD of -82dBm. In both these cases, all reported metrics for the non-replaced Wi-Fi operator are better with NR-U network as neighbour than Wi-Fi network as neighbour.

### 8.3.2.3 Summary of observations

For 6 GHz bands, though it is not in the scope of this study to define a fairness criterion with other RATs, a fairness criterion for coexistence has been discussed but no conclusions were reached. For 6GHz coexistence evaluation, the parameters and behaviour of Wi-Fi 802.11ax system and the fairness criterion were left for companies to choose, and are provided together with the evaluation results in Annex B. In the submitted evaluation results, the assumption on the technology neutral channel access mechanism is equal CCA-ED threshold.

Given the assumptions used in the evaluations, all three sources provided results that show that Wi-Fi and NR-U performance is improved when a common CCA-ED threshold is used between Wi-Fi and NR-U compared to when different CCA-ED thresholds are used between Wi-Fi and NR-U. This was shown for the case where Wi-Fi uses CCA-PD at -82 dBm, and for the case where Wi-Fi uses CCA-PD at the same threshold as CCA-ED. For indoor scenario, one source observed that Wi-Fi and NR-U performance is improved when a common CCA-ED threshold of -62dBm is used compared to when a common CCA-ED threshold of -72dBm is used.

## 8.4 Adjacent channel interference analysis

The aim of this section is to evaluate the impact of Adjacent Channel Interference (ACI) on system performance. Therefore, a generic scenario is considered in which the aggressor system and the victim system use adjacent channels. 3GPP has a consolidated procedure to evaluate the impact of ACI. This methodology is based on modelling Adjacent Channel Interference Ratio (ACIR) as described in [33].

Numerous evaluations on adjacent channel coexistence with a similar setup as above were done under Rel-13 LAA SI. These results were extensively documented in [31].

Since similar deployment scenarios are also considered in NR-U compared to LAA, and similar output power levels are considered, then the previous adjacent channel coexistence evaluation between LAA and WiFi can be directly used for comparison between NR-U and WiFi.

Note that, NR-U may have higher spectrum utilization compared to LAA. It is considered to define the same ACLR (and ACS) requirements for LAA and NR-U (in 5GHz as an example), since ACLR (and ACS) requirements for NR FR1 are the same as for LTE. So, regardless of the higher spectrum utilization in NR, the same ACLR has to be met by NR-U devices.

In NR-U, there will be higher channel bandwidth (CBW) than 20MHz. However, this will not change the already understood conclusions from LAA regarding ACLR and ACS, since the ACLR and ACS values specified in LAA are the same for single carrier operation and contiguous CA operation, meaning in both cases, an LAA BS has to satisfy 35dB ACLR outside its channel bandwidth.

Thus the following is concluded:

- The deployment scenario in Rel-15 NR-U is very similar to Rel-13 LAA deployment scenario and the regulatory requirements remain the same for 5GHz spectrum, so the conclusions of Rel-13 LAA adjacent channel coexistence evaluations are equally applicable to Rel-15 NR-U.
- It is possible to assume same ACLR (and ACS) requirements for LAA and NR-U (in 5GHz as an example), following the principle that, ACLR (and ACS) requirements for other NR FR1 bands are the same as LTE.

# 9 Conclusions

This technical report presents the results of a study on the operation of NR in sub 7 GHz unlicensed spectrum (NR-U). Multiple deployment scenarios for NR-U have been identified, including carrier aggregation (CA) with NR, dual connectivity (DC) with LTE or NR, stand-alone (SA), and SA with DL in unlicensed band and UL in licensed band.

The modifications to NR needed to allow it to operate in unlicensed spectrum as a Secondary cell through carrier aggregation, as a PSCell through DC, and as a primary cell in stand-alone deployment are studied and documented. The relevant regulatory requirements have been summarized in section 4. The study concludes that it is feasible to modify NR to operate in unlicensed spectrum in carrier aggregation (CA) with a licensed band NR carrier(s), dual connectivity (DC) with LTE or NR in a licensed band, stand-alone (SA) with DL and UL in unlicensed band, and SA with DL in unlicensed band and UL in licensed band.

#### **Release 1**

When deployed in unlicensed bands, NR-U needs to coexist with other deployments with same or other RATs, and coexistence performance has been evaluated. For the coexistence evaluation, three scenarios (indoor, outdoor scenario 1, and outdoor scenario 2) have been defined, as documented in section 8.

For 5GHz band, where Wi-Fi 802.11ac has been widely deployed, the coexistence evaluation assumes two independent networks (e.g., NR-U+Wi-Fi or Wi-Fi+Wi-Fi) are deployed in the same area, and the fairness criterion is defined as the NR-U network not degrading Wi-Fi 802.11ac network performance when NR-U and Wi-Fi 802.11ac are deployed in the area compared to the case where two Wi-Fi 802.11ac networks are deployed in the area, i.e., the same fairness criterion as used in the LTE LAA studies [31].

For 6GHz band (e.g. US 5925 – 7125 MHz, or European 5925 – 6425 MHz, or parts thereof), since both NR-U and Wi-Fi are new systems to be deployed in these bands (band definitions depending on regulations), a technology neutral fairness criterion is required for the coexistence evaluation. Though it is not in the scope of this study to define a fairness criterion with other RATs, a fairness criterion for coexistence has been discussed but no conclusions were reached. For the 6 GHz coexistence evaluation in this study, the assumption of same CCA-ED threshold across technologies is applied as the technology neutral channel access mechanism.

The coexistence evaluations performed during the study item are documented in section 8.3. The 5GHz band coexistence evaluation results are listed in Section 8.3.1. The studies show that when the appropriate channel access schemes, as defined in Section 8.2, are used, it is feasible for NR-U to achieve fair coexistence with Wi-Fi, and for NR-U to coexist with itself, under conditions described in Section 8.3.1.4. The 6GHz band coexistence evaluation results are listed in Section 8.3.2.

Wideband operation in integer multiple of 20MHz is supported in NR-U and channel access can be performed at least in units of 20MHz, at least for band where absence of Wi-Fi cannot be guaranteed. Options to support wideband operation have been identified (Section 7.2.1.1)

For LBE mode of operation, it is recommended that NR-U supports single DL/UL switching point operation within a gNB initiated COT, as in LTE-LAA, as well as multiple DL/UL switching points within a gNB initiated COT. It is recommended that Cat 4 channel access is used for gNB or UE to initiate a COT for normal data transmissions, while gNB can use Cat 2 channel access for DRS transmission when DRS satisfies some conditions (Section 7.2.1.3.1). It is recommended that for a switching point gap of up to 16 µs, where the gap accommodates for the transceiver turnaround time, immediate transmission can take place within the same COT. It is recommended that for a gap of more than 16 µs but less than 25 µs, Cat 2 LBT can be used within the same COT. It is also recommended that for the case of a single switching point within a COT, where the switching gap exceeds 25 µs, Cat 2 LBT can be used within the same COT. It is can be used within the same COT (Section 7.2.1.3.1). Partial slot transmission at the beginning of the gNB or UE initiated COT is identified as beneficial and multiple techniques to support partial slot transmissions have been studied.

For FBE mode of operation, according to regulation, the channel access of FBE is in unit of fixed frame periods. A Cat 2 LBT is used before each fixed frame period to determine if the fixed frame period can be occupied. Within an occupied fixed frame period, for a gap of up to 16 µs, Cat 1 channel access can be used. For a gap of more than 16 µs in an occupied fixed frame period, Cat 2 LBT should be used.

The enhancements needed for initial access and mobility procedures are captured in Section 7.2.1.3.2. The issue of reduced transmission opportunities due to LBT failure for SS/PBCH block transmission, message 1/2/3/4 transmission in 4-step RACH procedure, RLM/RRM, and paging has been identified, and some enhancements are described.

For HARQ, benefits of supporting the transmission of all HARQ A/N within the same shared COT as the PDSCH(s), have been identified. Multiple techniques to handle reduced HARQ A/N transmission opportunities due to LBT failure have been identified (Section 7.2.1.3.3). Furthermore, enhancements to UL scheduling, such as scheduling multiple slots for PUSCH(s) using a single UL grant, as is possible for LTE-eLAA, were identified as beneficial.

For configured grant, benefits of enhancing the NR design for NR-U have been identified (Section 7.2.1.3.4). Introducing UCI on PUSCH to carry HARQ process ID, NDI, RVID has been identified as beneficial in removing dependencies of HARQ process information to the timing. The identified enhancements also include introducing Downlink Feedback Information (DFI) including HARQ feedback for configured grant transmission, increased flexibility on time domain resource allocation for the configured grant transmissions and supporting retransmissions without explicit UL grant.

The enhancements identified for physical layer signal and channels are captured in Section 7.2.1.2. For SS/PBCH block transmission in NR-U DRS, it has been identified as beneficial to include CSI-RS and RMSI-CORESET(s) and RMSI-PDSCH(s) in the same contiguous burst when transmission of CSI-RS/RMSI are configured. Optionally OSI and paging can be transmitted in the same DRS if there are available resources. For UL signals/channels, a study on the

waveform design to satisfy the Occupied Channel Bandwidth requirement and Power Spectral Density requirements of unlicensed bands was conducted, and it was determined that it is feasible to introduce a block-interlaced waveform for PUCCH and PUSCH for UL as enhancements to existing NR UL waveforms to satisfy the requirements. It has been identified that enhancement of one or more Rel.15 NR PRACH formats is feasible. Several enhancements to SRS design have been identified.

From RAN2 perspective, the radio interface architecture and protocols between UE and RAN to support operation in unlicensed spectrum were studied. This included MAC, RLM, RRM, mobility, and other layer 2/3 user and control plane aspects. The recommended enhancements to NR baseline are of two types:

- A set of enhancements to alleviate the impact of LBT (e.g., impacts of reduced transmission opportunities);
- Enhancements needed due to the unique nature of operation in unlicensed spectrum (e.g. support for multiple operators in the same frequency).

It was concluded that the NR licensed baseline along with the enhancements captured in this TR can support NR-U operation in CA, DC, and stand-alone (SA) modes.

The system level aspects of NR-U were also studied. It was concluded that, other than support of differentiated policy and charging, no other impact to EPS and 5GS is expected. Furthermore, it is expected that aspects associated with non-public networks will be covered under ongoing work in SA groups.

From RAN4 perspective, based on the discussions in Section 8.4, it can be concluded that, if NR-U has similar adjacent channel leakage as LAA, then NR-U and Wi-Fi can coexist in adjacent channels. If NR-U has similar leakage and selectivity requirements as LAA, the LAA study can be used to conclude that NR-U will cause less adjacent channel interference to a Wi-Fi system compared to another Wi-Fi system.

It is feasible for UEs and BSs to operate in the 5GHz unlicensed spectrum as NR-U systems. Suitable RF requirements should be specified taking into account issues including implementation complexity and performance.

# Annex A: Evaluation methodology

# A.1 General evaluation assumptions

### A.1.1 Evaluation assumptions for sub 7GHz indoor scenario

The evaluation parameters for sub7 GHz indoor scenario are as given in Table A.1.1-1. Other parameters not explicitly included in the table will use values defined in [28] and [29].

Parameter	Value
Carrier Frequency	5GHz
Carrier Channel Bandwidth	20MHz baseline , 80MHz optional
Number of carriers	1
Number of users per operator	5 UEs associated with each gNB per 20MHz
SCS	To be reported together simulation results
Channel Model	NR InH Mixed Office model
BS/AP Tx Power	23dBm (total across all TX antennas)
UE/STA Tx Power	18dBm (total across all TX antennas)
BS/AP Antenna gain	OdBi
UE/STA Antenna gain	OdBi
BS/AP Noise Figure	5dB
UE/STA Receiver Noise Figure	9dB
Minimum received power from	-82dBm
serving cell for UE dropping	
UE receiver	MMSE-IRC as the baseline receiver
BS/AP antenna Array configuration	$(M, N, P, M_g, N_g) = (1, 2, 2, 1, 1), dH = dV = 0.5 \lambda$
UE/STA antenna Array	Baseline Tx/Rx: (M, N, P, Mg, Ng) = (1, 1, 2, 1, 1), dH = dV = $0.5 \lambda$
configuration	Optional Tx/Rx: (M, N, P, Mg, Ng) = (1, 2, 2, 1, 1), dH = dV = $0.5 \lambda$
Traffic model	Use 36.889 Table A.1.1.
	Note: Results based on the mixed traffic models can be used to
	determine the design.
UE/STA to UE/STA link pathloss	Directly use InH office pathloss model with proper d_3D with
model	indoor mixed office LOS probability
gNB to gNB link pathloss model	Directly use InH office pathloss model with proper d_3D with
	indoor mixed office LOS probability

### Table A.1.1-1: Evaluation parameters for sub7 GHz indoor scenario

### A.1.2 Evaluation assumptions for sub 7GHz outdoor scenarios

The evaluation parameters for sub7 GHz outdoor scenarios are as given in Table A.1.2-1. Other parameters not explicitly included in the table will use values defined in [28] and [29].

### Table A.1.2-1: Evaluation parameters for sub7 GHz outdoor scenario

Parameters	Outdoor Sub-7GHz

Carrier Frequency	5GHz
Carrier Channel	20MHz baseline , 80MHz optional
Bandwidth	
Number of carriers	1
Number of users per	5 UEs associated with each gNB per 20MHz
operator	
SCS	To be reported together simulation results
Channel Model	NR UMi street canyon
BS/AP Tx Power	23dBm (total across all TX antennas)
UE/STA Tx Power	18dBm (total across all TX antennas)
BS/AP Antenna gain	0 dBi
UE/STA Antenna gain	0 dBi
BS/AP Noise Figure	5dB
UE/STA Receiver Noise	9dB
Figure	
Minimum received power	-82dBm
from serving cell for UE	
dropping	
UE receiver	MMSE-IRC as the baseline receiver
BS/AP antenna Array	$(M, N, P, M_g, N_g) = (1, 2, 2, 1, 1), dH = dV = 0.5 \lambda$
configuration	
UE/STA antenna Array	Baseline Tx/Rx: (M, N, P, Mg, Ng) = (1, 1, 2, 1, 1), dH =
configuration	$dV = 0.5 \lambda$
	Optional Tx/Rx: (M, N, P, Mg, Ng) = (1, 2, 2, 1, 1), dH =
	$dV = 0.5 \lambda$
Traffic model	Use 36.889 Table A.1.1.
	Note: Results based on the mixed traffic models can be
	used to determine the design.
UE/STA to UE/STA link	Directly use UMi street canyon pathloss model with
pathloss model	proper d_3D with UMi street canyon LOS probability
gNB to gNB link pathloss	Directly use UMi street canyon pathloss model with
model	proper d_3D with UMi street canyon LOS probability

- B.1 Evaluation results for sub7GHz indoor
- B.1.1 Wi-Fi and NR-U coexistence evaluation with 20MHz and FTP traffic

Tdoc/Source	Repo param		В		<u>/ <b>load</b></u> for Wi-Fi	in	В	<u>Mediu</u> O range fo		1	<u>High load</u> BO range for Wi-Fi in				
c/S					i: 10%~2			/iFi+WiFi:			WiFi+WiFi: above 55%				
- Õp			Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	
Н			WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	
			WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	
	DL:	5%	40.958	50.921	12.749	20.9086	19.582	42.015	6.059	24.4146	7.768	42.348	2.854	24.2027	
	UPT	50%	51.341	58.429	44.530	83.6427	32.045	51.229	30.037	78.1366	22.447	49.634	15.259	75.6554	
	CDF	95%	61.063	64.120	63.951	114.0128	40.058	58.609	47.489	99.3320	28.934	55.007	36.573	100.744	
	[Mbps	5												7	
	]	Mea n	51.903	59.083	47.601	76.3185	32.107	52.505	32.781	72.6793	21.242	49.544	21.404	70.5092	
	DL:	5%	0.060	0.060	0.047	0.034	0.061	0.060	0.051	0.035	0.073	0.060	0.060	0.035	
	Delay	50%	0.066	0.062	0.088	0.047	0.142	0.065	0.153	0.052	0.297	0.072	0.277	0.053	
	CDF	95%	0.207	0.112	0.333	0.153	0.739	0.163	0.817	0.252	3.268	0.211	1.933	0.307	
	[s]	Mea n	0.096	0.072	0.130	0.068	0.232	0.088	0.276	0.083	0.817	0.096	0.527	0.087	
	UL:	5%	40.245	49.152	12.083	16.3911	23.012	48.127	4.081	15.4290	13.400	40.174	3.018	59.8555	
			49.537	58.413	42.110	74.4228	34.770	50.625	29.733	62.8715		49.411		16.4273	
			60.993	64.496	76.645	92.7418	39.682	54.735	55.973	90.0290		54.341		62.9272	
	[Mbps ]		50.859	58.871	49.220	68.3392	34.875	51.439	32.720	62.3984		48.391		84.8273	
	UL:	5%	0.060	0.060	0.042	0.041	0.062	0.060	0.042	0.041	0.065	0.060	0.047	0.041	
-	Delay			0.062	0.082	0.054	0.127	0.066	0.162	0.061	0.211	0.076	0.248	0.064	
Ц	CDF			0.132	0.363	0.259	0.454	0.174	0.792	0.274	0.864	0.187	1.392	0.290	
SOURCE	[s]	Mea	0.092	0.074	0.128	0.097	0.173	0.089	0.282	0.106	0.306	0.096	0.448	0.113	
Ы		n	0.002	0.071	0.120	0.007	0.170	0.005	0.202	0.100	0.000	0.050	0.110	0.115	
			1.00	1.00	1.00	1.00	0.99	0.93	1.00	99.8339	0.96	0.92	0.97	1.00	
R1-1812431/	QU		1.00	1.00	1.00	1.00	1.00	0.93	0.98	99.8333	1.00	0.92	0.95	1.00	
$12^{\circ}$	B		23.677	36.875	14.704	5.260	41.023	40.448	45.818	11.154	59.295	45.374	72.597	15.094	
-18	λ				Mbps;			DL:2N				DL:2.51			
R		,			Mbps			UL:21			UL:2.5Mbps				
			- TxOP a transmiss - Is RTS/ - PD/ED - Max m - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitori 0 0 0 0 0 - Cross-c	sion (CTS ena threshold odulation scheme a both Wi- IAC laye SCS: 15 H Lard inter processi SCH/PU ngSlotPe 0 0 0 0] carrier scl	ons of Wi bled for V d assump order su and numb Fi and N r A-MPD kHz val: 0.8 µ ng time c SCH map riodicity2 neduling	WiFi: No tions: For pported in per of MIN R-U U/A-MSE usec apability ( pping type	WiFi, -82/ each tech IO layers DU aggreg (#1 or #2): , PDCCH : 1slot; con	/62 dBm P nology: 25 used for be ation level Processin monitoring reset dura	D/ED three 56 QAM f oth techno , MPDU s g time cap g configur tion: 2 syr	eshold an or both W ologies: 2' size: 802. pability # ration: typ nbol; mon	d for NR- /iFi and N Fx2Rx an 11ac 1 ne A; nitoringSy	itenna conf ymbolswitl	m ED thr	eshold and 2	
	DL:	5%			32.719		19.582	44.334		54.2921		44.419	11.733	52.0858	
			51.341			179.0133	32.045	54.118	75.648	164.915 8		49.424		156.476	
		95%	61.063	64.916	136.431	207.9165	40.058	59.754	105.746	202.652 5	28.934	55.316	93.050	204.525 9	
		n	51.903	60.768		162.1622	32.107	54.513	66.707	150.690 7		50.293	57.011	145.935 6	
	DL:	5%	0.060	0.060	0.026	0.019	0.061	0.060	0.026	0.019	0.073	0.060	0.026	0.019	

Table B.1.1-1: Wi-Fi and NR-U coexistence evaluation with 20MHz and FTP traffic

Reported parameters		р		<u>7 <b>load</b></u> for Wi-Fi	in	р	<u>Mediu</u> O range fo		<u>High load</u> BO range for Wi-Fi in				
	leters								BO range for Wi-Fi in WiFi+WiFi: above 55%				
				i: 10%~2			iFi+WiFi:					1	
					NR-U in	Wi-Fi in		NR-U in					
		WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U
		WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
Delay			0.062	0.047	0.022	0.142	0.063	0.080	0.024	0.297	0.069	0.097	0.024
CDF			0.110	0.156	0.077	0.739	0.146	0.457	0.131	3.268	0.177	0.662	0.139
UL: UPT CDF	Mea n	0.096	0.069	0.063	0.034	0.232	0.081	0.137	0.039	0.817	0.093	0.197	0.04
UL:	5%	40.245	50.386	-	-	23.012	46.349	-	-	13.400	45.585	-	-
UPT		49.537	60.834	-	-	34.770	50.113	-	-	23.108	50.104	-	-
CDF		60.993	65.066	-	-	39.682	57.205	-	-	36.185	55.314	-	-
L[Mbps	Mea n	50.859	60.523	-	-	34.875	52.000	-	-	23.966	51.155	-	-
UL:	5%	0.060	0.060	-	-	0.062	0.060	-	-	0.065	0.060	-	-
Delay	50%	0.068	0.062	-	-	0.127	0.066	-	-	0.211	0.069	-	-
CDF			0.106	-	-	0.454	0.152	-	-	0.864	0.161	-	-
	Mea n		0.069	-	-	0.173	0.086	-	-	0.306	0.089	-	-
QD		1.00	0.95	1.00	1.00	0.99	0.96	0.97	1.00	0.96	91.821	0.97	1.00
		1.00	0.96	-	-	1.00	0.95	-	-	1.00	93.255	-	1.00
B		23.677	36.156	6.923	3.952	41.023	39.764	26.174	8.783	59.295	44.171	41.198	11.42
λ				; UL:1M			DL:2N				L:2Mbps;		
		Addition			-F-						F-,		
		- PD/ED - Max mo - MIMO layer for - WiFi M	CTS ena threshold odulation scheme a both Wi- IAC laye	order su and numb Fi and N r A-MPD	tions: For pported in per of MIM	each tech 10 layers	nology: 25 used for b	56 QAM f oth techno	or both W logies: 27	/iFi and N Гx2Rx an	U, -72 dBr IR-U tenna conf		
		- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin	CTS ena threshold odulation scheme a both Wi- IAC layer SCS: 15 H ard inter processi SCH/PU3 ngSlotPe	d assumpt order su and numb Fi and N r A-MPD κHz val: 0.8 μ ng time c SCH map	tions: For pported in per of MIM R-U U/A-MSD usec apability ( pping type,	each tech 10 layers 10 aggreg #1 or #2): PDCCH	nology: 25 used for b ation level Processin monitoring	56 QAM f oth techno , MPDU s g time cap g configur	or both W logies: 27 ize: 802.7 pability #1 ation: typ	/iFi and N [x2Rx an [1ac 1 e A;	IR-U	iguration	and 2
		- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorit 0 0 0 0 0	CTS ena threshold odulation scheme a both Wi- IAC layer SCS: 15 F ard inter processi SCH/PU3 ngSlotPe 0 0 0 0]	d assumpt order sug and numb Fi and N r A-MPD kHz val: 0.8 µ ng time c SCH map riodicity	tions: For pported in per of MIN R-U U/A-MSD usec apability ( pping type, AndOffset:	each tech 10 layers 10 aggreg #1 or #2): PDCCH	nology: 25 used for b ation level Processin monitoring	56 QAM f oth techno , MPDU s g time cap g configur	or both W logies: 27 ize: 802.7 pability #1 ation: typ	/iFi and N [x2Rx an [1ac 1 e A;	IR-U tenna conf	iguration	and 2
DL:		- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-c	CTS ena threshold odulation scheme a both Wi- IAC layer CCS: 15 F ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch	d assumpt order sug and numb Fi and N r A-MPD kHz val: 0.8 µ ng time c SCH map riodicity	tions: For pported in per of MIM R-U U/A-MSD usec apability ( pping type,	each tech IO layers DU aggreg #1 or #2): PDCCH 1slot; con	nology: 25 used for b ation level Processin monitoring reset dura	56 QAM fo oth techno , MPDU s g time cap g configur tion: 2 syn	or both W logies: 27 ize: 802.7 pability #2 ation: typ nbol; mor	/iFi and N Fx2Rx an 11ac 1 e A; hitoringSy	NR-U tenna conf ymbolswith	iguration hinSlot: [2	and 2
DL:		- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-c	CTS ena threshold odulation scheme a both Wi- IAC layer SCS: 15 F ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch 47.276	d assumption order sup and numb Fi and Ni r A-MPD kHz val: 0.8 μ ng time c SCH map riodicity heduling f	tions: For pported in per of MIN R-U U/A-MSD USEC apability ( pping type, AndOffset: for NR-U	each tech IO layers DU aggreg #1 or #2): PDCCH 1slot; con 19.582	nology: 25 used for b ation level Processin monitoring reset dura	56 QAM for oth techno , MPDU s g time cap g configur tion: 2 sym	or both W logies: 27 ize: 802.7 pability #7 ation: typ nbol; mor	/iFi and N Fx2Rx an 11ac 1 e A; hitoringSy 7.768	NR-U tenna conf ymbolswith 41.229	iguration hinSlot: [1	and 2
DL: UPT CDF		- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-c	CTS ena threshold odulation scheme a both Wi- IAC layer SCS: 15 k ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch 47.276 60.190	d assumpt order sup and numb Fi and N r A-MPD KHz val: 0.8 µ ng time c SCH map riodicity heduling t -	tions: For pported in per of MIN R-U U/A-MSD U/A-MSD usec apability ( pping type, AndOffset: for NR-U -	each tech IO layers IU aggreg #1 or #2): PDCCH 1slot; con 19.582 32.045	nology: 25 used for b ation level Processin monitoring reset durat 44.392 51.535	56 QAM front techno , MPDU s g time cap g configur tion: 2 sym	or both W logies: 2 <sup>-</sup> ize: 802.2 pability #2 ation: typ nbol; mor	7iFi and N Fx2Rx an 11ac 1 e A; nitoringSy 7.768 22.447	NR-U tenna conf ymbolswith 41.229 48.156	iguration hinSlot: [2 -	and 2 1 0 0 0 -
UPT CDF [Mbps]	5% 50% 95%	- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-c	CTS ena threshold odulation scheme a both Wi- IAC layer SCS: 15 F ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch 47.276	d assumption order sup and numb Fi and Ni r A-MPD kHz val: 0.8 μ ng time c SCH map riodicity heduling f	tions: For pported in per of MIN R-U U/A-MSD USEC apability ( pping type, AndOffset: for NR-U	each tech IO layers DU aggreg #1 or #2): PDCCH 1slot; con 19.582	nology: 25 used for b ation level Processin monitoring reset dura	56 QAM for oth techno , MPDU s g time cap g configur tion: 2 sym	or both W logies: 27 ize: 802.7 pability #7 ation: typ nbol; mor	/iFi and N Fx2Rx an 11ac 1 e A; hitoringSy 7.768	NR-U tenna conf ymbolswith 41.229	iguration hinSlot: [1	and 2
UPT CDF [Mbps ] DL:		- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-c	CTS ena threshold odulation scheme a both Wi- IAC layer CS: 15 H ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch 47.276 60.190 64.231	d assumpt order sug and numb Fi and N r A-MPD kHz val: 0.8 µ ng time c SCH map riodicity heduling t - -	tions: For pported in per of MIN R-U U/A-MSD usec apability ( oping type, AndOffset: for NR-U - -	each tech IO layers U aggreg #1 or #2): PDCCH 1slot; con 19.582 32.045 40.058	nology: 25 used for be ation level Processin monitoring reset durat 44.392 51.535 57.314	56 QAM fronth technoo , MPDU s g time cap g configur tion: 2 sym	or both W logies: 27 ize: 802.7 pability #7 ation: typ nbol; mor - -	7iFi and N Fx2Rx an 11ac 1 e A; hitoringSy 7.768 22.447 28.934	NR-U tenna conf ymbolswith 41.229 48.156 50.807	iguration hinSlot: [1 - -	and 2 1 0 0 0 -
UPT CDF [Mbps ] DL:	5% 50% 95% Mea n 5%	- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-C 40.958 51.341 61.063 51.903	CTS ena threshold odulation scheme a both Wi- IAC layer GCS: 15 F ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] carrier sch 47.276 60.190 64.231 59.268	d assumpt order sug and numb Fi and N. r A-MPD KHz val: 0.8 µ ng time c SCH map riodicity heduling t - - -	tions: For pported in per of MIN R-U U/A-MSD usec apability ( oping type, AndOffset: for NR-U - - -	each tech IO layers DU aggreg #1 or #2): PDCCH 1slot; con 19.582 32.045 40.058 32.107	nology: 25 used for b ation level Processin monitoring reset dura 44.392 51.535 57.314 51.647	56 QAM for the techno of the technology of techn	or both W logies: 27 ize: 802.7 pability #2 ation: typ nbol; mor	/iFi and N fx2Rx an l1ac l e A; nitoringSy 7.768 22.447 28.934 21.242	NR-U tenna conf ymbolswith 41.229 48.156 50.807 47.494	iguration hinSlot: [2 - - -	and 2 1 0 0 0 -
UPT CDF [Mbps ] DL:	5% 50% 95% 5% 5% 50%	- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - NR UE - NR VE - NR PD monitorin 0 0 0 0 0 - Cross-c 40.958 51.341 61.063 51.903 0.060 0.066	CTS ena threshold odulation scheme a both Wi- IAC layer SCS: 15 H ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch 47.276 60.190 64.231 59.268 0.060 0.062	d assumption order superiod order superiod order superiod for the second secon	tions: For pported in per of MIN R-U U/A-MSD usec apability ( oping type, AndOffset: for NR-U - - -	each tech IO layers DU aggrege #1 or #2): PDCCH 1slot; con 19.582 32.045 40.058 32.107 0.061 0.142	nology: 25 used for be ation level Processin monitoring reset durat 44.392 51.535 57.314 51.647 0.060 0.066	56 QAM for the technood of	or both W logies: 27 ize: 802.7 pability #7 ation: typ nbol; mor - - - - - -	7:Fi and N Fx2Rx an 11ac 1 e A; nitoringSy 7.768 22.447 28.934 21.242 0.073 0.297	VR-U tenna conf vmbolswith 41.229 48.156 50.807 47.494 0.060 0.077	iguration hinSlot: [1 - - - -	and 2 1 0 0 0 - -
UPT CDF [Mbps ] DL: Delay CDF	5% 50% 95% 50% 95% 50% 95% Mea	- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-c 40.958 51.341 61.063 51.903 0.060 0.066 0.207	CTS ena threshold odulation scheme a both Wi- IAC layer CCS: 15 H ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch 47.276 60.190 64.231 59.268 0.060	d assumption order supand numb Fi and N. Fi and N. r A-MPD cHz val: 0.8 μ ng time c SCH map riodicity heduling t - - - -	tions: For pported in per of MIN R-U U/A-MSD USEC apability ( pping type, AndOffset: <u>for NR-U</u> - - - - - - -	each tech IO layers DU aggrega #1 or #2): PDCCH 1slot; con 19.582 32.045 40.058 32.107 0.061	nology: 25 used for b ation level Processin monitoring reset dura 44.392 51.535 57.314 51.647 0.060	56 QAM for the technood of	or both W logies: 27 ize: 802.7 pability #2 ation: typ nbol; mor - - - -	7:Fi and Ν Γx2Rx an 11ac 1 e A; hitoringSy 7.768 22.447 28.934 21.242 0.073	VR-U tenna conf vmbolswith 41.229 48.156 50.807 47.494 0.060	iguration hinSlot: [1 - - - - -	and 2
UPT CDF [Mbps ] DL: Delay CDF [s]	5% 50% 95% 50% 95% 95% Mea n	- Is RTS/ - PD/ED - Max ma - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitoria 0 0 0 0 0 - Cross-cc 40.958 51.341 61.063 51.903 0.060 0.066 0.207 0.096	CTS ena threshold odulation scheme a both Wi- IAC layer GCS: 15 F ard inter processi SCH/PU3 ngSlotPer 0 0 0 0] arrier scl 47.276 60.190 64.231 59.268 0.060 0.062 0.130 0.072	d assumption order super and number order super	tions: For pported in per of MIW R-U U/A-MSD USEC apability ( pping type, AndOffset: for NR-U - - - - - - - - - -	each tech IO layers U aggreg #1 or #2): PDCCH 1slot; con 19.582 32.045 40.058 32.107 0.061 0.142 0.739 0.232	nology: 25 used for be ation level Processin monitoring reset durat 44.392 51.535 57.314 51.647 0.060 0.066 0.170 0.089	56 QAM for the technoor of tec	or both W logies: 27 ize: 802.7 pability #7 ation: typ nbol; mor - - - - - - - - - - -	7:Fi and N Fx2Rx an L1ac l e A; nitoringSy 7.768 22.447 28.934 21.242 0.073 0.297 3.268 0.817	VR-U tenna conf vmbolswith 41.229 48.156 50.807 47.494 0.060 0.077 0.250 0.107	iguration hinSlot: [2 - - - - - - - - - - - - -	and 2
UPT CDF [Mbps ] DL: Delay CDF [s] UL: UPT	5% 50% 95% Mea n 50% 95% Mea n 5%	- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-c 40.958 51.341 61.063 51.903 0.060 0.066 0.207	CTS ena threshold odulation scheme a both Wi- IAC layer SCS: 15 F ard inter processi SCH/PU2 ngSlotPe 0 0 0 0] arrier sch 47.276 60.190 64.231 59.268 0.060 0.062 0.130	d assumption order super order super	tions: For pported in per of MIW R-U U/A-MSD USEC apability ( pping type, AndOffset: for NR-U - - - - - - - - - -	each tech IO layers DU aggreg, #1 or #2): PDCCH 1slot; con 19.582 32.045 40.058 32.107 0.061 0.142 0.739	nology: 25 used for be ation level Processin monitoring reset durat 44.392 51.535 57.314 51.647 0.060 0.066 0.170	56 QAM front technood for techn	or both W logies: 27 ize: 802.7 pability #2 ation: typ nbol; mor - - - - - - - - - - - - - - - - - - -	7:Fi and N Fx2Rx an 11ac 1 e A; nitoringSy 7.768 22.447 28.934 21.242 0.073 0.297 3.268	VR-U tenna conf vmbolswith 41.229 48.156 50.807 47.494 0.060 0.077 0.250	iguration hinSlot: [1 - - - - - - -	and 2
UPT CDF [Mbps ] DL: CDF [s] UL: UPT CDF [Mbps	5% 50% 95% 50% 95% Mea n 5% 50%	- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-cc 40.958 51.341 61.063 51.903 0.066 0.207 0.096 40.245	CTS ena threshold odulation scheme a both Wi- IAC layer CS: 15 H ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch 47.276 60.190 64.231 59.268 0.060 0.062 0.130 0.072 50.842 61.343	d assumption order support Fi and N. Fi and N. r A-MPD dHz val: 0.8 μ ng time c SCH map riodicity/ neduling t - - - - - - - - - - - - - - - - - - -	tions: For pported in per of MIN R-U U/A-MSD usec apability ( oping type, AndOffset: for NR-U - - - - - - - - - - - - - - - - - -	each tech IO layers U aggreg, #1 or #2): PDCCH 1slot; con 19.582 32.045 40.058 32.107 0.061 0.142 0.739 0.232 23.012	nology: 25 used for be ation level Processin monitoring reset durat 44.392 51.535 57.314 51.647 0.060 0.066 0.170 0.089 42.962	56 QAM for the technoor of	or both W logies: 27 ize: 802.7 pability #7 ation: typ nbol; mor - - - - - - - - - - - - - - - - - - -	<ul> <li>7:Fi and N</li> <li>7:2Rx an</li> <li>11ac</li> <li>1</li> <li>e A;</li> <li>nitoringSy</li> <li>7.768</li> <li>22.447</li> <li>28.934</li> <li>21.242</li> <li>0.073</li> <li>0.297</li> <li>3.268</li> <li>0.817</li> <li>13.400</li> </ul>	VR-U tenna conf vmbolswith 41.229 48.156 50.807 47.494 0.060 0.077 0.250 0.107 38.706	iguration hinSlot: [2 - - - - - - - - - - - - - - - - - - -	and 2 1 0 0 0 - - - - - - - - - - - - -
UPT CDF [Mbps ] Delay CDF [s] UL: UPT CDF	5% 50% 95% Mea n 5% 50% 95% 50% 50% Mea n	- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 - Cross-c 40.958 51.341 61.063 51.903 0.060 0.066 0.207 0.096 40.245 49.537	CTS ena threshold odulation scheme a both Wi- IAC layer CS: 15 H ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch 47.276 60.190 64.231 59.268 0.060 0.062 0.130 0.072 50.842 61.343	d assumption order support Fi and N. Fi and N. r A-MPD dHz val: 0.8 μ ng time c SCH map riodicity neduling t - - - - - - - - - - - - - - - - - - -	tions: For pported in per of MIN R-U U/A-MSD usec apability ( oping type, AndOffset: for NR-U - - - - - - - - - - - - - - - - - -	each tech IO layers DU aggrega #1 or #2): PDCCH 1slot; con 19.582 32.045 40.058 32.107 0.061 0.142 0.739 0.232 23.012 34.770	nology: 25 used for be ation level Processim monitoring reset durat 44.392 51.535 57.314 51.647 0.060 0.066 0.170 0.089 42.962 48.151	56 QAM for the technood of	or both W logies: 2 <sup>-</sup> ize: 802.1 <sup>-</sup> pability #1 ation: typ nbol; mor - - - - - - - - - - - - - - - - - - -	<ul> <li>7iFi and N Fx2Rx an</li> <li>11ac</li> <li>1</li> <li>e A; nitoringSy</li> <li>7.768</li> <li>22.447</li> <li>28.934</li> <li>21.242</li> <li>0.073</li> <li>0.297</li> <li>3.268</li> <li>0.817</li> <li>13.400</li> <li>23.108</li> <li>36.185</li> </ul>	VR-U tenna conf vmbolswith 41.229 48.156 50.807 47.494 0.060 0.077 0.250 0.107 38.706 48.265	iguration hinSlot: [2 - - - - - - - - - - - - - - - - - - -	and 2
UPT CDF [Mbps] DL: Delay CDF [s] UL: UPT CDF [Mbps]	5% 50% 95% 50% 95% 50% 50% 50%	- Is RTS/ - PD/ED - Max mo - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD monitorin 0 0 0 0 0 0 - Cross-c 40.958 51.341 61.063 51.903 0.066 0.207 0.096 40.245 49.537 60.993	CTS ena threshold odulation scheme a both Wi- IAC layer SCS: 15 F ard inter processi SCH/PU3 ngSlotPe 0 0 0 0] arrier sch 47.276 60.190 64.231 59.268 0.060 0.062 0.130 0.072 50.842 61.343 65.154	d assumption order support Fi and N. Fi and N. r A-MPD dHz val: 0.8 μ ng time c SCH map riodicity neduling t - - - - - - - - - - - - - - - - - - -	tions: For pported in per of MIN R-U U/A-MSD usec apability ( oping type, AndOffset: for NR-U - - - - - - - - - - - - - - - - - -	each tech IO layers DU aggreg, #1 or #2): PDCCH 1slot; con 19.582 32.045 40.058 32.107 0.061 0.142 0.739 0.232 23.012 34.770 39.682	nology: 25 used for be ation level Processin monitoring reset durat 44.392 51.535 57.314 51.647 0.060 0.066 0.170 0.089 42.962 48.151 55.809	56 QAM for the technor of te	or both W logies: 27 ize: 802.7 pability #2 ation: typ nbol; mor - - - - - - - - - - - - - - - - - - -	<ul> <li>7iFi and N Fx2Rx an</li> <li>11ac</li> <li>1</li> <li>e A; nitoringSy</li> <li>7.768</li> <li>22.447</li> <li>28.934</li> <li>21.242</li> <li>0.073</li> <li>0.297</li> <li>3.268</li> <li>0.817</li> <li>13.400</li> <li>23.108</li> <li>36.185</li> </ul>	VR-U tenna conf 41.229 48.156 50.807 47.494 0.060 0.077 0.250 0.107 38.706 48.265 54.055	iguration inSlot: [2 - - - - - - - - - - - - -	and 2

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-1	orted			load			Mediur			High load				
gparan	ieters		O range f				O range fo				O range fo			
<u>C</u>			iFi+WiF				<u>'iFi+WiFi</u> :			WiFi+WiFi: above 55%				
Paran Paran CoppL		Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U iı	
		WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	
		WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	
	95%		0.117	0.193	0.111	0.454	0.193	0.474	0.125	0.864	0.187	0.738	0.137	
[s]	Mea n	0.092	0.071	0.067	0.045	0.173	0.095	0.151	0.052	0.306	0.098	0.224	0.056	
QI	-	1.00	95.070	-	-	0.99	0.96	-	-	0.96	0.93	-	-	
$Q_{\rm U}$	ЛL	1.00	95.620	1.00	1.00	1.00	0.95	0.98	1.00	1.00	0.92	0.93	1.00	
B	0	23.677	36.196	8.38	5.280	41.023	40.487	36.885	11.545	59.295	44.734	40.175	14.749	
2	l	D	L:1Mbps	; UL:1M	bps		UL:2N	/lbps;		D	L:2Mbps;	UL:2Mbp	)S	
		Addition	al comm	ents:						-				
		- Max ma - MIMO layer for - WiFi M - NR-U S - WiFi gu - NR UE - NR PD	odulation scheme a both Wi- IAC layer SCS: 15 k lard inter processi SCH/PUS	order su and numb Fi and N r A-MPD tHz val: 0.8 µ ng time c SCH map	pported in per of MIN R-U U/A-MSE usec apability ( pping type	each tech 40 layers a 0U aggrega (#1 or #2): , PDCCH a	nology: 25 used for bo ation level Processin monitoriną	56 QAM fo oth techno , MPDU s g time cap g configur	or both W logies: 27 ize: 802.7 pability #1 ation: typ	/iFi and N Fx2Rx an 11ac 1 re A;	tenna conf.	iguration	and 2	
		monitorii 0 0 0 0 0 0		riodicity	AndOffset	: 1slot; cor	eset durat	tion: 2 syn	nbol; mor	nitoringSy	ymbolswith	inSlot: [1	10000	
					for NR-U		1							
DL:		6.89	7.59	39.87	42.19	3.38		1		I				
	150%		~ ~ ~ ~				3.23	23.87	42.12	1.34	1.49	7.05	36,50	
UPT			36,97	120,95	97,80	22,79	24,96	100,97	94,25	11,26	14,17	74,25	87,78	
	95%		36,97 79,51	120,95 190,84									87,78	
	95% Mea	77,98	79,51	190,84	97,80 186,51	22,79 61,50	24,96 62,42	100,97 172,75	94,25 182,16	11,26 40,72	14,17 51,33	74,25 143,82	87,78 177,31	
[Mbps [92] [92]	95% Mea n	77,98 39,91	79,51 37,63	190,84 120,04	97,80 186,51 106,00	22,79 61,50 26,77	24,96 62,42 28,10	100,97 172,75 100,36	94,25 182,16 102,11	11,26 40,72 14,91	14,17 51,33 18,57	74,25 143,82 75,30	87,78 177,31 95,65	
[Mbps [] [] [] [] [] [] [] [] [] [] [] [] []	95% Mea n 5%	77,98 39,91 42,23	79,51 37,63 45,77	190,84 120,04 19,76	97,80 186,51 106,00 20,79	22,79 61,50 26,77 49,01	24,96 62,42 28,10 49,52	100,97 172,75 100,36 20,67	94,25 182,16 102,11 20,70	11,26 40,72 14,91 68,97	14,17 51,33 18,57 59,83	74,25 143,82 75,30 21,84	87,78 177,31 95,65 21,03	
[Mbps [600] ] <b>DL:</b> Jelay	95% Mea n 5% 50%	77,98 39,91 42,23 116,70	79,51 37,63 45,77 112,65	190,84 120,04 19,76 31,06	97,80 186,51 106,00 20,79 42,11	22,79 61,50 26,77 49,01 211,95	24,96 62,42 28,10 49,52 183,95	100,97 172,75 100,36 20,67 40,22	94,25 182,16 102,11 20,70 43,36	11,26 40,72 14,91 68,97 448,90	14,17 51,33 18,57 59,83 325,72	74,25 143,82 75,30 21,84 57,77	87,78 177,31 95,65 21,03 45,74	
[Mbp: [ 1815629/ [ 202] DL: Delay CDF	95% Mea n 5% 50% 95%	77,98 39,91 42,23 116,70 577,53	79,51 37,63 45,77 112,65	190,84 120,04 19,76 31,06	97,80 186,51 106,00 20,79	22,79 61,50 26,77 49,01	24,96 62,42 28,10 49,52 183,95	100,97 172,75 100,36 20,67 40,22	94,25 182,16 102,11 20,70 43,36	11,26 40,72 14,91 68,97 448,90	14,17 51,33 18,57 59,83	74,25 143,82 75,30 21,84 57,77	87,78 177,31 95,65 21,03 45,74	
[Mbps] ] <b>DL:</b> Jelay	95% Mea n 5% 50% 95% Mea	77,98 39,91 42,23 116,70 577,53	79,51 37,63 45,77 112,65 521,78	190,84 120,04 19,76 31,06 101,94	97,80 186,51 106,00 20,79 42,11 111,14	22,79 61,50 26,77 49,01 211,95 1234,80	24,96 62,42 28,10 49,52 183,95 931,37	100,97 172,75 100,36 20,67 40,22 205,60	94,25 182,16 102,11 20,70 43,36 137,24	11,26 40,72 14,91 68,97 448,90 2895,40	14,17 51,33 18,57 59,83 325,72 2041,24	74,25 143,82 75,30 21,84 57,77 430,25	87,78 177,31 95,65 21,03 45,74 181,75	
[Mbps ] DL: 1815620/ Delay [s]	95% Mea 5% 50% 95% Mea n	77,98 39,91 42,23 116,70 577,53 194,41	79,51 37,63 45,77 112,65 521,78 191,64	190,84 120,04 19,76 31,06 101,94 43,98	97,80 186,51 106,00 20,79 42,11 111,14 52,49	22,79 61,50 26,77 49,01 211,95 1234,80 370,92	24,96 62,42 28,10 49,52 183,95 931,37 306,45	100,97 172,75 100,36 20,67 40,22 205,60 67,79	94,25 182,16 102,11 20,70 43,36 137,24 58,06	11,26 40,72 14,91 68,97 448,90 2895,40 832,30	14,17 51,33 18,57 59,83 325,72 2041,24 571,74	74,25 143,82 75,30 21,84 57,77 430,25 114,17	87,78 177,31 95,65 21,03 45,74 181,75 83,90	
[Mbps] ] DL: 1815620/ UL: [s] UL:	95% Mea n 5% 750% 95% Mea n 5%	77,98 39,91 42,23 116,70 577,53 194,41 5,36	79,51 37,63 45,77 112,65 521,78 191,64 5,86	190,84 120,04 19,76 31,06 101,94 43,98 6,00	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38	
[Mbps] ] DL: Delay CDF [s] UL: UPT	95% Mea 5% 50% 95% Mea n 5% 50%	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46 24,10	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35	
[Mbps] ] DL: 1815629 [S] UL: [S] UL: UPT CDF	95% Mea n 5% 95% Mea n 5% 50% 95%	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30	79,51 37,63 45,77 112,65 521,78 191,64 5,86	190,84 120,04 19,76 31,06 101,94 43,98 6,00	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35	
[Mbps] ] DL: Delay CDF [s] UL: UPT	95% Mea n 50% 95% Mea 5% 50% 95% Mea	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30 48,09	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15 49,77	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98 51,90	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30 52,79	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48 41,25	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60 42,11	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46 24,10 46,86	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82 49,24	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00 30,34	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19 34,02	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97 36,36	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35 47,76	
[Mbps] [M1-1815629/ Delay CDF [s] UL: UPT CDF [Mbps] ]	95% Mea n 5% 95% Mea n 50% 95% 95% Mea n	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30 48,09 32,44	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15 49,77 31,29	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98 51,90 32,51	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30 52,79 33,53	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48 41,25 22,68	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60 42,11 23,22	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46 24,10 46,86 24,68	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82 49,24 31,51	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00 30,34 13,32	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19 34,02 15,27	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97 36,36 16,65	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35 47,76 29,13	
CDF [Mbps] [Mbps] [Mbps] [S] [S] [S] [S] [S] [S] [S] [S] [S] [S	95% Mea n 50% 95% Mea n 50% 95% Mea n 5%	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30 48,09 32,44 74,44	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15 49,77 31,29 77,59	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98 51,90 32,51 67,16	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30 52,79 33,53 68,58	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48 41,25 22,68 77,41	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60 42,11 23,22 81,41	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46 24,10 46,86 24,68 69,98	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82 49,24 31,51 69,75	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00 30,34 13,32 91,63	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19 34,02 15,27 87,31	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97 36,36 16,65 76,77	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35 47,76 29,13 70,20	
[Mbps] ] DL: Delay CDF [s] UL: [Mbps] UL: Delay	95% Mea n 50% 95% Mea n 50% 95% Mea n 5% 50%	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30 48,09 32,44 74,44 124,75	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15 49,77 31,29 77,59 116,30	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98 51,90 32,51 67,16 108,33	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30 52,79 33,53 68,58 116,65	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48 41,25 22,68 77,41 201,97	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60 42,11 23,22 81,41 178,00	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46 24,10 46,86 24,68 69,98 172,55	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82 49,24 31,51 69,75 129,67	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00 30,34 13,32 91,63 398,35	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19 34,02 15,27 87,31 304,75	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97 36,36 16,65 76,77 274,75	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35 47,76 29,13 70,20 138,97	
[Mbps] ] DL: Delay [s] UL: [S] UL: [Mbps] ] UL: Delay CDF	95% Mea n 50% 95% Mea n 50% 95% 50% 95% 95%	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30 48,09 32,44 74,44 124,75 550,71	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15 49,77 31,29 77,59	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98 51,90 32,51 67,16	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30 52,79 33,53 68,58	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48 41,25 22,68 77,41	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60 42,11 23,22 81,41	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46 24,10 46,86 24,68 69,98	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82 49,24 31,51 69,75	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00 30,34 13,32 91,63	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19 34,02 15,27 87,31	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97 36,36 16,65 76,77	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35 47,76 29,13 70,20 138,97	
[Mbps] ] DL: Delay CDF [s] UL: [Mbps] UL: Delay	95% Mea n 50% 95% Mea n 50% 95% Mea n 5% 50%	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30 48,09 32,44 74,44 124,75 550,71	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15 49,77 31,29 77,59 116,30	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98 51,90 32,51 67,16 108,33	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30 52,79 33,53 68,58 116,65	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48 41,25 22,68 77,41 201,97	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60 42,11 23,22 81,41 178,00	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46 24,10 46,86 24,68 69,98 172,55	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82 49,24 31,51 69,75 129,67	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00 30,34 13,32 91,63 398,35	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19 34,02 15,27 87,31 304,75	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97 36,36 16,65 76,77 274,75	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35 47,76 29,13 70,20 138,97 376,14	
[Mbps] ] DL: Delay [s] UL: [S] UL: [Mbps] ] UL: Delay CDF	95% Mea n 50% 95% Mea n 5% 50% 95% Mea n 50% 95% Mea n	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30 48,09 32,44 74,44 124,75 550,71	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15 49,77 31,29 77,59 116,30 548,54	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98 51,90 32,51 67,16 108,33 496,94	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30 52,79 33,53 68,58 116,65 269,00	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48 41,25 22,68 77,41 201,97 1301,15	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60 42,11 23,22 81,41 178,00 1140,48	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46 24,10 46,86 24,68 69,98 172,55 824,32	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82 49,24 31,51 69,75 129,67 292,93	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00 30,34 13,32 91,63 398,35 3245,64	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19 34,02 15,27 87,31 304,75 2660,31	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97 36,36 16,65 76,77 274,75 1694,62	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35 47,76 29,13	
[Mbps] ] DL: Delay CDF [s] UL: UPT CDF [Mbps] ] UL: Delay CDF [s]	95% Mea n 50% 95% Mea n 50% 95% Mea n 50% 95% Mea n 50% 95% Mea n 50%	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30 48,09 32,44 74,44 124,75 550,71 190,20	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15 49,77 31,29 77,59 116,30 548,54 192,89	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98 51,90 32,51 67,16 108,33 496,94 197,54	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30 52,79 33,53 68,58 116,65 269,00 186,67	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48 41,25 22,68 77,41 201,97 1301,15 379,81	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60 42,11 23,22 81,41 178,00 1140,48 352,00	100,97 172,75 20,67 40,22 205,60 67,79 4,46 24,10 46,86 24,68 69,98 172,55 824,32 301,40	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82 49,24 31,51 69,75 129,67 292,93 172,35	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00 30,34 13,32 91,63 398,35 3245,64 869,47	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19 34,02 15,27 87,31 304,75 2660,31 700,39	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97 36,36 16,65 76,77 274,75 1694,62 517,89	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35 47,76 29,13 70,20 138,97 376,14 202,12	
[Mbps] ] DL: Delay CDF [s] UL: UPT CDF [Mbps] ] UL: Delay CDF [s]	95% Mea n 50% 95% Mea n 50% 95% Mea n 50% 95% Mea n 50% 95% Mea n 50% 95%	77,98 39,91 42,23 116,70 577,53 194,41 5,36 32,30 48,09 32,44 74,44 124,75 550,71 190,20 0,92	79,51 37,63 45,77 112,65 521,78 191,64 5,86 33,15 49,77 31,29 77,59 116,30 548,54 192,89 0,88	190,84 120,04 19,76 31,06 101,94 43,98 6,00 33,98 51,90 32,51 67,16 108,33 496,94 197,54 0,97	97,80 186,51 106,00 20,79 42,11 111,14 52,49 15,49 33,30 52,79 33,53 68,58 116,65 269,00 186,67 1,00	22,79 61,50 26,77 49,01 211,95 1234,80 370,92 2,29 22,48 41,25 22,68 77,41 201,97 1301,15 379,81 0,89	24,96 62,42 28,10 49,52 183,95 931,37 306,45 2,59 23,60 42,11 23,22 81,41 178,00 1140,48 352,00 0,85	100,97 172,75 100,36 20,67 40,22 205,60 67,79 4,46 24,10 46,86 24,68 69,98 172,55 824,32 301,40 0,96	94,25 182,16 102,11 20,70 43,36 137,24 58,06 16,07 30,82 49,24 31,51 69,75 129,67 292,93 172,35 1,00	11,26 40,72 14,91 68,97 448,90 2895,40 832,30 0,19 12,00 30,34 13,32 91,63 398,35 3245,64 869,47 0,85	14,17 51,33 18,57 59,83 325,72 2041,24 571,74 0,29 14,19 34,02 15,27 87,31 304,75 2660,31 700,39 0,78	74,25 143,82 75,30 21,84 57,77 430,25 114,17 0,87 14,97 36,36 16,65 76,77 274,75 1694,62 517,89 0,93	87,78 177,31 95,65 21,03 45,74 181,75 83,90 13,38 28,35 47,76 29,13 70,20 138,97 376,14 202,12 0,99	

Tdoc/Source	Repo				<u>v load</u>			Mediur		High load BO range for Wi-Fi in				
Sol	param	eters		0	for Wi-Fi			O range fo						
OC/					i: 10%~2			'iFi+WiFi:				<u>'iFi+WiFi:</u>		
μŢ						NR-U in	Wi-Fi in					Wi-Fi in		
			WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+
_			WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
			supporte	n assumj d 256 QA	otions: 27 M, MIM	O scheme	with Tx E	3F upto rai	nk 2 in the	DL, Rar	ık 1 in the	ackoff, Ma e UL Interval sł		
								tion 4.096		,			, -	
			NRU ass	sumptior	is: ED thi	eshold -7	2 dBm, S	CS 30 kHz	, UE proc			lity #1, NF RQ, realis		
												gNB acqui		
												at the beg		
												of UL burs		
								40 ms, DI					., - 0 -	
$\uparrow$	DL:	5%	15.66	21.56	31.42	36.39	7.53	15.89	26.17	30.57	3.11	13.19	23.9	26.84
		50%		66.4	87.54	97.08	35.61	56.64	75.05	87.45	27.16	51.13	67.41	81.65
		95%		78.23	103.9	104.8	77.3	78.02	103.9	104.8	75.23	77.93	103.7	104.8
[	Mbps 1			59.5	78.05	83.71	38.52	53.61	71.56	78.44	30.88	50.07	67.9	75.28
F	DL:	5%	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04
	Delay			0.06	0.04	0.04	0.00	0.08	0.04	0.05	0.05	0.08	0.04	0.05
		95%		0.19	0.03	0.11	0.51	0.25	0.05	0.13	1.13	0.30	0.00	0.15
		Mea n		0.19	0.06	0.05	0.18	0.10	0.07	0.06	0.32	0.11	0.07	0.13
ŀ	UL:	5%	18.43	26.83	18.46	29.85	6.98	18.39	13.13	24	1.49	13.13	9.97	20.6
		57% 50%		72.26	56.06	76.68	38.48	59.77	42.8	66.15	29.2	56.98	37.55	60.15
Source 4		<u>95%</u>			72.22			79.32			77.61	79.34	+	83.5
ILC.		95%	79.2	79.44		83.73	78.72		72.1	83.56			71.91	
<u>S</u>	Mbps		53.4	62.72	51.35	66.81	40.75	56.58	44.75	61.31	31.98	53.54	40.72	58.36
	J TTL.	n ro/	0.05	0.05	0.00	0.05	0.05	0.05	0.00	0.05	0.05	0.05	0.00	0.05
R1-1814085/	UL:	5%	0.05	0.05	0.06	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.06	0.05
317	Delay CDF			0.06	0.07	0.05	0.10	0.07	0.09	0.06	0.14	0.07	0.10	0.07
Ξ		95%		0.15	0.21	0.13	0.56	0.22	0.30	0.17	1.89	0.28	0.39	0.19
Ы	[5]	Mea	0.10	0.07	0.09	0.07	0.18	0.09	0.12	0.08	0.43	0.11	0.15	0.09
┝		n	00.00/	00 7 40/	00.720/	1000/	00.040/	00.00/	1000/	00.010/	00.400/	00 700/		00.000
ŀ	$\varrho_{\rm D}$			99.74%		100%	99.64%	99.69%	100%		98.46%	99.70%	99.80%	
-	Qu				99.52%	100%	99.56%	99.64%	99.63%		96.78%	99.56%	99.52%	
╞	BC		17%		13.00%	11.00%	35%	22.00%	22.00%	17.00%	55%	28.00%	28.00%	21.00%
ŀ	λ				files/s			0.3 fi	les/s			0.35 f	iles/s	
			Addition											
												ith single s		
										60 kHz SC	LS NCP;	UE proces	sing time	
	capability #1; NR type B for PDSCH									AT7 .1	1 7			
	<b>802.11ac assumption:</b> 4ms TXOF 62dBm EDCA; 256 QAM BCC; A													
				EDCA; 2	JO QAM	DUU; A-N	17DU, 15		U T 14 B I	leader; If	mneulate	AUN,312.	JKHZ SU	J GI=
4	DI -	1	0.8us 15.66	10.42	36.01	<i>A</i> 1 07	7 5 2	1167	20	24.04	2 11	10.00	24.20	20 57
Ģ	DL: UPT	5%		19.43	36.84	41.97	7.53	14.67	29	34.94	3.11	10.98	24.29	30.57
mo				61.14	95.91	101.8	35.61	53.78	83.89	91.97	27.16	47.46	76	87.3
N/S	CDF Mbps			78.16	107.1	107.2	77.3	78	107.2	107.2	75.23	77.83	107.1	107.2
408	]	n	49.69	57.19	85.24	88.05	38.52	51.51	77.5	82.54	30.88	47.84	72.89	79.57
	DL:	5%	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04
181				0.06	0.04	0.04	0.11	0.07	0.05	0.04	0.15	0.08	0.05	0.05
<del>31-181</del>	Delay		0.25	0.21	0.11	0.10	0.51	0.27	0.14	0.11	1.13	0.34	0.16	0.13
1-1	CDF	95%	0.20											0.00
R1-181	CDF	95% Mea n		0.09	0.05	0.05	0.18	0.11	0.06	0.06	0.32	0.12	0.07	0.06
R1-181	CDF	Mea			0.05 27.56	0.05	0.18 6.98	0.11	0.06	0.06 27.88	0.32	0.12	0.07	0.06 24.38

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1 1	Repo	rted			r <b>load</b>			Mediur	n load			<u>High</u>		
no	param	eters	В	O range f	for Wi-Fi	in	В	O range fo	or Wi-Fi in	L	В	O range fo	or Wi-Fi ii	1
c/S	-				i: 10%~2		W	'iFi+WiFi:	35%~50%	6	W	iFi+WiFi:	above 55	%
Tdoc/Source			Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in
			WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+
			WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
	CDF		79.2	79.41	93.45	93.47	78.72	79.34	93.44	93.46	77.61	79.23	93.38	93.44
	[Mbps ]	Mea n	53.4	62	71.19	75.7	40.75	55.84	62.69	69.87	31.98	52.07	57.53	66.71
	UL:	5%	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04
	Delay	50%	0.07	0.06	0.05	0.05	0.10	0.07	0.06	0.05	0.14	0.07	0.07	0.06
	CDF	95%	0.21	0.16	0.14	0.12	0.56	0.22	0.20	0.14	1.89	0.31	0.25	0.16
	[s]	Mea	0.10	0.08	0.07	0.06	0.18	0.09	0.08	0.07	0.43	0.11	0.10	0.07
		n												
	$\varrho_{\rm D}$	L	99.68%	99.69%	99.72%	100%	99.64%	99.67%	99.99%	99.89%	98.46%	99.72%	99.75%	99.83%
	Qu	L	99.60%	99.85%	99.61%	100%	99.56%	99.61%	99.74%	99.76%	96.78%	99.55%	99.63%	99.73%
	BC	)	17%	14.00%	11.00%	10.00%	35%	23.00%	18.00%	16.00%	55%	29.00%	23.00%	19.00%
	$\frac{BO}{\lambda}$			0.2	files/s			0.3 fi	les/s			0.35 fi	iles/s	
			Addition	al comm	ents:									
			NRU ass capabilit 802.11ac	sumption y #1; NR c assump	type B fo tion: 4ms	COT; ED or PDSCH 5 TXOP; F	=-72dBm; i, type A fo RTS/CTS o	256 QAN or PUSCH lisabled fo	1 LDPC; 6 r WiFi, N	60 kHz SO AV set ba	CS NCP;	th single s UE process SIG; PD=- ACK,312.	sing time -82dBm/H	
0	DL:	5%	2.077	2.086	3.529	12.000	0.103	0.436	4.184	4.700	0.04	0.267	0.057	0.797
Source	UPT		30.508	35.679	63.412	63.704	12.735	21.654	38.000	39.07	1.62	4.936	14.045	20.731
Sol	CDF	95%	52.927	56.945	74.133	74.078	49.774	53.152	73.624	74.058	33.656	32.256	42.991	
814074 /	[Mbps ]	Mea n	28.461	31.821	54.791	55.576	17.523					02.200		66.636
314	DL:	5%					17.525	22.865	36.523	39.550	8.016	9.708	16.644	66.636 23.482
			0.050	0.05	0.054	0.054	0.050	22.865 0.050			8.016 0.050			
	Denuy	50%	0.050	0.05 0.056	0.054 0.058	0.054			36.523	39.550		9.708	16.644	23.482
R1	Delay	50% 95%					0.050	0.050	36.523 0.054	39.550 0.054	0.050	9.708 0.05	16.644 0.054	23.482 0.054
R	CDF		0.086	0.056	0.058	0.058	0.050 0.183	0.050 0.100	36.523 0.054 0.100	39.550 0.054 0.106	0.050 0.800	9.708 0.05 0.624	16.644 0.054 0.333	23.482 0.054 0.219
R,	CDF	95% Mea	0.086 1.760	0.056 1.121	0.058 0.308	0.058 0.378	0.050 0.183 5.535	0.050 0.100 1.913	36.523 0.054 0.100 0.801	39.550 0.054 0.106 0.698	0.050 0.800 6.56	9.708 0.05 0.624 5.244	16.644 0.054 0.333 1.787	23.482 0.054 0.219 1.403
R	CDF [s] UL:	95% Mea n 5%	0.086 1.760 0.362	0.056 1.121 0.289 1.895	0.058 0.308 0.131 8.945	0.058 0.378 0.112	0.050 0.183 5.535 1.060 0.216	0.050 0.100 1.913 0.418 0.396	36.523 0.054 0.100 0.801 0.206 2.490	39.550 0.054 0.106 0.698 0.194	0.050 0.800 6.56 1.809	9.708 0.05 0.624 5.244 1.301	16.644 0.054 0.333 1.787 0.516	23.482 0.054 0.219 1.403 0.392
R	CDF [s] UL: UPT	95% Mea n 5% 50%	0.086 1.760 0.362 1.450 35.542	0.056 1.121 0.289 1.895 39.754	0.058 0.308 0.131	0.058 0.378 0.112 19.057	0.050 0.183 5.535 1.060	0.050 0.100 1.913 0.418	36.523 0.054 0.100 0.801 0.206	39.550 0.054 0.106 0.698 0.194 5.646	0.050 0.800 6.56 1.809 0.022	9.708 0.05 0.624 5.244 1.301 0.018	16.644 0.054 0.333 1.787 0.516 1.738	23.482 0.054 0.219 1.403 0.392 2.071
	CDF [s] UL: UPT CDF	95% Mea n 5% 50% 95%	0.086 1.760 0.362 1.450 35.542	0.056 1.121 0.289 1.895	0.058 0.308 0.131 8.945 57.249	0.058 0.378 0.112 19.057 57.542	0.050 0.183 5.535 1.060 0.216 16.897	0.050 0.100 1.913 0.418 0.396 23.044	36.523 0.054 0.100 0.801 0.206 2.490 31.288	39.550 0.054 0.106 0.698 0.194 5.646 38.075	0.050 0.800 6.56 1.809 0.022 3.016	9.708 0.05 0.624 5.244 1.301 0.018 4.215	16.644 0.054 0.333 1.787 0.516 1.738 14.792	23.482 0.054 0.219 1.403 0.392 2.071 21.480
	CDF [s] UL: UPT CDF	95% Mea n 5% 50% 95%	0.086 1.760 0.362 1.450 35.542 53.493	0.056 1.121 0.289 1.895 39.754 53.399	0.058 0.308 0.131 8.945 57.249 73.471	0.058 0.378 0.112 19.057 57.542 73.5533	0.050 0.183 5.535 1.060 0.216 16.897 53.622	0.050 0.100 1.913 0.418 0.396 23.044 48.525	36.523 0.054 0.100 0.801 0.206 2.490 31.288 72.538	39.550 0.054 0.106 0.698 0.194 5.646 38.075 73.230	0.050 0.800 6.56 1.809 0.022 3.016 32.975	9.708 0.05 0.624 5.244 1.301 0.018 4.215 40.011	16.644 0.054 0.333 1.787 0.516 1.738 14.792 43.120	23.482 0.054 0.219 1.403 0.392 2.071 21.480 59.95
	CDF [s] UL: UPT CDF [Mbps	95% Mea 5% 50% 95% Mea	0.086 1.760 0.362 1.450 35.542 53.493	0.056 1.121 0.289 1.895 39.754 53.399	0.058 0.308 0.131 8.945 57.249 73.471	0.058 0.378 0.112 19.057 57.542 73.5533	0.050 0.183 5.535 1.060 0.216 16.897 53.622	0.050 0.100 1.913 0.418 0.396 23.044 48.525	36.523 0.054 0.100 0.801 0.206 2.490 31.288 72.538	39.550 0.054 0.106 0.698 0.194 5.646 38.075 73.230	0.050 0.800 6.56 1.809 0.022 3.016 32.975	9.708 0.05 0.624 5.244 1.301 0.018 4.215 40.011	16.644 0.054 0.333 1.787 0.516 1.738 14.792 43.120	23.482 0.054 0.219 1.403 0.392 2.071 21.480 59.95
	CDF [s] UL: UPT CDF [Mbps ]	95% Mea 5% 50% 95% Mea n 5%	0.086 1.760 0.362 1.450 35.542 53.493 30.904 0.050	0.056 1.121 0.289 1.895 39.754 53.399 33.153	0.058 0.308 0.131 8.945 57.249 73.471 51.827	0.058 0.378 0.112 19.057 57.542 73.5533 54.91	0.050 0.183 5.535 1.060 0.216 16.897 53.622 20.958	0.050 0.100 1.913 0.418 0.396 23.044 48.525 23.444	36.523 0.054 0.100 0.801 0.206 2.490 31.288 72.538 33.162	39.550 0.054 0.106 0.698 0.194 5.646 38.075 73.230 39.735	0.050 0.800 6.56 1.809 0.022 3.016 32.975 9.049	9.708 0.05 0.624 5.244 1.301 0.018 4.215 40.011 10.498	16.644 0.054 0.333 1.787 0.516 1.738 14.792 43.120 18.290	23.482 0.054 0.219 1.403 0.392 2.071 21.480 59.95 24.595
	CDF [s] UL: UPT CDF [Mbps ] UL:	95% Mea 5% 50% 95% Mea n 5% 50%	0.086 1.760 0.362 1.450 35.542 53.493 30.904 0.050	0.056 1.121 0.289 1.895 39.754 53.399 33.153 0.050	0.058 0.308 0.131 8.945 57.249 73.471 51.827 0.054	0.058 0.378 0.112 19.057 57.542 73.5533 54.91	0.050 0.183 5.535 1.060 0.216 16.897 53.622 20.958	0.050 0.100 1.913 0.418 0.396 23.044 48.525 23.444 0.050	36.523 0.054 0.100 0.801 0.206 2.490 31.288 72.538 33.162 0.054	39.550 0.054 0.698 0.194 5.646 38.075 73.230 39.735 0.054	0.050 0.800 6.56 1.809 0.022 3.016 32.975 9.049 0.050	9.708 0.05 0.624 5.244 1.301 0.018 4.215 40.011 10.498 0.05	16.644 0.054 0.333 1.787 0.516 1.738 14.792 43.120 18.290 0.055	23.482 0.054 0.219 1.403 0.392 2.071 21.480 59.95 24.595 0.054
	CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF	95% Mea 5% 50% 95% Mea n 5% 50%	0.086 1.760 0.362 1.450 35.542 53.493 30.904 0.050 0.070	0.056 1.121 0.289 1.895 39.754 53.399 33.153 0.050 0.059	0.058 0.308 0.131 8.945 57.249 73.471 51.827 0.054 0.070	0.058 0.378 0.112 19.057 57.542 73.5533 54.91 0.054 0.064	0.050 0.183 5.535 1.060 0.216 16.897 53.622 20.958 0.050 0.132	0.050 0.100 1.913 0.418 0.396 23.044 48.525 23.444 0.050 0.111	36.523 0.054 0.100 0.801 0.206 2.490 31.288 72.538 33.162 0.054 0.130	39.550 0.054 0.698 0.194 5.646 38.075 73.230 39.735 0.054 0.103	0.050 0.800 6.56 1.809 0.022 3.016 32.975 9.049 0.050 0.805	9.708 0.05 0.624 5.244 1.301 0.018 4.215 40.011 10.498 0.05 0.754	16.644 0.054 0.333 1.787 0.516 1.738 14.792 43.120 18.290 0.055 0.279	23.482 0.054 0.219 1.403 0.392 2.071 21.480 59.95 24.595 0.054 0.209
	CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF [s]	95% Mea n 50% 95% Mea n 5% 95% Mea n	0.086 1.760 0.362 35.542 53.493 30.904 0.050 0.070 2.165 0.360	0.056 1.121 0.289 1.895 39.754 53.399 33.153 0.050 0.059 1.334 0.295	0.058 0.308 0.131 8.945 57.249 73.471 51.827 0.054 0.070 0.434 0.128	0.058 0.378 0.112 19.057 57.542 73.5533 54.91 0.054 0.064 0.204 0.204	0.050 0.183 5.535 1.060 0.216 16.897 53.622 20.958 0.050 0.132 5.584 1.04	0.050 0.100 1.913 0.418 0.396 23.044 48.525 23.444 0.050 0.111 3.672 0.647	36.523 0.054 0.100 0.801 0.206 2.490 31.288 72.538 33.162 0.054 0.130 1.309 0.299	39.550 0.054 0.106 0.698 0.194 5.646 38.075 73.230 39.735 0.054 0.103 0.739 0.203	0.050 0.800 6.56 1.809 0.022 3.016 32.975 9.049 0.050 0.805 5.748 1.505	9.708 0.05 0.624 5.244 1.301 0.018 4.215 40.011 10.498 0.05 0.754 5.106 1.4	16.644         0.054         0.333         1.787         0.516         1.738         14.792         43.120         18.290         0.055         0.279         1.563         0.474	23.482 0.054 0.219 1.403 0.392 2.071 21.480 59.95 24.595 0.054 0.209 1.388 0.426
	CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF [s] $\varrho_{\rm D}$	95% Mea 5% 50% 95% Mea 5% 50% 95% Mea n	0.086 1.760 0.362 35.542 53.493 30.904 0.050 0.070 2.165 0.360 0.988	0.056 1.121 0.289 1.895 39.754 53.399 33.153 0.050 0.059 1.334 0.295 0.993	0.058 0.308 0.131 8.945 57.249 73.471 51.827 0.054 0.070 0.434 0.128 0.992	0.058 0.378 0.112 19.057 57.542 73.5533 54.91 0.054 0.064 0.204 0.204 0.092	0.050 0.183 5.535 1.060 0.216 16.897 53.622 20.958 20.958 0.050 0.132 5.584 1.04	0.050 0.100 1.913 0.418 0.396 23.044 48.525 23.444 0.050 0.111 3.672 0.647	36.523 0.054 0.100 0.801 0.206 2.490 31.288 72.538 33.162 0.054 0.130 1.309 0.299 0.945	39.550 0.054 0.698 0.194 5.646 38.075 73.230 39.735 0.054 0.103 0.739 0.203 0.962	0.050 0.800 6.56 1.809 0.022 3.016 32.975 9.049 0.050 0.805 5.748 1.505 0.733	9.708 0.05 0.624 5.244 1.301 0.018 4.215 40.011 10.498 0.05 0.754 5.106 1.4 0.8385	16.644         0.054         0.333         1.787         0.516         1.738         14.792         43.120         18.290         0.055         0.279         1.563         0.474         0.870	23.482 0.054 0.219 1.403 0.392 2.071 21.480 59.95 24.595 0.054 0.209 1.388 0.426 0.932
	CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF [s]	95% Mea 5% 50% 95% Mea 5% 50% 95% Mea n ⊥	0.086 1.760 0.362 35.542 53.493 30.904 0.050 0.070 2.165 0.360	0.056 1.121 0.289 1.895 39.754 53.399 33.153 0.050 0.059 1.334 0.295	0.058 0.308 0.131 8.945 57.249 73.471 51.827 0.054 0.070 0.434 0.128	0.058 0.378 0.112 19.057 57.542 73.5533 54.91 0.054 0.064 0.204 0.204	0.050 0.183 5.535 1.060 0.216 16.897 53.622 20.958 0.050 0.132 5.584 1.04	0.050 0.100 1.913 0.418 0.396 23.044 48.525 23.444 0.050 0.111 3.672 0.647	36.523 0.054 0.100 0.801 0.206 2.490 31.288 72.538 33.162 0.054 0.130 1.309 0.299	39.550 0.054 0.106 0.698 0.194 5.646 38.075 73.230 39.735 0.054 0.103 0.739 0.203	0.050 0.800 6.56 1.809 0.022 3.016 32.975 9.049 0.050 0.805 5.748 1.505	9.708 0.05 0.624 5.244 1.301 0.018 4.215 40.011 10.498 0.05 0.754 5.106 1.4	16.644         0.054         0.333         1.787         0.516         1.738         14.792         43.120         18.290         0.055         0.279         1.563         0.474	23.482 0.054 0.219 1.403 0.392 2.071 21.480 59.95 24.595 0.054 0.209 1.388 0.426

Tdoc/Source	Repo	rted			/ load			Mediur				High		
Sou	param	eters			for Wi-Fi			O range fo				O range fo		
OC/					i: 10%~2			'iFi+WiFi:				iFi+WiFi:		
P L			WiFi+	WiFi H	WiFi+	NR-U in NR-U+	Wi-Fi in WiFi+	WiFi+	NR-U in WiFi+	NR-U II NR-U+	Wi-Fi In WiFi+	Wi-Fi in WiFi+	WiFi+	NR-U III NR-U+
			WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
				al comm	1	1111 0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1.111 0	1.11.0	1.111 0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1111 0	1111 0	1.11 0
						and NR-U	ſ							
			- N	0										
						82 dBm, E		dBm; for l	NR-U ED	$\Gamma = -72 d$	Bm (base	line)		
				•		Wi-Fi and		1		1		- ID:	• •• .•	1.0
				R-U witt /i-Fi	i array ra	diation pat	tern accor	ding to 1 F	(38.802 ar	ia max B	F gain of	5 dBi; om	ni-directio	onal for
					e = 3250	bytes by d	lefault. 1m	is der MPI	JU					
				0 kHz	0_00	ojico oj c		o per mir i						
			- 0.	.8 µs										
				apability										
												for flexible	starting <sub>I</sub>	position
					-	ion utilizir	0 1	e switching	g points w	ithin CO	I for NR-	-U		
	DL:	5%	- C		er schedi	uling in Ul 63.416	L 3.943	4.645	9.842	22.380	1.500	1.402	2.691	23.185
			77.534			171.191	32.930	4.645 36.844	9.842 82.630	146.557	13.770	1.402		122.645
					198.427		110.541	113.586	197.805			97.293		197.587
	[Mbps				140.165		0.0 11					2		
	]	n	76.170	80.257		155.393	42.386	47.433	94.770	131.612	21.862	31.864	75.520	120.925
	DL:	5%	0.032	0.031	0.021	0.021	0.036	0.036	0.021	0.021	0.063	0.044	0.021	0.021
	Delay			0.050	0.027	0.025	0.133	0.129	0.055	0.30	0.385	0.280	0.094	0.034
		95%		0.232	0.094	0.064	1.063	1.391	1.116	0.187	2.866	2.908	2.647	0.191
	[s]	Mea n	0.085	0.081	0.043	0.037	0.278	0.325	0.225	0.055	0.782	0.658	0.505	0.062
	UL:	5%	28.220	31.549	30.852	26.097	13.497	10.113	7.552	18.442	7.330	3.494	4.978	16.160
			81.430		147.554		44.765	52.213	66.107	67.717	28.108	31.130	40.481	
e 6				129.270	198.879	198.460	113.807	116.741	167.788	171.151	77.057	109.554	162.036	170.362
Source	[Mbps	Mea												
	]	n	80.987		133.846		53.162	56.365	75.220	79.673	33.345	41.111	59.763	
4062	UL:	5%	0.033	0.031	0.021	0.032	0.035	0.036	0.026	0.024	0.060	0.038	0.030	0.024
	Delay CDF	50% 95%		0.044	0.027	0.024	0.095	0.085	0.072	0.063	0.150	0.160	0.160	0.063
. 18	<b>F B</b>	Mea		0.127	0.134	0.122	0.306 0.125	0.913 0.223	0.726 0.203	0.224	0.659 0.227	0.338	0.338	0.220
R1- 181	r-1	n	0.004	0.000	0.044	0.044	0.120	0.220	0.200	0.000	0.227	0.000	0.000	0.004
	QD		0.9990	0.9994	0.9994	1.00	0.9916	0.9960	0.9960	1.00	0.9786	0.967	0.9760	1.00
	QU		0.9984	0.9995	1.00	1.00	0.9980	0.9974	1.00	1.00	0.9957	0.976	0.9673	
	BC	)	11.00	10.4	5.83	4.68	39.50	42.00	28.60	16.6	67.88	62.00	40.60	18.00
	λ				7/0.167	_		0.3/				0.4/		0.055
												nario are f		
												zed, open le , RTS/CTS		
												, K13/C13 Bm, ED=-(		
												: proportio		nk
			adaptatio	on realisti	c, ED=-7	2 dBm, Cl	P=Normal	, SCS=30I	KHz, TXC	)P=4 ms,	UE Capa	bility #1, N	MCS: DL	{15,63}
											and mixe	d DL/UL ł	oased on t	raffic
	DI .					a symbols,					0.12	2.10	20.4	61.07
Source 7	DL: UPT		31.00 70.47	36.97 81.84	67.65 129.98	80.12 146.32	3.56 42.25	17.46 59.81	42.46 96.86	70.49 132.4	0.12 30.03	3.16 48.11	28.4 75.5	61.97 123.69
joui			109.34	126.11	129.98	140.32	42.25 81.53	103.99	144.27	162.31	67.07	96.02	135.97	125.09
וניט ו	[Mbps			120,11	100.27	10/.00	01,00	100,00	1-7 <b>-7</b> ,4/	102.01	57.07	50.02	100.07	100.10
6	1 -		70.45	80.54	124.22	138.4	43.61	61.02	95.74	126.42	30.79	49.75	78.81	119.78
3409 /	]	n	/0.45	00.54	127,22	100.1								
813409 /	]	n 5%	0.028	0.024	0.02	0.02	0.031	0.029	0.021	0.02	0.04	0.03	0.022	0.021
813409	] DL: Delay	5%	0.028 0.061	1								0.03 0.098 1.929		0.021 0.03 0.107

e l	Repo	rtod		Lor	/ load			Mediur	n load			High	laad	
Tdoc/Source	param		в		for Wi-Fi	in	В	O range fc			В	O range fo		
/Sc	Param	icici 5			i: 10%~2			'iFi+WiFi:				'iFi+WiFi:		
ŏp						NR-U in	Wi-Fi in		NR-U in					
[+			WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+
			WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
	CDF													
	[s]	n Fo(	0.092	0.074	0.044	0.032	3.348	0.819	0.083	0.039	10.506	5.201	0.165	0.044
	UL: UPT	5% 50%	17.13 62.13	20.95	41.54	50.06	0.39	9.6	22.67	38.81	0.03	0.1	10.98	33.44
	1		103.57	69.72 117.82	112.84 150.09	131.13 160.99	33.93 73.5	49.09 95.04	73.86 129.4	112.6 148.55	24.07 61.69	37.17 88.23	52.94 113.94	100.38 140.78
	[Mbps			117.02	130.09	100.99	/3.5	95.04	129.4	140.55	01.05	00.25	115.54	140.70
	]	n	61.52	70.21	107.6	121.67	36.78	50.85	73.52	105.14	26.02	41.08	56.19	96.02
	UL:	5%	0.029	0.026	0.021	0.021	0.034	0.03	0.021	0.021	0.042	0.032	0.022	0.021
	Delay			0.063	0.034	0.029	0.162	0.1	0.073	0.036	0.254	0.13	0.115	0.043
		95%		0.307	0.196	0.108	7.523	1.026	0.615	0.179	108.027	3.7	1.417	0.24
	[s]	Mea		0 102	0.000	0.047	7 01 4	1 710	0.100	0.001	10 707	0.02	0.270	0.070
		n	0.131	0.103	0.063	0.043	7.214 0.99	1.713 1.00	0.169	0.061	16.787 0.97	8.03 0.98	0.378	0.076
	$Q_{\rm D}$		1.00	0.99	1.00	1.00	0.99	1.00	1.00	1.00	0.97	0.98	1.00	0.99
	$\frac{\varrho_{U}}{BC}$		0.17	0.35	0.09	0.06	0.50	0.36	0.26	0.13	0.70	0.50	0.41	0.18
	λ		0.17		Mbps	0.00	0.50	2.5 M		0.15	0.70	3.0 M		0.10
			Addition	al comm									-F-	
			Commo	n assump	otions: 27	Гх, 2Rx, P	rimary LE	BT : Cat-4	LBT with	exponen	tial CW b	ackoff, MO	COT dura	tion: 5.5
							QAM, MIN							
												e is choser		
					<i>W</i> i-Fi Gua	ard Interva	al short, W	'i-Fi beaco	ns enableo	d (periodi	city 100n	ns), Minstr	el Algorit	hm for
			rate pred			ashald 5			- UE ava			:1: #1 NT		т
												ility #1, NI procity base		
												BT every 2		
												anularity o		
												no longer		
				1		grant upda								
Source 7	DL:	5%	31.00	34.36	64.17	77.4	3.56	16.93	38.99	65.54	0.12	1.74	24.3	59.97
) Inc	UPT			79.89	123.64	142.29	42.25	58.61	91.44	128.66	30.03	45.96	70.35	119.53
	Mbpc		109.34	124.51	156.48	163.03	81.53	101.14	140.5	156.6	67.07	96.64	131.88	153.45
R1-1813409	1	n	70.45	78.99	119.81	134.46	43.61	59.61	90.96	122.27	30.79	49.41	74.28	114.92
132	DL:	5%	0.028	0.025	0.02	0.02	0.031	0.029	0.02	0.02	0.04	0.03	0.022	0.02
-18	Delay			0.053	0.029	0.027	0.123	0.075	0.046	0.029	0.198	0.099	0.064	0.032
R	CDF			0.203	0.127	0.068	2.287	0.58	0.314	0.095	54.959	2.206	0.717	0.12
	1	Mea												
		n	0.092	0.077	0.047	0.033	3.348	1.016	0.096	0.041	10.506	5.613	0.249	0.048
	UL:	5%	17.13	20.72	42.8	49.8	0.39	9.16	22.29	37.47	0.03	0.19	10.82	32.13
	UPT			69.33	112.77	134.82	33.93	46.82	73.23	112.81	24.07	36.08	51.95	99.59
			103.57	117.96	154.06	163.25	73.5	94.78	126.26	150.15	61.69	87.22	115.27	142.33
	[Mbps			60.53	100.40	100 47	26.70	40.22	70 75	105.01	26.02	40.47		95.84
1		n 5%	61.52 0.029	69.52 0.028	108.46 0.02	123.47 0.02	36.78 0.034	49.32 0.03	72.75 0.021	105.91 0.021	26.02 0.042	40.47	55.01 0.022	45 X/L
1		570					0.034	0.03	0.021	0.021	0.042	0.031	0.022	
	UL: Delay	500/	0 074	0 062	0 0 2 1	111170	- U IUZ			1 0.03/	0.204	U. L.).)		0.021
	Delay			0.062	0.034	0.029					108 027		0.125	0.021 0.044
	Delay CDF	95%	0.411	0.062	0.034	0.029	7.523	1.099	0.716	0.19	108.027	3.287		0.021
	Delay CDF		0.411								108.027 16.787		0.125	0.021 0.044
	Delay CDF	95% Mea n	0.411	0.318	0.211	0.11	7.523	1.099	0.716	0.19		3.287	0.125 1.904	0.021 0.044 0.268
	Delay CDF [s]	95% Mea n	0.411 0.131	0.318 0.104	0.211 0.065	0.11 0.043	7.523 7.214	1.099 1.806 1.00 1.00	0.716 0.188	0.19 0.063	16.787	3.287 9.138	0.125 1.904 0.525	0.021 0.044 0.268 0.083
	Delay CDF [s] 	95% Mea n	0.411 0.131 1.00	0.318 0.104 0.99 1.00 0.14	0.211 0.065 1.00	0.11 0.043 1.00	7.523 7.214 0.99	1.099 1.806 1.00	0.716 0.188 1.00 0.99 0.28	0.19 0.063 1.00	16.787 0.97	3.287 9.138 0.98	0.125 1.904 0.525 1.00 1.00 0.45	0.021 0.044 0.268 0.083 1.00

Tdoc/Source	Repo	rted			load			Mediur				<u>High</u>		
Sou	param	eters			or Wi-Fi			O range fo				O range fo		
0					i: 10%~2			'iFi+WiFi:				iFi+WiFi:		
Гdс						NR-U in	Wi-Fi in					Wi-Fi in		
			WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+
			WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
			Addition								. 1	1 66 14		
												ackoff, MO	LOI dura	tion: 5.5
								MO schem				e is choser	to got M	ווחח
												ns), Minstr		
			rate pred		vi ii Gu		ii 511011, vv	1 11 Deaco		i (periodi	city 100ii	15), 1011150	ci / iigoin	
					s: ED th	reshold -7	2 dBm. S	CS 30 KH2	z. UE proc	essing ti	me capab	ility #1, NI	R PDCCH	Ŧ
												procity base		
			delays in	CSI repo	orts, stand	l-alone wi	th self-sch	eduling, D	RS enable	ed (250us	, cat-2 Ll	3T every 2	50us, 40r	ns
												anularity o		
									, UL grant	t. COT st	ructure in	cludes a pi	reparation	ı stage
		1		<u>v</u>			2 switchin							
	DL:	5%	22.94	28	62.3	70.69	14.61	24.45	50.22	67.02	1.83	17.69	38.7	59.74
			61.23	71.65	124.97	142.3	48.34	62.44	110.42	135.79	38.45	54.9	93.18	127.03
	CDF [Mbps		109.37	124.11	160.51	167.97	98.69	117.26	153.25	165.12	87.09	108.19	146.81	162.44
	lwioba J			74 51	110.06	104.15	51.71	69.00	106.0	170 10	40.64	E0 6 4	02.17	121.00
ł	DL:	n 5%	63.36 0.029	74.51 0.028	119.86 0.02	134.15 0.02	0.031	68.02 0.029	106.8 0.021	128.18 0.02	40.64 0.035	59.64 0.029	92.17 0.021	121.98 0.021
	Delay			0.028	0.02	0.02	0.031	0.029	0.021	0.02	0.035	0.029	0.021	0.021
		95%		0.217	0.025	0.020	0.656	0.294	0.179	0.020	4.491	0.494	0.303	0.025
	[s]	Mea				5107 I	0.000	0.207	0,1,0		., .01	5,104	0.000	
		n	0.11	0.081	0.047	0.034	0.315	0.104	0.061	0.037	5.567	0.987	0.099	0.042
ŀ	UL:	5%	13.07	16.53	40.04	42.83	7.03	12.05	31.51	39.66	0.08	8.55	22.51	33.72
	UPT	50%		58.56	105.98	125.05	38.4	53.27	91.8	116.74	30.41	45.83	67.52	105.87
			102.22	121.4	147.19	160.27	93.14	110.99	138.3	154.81	83.44	104.12	123.81	147.5
~	[Mbps	Mea												
		n	52.89	64.21	102.17	116.19	42.07	57.13	87.14	108.72	32.76	49.37	69.99	100.33
Source	UL:	5%	0.03	0.029	0.021	0.021	0.033	0.029	0.021	0.021	0.037	0.03	0.022	0.021
/S	Delay			0.067	0.038	0.031	0.123	0.081	0.052	0.035	0.167	0.101	0.079	0.04
3409 /	CDF [s]	95%		0.371	0.231	0.123	1.301	0.551	0.409	0.156	19.42	0.988	0.792	0.205
134	[5]	Mea	0.172	0.12	0.072	0.047	0.602	0.172	0.114	0.055	9.271	1.706	0.213	0.068
19	0-	n	1.00	0.12	1.01	1.00	0.002	1.00	0.114	1.00	0.98	1.00	1.00	1.00
R1-181	Q_D 					1.00	1.00			1.00			1	
· .	ųυ		1 00	1 01				1 00	1 00	1.00	0 97	0 00	1 00	1 00
	BO		1.00 0.20	1.01 0.16	1.00 0.10			1.00 0.24	1.00 0.17	1.00 0.10	0.97	0.99	1.00 0.28	1.00 0.14
	<u>Β</u>	C	1.00 0.20	0.16	0.10	0.07	0.35	0.24	0.17	1.00 0.10	0.97 0.56	0.36	0.28	1.00 0.14
-	<u>Β</u> λ	C		0.16 1.5	0.10 Mbps				0.17				0.28	
		C	0.20 Addition	0.16 1.5 al comm	0.10 Mbps ents:	0.07	0.35	0.24 2.0 M	0.17 Ibps	0.10	0.56	0.36	0.28 Ibps	0.14
-		D	0.20 Addition <b>Commo</b> ms, Max	0.16 1.5 al comm n assump modulat	0.10 Mbps ents: otions: 27 ion suppo	0.07 Fx, 2Rx, P orted 256 (	0.35 Primary LE QAM, MIN	0.24 2.0 M 3T : Cat-4 MO schem	0.17 Ibps LBT with e with Tx	0.10 exponent BF upto	0.56 tial CW b rank 2.	0.36 2.5 M ackoff, MC	0.28 Ibps COT dura	0.14 tion: 5.5
-		<u>)</u>	0.20 Addition <b>Commo</b> r ms, Max <b>Wi-Fi as</b>	0.16 1.5 al common <b>assump</b> modulat sumptio	0.10 Mbps ents: otions: 27 ion suppo ns: RTS/0	0.07 Fx, 2Rx, P orted 256 ( CTS disab	0.35 Primary LE QAM, MIN led, Prean	0.24 2.0 M 3T : Cat-4 MO schem able detect	0.17 Ibps LBT with e with Tx ion enable	0.10 exponent BF upto : ed, ED/PI	0.56 tial CW b rank 2. D thresho	0.36 2.5 M ackoff, MC ld -62/-82 (	0.28 Ibps COT dura dBm, A-N	0.14 tion: 5.5
-		)	0.20 Addition <b>Commo</b> r ms, Max <b>Wi-Fi as</b> size is ch	0.16 1.5 al common n assump modulat sumption to gen to g	0.10 Mbps ents: otions: 2 <sup>-1</sup> ion suppo ns: RTS/0 get MPDU	0.07 Fx, 2Rx, P orted 256 C CTS disab J duration	0.35 Primary LE QAM, MIN led, Prean of 1ms, W	0.24 2.0 M 3T : Cat-4 MO schem able detect 7i-Fi Guard	0.17 Ibps LBT with e with Tx ion enable	0.10 exponent BF upto : ed, ED/PI	0.56 tial CW b rank 2. D thresho	0.36 2.5 M ackoff, MC	0.28 Ibps COT dura dBm, A-N	0.14 tion: 5.5
-			0.20 Addition Commor ms, Max Wi-Fi as size is ch 100ms),	0.16 1.5 al common n assump modulation sumption to generation Minstrel	0.10 Mbps ents: ptions: 27 ion suppo ns: RTS/0 get MPDU Algorithr	0.07 Fx, 2Rx, F orted 256 ( CTS disab J duration n for rate	0.35 Primary LE QAM, MIN led, Prean of 1ms, W prediction	0.24 2.0 M 3T : Cat-4 MO schem able detect /i-Fi Guard	0.17 Ibps LBT with e with Tx ion enable I Interval	0.10 exponent BF upto 2 ed, ED/PI short, Wi	0.56 tial CW b rank 2. O thresho -Fi beaco	0.36 2.5 M ackoff, MC ld -62/-82 ( ns enabled	0.28 Ibps COT dura dBm, A-N (periodic	0.14 tion: 5.5 MPDU city
-			0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass	0.16 1.5 al common n assump modulat sumption Minstrel sumption	0.10 Mbps ents: otions: 27 ion suppo ns: RTS/0 get MPDU Algorithr ns: ED thr	0.07 Fx, 2Rx, F orted 256 ( CTS disab J duration n for rate j reshold -7	0.35 Primary LE QAM, MIP led, Prean of 1ms, W prediction '2 dBm, So	0.24 2.0 M 3T : Cat-4 MO schem ible detect /i-Fi Guard CS 30 KH2	0.17 Ibps LBT with e with Tx ion enable I Interval z, UE proc	0.10 exponent BF upto 2 ed, ED/PI short, Wi	0.56 tial CW b rank 2. D thresho -Fi beaco me capab	0.36 2.5 M ackoff, MC ld -62/-82 o ns enabled ility #1, NI	0.28 Ibps COT dura dBm, A-M (periodic R PDCCH	0.14 tion: 5.5 MPDU city H
-			0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass monitori	0.16 1.5 al common modulat sumption osen to g Minstrel sumption ng is 4 tin	0.10 Mbps ents: otions: 27 ion suppo ns: RTS/( get MPDU Algorithr is: ED thu nes per si	0.07 Fx, 2Rx, P orted 256 ( CTS disab J duration n for rate reshold -7 lot (slot siz	0.35 Primary LE QAM, MIR led, Prean of 1ms, W prediction '2 dBm, St ze = 0.5ms	0.24 2.0 M 3T : Cat-4 MO schem able detect Vi-Fi Guard CS 30 KH2 s), Link ad	0.17 Ibps LBT with e with Tx ion enable d Interval z, UE proc aptation as	0.10 exponent BF upto ed, ED/PI short, Wi cessing tin ssumption	0.56 tial CW b rank 2. D thresho -Fi beaco me capab ns : Recip	0.36 2.5 M ackoff, MC ld -62/-82 o ns enabled ility #1, NI procity base	0.28 Ibps COT dura dBm, A-N (periodic R PDCCH ed BF, rea	0.14 tion: 5.5 MPDU city H allistic
-			0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass monitorin delays in	0.16 1.5 al common modulation modulation sumption sumption ng is 4 tin CSI repo	0.10 Mbps ents: otions: 27 ion suppo ns: RTS/0 get MPDU Algorithm ns: ED thin nes per sionts, stand	0.07 Fx, 2Rx, P orted 256 ( CTS disab J duration n for rate p reshold -7 lot (slot siz l-alone wi	0.35 Primary LE QAM, MIP led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch	0.24 2.0 M MO schem able detect Vi-Fi Guard CS 30 KHz s), Link ad eduling, D	0.17 Ibps LBT with e with Tx ion enable d Interval z, UE proc aptation as PRS enable	0.10 exponent BF upto 5 ed, ED/PI short, Wi cessing the ssumption ed (250us	0.56 tial CW b rank 2. O thresho -Fi beaco me capab ns : Recip , cat-2 L1	0.36 2.5 M ackoff, MC Id -62/-82 o ns enabled ility #1, NI procity base 3T every 2	0.28 Ibps COT dura dBm, A-N (periodic R PDCCH ed BF, rea 50us, 40r	0.14 tion: 5.5 MPDU city H alistic ns
-		D	0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici	0.16 1.5 al communication n assumption to sen to generation modulation to sen to generation modulation to sen to generation sumption to sen to generation to sen to sen to sen to sen to sen to sen to sen to sen to sen to sen to s	0.10 Mbps ents: otions: 27 ion suppo ns: RTS/0 get MPDU Algorithm nes per sions, stand chronous	0.07 Fx, 2Rx, P orted 256 ( CTS disab J duration n for rate p reshold -7 lot (slot sin l-alone wi nodes, UI	0.35 Primary LE QAM, MIN led, Prean of 1ms, W prediction 72 dBm, So ze = 0.5ms th self-sch L LBT in g	0.24 2.0 M 3T : Cat-4 MO schem able detect Vi-Fi Guard CS 30 KH s), Link ad eduling, D NB acquir	0.17 Ibps LBT with e with Tx ion enable d Interval z, UE proc aptation a PRS enable red COT: (	0.10 exponent BF upto 5 ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB'	0.56 tial CW b rank 2. O thresho -Fi beaco me capab ns : Recip , cat-2 L1 T with gr	0.36 2.5 M ackoff, MC Id -62/-82 o ns enabled ility #1, NI procity base 3T every 2 anularity o	0.28 Ibps COT dura dBm, A-N (periodic R PDCCF ed BF, rea 50us, 40r f 0.5ms, 1	0.14 tion: 5.5 MPDU city H alistic ns L symbol
-			0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o	0.16 1.5 al common n assumption modulation assumption assumption modulation assumption assumption modulation assump	0.10 Mbps ents: otions: 27 ion suppo ns: RTS/0 get MPDU Algorithm nes per sions, stand chronous 1 symbol	0.07 Fx, 2Rx, P orted 256 ( CTS disab J duration n for rate p reshold -7 lot (slot sin l-alone wi nodes, UI	0.35 Primary LE QAM, MIN led, Prean of 1ms, W prediction '2 dBm, So ze = 0.5ms th self-sch L LBT in g ACK/CQ	0.24 2.0 M 3T : Cat-4 MO schem able detect Vi-Fi Guard CS 30 KH s), Link ad eduling, D NB acquir	0.17 Ibps LBT with e with Tx ion enable d Interval z, UE proc aptation a PRS enable red COT: (	0.10 exponent BF upto 5 ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB'	0.56 tial CW b rank 2. O thresho -Fi beaco me capab ns : Recip , cat-2 L1 T with gr	0.36 2.5 M ackoff, MC Id -62/-82 o ns enabled ility #1, NI procity base 3T every 2	0.28 Ibps COT dura dBm, A-N (periodic R PDCCF ed BF, rea 50us, 40r f 0.5ms, 1	0.14 tion: 5.5 MPDU city H alistic ns L symbol
-			0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o	0.16 1.5 al common n assumption modulation assumption assumption modulation assumption assumption modulation assump	0.10 Mbps ents: otions: 27 ion suppo ns: RTS/0 get MPDU Algorithm nes per sions, stand chronous 1 symbol	0.07 Fx, 2Rx, P orted 256 ( CTS disab J duration n for rate j reshold -7 lot (slot si: l-alone wi nodes, UI l for every	0.35 Primary LE QAM, MIN led, Prean of 1ms, W prediction '2 dBm, So ze = 0.5ms th self-sch L LBT in g ACK/CQ	0.24 2.0 M 3T : Cat-4 MO schem able detect Vi-Fi Guard CS 30 KH s), Link ad eduling, D NB acquir	0.17 Ibps LBT with e with Tx ion enable d Interval z, UE proc aptation a PRS enable red COT: (	0.10 exponent BF upto 5 ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB'	0.56 tial CW b rank 2. O thresho -Fi beaco me capab ns : Recip , cat-2 L1 T with gr	0.36 2.5 M ackoff, MC Id -62/-82 o ns enabled ility #1, NI procity base 3T every 2 anularity o	0.28 Ibps COT dura dBm, A-N (periodic R PDCCF ed BF, rea 50us, 40r f 0.5ms, 1	0.14 tion: 5.5 MPDU city H alistic ns L symbol
-	λ DL: UPT	D 5% 50%	0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o 2ms for ( 24.73 61.49	0.16 1.5 al common n assumption modulation sumption cosen to g Minstrel sumption ng is 4 tin CSI report ty), asyno- verhead, CSI feedl	0.10 Mbps ents: otions: 27 on suppo ns: RTS/0 get MPDU Algorithr nes per si orts, stand chronous 1 symbol oack, UL	0.07 Fx, 2Rx, P orted 256 ( CTS disab J duration n for rate j reshold -7 lot (slot siz l-alone wi nodes, UI l for every grant upda	0.35 Primary LE QAM, MIN led, Prean of 1ms, W prediction '2 dBm, So ze = 0.5ms th self-sch L LBT in g ACK/CQ ate.	0.24 2.0 M 3T : Cat-4 MO schem able detect Vi-Fi Guard CS 30 KH s), Link ad eduling, D NB acquir I feedback	0.17 Ibps LBT with e with Tx ion enable d Interval z, UE proc aptation as PRS enable red COT: ( , UL grant	0.10 exponent BF upto 5 ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB' t. Switchi	0.56 tial CW b rank 2. O thresho -Fi beaco me capab ns : Recip , cat-2 L1 T with gr ng points	0.36 2.5 M ackoff, MC Id -62/-82 ( ns enabled ility #1, NI procity base 3T every 2 anularity o no longer	0.28 Ibps COT dura dBm, A-N (periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than 16 p	0.14 Ition: 5.5 MPDU city H allistic ns I symbol is every
	λ DL: UPT CDF	D 5% 50% 95%	0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o 2ms for ( 24.73 61.49 110.75	0.16 1.5 al common modulation sumption to sen to generation mosen to generation mosen to generation mosen to generation to sumption mosen to generation to sumption to sumption	0.10 Mbps ents: otions: 27 on suppo ns: RTS/0 tet MPDU Algorithr is: ED thi nes per si orts, stand chronous 1 symbol oack, UL 62.58	0.07 Fx, 2Rx, P orted 256 ( CTS disab J duration n for rate reshold -7 lot (slot si: l-alone wi nodes, UI l for every grant upda 70.69	0.35 Primary LE QAM, MI led, Prean of 1ms, W prediction '2 dBm, Sv ze = 0.5ms th self-sch LBT in g ACK/CQ ate. 18.15	0.24 2.0 M 3T : Cat-4 MO schem able detect /i-Fi Guard CS 30 KH s), Link ad eduling, D NB acquir I feedback 23.54	0.17 Ibps LBT with e with Tx ion enable d Interval z, UE proc aptation a: PRS enable red COT: ( , UL grant 54.84	0.10 exponent BF upto 2 ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB' t. Switchi 67.02	0.56 tial CW b rank 2. O thresho -Fi beaco me capab ns : Recip c, cat-2 LI T with gr. ng points 7.31	0.36 2.5 M ackoff, MC d -62/-82 o ns enabled ility #1, NI procity base 3T every 2 anularity o no longer 18.07	0.28 Ibps COT dura dBm, A-M (periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than 16 p 39.05	0.14 tion: 5.5 MPDU city I alistic ns L symbol ns every 59.74
	λ DL: UPT	D 5% 50% 95%	0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o 2ms for ( 24.73 61.49 110.75	0.16 1.5 al communications n assumption assumption assumption assumption assumption assumption assumption (CSI reported) (CSI reported) (CSI feedly 28.8 71.51 124.67	0.10 Mbps ents: otions: 27 ion suppo ns: RTS/0 get MPDU Algorithm nes per si orts, stand chronous 1 symbol oack, UL 62.58 126.51 161.52	0.07 Fx, 2Rx, P orted 256 ( CTS disab J duration n for rate p reshold -7 lot (slot si: l-alone wi nodes, UI l for every grant upda 70.69 142.3 167.97	0.35 Primary LE QAM, MIN led, Prean of 1ms, W prediction 72 dBm, So ze = 0.5ms th self-sch L LBT in g ACK/CQ ate. 18.15 51.42 100.96	0.24 2.0 M 3T : Cat-4 MO schem able detect Vi-Fi Guard CS 30 KHz s), Link ad eduling, D NB acquir I feedback 23.54 63.13 119.1	0.17 Ibps LBT with e with Tx ion enable d Interval z, UE proc aptation a PRS enable red COT: ( , UL grant 54.84 115.66 154.61	0.10 exponent BF upto 5 ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB' t. Switchi 67.02 135.79 165.12	0.56 tial CW b rank 2. O thresho -Fi beaco me capab ns : Recip , cat-2 LI T with grand ng points 7.31 40.52 89.1	0.36 2.5 M ackoff, MC ld -62/-82 o ns enabled ility #1, NI procity base 3T every 2 anularity o no longer 18.07 55.96 109.07	0.28 Ibps COT dura dBm, A-M (periodic R PDCCF ed BF, rea 50us, 40r f 0.5ms, 1 than 16 p 39.05 96.85 147.22	0.14 tion: 5.5 MPDU city H alistic ns I symbol is every 59.74 127.03 162.44
	λ DL: UPT CDF	D 5% 50% 95%	0.20 Addition Common ms, Max Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o 2ms for ( 24.73 61.49 110.75	0.16 1.5 al common modulation modulation sumption iosen to gen Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, CSI feedle 28.8 71.51	0.10 Mbps ents: otions: 27 ion suppo ns: RTS/0 jet MPDU Algorithr nes per sion orts, stand chronous 1 symbol oack, UL 62.58 126.51	0.07 Tx, 2Rx, P orted 256 ( CTS disab J duration n for rate p reshold -7 lot (slot size l-alone wi nodes, UI l for every grant upda 70.69 142.3	0.35 Primary LE QAM, MIP led, Prean of 1ms, W prediction '2 dBm, S' ze = 0.5ms th self-sch L BT in g ACK/CQ ate. 18.15 51.42	0.24 2.0 M 3T : Cat-4 MO schem bble detect Vi-Fi Guard CS 30 KH2 S), Link ad eduling, D SNB acquir I feedback 23.54 63.13	0.17 Ibps LBT with e with Tx ion enable d Interval z, UE proc aptation as PRS enable red COT: ( , UL grant 54.84 115.66	0.10 exponent BF upto ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB' t. Switchi 67.02 135.79	0.56 tial CW b rank 2. O thresho -Fi beaco me capab ns : Recip , cat-2 LI T with gr ng points 7.31 40.52	0.36 2.5 M ackoff, MC ld -62/-82 o ns enabled ility #1, NI procity base 3T every 2 anularity o no longer 18.07 55.96	0.28 Ibps COT dura dBm, A-N (periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than 16 p 39.05 96.85	0.14 tion: 5.5 MPDU city H alistic ns I symbol is every 59.74 127.03

Repo		ъ		<u>v load</u>				<u>n load</u>			<u>High</u>		
param	ieters			for Wi-Fi			O range fo				O range fo		
				i: 10%~2			'iFi+WiFi:				iFi+WiFi:	-	
					NR-U in	Wi-Fi in	Wi-Fi in						
		WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U
	= 0.0 (	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
DL:	50%		0.058	0.029	0.026	0.081	0.063	0.034	0.028	0.111	0.073	0.043	0.029
DL: Delay CDF		0.283	0.216	0.11	0.071	0.457	0.29	0.143	0.083	1.517	0.482	0.219	0.1
CDF	1 1	0.400	0.001			0.000	0.400				0.00		
[s]	n	0.102	0.081	0.044	0.034	0.206	0.102	0.055	0.037	2.555	0.26	0.075	0.042
UL: UPT CDF	5%	12.54	16.79	40.72	42.83	8.47	12.95	31.14	39.66	2.11	8.48	22.2	33.7
OPT	50%		60.7	107.17	125.05	41.76	52.3	92.76	116.74	32.35	45.56	72.5	105.8
	95%	104.61	116.74	148.37	160.27	94.54	109.1	137.83	154.81	83.02	104.62	127.41	147.
[Mbps	1 1	- 4 0 0	6 4 <b>-</b> 4	100.00	110.10	45.64		00.04	100 50	25.02		=0 =0	100 5
	n Fo(	54.86	64.54	102.69	116.19	45.61	57.58	88.34	108.72	35.93	50.09	72.53	100.3
UL:	5%	0.029	0.029	0.021	0.021	0.03	0.029	0.021	0.021	0.035	0.03	0.021	0.02
Delay			0.067	0.037	0.031	0.112	0.081	0.051	0.035	0.154	0.102	0.073	0.04
		0.501	0.366	0.221	0.123	0.879	0.528	0.343	0.156	4.109	0.95	0.599	0.20
[s]	Mea	0.150	0 110	0.07	0.047	0.221	0.100	0.100	0.055	A 1 4F	0.000	0.104	0.00
	n	0.156	0.118	0.07	0.047	0.321	0.162	0.102	0.055	4.145	0.889	0.164	0.06
$Q_{I}$		1.00	1.00	0.99	1.00	1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00
		1.00	1.01	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	1.00	1.00
B		0.19	0.16	0.09	0.07	0.31	0.24	0.16	0.10	0.49	0.36	0.26	0.14
λ		A 1 1		Mbps			2.0 N	Ibps			2.5 M	lbps	
			al comm								1 66 1 6		
											ackoff, M		
		size is ch	<b>sumptio</b> losen to g	ns: RTS/ get MPDU	CTS disab J duration	led, Prean of 1ms, W		ion enable	ed, ED/PI		ld -72/-82 ns enabled		
		<b>Wi-Fi as</b> size is ch 100ms), ∶ <b>NRU ass</b> monitorii	sumption losen to g Minstrel sumption ng is 4 tin	ns: RTS/ get MPDU Algorithr ns: ED the mes per s	CTS disab J duration n for rate j reshold -7 lot (slot si:	oled, Pream of 1ms, W prediction 72 dBm, So ze = 0.5ms	/i-Fi Guar CS 30 KH s), Link ad	tion enable d Interval z, UE proc aptation a	ed, ED/PI short, Wi cessing tin ssumptio	-Fi beaco me capab ns : Recip	ns enabled ility #1, N procity base	l (periodio R PDCCH ed BF, rea	city H alistic
	- - - - -	Wi-Fi as size is ch 100ms), 1 NRU ass monitorin delays in	sumption losen to g Minstrel sumption ng is 4 tin CSI repo	ns: RTS/ get MPDU Algorithr ns: ED thu nes per s orts, stand	CTS disab J duration n for rate p reshold -7 lot (slot siz d-alone wi	of 1ms, W prediction 2 dBm, So ze = 0.5ms th self-sch	7i-Fi Guan CS 30 KH s), Link ad eduling, D	ion enable d Interval z, UE proo laptation a DRS enable	ed, ED/PI short, Wi cessing tin ssumption ed (250us	-Fi beaco me capab ns : Recip , cat-2 LI	ns enabled ility #1, NI procity bas 3T every 2	l (periodio R PDCCH ed BF, rea 50us, 40r	city H alistic ns
	: - - - - - - - - - - - - - - - 	Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici	sumption losen to g Minstrel sumption ng is 4 tin CSI repo ty), asyno	ns: RTS/ get MPDU Algorithr ns: ED thi nes per s orts, stand chronous	CTS disab J duration n for rate j reshold -7 lot (slot siz l-alone wi nodes, UI	of 1ms, W prediction 2 dBm, So ze = 0.5ms th self-sch 2 LBT in g	/i-Fi Guar CS 30 KH s), Link ad eduling, E NB acquin	ion enable d Interval z, UE prod aptation a DRS enable red COT: (	ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB	-Fi beaco me capab ns : Recip , cat-2 LI T with gra	ns enabled ility #1, NJ procity bas 3T every 2 anularity o	l (periodio R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1	city H alistic ns L symb
	]	Wi-Fi as size is ch 100ms), 1 NRU ass monitorin delays in periodici DMRS o	sumption losen to g Minstrel sumption ng is 4 tin CSI repo ty), asyno verhead,	ns: RTS/ get MPDU Algorithr ns: ED the nes per s orts, stand chronous 1 symbol	CTS disab J duration n for rate j reshold -7 lot (slot si l-alone wi nodes, UI l for every	of 1ms, W prediction 72 dBm, So ze = 0.5ms th self-sch L LBT in g ACK/CQ	/i-Fi Guar CS 30 KH s), Link ad eduling, E NB acquin	ion enable d Interval z, UE prod aptation a DRS enable red COT: (	ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB	-Fi beaco me capab ns : Recip , cat-2 LI T with gra	ns enabled ility #1, NI procity bas 3T every 2	l (periodio R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1	city H alistic ns L symb
	-	Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o every 2m	sumption osen to g Minstrel sumption ng is 4 tin CSI repo ty), asyno verhead, ns for CS	ns: RTS/ tet MPDU Algorithr ns: ED thin nes per s orts, stand chronous 1 symbo I feedbac	CTS disab J duration n for rate reshold -7 lot (slot si l-alone wi nodes, UI l for every k, UL gran	led, Prean of 1ms, W prediction 72 dBm, So ze = 0.5ms th self-sch LBT in g ACK/CQ nt update.	/i-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback	ion enable d Interval z, UE proo laptation a DRS enable red COT: ( z, UL gran	ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB' t. Switchi	-Fi beaco me capab ns : Recip , cat-2 LH T with gra ng points	ns enabled ility #1, Ni procity base 3T every 2 anularity o no longer	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 2 than than	city H alistic ns I symb 16 µs
DL:	5%	Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o every 2m 37.34	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asymo- verhead, ns for CS 41.40	ns: RTS/ yet MPDU Algorithr ns: ED the nes per s. orts, stand chronous 1 symbol I feedbac 43.88	CTS disab J duration n for rate reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48	led, Prean of 1ms, W prediction 72 dBm, St ze = 0.5ms th self-sch L LBT in g ACK/CQ nt update. 20.79	7i-Fi Guar CS 30 KH 5), Link ad eduling, E NB acquir I feedback 30.06	ion enable d Interval z, UE prod laptation a DRS enable red COT: ( c, UL gran 32.88	ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB t. Switchi 47.80	-Fi beaco me capab ns : Recip , cat-2 LI T with gra ng points 10.03	ns enabled ility #1, NJ orocity bas 3T every 2 anularity o no longer 19.63	PDCCH R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23	tity I Ilistic ns I symb I 6 µs 41.7
DL: UPT	5% 50%	Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99	ns: RTS/ tet MPDU Algorithr ns: ED the nes per storts, stand chronous 1 symbol feedbac 43.88 103.86	CTS disab J duration n for rate j reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39	of 1ms, W prediction 72 dBm, Sv ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52	7i-Fi Guar CS 30 KH 5), Link ad eduling, E NB acquin I feedback 30.06 70.17	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95	ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB' t. Switchi 47.80 100.69	-Fi beaco me capab ns : Recip , cat-2 LI T with gra ng points 10.03 26.09	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35	R PDCCH ed BF, rea 50us, 40r f 0.5ms, 7 than than 20.23 53.00	tity H Histic ns Symb 16 µs 41.7 91.7
UPT CDF	5% 50% 95%	Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99 107.64	ns: RTS/ tet MPDU Algorithm nes ED the nes per storts, stand chronous 1 symbol I feedbac 43.88 103.86 128.32	CTS disab J duration n for rate p reshold -7 lot (slot siz l-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85	7i-Fi Guar CS 30 KH s), Link ad eduling, E NB acquin I feedback 30.06 70.17 96.08	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 a, UL gran 32.88 82.95 110.96	ed, ED/PI short, Wi cessing the ssumptio ed (250us Cat-2 LB' t. Switchi 47.80 100.69 125.58	-Fi beaco me capab ns : Recip , cat-2 LI T with gra- ng points 10.03 26.09 50.83	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 2 than than 20.23 53.00 81.33	2ity H alistic 1 symt 16 µs 41.7 91.7 122.7
UPT CDF [Mbps	5% 50% 95% <sup>5</sup> Mea	Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99	ns: RTS/ tet MPDU Algorithr ns: ED the nes per storts, stand chronous 1 symbol feedbac 43.88 103.86	CTS disab J duration n for rate j reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39	of 1ms, W prediction 72 dBm, Sv ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52	7i-Fi Guar CS 30 KH 5), Link ad eduling, E NB acquin I feedback 30.06 70.17	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95	ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB' t. Switchi 47.80 100.69	-Fi beaco me capab ns : Recip , cat-2 LI T with gra ng points 10.03 26.09	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35	R PDCCH ed BF, rea 50us, 40r f 0.5ms, 7 than than 20.23 53.00	2ity H alistic 1 symt 16 µs 41.7 91.7 122.7
UPT CDF [Mbps	5% 50% 95% Mea n	Wi-Fi as size is ch 100ms), 2 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85	ns: RTS/ get MPDU Algorithr ns: ED the nes per s orts, stand chronous 1 symbol I feedbac 43.88 103.86 128.32 101.63	CTS disab J duration n for rate p reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch L LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14	7i-Fi Guar CS 30 KH s), Link ad eduling, E NB acquin I feedback 30.06 70.17 96.08 71.08	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27	ed, ED/PI short, Wi cessing the ssumptio ed (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89	-Fi beaco me capab ns : Recip c, cat-2 LH T with gra- ng points 10.03 26.09 50.83 30.03	ns enabled ility #1, NI procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92	tity H Histic symb 16 µs 41.7 91.7 122.7 93.2
UPT CDF [Mbps ] DL:	5% 50% 95% Mea n 5%	<b>Wi-Fi as</b> size is ch 100ms), 2 <b>NRU ass</b> monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036	sumption osen to g Minstrel sumption ng is 4 tin CSI reporty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033	ns: RTS/ get MPDU Algorithr nes ED the nes per siorts, stand chronous 1 symbol I feedbac 43.88 103.86 128.32 101.63 0.027	CTS disab J duration n for rate p reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch L LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043	7i-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045	ion enable d Interval z, UE prod aptation a DRS enable red COT: ( t, UL gran 32.88 82.95 110.96 83.27 0.061	ed, ED/PI short, Wi cessing the ssumptio ed (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89 0.028	-Fi beaco me capab ns : Recip c, cat-2 LH T with grand ng points 10.03 26.09 50.83 30.03 0.081	ns enabled ility #1, N1 procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 7 than than 20.23 53.00 81.33 55.92 0.130	tity H Alistic symb 16 µs 41.7 91.7 122.7 93.2 0.02
UPT CDF [Mbps ] DL: Delay	5% 50% 95% Mea n 5% 750%	Wi-Fi as size is ch 100ms), 2 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153	sumption osen to g Minstrel sumption ng is 4 tin CSI reporty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047	ns: RTS/ get MPDU Algorithr nes ED the nes per siorts, stand chronous 1 symbol 1 feedbac 43.88 103.86 128.32 101.63 0.027 0.043	CTS disab J duration n for rate j reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ th update. 20.79 53.52 75.85 54.14 0.043 0.419	7i-Fi Guar CS 30 KH a), Link ad eduling, E NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352	ed, ED/PI short, Wi cessing the ssumptioned (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039	-Fi beaco me capab ns : Recip , cat-2 LI T with grang points 10.03 26.09 50.83 30.03 0.081 0.795	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728	l (periodia R PDCCH ed BF, rea 50us, 40r f 0.5ms, 7 than than 20.23 53.00 81.33 55.92 0.130 1.233	tity H alistic symt 16 µs 41.7 91.7 122.7 93.2 0.02 0.04
UPT CDF [Mbps ] DL: Delay CDF	5% 50% 95% Mea n 5% 750% 95%	<b>Wi-Fi as</b> size is ch 100ms), <b>NRU ass</b> monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330	sumption osen to g Minstrel sumption ng is 4 tin CSI reporty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133	ns: RTS/ get MPDU Algorithr nes ED the nes per siorts, stand chronous 1 symbol I feedbac 43.88 103.86 128.32 101.63 0.027 0.043 0.144	CTS disab J duration n for rate j reshold -7 lot (slot si l-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch L LBT in g ACK/CQ at update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769	7-Fi Guar CS 30 KH s), Link ad eduling, E NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357	ed, ED/PI short, Wi cessing the ssumptioned (250us Cat-2 LB' t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114	-Fi beaco me capab ns : Recip c, cat-2 LI T with gra- ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227	ns enabled ility #1, NJ procity bass 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 7 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757	tity H alistic symt 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15
UPT CDF [Mbps ] DL: Delay	5% 50% 95% 50% 50% 50% 95% 95% Mea	<b>Wi-Fi as</b> size is ch 100ms), <b>NRU ass</b> monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330	sumption osen to g Minstrel sumption ng is 4 tin CSI reporty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047	ns: RTS/ get MPDU Algorithr nes ED the nes per siorts, stand chronous 1 symbol 1 feedbac 43.88 103.86 128.32 101.63 0.027 0.043	CTS disab J duration n for rate j reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ th update. 20.79 53.52 75.85 54.14 0.043 0.419	7i-Fi Guar CS 30 KH a), Link ad eduling, E NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352	ed, ED/PI short, Wi cessing the ssumptioned (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039	-Fi beaco me capab ns : Recip , cat-2 LI T with grang points 10.03 26.09 50.83 30.03 0.081 0.795	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728	l (periodia R PDCCH ed BF, rea 50us, 40r f 0.5ms, 7 than than 20.23 53.00 81.33 55.92 0.130 1.233	tity H alistic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15
UPT CDF [Mbps ] DL: Delay CDF [s]	5% 50% 95% 50% 50% 50% 95% Mea n	Wi-Fi as size is ch 100ms), NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447	sumptio osen to g Minstrel sumption ng is 4 tin CSI repo ty), asyno verhead, as for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.071	ns: RTS/ get MPDU Algorithr nes ED the nes per s orts, stand chronous 1 symbol I feedbac 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069	CTS disab J duration n for rate p reshold -7 lot (slot si: l-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536	7-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gram 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609	ed, ED/PI short, Wi cessing the ssumptio ed (250us Cat-2 LB' t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060	-Fi beaco me capab ns : Recip c, cat-2 LI T with gra- ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075	tity H alistic symt 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07
UPT CDF [Mbps ] DL: Delay CDF [s] UL:	5% 50% 95% 50% 50% 95% 95% 0% 95%	Wi-Fi as size is ch 100ms), 2 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.071 44.75	ns: RTS// get MPDU Algorithm nes ED thm nes per sionts, stand chronous 1 symbol I feedbace 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41	CTS disab J duration n for rate p reshold -7 lot (slot si: l-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 45.44	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36	7i-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51	ed, ED/PI short, Wi cessing the ssumptioned (250us Cat-2 LB' t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79	-Fi beaco me capab ns : Recip c, cat-2 LH T with gra- ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 19.35	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65	tity H Istic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7
UPT CDF [Mbps ] DL: Delay CDF [s] UL: UPT	5% 50% 95% Mea n 5% 50% 95% Mea n 5% 50%	Wi-Fi as size is ch 100ms), 2 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.047 0.133 0.071 44.75 88.39	ns: RTS// get MPDU Algorithm nes per sionts, stand chronous 1 symbol I feedbace 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06	CTS disab J duration n for rate p reshold -7 lot (slot si: l-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 45.44 85.38	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch L LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08	7-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99	ed, ED/PI short, Wi cessing the ssumptio ed (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66	-Fi beaco me capab ns : Recip c, cat-2 LH T with gra- ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37	ns enabled ility #1, NI procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 19.35 46.54	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21	tity H Ilistic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7 67.8
UPT CDF [Mbps ] DL: Delay CDF [s] UL: UPT CDF	5% 50% 95% Mea n 5% 95% Mea n 5% 50% 95%	Wi-Fi as size is ch 100ms), 2 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62 100.22	sumption osen to g Minstrel sumption ng is 4 tin CSI reporty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.047 0.133 0.071 44.75 88.39 106.42	ns: RTS// get MPDU Algorithr nes per siorts, stand chronous 1 symbol I feedbac 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06 99.98	CTS disab J duration n for rate j reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 45.44 85.38 102.96	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08 74.51	7i-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33 93.30	ion enable d Interval z, UE prod aptation a DRS enable red COT: ( t, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99 84.68	ed, ED/PI short, Wi cessing the ssumptio ed (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66 97.05	-Fi beaco me capab ns : Recip c, cat-2 LI T with grand ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37 48.94	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 19.35 46.54 74.92	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 7 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21 60.96	tity H allistic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7 67.8 91.6
UPT CDF [Mbps ] DL: Delay CDF [s] UL: UPT	5% 50% 95% Mea n 5% 95% Mea n 5% 50% 95%	Wi-Fi as size is ch 100ms), 2 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62 100.22	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.047 0.133 0.071 44.75 88.39	ns: RTS// get MPDU Algorithm nes per sionts, stand chronous 1 symbol I feedbace 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06	CTS disab J duration n for rate p reshold -7 lot (slot si: l-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 45.44 85.38	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch L LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08	7-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99	ed, ED/PI short, Wi cessing the ssumptio ed (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66	-Fi beaco me capab ns : Recip c, cat-2 LH T with gra- ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37	ns enabled ility #1, NI procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 19.35 46.54	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21	tity H allistic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7 67.8 91.6
UPT CDF [Mbps ] DL: Delay CDF [s] UL: UPT CDF [Mbps	5% 50% 95% Mea n 5% 50% 95% Mea n 50% 50% 50% 50%	Wi-Fi as size is ch 100ms), 2 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62 100.22	sumption osen to g Minstrel sumption ng is 4 tin CSI reporty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.047 0.133 0.071 44.75 88.39 106.42	ns: RTS// get MPDU Algorithr nes per siorts, stand chronous 1 symbol I feedbac 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06 99.98	CTS disab J duration n for rate j reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 45.44 85.38 102.96	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08 74.51	7i-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33 93.30	ion enable d Interval z, UE prod aptation a DRS enable red COT: ( t, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99 84.68	ed, ED/PI short, Wi cessing the ssumptio ed (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66 97.05	-Fi beaco me capab ns : Recip c, cat-2 LI T with grand ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37 48.94	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 19.35 46.54 74.92	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 7 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21 60.96	tity H alistic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7 67.8 91.6 69.6
UPT CDF [Mbps ] DL: Delay CDF [s] UL: UPT CDF [Mbps ] UL:	5% 50% 95% Mea n 50% 95% 50% 50% 50% 50% 50% 50%	<b>Wi-Fi as</b> size is ch 100ms), 2 <b>NRU ass</b> monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62 100.22 81.03 0.036	sumptio osen to g Minstrel sumption ng is 4 tin CSI repo ty), asyno verhead, as for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.047 0.133 0.071 44.75 88.39 106.42 86.68	ns: RTS/ get MPDU Algorithm nes per si ports, stand chronous 1 symbol I feedbace 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06 99.98 79.98	CTS disab J duration n for rate p reshold -7 lot (slot si: l-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 45.44 85.38 102.96 83.83	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ tupdate. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08 74.51 53.70	7-Fi Guar CS 30 KH s), Link ad eduling, E NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33 93.30 71.61	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99 84.68 63.79	ed, ED/PI short, Wi cessing the ssumptioned (250us Cat-2 LB' t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66 97.05 75.65	-Fi beaco me capab ns : Recip c, cat-2 LI T with gra- ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37 48.94 28.86	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 19.35 46.54 74.92 50.74	(periodic R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21 60.96 41.09	tity H alistic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7 67.8 91.6 69.6 0.04
UPT CDF [Mbps ] DL: Delay CDF [s] UL: UPT CDF [Mbps ] UL: Delay	5% 50% 95% 50% 95% 50% 95% 50% 95% 50% 95% 50%	<b>Wi-Fi as</b> size is ch 100ms), 2 <b>NRU ass</b> monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62 100.22 81.03 0.036 0.036 0.092	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.047 44.75 88.39 106.42 86.68 0.033 0.047	ns: RTS// get MPDU Algorithmes per sions, stand chronous 1 symbol I feedbace 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06 99.98 79.98 0.035 0.058	CTS disab J duration n for rate p reshold -7 lot (slot si: l-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 45.44 85.38 102.96 83.83 0.034 0.045	led, Prean of 1ms, W prediction 72 dBm, SV ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08 74.51 53.70 0.059 0.478	7i-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33 93.30 71.61 0.042 0.136	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99 84.68 63.79 0.044 0.263	ed, ED/PI short, Wi cessing the ssumptioned (250us Cat-2 LB' t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66 97.05 75.65 0.036 0.061	-Fi beaco me capab ns : Recip c, cat-2 LH T with gra- ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37 48.94 28.86 0.092 0.820	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 19.35 46.54 74.92 50.74 0.061 0.295	(periodia R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21 60.96 41.09 0.083 1.079	tity H Istic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7 67.8 91.6 69.6 0.04 0.07
UPT CDF [Mbps ] DL: Delay CDF [s] UL: UPT CDF [Mbps ] UL: Delay	5% 50% 95% 50% 95% 5% 750% 95% 50% 95% 5% 50% 95% 50% 95%	Wi-Fi as size is ch 100ms), 1 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62 100.22 81.03 0.036 0.092 1.147	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.071 44.75 88.39 106.42 86.68 0.033 0.047 0.135	ns: RTS/ get MPDU Algorithm nes per sionts, stand chronous 1 symbol I feedbace 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06 99.98 79.98 0.035	CTS disab J duration n for rate p reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08 74.51 53.70 0.059 0.478 4.177	7i-Fi Guar CS 30 KH s), Link ad eduling, E NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33 93.30 71.61 0.042 0.136 1.001	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99 84.68 63.79 0.044 0.263 1.816	ed, ED/PI short, Wi cessing the ssumptioned (250us Cat-2 LB' t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66 97.05 75.65 0.036	-Fi beaco me capab ns : Recip , cat-2 LI T with gra ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37 48.94 28.86 0.092 0.820 7.586	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 0.080 0.728 3.623 1.473 19.35 46.54 74.92 50.74 0.061 0.295 2.958	(periodia R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21 60.96 41.09 0.083 1.079 7.736	tity H Ilistic symt 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7 67.8 91.6 69.6 0.04 0.07 0.19
UPT CDF [Mbps ] Delay CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF	5% 50% 95% 50% 95% 50% 95% 50% 95% 50% 95% 50%	Wi-Fi as size is ch 100ms), 1 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62 100.22 81.03 0.036 0.092 1.147	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.047 44.75 88.39 106.42 86.68 0.033 0.047	ns: RTS/ get MPDU Algorithm nes per sionts, stand chronous 1 symbol I feedbace 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06 99.98 79.98 0.035 0.058 0.159	CTS disab J duration n for rate p reshold -7 lot (slot si: l-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 45.44 85.38 102.96 83.83 0.034 0.045	led, Prean of 1ms, W prediction 72 dBm, SV ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08 74.51 53.70 0.059 0.478	7i-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33 93.30 71.61 0.042 0.136	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99 84.68 63.79 0.044 0.263	ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66 97.05 75.65 0.036 0.061 0.167	-Fi beaco me capab ns : Recip c, cat-2 LH T with gra- ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37 48.94 28.86 0.092 0.820	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 19.35 46.54 74.92 50.74 0.061 0.295	(periodia R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21 60.96 41.09 0.083 1.079	tity H Ilistic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7 67.8 91.6 69.6 0.04 0.07 0.19
UPT CDF [Mbps DL: Delay CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF [s]	5% 50% 95% Mea n 5% 50% 95% Mea n 5% 50% 95% Mea n 5% 50% 95% Mea n	Wi-Fi as size is ch 100ms), 1 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62 100.22 81.03 0.036 0.092 1.147	sumption osen to g Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, ns for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.071 44.75 88.39 106.42 86.68 0.033 0.047 0.135	ns: RTS/ get MPDU Algorithm nes per sionts, stand chronous 1 symbol I feedbace 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06 99.98 79.98 0.035 0.058 0.159	CTS disab J duration n for rate p reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08 74.51 53.70 0.059 0.478 4.177	7i-Fi Guar CS 30 KH s), Link ad eduling, E NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33 93.30 71.61 0.042 0.136 1.001	ion enable d Interval z, UE prod aptation a DRS enable red COT: 0 c, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99 84.68 63.79 0.044 0.263 1.816	ed, ED/PI short, Wi cessing the ssumption ed (250us Cat-2 LB t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66 97.05 75.65 0.036 0.061 0.167	-Fi beaco me capab ns : Recip , cat-2 LI T with gra ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37 48.94 28.86 0.092 0.820 7.586	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 0.080 0.728 3.623 1.473 19.35 46.54 74.92 50.74 0.061 0.295 2.958	(periodia R PDCCH ed BF, rea 50us, 40r f 0.5ms, 1 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21 60.96 41.09 0.083 1.079 7.736	city H alistic ns L symb
UPT CDF [Mbps ] Delay CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF	5% 50% 95% Mea n 5% 50% 95% Mea n 5% 50% 95% Mea n 5% 50% 95% Mea n 5% 50%	Wi-Fi as size is ch 100ms), 1 NRU ass monitorin delays in periodici DMRS o every 2m 37.34 82.65 101.71 80.59 0.036 0.153 1.330 0.447 42.00 82.62 100.22 81.03 0.036 0.092 1.147 0.377	sumption osen to get Minstrel sumption ng is 4 tin CSI report ty), asyno verhead, as for CS 41.40 87.99 107.64 85.85 0.033 0.047 0.133 0.071 44.75 88.39 106.42 86.68 0.033 0.047 0.135 0.071	ns: RTS/ get MPDU Algorithm nes per si prts, stand chronous 1 symbol I feedbac 43.88 103.86 128.32 101.63 0.027 0.043 0.144 0.069 41.41 80.06 99.98 79.98 0.035 0.058 0.159 0.083	CTS disab J duration n for rate p reshold -7 lot (slot si: d-alone wi nodes, UI l for every k, UL gran 52.48 109.39 131.27 106.44 0.027 0.033 0.085 0.045 45.44 85.38 102.96 83.83 0.034 0.045 0.100 0.059	led, Prean of 1ms, W prediction 72 dBm, S0 ze = 0.5ms th self-sch LBT in g ACK/CQ nt update. 20.79 53.52 75.85 54.14 0.043 0.419 4.769 1.536 22.36 52.08 74.51 53.70 0.059 0.478 4.177 1.556	7i-Fi Guar CS 30 KH s), Link ad eduling, D NB acquin I feedback 30.06 70.17 96.08 71.08 0.045 0.181 1.281 0.447 34.18 71.33 93.30 71.61 0.042 0.136 1.001 0.377	ion enable d Interval z, UE prod aptation a DRS enable red COT: ( t, UL gran 32.88 82.95 110.96 83.27 0.061 0.352 1.357 0.609 31.51 61.99 84.68 63.79 0.044 0.263 1.816 0.662	ed, ED/PI short, Wi cessing the ssumptio ed (250us Cat-2 LB' t. Switchi 47.80 100.69 125.58 98.89 0.028 0.039 0.114 0.060 39.79 75.66 97.05 75.65 0.036 0.061 0.167 0.091	-Fi beaco me capab ns : Recip c, cat-2 LI T with gra ng points 10.03 26.09 50.83 30.03 0.081 0.795 8.227 2.768 9.59 24.37 48.94 28.86 0.092 0.820 7.586 2.565	ns enabled ility #1, NJ procity bas 3T every 2 anularity o no longer 19.63 47.35 77.18 51.30 0.080 0.728 3.623 1.473 0.080 0.728 3.623 1.473 19.35 46.54 74.92 50.74 0.061 0.295 2.958 0.987	l (periodia R PDCCH ed BF, rea 50us, 40r f 0.5ms, 7 than than 20.23 53.00 81.33 55.92 0.130 1.233 4.757 2.075 16.65 38.21 60.96 41.09 0.083 1.079 7.736 2.790	tity H Ilistic symb 16 µs 41.7 91.7 122.7 93.2 0.02 0.04 0.15 0.07 34.7 67.8 91.6 69.6 0.04 0.07 0.19 0.10

	Repor				v load			Mediu				High		
<b>o</b> pa	aram	eters			or Wi-Fi			O range fo				O range fo		
2					i: 10%~2			iFi+WiFi:				'iFi+WiFi:		
ğ			Wi-Fi in			NR-U in	Wi-Fi in		NR-U in					
`			WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U
			WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
	λ			0.19	file/s			0.29	file/s			0.37	file/s	
			Addition	al comm	ents:									
			Simulati	on setup	: NR-U i	ndoor scei	nario. 50/5	50 DL/UL	traffics.					
										al CW bac	k-off. M	COT durat	ion: 6ms.	Max
												d Rx BF a		
												smit powe		
												L{15,1023		5421,
												me aggreg		ווחכ
								Fi guard in		uDiii, 11 ii	II DO IIu	inc uggree	,ution, 101	DU
										occina tin	o canabil	lity #1, PU	SCH mar	ning
												ortional fai		
								fintoring e	very 103,	Schedun	ng. propo		i, sen-sch	eaunn
			COT SHA	ring enac	nea (give	3 initiated	COI).							
ר ח	DL:	5%	36.07	36.72	40.01		20.58	28.27	30.45		8.01	16.81	18.02	
			82.07	84.66	97.06		51.12	69.15	77.49		26.77	45.49	48.81	
			101.56	108.41	126.90		76.09	93.57	108.07		52.36	73.29	78.57	
LIV.	robs	Mea	79.66	84.17	96.94		53.74	69.22	79.15		31.05	48.27	52.77	
	]	n								ļ				
	DL:	5%	0.036	0.033	0.027		0.052	0.045	0.054		0.063	0.061	0.129	
		50%		0.047	0.043		0.592	0.328	0.315		0.766	0.674	1.250	
C	DF	95%	1.330	0.133	0.144		5.923	1.644	1.620		7.578	4.717	5.346	
[	[s]	Mea	0.447	0.071	0.069		1.865	0.611	0.667		2.534	1.694	2.280	
		n												
τ	JL:	5%	37.38	37.22	38.36		20.29	29.29	28.78		8.04	17.35	15.39	
		50%		82.84	79.06		48.77	64.94	59.72		24.69	41.37	36.21	
		95%		104.38	97.12		72.06	90.24	82.12	1	48.73	69.64	58.61	
		Mea		81.87	78.15		50.86	66.43	61.12		28.66	45.68	39.17	
[17.	1005		/0.04	01.07	/0.15		50.00	00.45	01.12		20.00	45.00	59.17	
-	<u></u> л.	n	0.024	0.022	0.020		0.070	0.040	0.050		0.100	0.000	0.1.40	
	JL:	5%	0.024	0.033	0.028		0.076	0.046	0.059		0.106	0.069	0.140	
		50%		0.047	0.058		0.566	0.158	0.490		0.826	0.359	1.186	
	1	95%		0.135	0.159		5.351	1.105	2.151		7.660	3.326	6.159	
g I	[s]	Mea	0.130	0.071	0.083		1.750	0.454	0.927		2.582	1.176	2.407	
		n												
-1014020/ 201	Qы	L	97%	100%	100%		83%	97%	96%		66%	88%	86%	
1	QUI		99%	100%	100%		88%	98%	95%		76%	93%	83%	
	BC		10%	16%	2.6%		35%	17%	16%		60%	39%	39%	
ł	λ		- / -		file/s			0.24		1	/ -	0.33		<u>I</u>
-			Addition					0.21	1110/0			0.00	liic, b	
						ndoor con	arria = 50/5	50 DL/UL	traffics					
											l off M	COT durat	ion: 6mc	Max
												d Rx BF at		
												smit powe	r 200Bm,	OE/S
								CW {min,						
										dBm, A-N	IPDU fra	me aggreg	gation, MI	DU
								Fi guard i			_			
												lity #1, PU		
								nitoring e	very 10S,	Scheduli	ng: propo	rtional fai	r, self-sch	edulin
						3 initiated	COT).							
			Other as	sumptio	ns:									
						nodelled p	er operato	or for the n	on-replac	ed operate	or			
												. The follo	wing is a	ssume
													0	
			-	hardwa					1					
			-		re turnaro	ound time	is less tha		-	U U				

parameters BO range for Wi-Fi in WiFi+WiFi: 10%~25% BO range for Wi-Fi in Wi-Fi in Wi-Fi in WiFi WiFi WiFi NR-U in WiFi WiFi WiFi WiFi NR-U in WiFi WiFi WiFi WiFi WiFi WiFi WiFi WiFi	ce	Repo	rted		Low	v load			Mediu	n load			High	load	
With:         With:         NR-0         With:         With:         With:         With:         NR-0         With:           DL:         [5%]         37.34         35.48         41.46         20.79         26.38         32.47         10.03         16.62         16.11           DF         [50%]         82.65         31.62         97.56         53.52         65.42         76.81         26.00         46.09         46.02         57.27         82.38           JMbpSMag         80.59         80.73         103.09         75.85         92.94         105.80         50.83         75.27         82.38           JL:         5%         0.036         0.024         0.024         0.054         0.061         0.067         0.375         0.583         1.031         0.200         0.275         0.583         1.733         1         1.556         0.107         0.567         24.	IIIO			В	O range t	for Wi-Fi	in	В	O range fo	or Wi-Fi in	1	В	O range fo	or Wi-Fi i	n
With:         With:         NR-0         With:         With:         With:         With:         NR-0         With:           DL:         [5%]         37.34         35.48         41.46         20.79         26.38         32.47         10.03         16.62         16.11           DF         [50%]         82.65         31.62         97.56         53.52         65.42         76.81         26.00         46.09         46.02         57.27         82.38           JMbpSMag         80.59         80.73         103.09         75.85         92.94         105.80         50.83         75.27         82.38           JL:         5%         0.036         0.024         0.024         0.054         0.061         0.067         0.375         0.583         1.031         0.200         0.275         0.583         1.733         1         1.556         0.107         0.567         24.	Ś	1			0				0						
With:         With:         NR-0         With:         With:         With:         With:         NR-0         With:           DL:         [5%]         37.34         35.48         41.46         20.79         26.38         32.47         10.03         16.62         16.11           DF         [50%]         82.65         31.62         97.56         53.52         65.42         76.81         26.00         46.09         46.02         57.27         82.38           JMbpSMag         80.59         80.73         103.09         75.85         92.94         105.80         50.83         75.27         82.38           JL:         5%         0.036         0.024         0.024         0.054         0.061         0.067         0.375         0.583         1.031         0.200         0.275         0.583         1.733         1         1.556         0.107         0.567         24.	ŏp				1									-	
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CDF         59%         101.71         103.75         123.09         75.85         92.94         105.80         50.83         75.27         82.38           Imps/Mag         80.59         80.78         95.92         54.14         66.81         78.40         30.03         49.20         54.11           DL:         5%         0.036         0.024         0.043         0.054         0.061         0.081         0.061         0.101           Delay 50%         0.130         0.200         0.215         4.769         1.362         1.734         8.227         3.519         3.883           18         Meg         0.447         0.090         1.556         0.526         0.746         2.768         1.385         1.567           UF         59%         82.62         82.61         76.13         52.08         65.68         57.62         24.37         43.63         36.81           Mbps/Meg         81.03         81.57         75.49         53.70         66.42         59.10         22.86         40.21         1         1         1.67         1.043         40.22         0.276         0.936         1.011         1.156         1.012         1.568         1.022         0.657														+	
Member Meal         R0.58         80.78         95.92         54.14         66.81         78.40         30.03         49.20         54.21           D1:         5%         0.036         0.034         0.029         0.043         0.054         0.061         0.061         0.017           Delay 50%         0.133         0.050         0.046         0.419         0.267         0.382         0.795         0.588         1.018           CDF         95%         1.330         0.207         0.215         4.769         1.362         1.734         8.227         3.519         3.883           IL         1.30         0.247         0.997         1.356         0.526         0.746         2.768         1.807         15.67           UPT 50% 82.62         82.61         76.13         53.70         66.42         59.10         28.86         48.28         40.21           I         n         0.03         0.037         0.059         0.445         0.4820         0.257         0.663           Delay 50%         0.144         0.181         0.250         0.4177         1.017         1.961         7.566         2.582         6.071           Delay 50%         0.090         0														+	
Image: Display 50%         0.036         0.034         0.026         0.046         0.041         0.063         0.063 </td <td></td> <td>+</td> <td></td>														+	
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Delay 50%         0.153         0.050         0.046         0.419         0.267         0.382         0.795         0.558         1.018           CDF         95%         1.330         0.207         0.215         4.769         1.362         1.734         8.227         3.519         3.883           Is         Mea         0.447         0.090         0.097         1.536         0.526         0.746         2.768         1.385         1.733           n         T         55%         42.00         39.55         38.97         22.36         26.79         28.29         9.59         18.07         15.67           UF         55%         10022         10.27         9.469         74.51         91.29         78.41         48.94         73.29         60.47           US         5%         0.036         0.037         0.059         0.045         0.048         0.092         0.057         0.063           US         5%         0.036         0.037         0.059         0.042         0.324         0.280         6.071           US         5%         0.39         0.423         0.324         0.282         6.071         0.836         0.976         0.966         <		]		0.000	0.004	0.000		0.047	0.054	0.001		0.001	0.001	0.407	
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		[s]	Mea	0.447	0.090	0.097		1.536	0.526	0.746		2.768	1.385	1.733	
UP         50%         82.62         82.61         76.13         52.08         65.68         57.62         24.37         43.63         36.81           IMbpSMes         81.03         81.57         75.49         53.70         66.42         59.10         28.86         48.28         40.21           In         n         0.036         0.037         0.059         0.045         0.048         0.092         0.057         0.063           Delay50%         0.092         0.052         0.065         0.478         0.154         0.334         0.820         0.279         0.036           Delay50%         0.092         0.052         0.065         0.478         0.154         0.334         0.820         0.279         0.036           Isl         Mea         0.377         0.086         0.108         1.556         0.392         0.823         2.565         0.909         2.283         1.67           Put.         98%         100%         100%         86%         98%         93%         74%         96%         75%         2.037         1.87%         1.87%         1.87%         1.87%         1.87%         1.87%         1.87%         1.87%         1.87%         1.87%         1															
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II.:         5%         0.036         0.037         0.059         0.048         0.092         0.057         0.063           Delay 50%         0.092         0.052         0.065         0.478         0.154         0.334         0.020         0.279         0.936           Delay 50%         0.092         0.057         0.065         0.478         0.154         0.334         0.820         0.279         0.936           Delay 50%         0.092         0.082         0.823         2.565         0.909         2.283           n         n         n         n         n         n         87%         66%         65%         91%         87%           0.0         97%         100%         100%         86%         98%         93%         74%         96%         75%           0.0         10%         100%         86%         98%         93%         74%         96%         75%         0.37         10%         38%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%         10%												<u> </u>		+	
The system         UL:         5%         0.036         0.037         0.059         0.045         0.048         0.092         0.057         0.063           CDF         95%         0.147         0.051         0.478         0.154         0.334         0.020         0.279         0.936           CDF         95%         1.147         0.1101         1.950         4.177         1.017         1.961         7.586         2.582         6.071           Isl         Mea         0.377         0.086         0.108         1.556         0.392         0.823         2.565         0.909         2.283 $0_{TN}$ 97%         100%         100%         86%         98%         93%         74%         96%         75%           BO         10%         6.3%         6.2%         35%         19%         19%         00%         37%         38%           i         .0.19 file/s         0.29 file/s         0.37 file/s         0.37 file/s         0.37 file/s           Additional comments:         Simulation setup: NR-U indoor scenario, 50/50 DL/UL traffics.         Common asumptions: ETS/CTS disabled, ED/PD threshold -62/-82dBm, A-MPDU frame aggregation, MPDU size: 1500B MSDU plus 14B header, short Wi-Fi guard interval.         NR-U asumptions: ETS/CTS d		[Mbps	Mea	81.03	81.57	75.49		53.70	66.42	59.10		28.86	48.28	40.21	
Image: Second		]	n												
Image: Second	e 8	UL:	5%	0.036	0.034	0.037		0.059	0.045	0.048		0.092	0.057	0.063	
Image: Second	Ũ	Delay	50%	0.092	0.052	0.065		0.478	0.154	0.334		0.820	0.279	0.936	
Image: Second	Sol	CDF	95%	1.147	0.181	0.250		4.177	1.017	1.961		7.586	2.582	6.071	
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DC         10.0         0.19         0.19         0.19         10.0 <th1< td=""><td>02</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th1<>	02														
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DC         10/0         0.19         0.19         10/0 <th1< td=""><td>7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>     </td><td></td><td></td><td></td></th1<>	7														
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Additional comments:           Simulation setup:         NR-U indoor scenario, 50/50 DL/UL traffics.           Common assumptions:         Primary LBT: Cat-4 LBT with exponential CW back-off, MCOT duration: 6ms, Max modulation:           number of layers:         2 for DL and 2 for UL, single carrier with 20MHz BW, BS/AP transmit power 20dBm, UE/ST transmit power 18dBm, MMSE-IRC receiver. CW (min,max) DL(15,63) UL(15,1023).           Wi-Fi assumptions:         RTS/CTS disabled, ED/PD threshold -62/-82dBm, A-MPDU frame aggregation, MPDU size: 1500B MSDU plus 14B header, short Wi-Fi guard interval.           NR-U assumptions:         ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH mapping Type A, PDSCH mapping Type B, PDCCH monitoring every 1OS, Scheduling: proportional fair, self-scheduling: COT sharing enabled (gNB initiated COT).           Other assumptions for NR-U:         -         1 ms long DRS is transmisted         25.027         20.79         30.58         36.29         10.03         18.05         22.99           UPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           CDF         55%         101.71         105.96         127.76         75.85         97.03         113.45         50.83         80.59           MbpsMea         80.59         84.07         9.63         54.14         72.78         <				1070				5570			1	0070			
View         Simulation setup:         NR-U indoor scenario, 50/50 DL/UL traffics.           Common assumptions:         Primary LBT: Cat-4 LBT with exponential CW back-off, MCOT duration: 6ms, Max modulation:         256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx and Rx BF at BS/AP, Maxim, number of layers:         2 for DL and 2 for UL, single carrier with 20MHz BW, BS/AP transmit power 20dBm, UE/ST transmit power 18dBm, MMSE-IRC receiver. CW {min,max} DL{15,63} UL{15,1023}.           Wi-Fi assumptions:         RTS/CTS disabled, ED/PD threshold -62/-82dBm, A-MPDU frame aggregation, MPDU size: 1500B MSDU plus 14B header, short Wi-Fi guard interval.         NR-U assumptions: ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH mapping Type A, PDSCH mapping Type B, PDCCH monitoring every 1OS, Scheduling: proportional fair, self-scheduling COT sharing enabled (gNB initiated COT).         36.29         10.03         18.05         22.99           UPT         5%         37.34         39.55         42.27         20.79         30.58         36.29         10.03         18.05         22.99           UPT         5%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           WPD         5%         10.17         105.96         127.76         75.85         97.03         113.45         50.83         80.59         88.05           DL:         5%         0.036 <td></td> <td>70</td> <td></td> <td>Addition</td> <td></td> <td></td> <td></td> <td></td> <td>0.201</td> <td>inc/5</td> <td></td> <td></td> <td>0.07</td> <td>inc/5</td> <td></td>		70		Addition					0.201	inc/5			0.07	inc/5	
Production:         Common assumptions:         Primary LBT: Cat-4 LBT with exponential CW back-off, MCOT duration: 6ms, Max modulation:         State							ndoor coo	arria = 50/5	עון/ ום מ	traffics					
Produlation: 256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx and Rx BF at BS/AP, Maximulation: 256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx and Rx BF at BS/AP, Maximulation: 256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx and Rx BF at BS/AP, Maximulation: 256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx and Rx BF at BS/AP, Maximulation: 256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx and Rx BF at BS/AP, Maximulation: 256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx and Rx BF at BS/AP, Maximulation: 256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx and Rx BF at BS/AP, Maximulation: 2001 and 2 for UL, single carrier with 20MHz BW, BS/AP transmit power 20dBm, UE/ST transmite power 18dBm, MMSE-IRC receiver. CW { min,max} DL {15,63} UL {15,63} UL {15,1023}.           Wi-Fi assumptions: FTS/CTS disabled, ED/PD threshold -62/-82dBm, A-MPDU frame aggregation, MPDU size: 1500B MSDU plus 14B header, short Wi-Fi guard interval.         NR-U assumptions: FTS/CTS disabled, ED/PD threshold -62/-82dBm, A-MPDU frame aggregation, MPDU size: 1500B MSDU plus 14B header, short Wi-Fi guard interval.           NR-U assumptions: ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH mapping Type A, PDSCH mapping Type B, PDCCH monitoring every 10S, Scheduling: proportional fair, self-scheduling COT sharing enabled (gNB initiated COT).           Other assumptions for NR-U:         -         1 ms long DRS is transmiston         36.29         10.03         18.05         22.99           UPT         50%         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           UPT </td <td></td> <td>CW ba</td> <td>ble off M</td> <td>OT durat</td> <td>ion: 6mc</td> <td>Max</td>											CW ba	ble off M	OT durat	ion: 6mc	Max
View         pnumber of layers: 2 for DL and 2 for UL, single carrier with 20MHz BW, BS/AP transmit power 20dBm, UE/ST transmit power 18dBm, MMSE-IRC receiver. CW {min,max} DL{15,63} UL{15,1023}.           Wi-Fi assumptions: RTS/CTS disabled, ED/PD threshold -62/-82dBm, A-MPDU frame aggregation, MPDU size: 1500B MSDU plus 14B header, short Wi-Fi guard interval.         NR-U assumptions: ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH mapping Type A, PDSCH mapping Type B, PDCCH monitoring every 1OS, Scheduling: proportional fair, self-scheduling COT sharing enabled (gNB initiated COT).           Other assumptions: for NR-U:         - 1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmission         36.29         10.03         18.05         22.99           WiPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           OL:         5%         37.34         39.55         42.27         20.79         30.58         36.29         10.03         18.05         22.99           IVPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           Mbps Mea         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44<															
View         Itansmit power 18dBm, MMSE-IRC receiver. CW {min,max} DL{15,63} UL{15,1023}.           Wi-Fi assumptions: RTS/CTS disabled, ED/PD threshold -62/-82dBm, A-MPDU frame aggregation, MPDU size: 150/B MSDU plus 14B header, short Wi-Fi guard interval.           NR-U assumptions: ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH mapping Type A, PDSCH mapping Type B, PDCCH monitoring every 10S, Scheduling: proportional fair, self-scheduling: COT sharing enabled (gNB initiated COT).           Other assumptions: for NR-U:         -         1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmission         View         View         View         View         Sc.30,82         0.03         18.05         22.99           UPT         5%         37.34         39.55         42.27         20.79         30.58         36.29         10.03         18.05         22.99           UPT         5%         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           OL:         5%         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           I         n         -         -         -         -         -         -         -         -           UPT															
Vi-Fi assumptions:         RTS/CTS disabled, ED/PD threshold -62/-82dBm, A-MPDU frame aggregation, MPDU size:         1500 MSDU plus 14B header, short Wi-Fi guard interval.           NR-U assumptions:         ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH mapping Type 8, PDCCH monitoring every 10S, Scheduling: proportional fair, self-scheduling: COT sharing enabled (gNB initiated COT).           Other assumptions:         ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH mapping Type 8, PDCCH monitoring every 10S, Scheduling: proportional fair, self-scheduling: COT sharing enabled (gNB initiated COT).           Other assumptions:         For NR-U:           -         1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmission           UPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         586.3           UPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         586.3           UPT         50%         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           DL:         5%         0.036         0.027         0.043         0.043         0.081         0.058														20000111,	01/01/1
size: 1500B MSDU plus 14B header, short Wi-Fi guard interval.         NR-U assumptions: ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH mapping Type A, PDSCH mapping Type B, PDCCH monitoring every 1OS, Scheduling: proportional fair, self-scheduling: COT sharing enabled (gNB initiated COT).         Other assumptions for NR-U:       - 1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmission         DL:       5% 37.34       39.55       42.27       20.79       30.58       36.29       10.03       18.05       22.99         UPT       50% 82.65       86.13       101.46       53.52       73.21       85.70       26.09       51.70       58.63         CDF       95%       101.71       105.96       127.76       75.85       97.03       113.45       50.83       80.59       88.05         Mbps       Mea       80.59       84.07       99.63       54.14       72.78       85.86       30.03       54.31       61.44         1       n       - <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ation MI</td><td>וחס</td></t<>														ation MI	וחס
View         NR-U assumptions: ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH mapping Type A, PDSCH mapping Type B, PDCCH monitoring every 1OS, Scheduling: proportional fair, self-scheduling, COT sharing enabled (gNB initiated COT).           Other assumptions for NR-U:         - 1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmistor.           Other assumptions         60 NR-U         - 1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmistor.           Other assumptions         90.53         42.27         20.79         30.58         36.29         10.03         18.05         22.99           UPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           OL:         5%         101.71         105.96         127.76         75.85         97.03         113.45         50.83         80.59         88.05           IMps         Mea         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           DL:         5%         0.036         0.042         0.043         0.043         0.081         0.058         0.069           Delay													inc aggreg	,, 111	DU
View         Type A, PDSCH mapping Type B, PDCCH monitoring every 1OS, Scheduling: proportional fair, self-scheduling COT sharing enabled (gNB initiated COT).           Other assumptions for NR-U:         - 1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmission           UPT         5%         37.34         39.55         42.27         20.79         30.58         36.29         10.03         18.05         22.99           UPT         5%         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           OL:         5%         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           DL:         5%         0.036         0.036         0.027         0.043         0.044         0.043         0.081         0.058         0.069           DL:         5%         0.036         0.037         0.419         0.173         0.176         0.795         0.432         0.758           DL:         5%         0.036         0.027         0.043         0.044         0.433         0.081         0.058         0.069           Delay         50%         1.330         0.221 </td <td></td> <td>essing tin</td> <td>ne canahil</td> <td>lity #1 PI</td> <td>SCH mar</td> <td>nning</td>											essing tin	ne canahil	lity #1 PI	SCH mar	nning
COT sharing enabled (gNB initiated COT).         Other assumptions for NR-U:         -         1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmission           UPT         5%         37.34         39.55         42.27         20.79         30.58         36.29         10.03         18.05         22.99           UPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           CDF         95%         101.71         105.96         127.76         75.85         97.03         113.45         50.83         80.59         88.05           Mbps         Mea         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           I         n         -         -         -         -         -         -         -         61.44           IDL:         5%         0.036         0.027         0.043         0.044         0.043         0.081         0.058         0.069           DL:         5%         0.306         0.021         0.479         0.432         0.758           CDF         95% <td></td>															
Other assumptions for NR-U:         -         1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmission           DL:         5%         37.34         39.55         42.27         20.79         30.58         36.29         10.03         18.05         22.99           UPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           CDF         95%         101.71         105.96         127.76         75.85         97.03         113.45         50.83         80.59         88.05           Mbps Mea         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           1         n         -									intoring c	, ery 100,	benedun		itionai iai	i, bell bell	caanna.
- 1 ms long DRS is transmitted using 40ms periodicity and a DRS transmission window of 6 ms 25us LBT is used for DRS transmission           25us LBT is used for DRS transmission         30.58         36.29         10.03         18.05         22.99           DL:         5%         37.34         39.55         42.27         20.79         30.58         36.29         10.03         18.05         22.99           UPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           ODF         95%         101.71         105.96         127.76         75.85         97.03         113.45         50.83         80.59         88.05           Mbps         Mea         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           I         n         I         I         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII								001).							
25us LBT is used for DRS transmission           25us LBT is used for DRS								using 40m	ns periodic	ity and a l	DRS tran	smission	window of	<sup>2</sup> 6 ms	
Open         5%         37.34         39.55         42.27         20.79         30.58         36.29         10.03         18.05         22.99           UPT         50%         82.65         86.13         101.46         53.52         73.21         85.70         26.09         51.70         58.63           CDF         95%         101.71         105.96         127.76         75.85         97.03         113.45         50.83         80.59         88.05           [Mbps] Mea         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           DL:         5%         0.036         0.027         0.043         0.044         0.043         0.081         0.058         0.069           DL:         5%         0.153         0.053         0.045         0.419         0.173         0.176         0.795         0.432         0.758           CDF         95%         1.330         0.221         0.200         4.769         0.947         1.214         8.227         3.157         3.177           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2									perioure	ing and a		01111001011		0 1110	
Imps         Mea         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           DL:         5%         0.036         0.027         0.043         0.044         0.043         0.081         0.058         0.069           DL:         5%         0.153         0.053         0.045         0.419         0.173         0.176         0.795         0.432         0.758           Delay         50%         1.330         0.221         0.200         4.769         0.947         1.214         8.227         3.157         3.177           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2.768         1.154         1.372           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2.768         1.154         1.372           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2.768         1.154         1.372           [b]         Mea         82.62         86.91         78.08         52.08         70.71         61.68	8	DL						1	30.58	36.29		10.03	18.05	22.99	
[Mbps]         Mea         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           DL:         5%         0.036         0.027         0.043         0.044         0.043         0.081         0.058         0.069           DL:         5%         0.153         0.053         0.045         0.419         0.173         0.176         0.795         0.432         0.758           Delay         50%         1.330         0.221         0.200         4.769         0.947         1.214         8.227         3.157         3.177           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2.768         1.154         1.372           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2.768         1.154         1.372           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2.768         1.154         1.372           [b]         Mea         82.62         86.91         78.08         52.08         70.71         61.68	rce				-				1			1		1	
[Mbps]         Mea         80.59         84.07         99.63         54.14         72.78         85.86         30.03         54.31         61.44           DL:         5%         0.036         0.027         0.043         0.044         0.043         0.081         0.058         0.069           DL:         5%         0.153         0.053         0.045         0.419         0.173         0.176         0.795         0.432         0.758           Delay         50%         1.330         0.221         0.200         4.769         0.947         1.214         8.227         3.157         3.177           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2.768         1.154         1.372           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2.768         1.154         1.372           [s]         Mea         0.447         0.104         0.087         1.536         0.367         0.434         2.768         1.154         1.372           [b]         Mea         82.62         86.91         78.08         52.08         70.71         61.68	lou				1				1			1 1		1	
Image: Normal base of the state of					1				1			i		1	
Image: Signed state in the	<u> </u>	]		00.33	04.07	55.05		J4,14	/2./0	00.00		0.03	J4.J1	01.44	
Image: Signed state in the system of the system in the system of the system in the system of the	14	יזם		0.026	0.026	0.027		0.042	0.044	0.042		0.001	0.050	0.060	
Image: Signed state in the system of the system in the system of the system in the system of the	.18		<u> </u>									+ +		+	
Image: Signed state in the system of the system in the system of the system in the system of the	뒨					-								1	
n         -						-						+ +			
UL:         5%         42.00         42.41         37.74         22.36         33.36         26.97         9.59         18.82         15.85           UPT         50%         82.62         86.91         78.08         52.08         70.71         61.68         24.37         50.15         41.49           CDF         95%         100.22         104.90         96.85         74.51         93.64         85.94         48.94         77.51         62.82           [Mbps]         Mea         81.03         85.37         77.13         53.70         71.39         62.85         28.86         52.97         43.53		[٥]		0.447	0.104	0.087		1.530	0.30/	0.434		2./08	1.154	1.3/2	
UPT         50%         82.62         86.91         78.08         52.08         70.71         61.68         24.37         50.15         41.49           CDF         95%         100.22         104.90         96.85         74.51         93.64         85.94         48.94         77.51         62.82           Mbps         Mea         81.03         85.37         77.13         53.70         71.39         62.85         28.86         52.97         43.53		T 7T		40.00	40.44	27.74		22.22		26.07			10.00	15.05	
CDF         95%         100.22         104.90         96.85         74.51         93.64         85.94         48.94         77.51         62.82           [Mbps]         Mea         81.03         85.37         77.13         53.70         71.39         62.85         28.86         52.97         43.53												1 1		+	
[Mbps] Mea         81.03         85.37         77.13         53.70         71.39         62.85         28.86         52.97         43.53									÷			+ +			
					1				1		ļ	1 1		1	
		[Mbps	Mea	81.03	85.37	77.13		53.70	71.39	62.85		28.86	52.97	43.53	
			n												

R pac/Source	leport rame			O range f	<u>7 <b>load</b></u> for Wi-Fi			<u>Mediu</u> O range fo	or Wi-Fi in			High O range fo	r Wi-Fi iı	
C/5					i: 10%~2		W	'iFi+WiFi:	35%~50%	6	W	iFi+WiFi:	above 55	%
<u>qo</u>			Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U ir
H			WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+
			WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
U	JL:	5%	0.036	0.034	0.036		0.059	0.041	0.057		0.092	0.053	0.235	
De	elay 5	50%	0.092	0.051	0.066		0.478	0.117	0.486		0.820	0.265	1.305	
		95%		0.172	0.210		4.177	0.782	1.625		7.586	1.784	4.950	
[			0.377	0.088	0.105		1.556	0.287	0.733		2.565	0.717	2.140	
		n										••• =•		
	$Q_{\rm DL}$		97%	100%	100%		81%	97%	97%		65%	90%	90%	
	QUL	i	98%	100%	100%		86%	98%	95%		74%	95%	80%	
	BO		10%	6.2%	6.4%		35%	16%	16%		60%	33%	34%	
	<u>δ</u>		1070		file/s		5570	0.29 1			0070	0.37 f		
	λ		A J J					0.291	IIIe/S			0.571	110/5	
				al comm		- d			• <b>CC:</b>					
							nario, 50/5 Ti Cat 4 I				l off Ma	от <b>ч</b>	on Corre	M
												COT durati		
												d Rx BF at		
												mit power	200Bm,	UE/SIF
							receiver. (							
										IBM, A-N	IPDU Ira	me aggreg	ation, MI	DU
							short Wi-			•	1.1		0.011	
												ity #1, PU		
								nitoring e	very 10S,	Scheduli	ng: propo	rtional fair	, self-sch	eduling.
			()) cha											
						initiated		,	<b>.</b>			• • • • • •		-
	T I		Other as	sumptio	n for NR	-U: 20%	of the UL		î.		1	sions with 2	1	1
D E		5%	<b>Other as</b> 18.268	sumptio 28.927	n for NR 25.728	- <b>U:</b> 20% 54.975	of the UL 1.726	17.915	16.285	50.416	0.265	9.445	7.807	46.640
	PT 5	5% 50%	Other as 18.268 54.361	sumptio 28.927 58.016	n for NR 25.728 65.082	-U: 20% 54.975 69.197	of the UL 1.726 39.992	17.915 51.877	16.285 57.588	50.416 64.352	0.265 16.689	9.445 48.522	7.807 52.069	46.640 62.491
URCE D CE	PT 5 DF 9	5% 50% 95%	Other as 18.268 54.361 61.681	28.927 58.016 61.704	n for NR 25.728 65.082 70.643	- <b>U:</b> 20% 54.975 69.197 70.686	of the UL 1.726 39.992 56.865	17.915 51.877 59.919	16.285 57.588 68.391	50.416 64.352 70.239	0.265 16.689 54.012	9.445 48.522 58.880	7.807 52.069 65.850	46.640 62.491 68.941
URCE D CE	PT 5	5% 50% 95%	Other as 18.268 54.361 61.681	sumptio 28.927 58.016	n for NR 25.728 65.082	-U: 20% 54.975 69.197	of the UL 1.726 39.992	17.915 51.877	16.285 57.588	50.416 64.352	0.265 16.689	9.445 48.522	7.807 52.069	46.640 62.491 68.941
V SOURCE W D C M	PT DF Ibps ]	5% 50% 95% Mea n	Other as 18.268 54.361 61.681 49.522	<b>sumptio</b> 28.927 58.016 61.704 53.936	n for NR 25.728 65.082 70.643 60.081	-U: 20% 54.975 69.197 70.686 66.666	of the UL 1.726 39.992 56.865 34.027	17.915 51.877 59.919 47.806	16.285 57.588 68.391 52.259	50.416 64.352 70.239 62.680	0.265 16.689 54.012 22.774	9.445 48.522 58.880 44.045	7.807 52.069 65.850 46.999	46.640 62.491 68.941 60.818
D C C C C C C C C C C C C C C C C C C C	PT 5 DF 6 Ibps 1 ]	5% 50% 95% Mea n 5%	Other as 18.268 54.361 61.681 49.522 0.068	sumptio 28.927 58.016 61.704 53.936 0.068	n for NR 25.728 65.082 70.643 60.081 0.059	-U: 20% 54.975 69.197 70.686 66.666 0.059	of the UL 1.726 39.992 56.865 34.027 0.077	17.915 51.877 59.919 47.806 0.071	16.285 57.588 68.391 52.259 0.062	50.416 64.352 70.239	0.265 16.689 54.012 22.774 0.084	9.445 48.522 58.880 44.045 0.073	7.807 52.069 65.850 46.999 0.067	46.640 62.491 68.941 60.818 0.061
D URCE	PT 5 DF 9 Ibps 1 DL: 5 PL: 5	5% 50% 55% Mea n 5% 50%	Other as           18.268           54.361           61.681           49.522           0.068           0.082	<b>sumptio</b> 28.927 58.016 61.704 53.936	n for NR 25.728 65.082 70.643 60.081	-U: 20% 54.975 69.197 70.686 66.666	of the UL 1.726 39.992 56.865 34.027	17.915 51.877 59.919 47.806	16.285 57.588 68.391 52.259	50.416 64.352 70.239 62.680	0.265 16.689 54.012 22.774	9.445 48.522 58.880 44.045	7.807 52.069 65.850 46.999	46.640 62.491 68.941 60.818
812556 / SOURCE <b>G D N</b> O C <b>D</b>	PT 5 DF 6 Ibps 1 ]	5% 50% 55% Mea n 5% 50%	Other as           18.268           54.361           61.681           49.522           0.068           0.082	sumptio 28.927 58.016 61.704 53.936 0.068	n for NR 25.728 65.082 70.643 60.081 0.059	-U: 20% 54.975 69.197 70.686 66.666 0.059	of the UL 1.726 39.992 56.865 34.027 0.077	17.915 51.877 59.919 47.806 0.071	16.285 57.588 68.391 52.259 0.062	50.416 64.352 70.239 62.680 0.060	0.265 16.689 54.012 22.774 0.084	9.445 48.522 58.880 44.045 0.073	7.807 52.069 65.850 46.999 0.067	46.640 62.491 68.941 60.818 0.061
D ad M D C d	PT 5 DF 5 Ibps 1 J DL: 5 DF 5	5% 50% 55% Mea n 5% 50%	Other as           18.268           54.361           61.681           49.522           0.068           0.082	sumptio           28.927           58.016           61.704           53.936           0.068           0.074	n for NR 25.728 65.082 70.643 60.081 0.059 0.068	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061	of the UL 1.726 39.992 56.865 34.027 0.077 0.170	17.915 51.877 59.919 47.806 0.071 0.092	16.285 57.588 68.391 52.259 0.062 0.092	50.416 64.352 70.239 62.680 0.060 0.070	0.265 16.689 54.012 22.774 0.084 1.274	9.445 48.522 58.880 44.045 0.073 0.107	7.807 52.069 65.850 46.999 0.067 0.133	46.640 62.491 68.941 60.818 0.061 0.075
D D D M D UKCE	PT 5 DF 5 Ibps 1 J DL: 5 DF 5	5% 50% 95% Mea n 5% 50% 95%	Other as           18.268           54.361           61.681           49.522           0.068           0.082           1.028	28.927 58.016 61.704 53.936 0.068 0.074 0.243	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978	17.915 51.877 59.919 47.806 0.071 0.092 0.597	16.285 57.588 68.391 52.259 0.062 0.092 2.855	50.416 64.352 70.239 62.680 0.060 0.070 0.672	0.265 16.689 54.012 22.774 0.084 1.274 50.726	9.445 48.522 58.880 44.045 0.073 0.107 1.492	7.807 52.069 65.850 46.999 0.067 0.133 5.518	46.640 62.491 68.941 60.818 0.061 0.075 0.732
1-1812556 / SOURCE	PT 5 DF 9 Ibps 1 DL: 2 elay 5 DF 9 [s] 1	5% 50% 95% Mea 5% 50% 95% Mea n	Other as           18.268           54.361           61.681           49.522           0.068           0.082           1.028	sumptio           28.927           58.016           61.704           53.936           0.068           0.074           0.243           0.177	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519	50.416 64.352 70.239 62.680 0.060 0.070 0.672	0.265 16.689 54.012 22.774 0.084 1.274 50.726 9.934	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179
<b>1-1812556 / SOURCE</b>	PT 5 DF 9 Ibps 1 DL: DF 9 DF 9 S 1 N L:	5% 50% 55% Mea n 5% 50% 05% Mea n 5%	Other as 18.268 54.361 61.681 49.522 0.068 0.082 1.028 0.615 3.249	28.927 58.016 61.704 53.936 0.068 0.074 0.243 0.177 21.607	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399	50.416 64.352 70.239 62.680 0.060 0.070 0.672 0.173 24.877	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941
□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	PT 5 DF 9 Ibps 1 DL: 5 DF 9 DF 9 [s] 1 TL: 5 PT 5	5% 50% 95% Mea n 5% 50% 5% 5% 50%	Other as 18.268 54.361 61.681 49.522 0.068 0.082 1.028 0.615 3.249 53.859	sumptio           28.927           58.016           61.704           53.936           0.068           0.074           0.243           0.177           21.607           57.058	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200	50.416 64.352 70.239 62.680 0.060 0.070 0.672 0.173 24.877 49.174	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898
D C C 1-1812556/SOURCE	PT 5 DF 9 Ibps 1 DL: 5 DF 9 DF 9 S] 1 PT 5 DF 9 DF 9	5% 50% 95% Mea n 5% 50% 95% 50%	Other as 18.268 54.361 61.681 49.522 0.068 0.082 1.028 0.615 3.249 53.859 61.790	sumptio 28.927 58.016 61.704 53.936 0.068 0.074 0.243 0.177 21.607 57.058 61.815	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446	50.416 64.352 70.239 62.680 0.060 0.070 0.672 0.173 24.877 49.174 56.350	0.265 16.689 54.012 22.774 0.084 1.274 50.726 9.934 0.003 16.032 54.671	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014
M     1-1812556 / SOURCE       M     M     M       M     M     M	PT 5 DF 9 Ibps 1 DL: 5 DF 9 DF 9 S] 1 PT 5 DF 9 DF 9	5% 50% 55% Mea n 5% 50% 50% 55% 50% 50% 50% 50% 50% 50%	Other as 18.268 54.361 61.681 49.522 0.068 0.082 1.028 0.615 3.249 53.859	sumptio           28.927           58.016           61.704           53.936           0.068           0.074           0.243           0.177           21.607           57.058	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200	50.416 64.352 70.239 62.680 0.060 0.070 0.672 0.173 24.877 49.174	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014
$\begin{array}{c c} 1-1812556/SOURCE \\ \hline M \\ \square \\$	PT 5 DF 9 lbps 1 pL: 5 pL: 5 pT 5 lbps 1 DF 9 DF 9 lbps 1 ]	5% 50% 25% Mea n 55% 50% 55% 50% 50% 40% 25%	Other as 18.268 54.361 61.681 49.522 0.068 0.082 1.028 0.615 3.249 53.859 61.790 47.340	sumptio           28.927           58.016           61.704           53.936           0.068           0.074           0.243           0.177           21.607           57.058           61.815           52.428	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788 43.627	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297 53.066	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646 33.050	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269 46.962	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446 34.726	50.416 64.352 70.239 62.680 0.060 0.070 0.672 0.173 0.173 24.877 49.174 56.350 46.746	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894 43.239	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578 29.886	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014 44.700
	PT 5 DF 5 lbps 1 pL: 5 elay 5 elay 5 s] 1 F 5 PT 5 DF 5	5% 50% 25% Mea n 5% 50% 25% Mea n 5%	Other as 18.268 54.361 61.681 49.522 0.068 0.082 1.028 0.615 3.249 53.859 61.790 47.340 0.068	sumptio           28.927           58.016           61.704           53.936           0.068           0.074           0.243           0.177           21.607           57.058           61.815           52.428           0.068	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788 43.627 0.071	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297 53.066	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646 33.050 0.075	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269 46.962	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446 34.726	50.416 64.352 70.239 62.680 0.070 0.672 0.173 24.877 49.174 56.350 46.746	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894 43.239	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578 29.886 0.087	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014 44.700
$\begin{array}{c c} 1-1812556/SOURCE \\ \hline M \\ \square \\$	PT 5 DF 5 lbps 1 lL: DF 5 S 1 PT 5 PT 5 lbps 1 lbps 1 lbps 2 lbps 2 lbps 2 lbps 3 lbps 3 lbps 4 lbps	5% 50% 05% Mea n 5% 50% 05% 50% 50% 05% 05%	Other as 18.268 54.361 61.681 49.522 0.068 0.082 1.028 0.615 3.249 53.859 61.790 47.340 0.068 0.086	Sumptio           28.927           58.016           61.704           53.936           0.068           0.074           0.243           0.177           21.607           57.058           61.815           52.428           0.068           0.077	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788 43.627 0.071 0.090	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297 53.066 0.071 0.079	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646 33.050 0.075 0.205	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269 46.962 0.070 0.098	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446 34.726 0.080 0.171	50.416 64.352 70.239 62.680 0.070 0.672 0.173 24.877 49.174 56.350 46.746 0.075 0.097	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894 43.239 0.073 0.115	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578 29.886 0.087 0.280	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014 44.700 0.078 0.078
$\begin{array}{c c} 1-1812556 / SOURCE \\ \hline 0 & M \\ \hline 0 & $	PT 5 DF 5 lbps 1 lL: DF 5 s] 1 LL: pT 5 s] 1 lL: lbps 1 lbps 1 lbp	5% 50% 05% Mea n 5% 50% 55% 05% Mea n 5% 50% 55%	Other as 18.268 54.361 61.681 49.522 0.068 0.082 1.028 0.615 3.249 53.859 61.790 47.340 0.068 0.086 0.086 6.556	sumptio 28.927 58.016 61.704 53.936 0.068 0.074 0.243 0.177 21.607 57.058 61.815 52.428 0.068 0.077 0.350	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788 43.627 0.071 0.090 8.910	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297 53.066 0.071 0.079 0.866	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646 33.050 0.075 0.205 46.665	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269 46.962 0.070 0.098 1.200	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446 34.726 0.080 0.171 18.475	50.416 64.352 70.239 62.680 0.070 0.672 0.173 24.877 49.174 56.350 46.746 0.075 0.097 2.292	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894 43.239 0.073 0.115 12.454	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578 29.886 0.087 0.280 96.034	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014 44.700 0.078 0.109 2.234
1-1812556 / SOURCE       D D C       M D C C       M D C C	PT 5 DF 5 lbps 1 lL: DF 5 s] 1 LL: pT 5 s] 1 lL: lbps 1 lbps 1 lbp	5% 50% Mea n 5% 50% 05% 50% 50% 05% 05% 50% 05% 05%	Other as 18.268 54.361 61.681 49.522 0.068 0.082 1.028 0.615 3.249 53.859 61.790 47.340 0.068 0.086 0.086 6.556	Sumptio           28.927           58.016           61.704           53.936           0.068           0.074           0.243           0.177           21.607           57.058           61.815           52.428           0.068           0.077	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788 43.627 0.071 0.090	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297 53.066 0.071 0.079	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646 33.050 0.075 0.205	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269 46.962 0.070 0.098	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446 34.726 0.080 0.171	50.416 64.352 70.239 62.680 0.070 0.672 0.173 24.877 49.174 56.350 46.746 0.075 0.097	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894 43.239 0.073 0.115	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578 29.886 0.087 0.280	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014 44.700 0.078 0.078
D D C     1-1812556 / SOURCE       D D C     1     D D C       M D C C     1     D D C	PT 5 DF 5 lbps 1 ] L: elay 5 s] DF 6 s] PT 5 S N L: PT 5 S N L: L: DF 5 S N DF 5 S N L: S N DF 5 S N S N S N S N S N S N S N S S N S S N S S S S S S S S S S S S S	5% 50% Mea n 5% 50% 05% 50% 50% 50% 50% 50% 50% 00% 0	Other as         18.268         54.361         61.681         49.522         0.068         0.082         1.028         0.615         3.249         53.859         61.790         47.340         0.068         0.086         6.556         7.374	sumptio 28.927 58.016 61.704 53.936 0.068 0.074 0.243 0.177 21.607 57.058 61.815 52.428 0.068 0.077 0.350 7.033	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788 43.627 0.071 0.090 8.910 5.254	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297 53.066 0.071 0.079 0.866 0.372	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646 33.050 0.075 0.205 46.665 11.062	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269 46.962 0.070 0.098 1.200 7.123	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446 34.726 0.080 0.171 18.475 6.520	50.416 64.352 70.239 62.680 0.070 0.672 0.173 24.877 49.174 56.350 46.746 0.075 0.097 2.292 1.012	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894 43.239 0.073 0.115 12.454 7.643	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578 29.886 0.087 0.280 96.034 12.172	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014 44.700 0.078 0.109 2.234 0.893
$\begin{array}{c c} 1-1812556 / SOURCE \\ \hline 0 & M \\ \hline 0 & $	PT 5 DF 5 lbps 1 lL: DF 5 s] 1 LL: pT 5 s] 1 lL: lbps 1 lbps 1 lbp	5% 50% Mea n 5% 50% 05% 50% 50% 50% 50% 50% 50% 00% 0	Other as         18.268         54.361         61.681         49.522         0.068         0.082         1.028         0.615         3.249         53.859         61.790         47.340         0.068         0.086         0.3249         53.859         61.790         47.340         0.068         0.386         0.386         0.374         1.008	sumptio 28.927 58.016 61.704 53.936 0.068 0.074 0.243 0.177 21.607 57.058 61.815 52.428 0.068 0.077 0.350 7.033	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788 43.627 0.071 0.090 8.910 5.254 0.99	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297 53.066 0.071 0.079 0.866 0.372	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646 33.050 0.075 0.205 46.665 11.062 1.00	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269 46.962 0.070 0.098 1.200 7.123	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446 34.726 0.080 0.171 18.475 6.520	50.416 64.352 70.239 62.680 0.070 0.070 0.672 0.173 24.877 49.174 56.350 46.746 40.745 0.097 2.292 1.012	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894 43.239 0.073 0.115 12.454 7.643 1.00	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578 29.886 0.087 0.280 96.034 12.172	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014 44.700 0.078 0.109 2.234 0.893 1.00
D = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 = 0 =	PT 5 Ibps 1 J L: DF 5 S N CF 5 N PT 5 S N CF 5 N PT 5 S N PT 5 S PT 5 PT 5 S PT 5 PT 5	5% 50% Mea n 5% 50% 50% 50% 50% 50% 50% 50% 50% 50%	Other as         18.268         54.361         61.681         49.522         0.068         0.082         1.028         0.615         3.249         53.859         61.790         47.340         0.068         0.086         7.374         1.00         0.966	sumptio 28.927 58.016 61.704 53.936 0.068 0.074 0.243 0.177 21.607 57.058 61.815 52.428 0.068 0.077 0.350 7.033 7.033	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788 43.627 0.071 0.090 8.910 5.254 0.99 0.94	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297 53.066 0.071 0.079 0.866 0.372 1.00 0.99	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646 33.050 0.075 0.205 46.665 11.062 1.00 0.90	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269 46.962 0.070 0.098 1.200 7.123 	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446 34.726 0.080 0.171 18.475 6.520 0.98 0.92	50.416 64.352 70.239 62.680 0.070 0.672 0.173 24.877 49.174 56.350 46.746 56.350 46.746 0.097 2.292 1.012 1.00 0.97	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894 43.239 0.073 0.115 12.454 7.643 1.00 0.96	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578 29.886 0.087 0.280 96.034 12.172 0.97 0.87	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014 44.700 0.078 0.109 2.234 0.893 1.00 0.98
D → <b>U</b> → <b></b>	PT 5 Ibps 1 J L: DF 5 PT 5 S I Ibps 1 I Ibps 1 I Ibps 1 I Ibps 1 I Ibps 1 I I I I I I I I I I I I I	5% 50% Mea n 5% 50% 50% 50% 50% 50% 50% 50% 50% 50%	Other as         18.268         54.361         61.681         49.522         0.068         0.082         1.028         0.615         3.249         53.859         61.790         47.340         0.068         0.086         0.3249         53.859         61.790         47.340         0.068         0.386         0.386         0.374         1.008	sumptio 28.927 58.016 61.704 53.936 0.068 0.074 0.243 0.177 21.607 57.058 61.815 52.428 0.068 0.077 0.350 7.033 7.033 1.00 0.97 0.18	n for NR 25.728 65.082 70.643 60.081 0.059 0.068 2.193 1.537 5.012 50.527 58.788 43.627 0.071 0.090 8.910 5.254 0.99	-U: 20% 54.975 69.197 70.686 66.666 0.059 0.061 0.140 0.145 40.063 54.950 59.297 53.066 0.071 0.079 0.866 0.372	of the UL 1.726 39.992 56.865 34.027 0.077 0.170 20.978 3.480 0.148 37.878 57.646 33.050 0.075 0.205 46.665 11.062 1.00	17.915 51.877 59.919 47.806 0.071 0.092 0.597 0.268 12.103 51.712 60.269 46.962 0.070 0.098 1.200 7.123	16.285 57.588 68.391 52.259 0.062 0.092 2.855 1.519 2.399 40.200 54.446 34.726 0.080 0.171 18.475 6.520 0.98 0.92 0.35	50.416 64.352 70.239 62.680 0.070 0.070 0.672 0.173 24.877 49.174 56.350 46.746 40.745 0.097 2.292 1.012	0.265 16.689 54.012 22.774 	9.445 48.522 58.880 44.045 0.073 0.107 1.492 0.516 5.661 48.471 58.894 43.239 0.073 0.115 12.454 7.643 1.00	7.807 52.069 65.850 46.999 0.067 0.133 5.518 1.950 0.030 34.614 51.578 29.886 0.087 0.280 96.034 12.172 0.97 0.87 0.87 0.44	46.640 62.491 68.941 60.818 0.061 0.075 0.732 0.179 25.941 46.898 55.014 44.700 0.078 0.109 2.234 0.893 

e l	D (1													
	Reported	Low loadMedium loadHigh loadBO range for Wi-Fi inBO range for Wi-Fi inBO range for Wi-Fi in												
ق ا	parameters		0				0				0			
		W	'iFi+WiF	i: 10%~2	5%	W	iFi+WiFi:	35%~50%	6	W	iFi+WiFi:	above 55	%	
Tdoc/Source		Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	
		WiFi+ WiFi+ WiFi+ NR-U+ WiFi+ WiFi+ WiFi+ WiFi+ WiFi+ WiFi+ WiFi+ NR-U+												
		WiFi         NR-U         NR-U         WiFi         NR-U         NR-U <th< td=""></th<>												
		WIFI     NR-U     NR-U     NR-U     NR-U     NR-U     NR-U       Additional comments:												
					i and NR-	U: Up to 4	msec CO	T for both	DL/UL	Wi-Fi and	l DL/UL N	R-U trans	smission	
				bled for V										
						Wi-Fi82	/62 dBm I	PD/ED thr	eshold ar	nd for NR	-U, -72 dB	m ED thr	eshold	
						each tech							conora	
											itenna conf	iguration	for both	
		Wi-Fi an		ina namo		io iuyeis i	1500 101 00		105103, 1	1 A210A UII		iguiution		
						) U aggrega	ntion loval	MPDUs	izo. 802 ·	11ac				
			SCS: 15 k			o uggregi		, MI DO 3	120, 002,	iiuc				
		0		val: 0.8 µ			<b>.</b> .							
						(#1 or #2):								
											, PDSCH r			
				ibols), foi	r PUSCH,	PUSCH n	napping ty	pe A with	14 symb	ols, for P	DCCH, PE	OCCH mo	nitoring	
		every 7 s	ymbols											
		- Link ad	laptation	assumptio	ons: For V	Vi-Fi, oper	loop rate	adaptatio	n, for NR	-U, realis	tic closed l	oop link		
		adaptatio	n											
		- Cross-c	arrier sch	neduling f	for NR-U									
				0										

	1										
				<u>Low load</u>		1	<u>Medium loa</u>	<u>d</u>		<u>High load</u>	
	Repo	orted	BO ra	nge for NF	2-U in	BO ra	ange for NR	-U in	BO r	ange for NR	-U in
							Vi-Fi, with I				
	рагап	leters			NR-U uses		,			-Fi, with NR	
Tdoc / Source			ED = -7	72dBm: 10	%~25%	ED = -	72dBm: 359	<u>%~50%</u>	= -72	dBm: above	55%
			NR-U in	NR-U in	NR-U in	NR-U in	NR-U in	NR-U in	NR-U in	NR-U in	NR-U in
S			NR-U +	NR-U +	NR-U +	NR-U +	NR-U +	NR-U +	NR-U +	NR-U +	NR-U +
$\overline{\mathbf{u}}$											
ŏ			Wi-Fi,	Wi-Fi,						Wi-Fi, with	
Ĕ			with NR-	with NR-	with NR-	NR-U uses	NR-U uses	NR-U uses	NR-U uses	NR-U uses	NR-U uses
			U uses	U uses	U uses	ED =	ED =	preamble	ED =	ED =	preamble
			ED =	ED =	preamble	-72dBm	-77dBm	preumbre	-72dBm	-77dBm	preditione
					preamore	-/2uDill	-//uDill		-/ZuDIII	-//uDIII	
			-72dBm	-77dBm							
	DL:	5%	37.93	40.83	43.46	22.31	29.57	29.97	7.77	14.55	10.87
	UPT	50%	93.51	95.18	97.42	57.82	70.99	68.70	24.82	40.29	30.47
	CDF										
		95%	120.76	121.81	122.11	86.46	102.10	97.17	48.64	68.93	54.55
	[Mbp	Mean	92.96	93.87	96.01	60.44	73.38	70.83	28.72	44.18	34.22
	s]										
	DL:	5%	0.038	0.028	0.031	0.121	0.087	0.060	0.178	0.100	0.154
	Delay		0.126	0.119	0.129	1.105	0.498	0.530	1.911	1.108	1.603
ω	CDF	95%	0.470	0.446	0.539	4.212	1.916	2.730	7.922	4.527	7.550
G	[s]	Mean	0.217	0.212	0.240	1.856	0.808	1.037	3.266	1.937	2.984
R1-1814021/ Source	UL:	5%							6.29		6.79
So l			35.65	39.05	38.10	18.70	25.76	23.10		10.84	
	UPT	50%	70.55	73.56	73.38	41.95	52.63	50.44	16.86	27.90	20.41
5	CDF	95%	92.92	93.58	93.04	65.06	74.67	73.10	34.89	49.33	38.99
4		Mean	71.61	73.82	73.83	44.69	54.88	52.85	20.37	31.26	23.51
81		wiedli	/1.01	/ 5.02	/ 5.05	44.09	54.00	52.05	20.37	51.20	23.31
7	s]										
LT	UL:	5%	0.039	0.036	0.039	0.075	0.059	0.050	0.156	0.122	0.197
	Delay	50%	0.108	0.153	0.153	0.942	0.536	0.540	1.926	1.011	1.961
	CDF	95%	0.586	0.526	0.670	6.920	2.621	3.578	11.836	5.838	9.880
	[s]	Mean	0.231	0.263	0.324	2.486	1.041	1.228	4.362	2.353	3.797
	$Q_1$	DL	99%	99%	99%	88%	95%	90%	73%	81%	72%
	Q		98%	99%	98%	78%	91%	88%	50%	68%	64%
	В		10%	09%	10%	35%	23%	27%	60%	46%	58%
	1	l		0.25 file/s			0.36 file/s			0.48 file/s	
			Additional	comments	:						
						r sconario 5	0/50 DL/UI	traffics			
									CMILAL		
										ff, MCOT dı	
			6ms, Max	modulation	1: 256 QAN	A, Antennas	: 4  for BS/A	P and 2 for	UE/STA, BI	F scheme: Tx	and Rx BF
			at BS/AP, 1	Maximal n	umber of la	avers: 2 for 1	DL and 2 for	r UL, single	carrier with	20MHz BW	, BS/AP
			transmit no	wer 20dB	m LIE/STA	transmit no	wer 18dBm	MMSE-IE	C receiver	CW {min,ma	x}
			-	UL{15,10}		r transmit pe		,			
								11 62 ( 02 )		<b>TT</b> C	
										U frame agg	gregation,
			MPDU siz	e: 1500B N	ASDU plus	14B header	r, short Wi-F	i guard int?	rval.		
			NR-U assi	umptions:	SCS 30kH	z, UE proce	ssing time c	apability #1	, PUSCH ma	apping Type	A, PDSCH
										self-schedul	
							105, 50100	ianng, prop	ornonai iall,	Sen-Scheuul	
					B initiated C						
			<u> </u>	<u>tion resul</u> ts	of Wi-Fi i	<u>n an NR-U</u> -	+ Wi-Fi coe	<u>xistence in</u> i	ndoor scenai	io	
				Low load		ו	Medium loa	d		<u>High load</u>	
	Repo	ortod	BO m	nge for NF	-II in		ange for NR		RO w	ange for NR-	II in
	paran	ieters			NR-U uses		Vi-Fi, with I			-Fi, with NR	
بە			ED = -7	72dBm: 10	%~25%	ED = -	72dBm: 359	%~50%	= -72	dBm: above	55%
Tdoc / Source			Wi-Fi in	Wi-Fi in	Wi-Fi in	Wi-Fi in	Wi-Fi in	Wi-Fi in	Wi-Fi in	Wi-Fi in	Wi-Fi in
jõ			NR-U +	NR-U +	NR-U +	NR-U +	NR-U +	NR-U +	NR-U +	NR-U +	NR-U +
<u> </u>											
2 2			Wi-Fi,	Wi-Fi,						Wi-Fi, with	
dc			with NR-	with NR-	with NR-	NR-U uses	NR-U uses	NR-U uses	NR-U uses	NR-U uses	NR-U uses
E			U uses	U uses	U uses	ED =	ED =	preamble	ED =	ED =	preamble
			ED =	ED =	preamble	-72dBm	-77dBm	r	-72dBm	-77dBm	r
					Preamore	=/ 20DIII			=/ 20DIII	=//uDIII	
			-72dBm	-77dBm							
										-	

## Table B.1.1-2: Wi-Fi and NR-U coexistence evaluation with 20MHz and FTP traffic with and withoutNR-U PD

	DL:	5%	36.00	36.99	35.89	21.37	26.47	24.58	8.97	14.08	10.40
	UPT		78.53	83.05	82.75	51.09	67.01	60.71	25.08	41.67	29.13
	CDF		102.74	104.15	103.38	80.38	91.80	85.20	57.27	71.88	54.89
		Mean	78.56	81.13	81.05	54.61	67.01	61.56	31.12	44.93	33.24
	s]										
	DL:	5%	0.036	0.034	0.037	0.076	0.046	0.050	0.094	0.088	0.086
	Delay		0.081	0.069	0.098	0.670	0.200	0.589	0.969	0.570	0.994
8	CDF		0.477	0.296	0.634	3.188	1.064	2.606	6.670	3.621	6.885
ILCO		Mean	0.176	0.126	0.224	1.312	0.416	1.071	2.388	1.308	2.487
Sol	UL:	5%	39.30	40.53	39.01	21.54	29.15	26.16	7.62	14.50	10.67
1	UPT		79.42	83.43	81.81	50.43	63.95	60.45	24.42	38.09	29.54
102	CDF		100.50	102.76	101.66	77.94	90.60	84.28	56.90	70.67	56.14
R1-1814021/ Source 8	[Mbp s]	Mean	79.00	81.76	81.12	54.08	66.07	61.51	31.42	44.07	33.57
R1	UL:	5%	0.036	0.034	0.036	0.058	0.043	0.051	0.083	0.063	0.090
	Delay	50%	0.077	0.067	0.081	0.271	0.149	0.246	0.432	0.284	0.491
	CDF	95%	0.388	0.286	0.590	2.639	1.171	1.849	4.849	2.642	4.917
	[s]	Mean	0.163	0.128	0.229	0.888	0.417	0.700	1.560	0.984	1.635
	Q	DL	99%	100%	99%	93%	97%	92%	80%	91%	75%
	Q	UL	100%	100%	99%	95%	99%	96%	89%	94%	87%
	B	0	11%	8.7%	9.6%	34%	21%	28%	59%	43%	57%
		λ		0.25 file/s			0.36 file/s			0.48 file/s	
				comments							
							0/50 DL/UI				
										ff, MCOT du	
											k and Rx BF
										20MHz BW	
			1			transmit po	ower 18dBn	n, MMSE-IF	C receiver.	CW {min,ma	ax}
				} UL{15,10				11 00/07-1			.
										OU frame agg	gregation,
								i guard inte			
										apping Type	
			11 0			0 0	10S, Scheo	iuling: prop	ortional fair,	self-schedul	ling. COT
			snaring en	abled (gNE	3 initiated C	LUT).					

		_			load			Mediu				High		
U U	Repo			0	NR-U with 1	.5   BC	) ran	ge for NF		15 kHz	BO ran	ge for NI		15 kHz
Tdoc /Sourc	paran	neters			10%~25%			SCS: 35			NDT	SCS: ab		
/S			NR-U	NR-U	NR-U		t-U	NR-U	NR-U		NR-U	NR-U	NR-U	
doc			with	with	with SCS =		ith	with SCS =	with		with	with	with	
Ē			SCS =	SCS = 30 kHz			S = kHz	30 kHz	SCS = 60 kHz		SCS = 15 kHz	SCS = 30 kHz	SCS = 60 kHz	
			IJ KIIZ	JU KIIZ	OU KI IZ		KIIZ	JU KIIZ	00 KHZ		13 KIIZ	JU KI IZ	OU KI IZ	
	DL:	5%	45.76	45.65	43.84	30	.44	30.23	30.30		14.61	15.83	16.46	
	UPT	50%	102.66	105.01	97.29	73	.61	76.32	70.56		43.23	48.01	44.76	
	CDF	95%	127.84	128.03	121.30	105	5.71	106.15	103.64		77.31	80.52	78.27	
	[Mbp s]	Mean	101.23	101.99	95.85	76	.03	77.27	73.88		48.42	52.11	49.49	
	DL:	5%	0.028	0.027	0.029	0.0	)37	0.037	0.037		0.075	0.063	0.058	
		50%	0.037	0.035	0.038	0.0	)74	0.072	0.073		0.248	0.171	0.177	
	CDF	95%	0.077	0.077	0.086	0.2	242	0.201	0.225		0.952	0.673	0.666	
	[s]	Mean	0.047	0.045	0.050	0.1	L18	0.103	0.104		0.405	0.297	0.291	
	UL:	5%	35.40	42.16	41.93	21	.17	24.96	24.77		8.38	11.57	10.79	
	UPT	50%	65.65	79.95	83.71	44	.07	55.15	57.67		24.12	31.89	31.97	
	CDF	95%	79.60	99.91	104.84	65	.65	81.00	85.76		46.12	58.91	59.88	
R1-1814019/Source 8	[Mbp s]	Mean	65.19	80.08	83.38	46	.55	57.61	60.54		28.02	36.02	36.42	
no	UL:	5%	0.044	0.036	0.034	0.0	)59	0.049	0.045		0.097	0.099	0.095	
S/6	Delay	50%	0.057	0.046	0.046	0.1	L46	0.105	0.109		0.334	0.271	0.334	
01	CDF	95%	0.105	0.090	0.090	0.4	198	0.325	0.316		1.991	1.301	1.538	
314	[s]	Mean	0.069	0.057	0.057	0.2	224	0.182	0.156		0.736	0.568	0.627	
17	Q	DL	100%	100%	100%	99	7%	99%	100%		96%	97%	97%	
L	Q	UL	100%	99%	99%	99	7%	98%	99%		90%	91%	91%	
		0	12%	11%	11%	35	5%	32%	32%		60%	56%	56%	
	j	1		0.5 f	ile/s			1.1 f	ile/s			1.5 f	ile/s	
			Additior	nal comr	ments:									
					p: NR-U indo	oor scen	ario,	50/50 D	L/UL traff	ics, singl	e NR-U o	perator, N	IR-U uses	15kHz,
				and 60kl										
				-	ons: ED three				•		-			
					Max modulat									
					mber of laye				-					
					smit power :									
					capability #									
			every 10	US, Sche	duling: prop	ortional	tair,	self-sche	duling. C	OI sharir	ng enable	d (gNB in	itiated CC	ו).
	L													

# Table B.1.1-3: Evaluation results for NR-U with using different SCS in a single NR-U indoor network deployment

	Repo				<u>load</u> WiFi in Fi with	NR-	BO rang	e for Wil	<u>m load</u> Fi in NR- ith	U+WiFi	BO rang	ge for Wil	<u>load</u> Fi in NR- ith	U+WiFi
Tdoc /Source	1.	neter S	NR-		l5 kHz S	CS:	NR-U uses 15 kHz SCS:			NR-U use 15 kHz SCS: above 55%				
		5			~25%				~50%	1				
loc			NR-U	NR-U	NR-U		NR-U	NR-U	NR-U		NR-U	NR-U	NR-U	
L T			with	with SCS =	with		with SCS =	with SCS =	with SCS =		with SCS =	with SCS =	with SCS =	
				30 kHz			15 kHz	30 kHz			15 kHz	30 kHz	60 kHz	
	DL:	5%	37.58	38.68	36.81		20.53	20.00	19.94		5.08	7.89	6.39	
	UPT	50%		93.88	86.31		54.62	52.63	49.33		22.27	25.86	21.70	
	CDF [Mbn	95%	120.41	121.31			84.76	81.61	75.09		46.45	50.51	45.51	
	[Mbp s]	Mean	90.67	93.20	86.40		57.59	56.18	51.94		26.33	30.32	26.51	
	DL:	5%	0.034	0.030	0.037		0.170	0.109	0.131		0.225	0.168	0.251	
	Delay	50%	0.219	0.099	0.219		1.020	1.210	1.221		2.326	1.758	1.761	
	CDF	95%	1.074	0.543	1.458		3.984	5.008	6.284		9.477	7.743	7.913	
	[s]	Mean	0.411	36.46	0.489		1.747	2.115	2.366		3.944	3.151	3.307	
	UL: UPT	5%	29.47	36.46	36.58		15.22	17.49	16.79		3.54	6.42	5.31	
		50%	55.38	71.12	72.63		33.00	39.70	38.75		12.06	18.15	16.83	
	CDF	95%	73.31	92.86	96.49		49.54	61.51	60.87		25.13	36.27	35.35	
ω	[Mbp s]	Mean	56.80	71.88	73.66		35.03	42.22	41.40		14.65	21.43	19.90	
Ce	UL: Delay	5%	0.048	0.039	0.040		0.126	0.074	0.087		0.146	0.117	0.171	
Inog		50%	0.304	0.112	0.151		1.019	1.573	1.020		2.030	1.903	1.835	
19/5	CDF	95%	1.438	0.970	1.389		5.895	7.188	8.400		13.762	10.763	12.443	
[40]	[s]	Mean	0.606	0.334	0.430		2.197	2.778	2.917		4.942	4.171	4.510	
R1-1814019/Source	$\varrho_1$	DL	98%	99%	98%		88%	88%	86%		72%	76%	74%	
R1-	Q	UL	97%	98%	97%		77%	77%	74%		48%	53%	52%	
	В	0	13%	10%	12%		37%	37%	40%		63%	58%	61%	
	j	1		0.25				0.38	file/s			0.48	file/s	
				nal com				50/50 1	<b>ST (TTT )</b>					
							r scenario				CW bac	k-off, MC	OT dura	ion
														nd Rx BF
												ith 20MF		
							A transmi	t power 1	8dBm, M	1MSE-IF	RC receiv	er. CW {r	nin,max}	
				,	15,1023	,	3 1 1 . 3		1	C2/024				
							aisabiea, s 14B hea					IPDU frai	me aggreg	gation,
												Iz, UE pr	ocessing	time
			capabili	ty #1, P	USCH m	apping	Type A, I	PDSCH	napping '	Type B, I	PDCCH r	nonitorin	g every 1	
			Schedul	ing: pro	portiona	l fair, se	elf-schedu	ıling, CO	T sharing	g enabled	(gNB in	itiated CO	DT).	

# Table B.1.1-4: Evaluation results for Wi-Fi and NRU coexistence using different SCS for NR-U in an indoor deployment

Table B.1.1-5 Evaluation results for 11ax and NR-U in 11ax+NR-U coexistence in indoor scenario. Two
cases are considered: (1) 11ax uses ED = -62dBm; and (2) 11ax uses ED=-72dBm.

	-													
				Low	<u>load</u>				<u>m load</u>				load	
	Repo	orted	BC	) range f	for NR-U	J in	BO rang	e for NR	-U in 11a	ax+NR-U	BO rang	ge for NR	-U in 11a	x+NR-U
	paran	neters	11ax+	NR-U v	vith 11az	c using	with 1	1ax using	g ED = -6	2dBm:	with 1	1ax using	g ED = -6	2dBm:
G	-		ED =	-62dB	m: 10% <sup>-</sup>	~25%	35%~50%			above 55%				
Tdoc /Source			11ax	11ax	NR-U	NR-U	11ax	11ax	NR-U	NR-U	11ax	11ax	NR-U	NR-U
/St			when	when	when11	when	when	when	when	when	when	when	when	when
loc			11ax	11ax	ax uses	11ax	11ax	11ax	11ax	11ax	11ax	11ax	11ax	11ax
10			uses	uses	ED =-	uses	uses ED	uses ED	uses ED	uses ED	uses ED	uses ED	uses ED	uses ED
			ED =	ED =	62dBm	ED =	=	=	=	=	=	=	=	=
			-62dB	-72dB		-72dBm	-62dBm	-72dBm	-62dBm	-72dBm	-62dBm	-72dBm	-62dBm	-72dBm
			m	m										
	DL:	5%	34.47	35.06	42.91	45.32	19.69	23.81	23.21	29.09	7.73	10.56	8.32	12.87
	UPT	50%	85.92	87.86	93.48	99.59	53.19	61.04	55.16	70.13	24.20	31.53	25.01	35.86
	CDF		108.87	111.00		125.69	81.96	88.03	88.96	104.38	53.36	58.99	54.62	70.73
		Mean	84.06	86.13	94.26	98.08	56.08	62.86	59.93	72.61	30.12	36.24	30.98	42.03
	s]													
	DL:	5%	0.034	0.032	0.030	0.029	0.088	0.086	0.113	0.047	0.169	0.159	0.195	0.093
	Delay		0.086	0.051	0.062	0.043	0.774	0.419	0.580	0.193	1.560	1.225	1.457	0.531
	CDF	95%	0.540	0.249	0.286	0.167	2.627	1.598	3.295	0.899	5.650	4.421	6.918	3.000
		Mean		0.104	0.127	0.080	1.204	0.681	1.300	0.373	2.444	1.892	2.814	1.142
	UL:	5%	34.98	38.18	42.16	45.55	18.40	23.38	19.11	25.10	5.92	8.10	5.71	8.30
	UPT	50%	78.76	83.02	86.16	91.22	46.82	53.78	46.47	57.49	21.21	25.80	17.15	24.02
	CDF		106.81	108.13		119.12	75.02	79.84	76.93	89.50	44.59	50.23	38.95	51.63
		Mean	80.39	83.09	88.30	91.26	49.89	56.25	51.03	61.10	25.10	29.54	21.52	29.51
e 8	s] UL:	5%	0.036	0.034	0.034	0.031	0.096	0.098	0.110	0.103	0.177	0.186	0.251	0.230
nrc	Delay		0.030	0.054	0.034	0.051	0.030	0.098	0.990	0.103	0.959	1.234	2.254	1.306
Sol	CDF	95%	0.092	0.000	0.520	0.002	3.540	1.903	4.595	2.210	6.068	5.078	9.311	6.682
/0		Mean	0.300	0.242	0.320	0.221	1.167	0.825	4.595	0.934	2.243	2.153	3.820	2.599
R1-1814020/ Source			99.7%	99.7%	99.8%	99.9%	94.4%	97.1%	93.2%	98.8%	86.8%	89.6%	82.2%	95.1%
81		DL	99.8%	99.9%	99.4%	99.8%	95.7%	96.9%	85%	94.7%	87.6%	88.5%	63.5%	81.6%
1-1-1		UL 0	10.1%	8.5%	10%	7.8%	33.6%	28%	35%	25.8%	57.8%	53.4%	60%	50.1%
×	-	λ	10.170		file/s	7.070	33.070		file/s	23.070	37.070		file/s	50.1%
			Additio					0.42	IIIe/S			0.55	IIIe/S	
						Lindoo	r scenario	50/50 1	JI/III tr	affice				
											CWbac	k-off, MC		tion
					-					1				
6ms, Max modulation: 256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx ar at BS/AP, Maximal number of layers: 2 for DL and 2 for UL, single carrier with 20MHz BW, B														
	transmit power 20dBm, UE/STA transmit power 18dBm, MMSE-IRC receiver. CW {min,max} DL{15,63} UL{15,1023}.													
							CTS disa	bled ED	/PD thre	shold -62	/-82dBm	or -72/-8	2dBm A	-MPDU
	<b>Wi-Fi 11ax assumptions:</b> RTS/CTS disabled, ED/PD threshold -62/-82dBm or -72/-82dBm, A-MPD frame aggregation, Wi-Fi guard interval 1.6us, UL OFDMA with 16us carrier sensing.									III D C				
												e capabil		ISCH
												Schedulii		
										ed (gNB			5 FF0	
			,						5	0				

	Repo	orted	ВО		<u>load</u> or Wi-Fi	i in	BC	<u>Mediu</u> D range f	<u>m load</u> or Wi-Fi	in	В	<u>High</u> O range f	<u>load</u> or Wi-Fi	in
	paran		Wil	Fi+WiFi	: 10%~2	25%	Wi	Fi+WiFi	: 35%~5	0%	Wi	iFi+WiFi:	above 5	5%
L a			Wi-Fi		Wi-Fi		Wi-Fi in WiFi+	NR-U in WiFi+	Wi-Fi in WiFi+		Wi-Fi in WiFi+	NR-U in WiFi+	Wi-Fi in WiFi+	NR-U in WiFi+
Tdoc /Source			in WiFi+	in WiFi+	in WiFi+	in WiFi+	NR-U	NR-U	NR-U	WiFi+ NR-U	NR-U	NR-U	NR-U	NR-U
/So			NR-U	NR-U	NR-U		with -82			with		with -82	with	with
loc			with	with	with	with	dBm	dBm		preambl	dBm	dBm		preambl
Ľ			-82	-82	*	*	EDT for			e for		EDT for	e for	e for
			dBm	dBm	le for	le for	NR-U	NR-U	NR-U	NR-U	NR-U	NR-U	NR-U	NR-U
			EDT	EDT	NR-U	NR-U								
			for NR-U	for NR-U										
ъ	DL:	5%				15.359				4.121				0.862
Irce	UPT	570	11.844	20.740	6.704	10.000	3.058	3.269	4.072	7,121	0.459	0.792	0.417	0.002
R1-1814074 / Source	CDF [Mbp		39.777	64.211	39.299		27.595	37.322	26.132	31.967	12.037	14.931	6.926	16.210
4074	s]			74.117		73.970	53.332	74.131	50.016	74.092	43.630	73.584	40.343	45.916
l-181		Mean	35.605	58.521	35.192	54.882	26.831	36.968	26.143	36.561	15.475	21.909	14.680	18.319
R	<b>DL:</b> Delay	5%	0.050	0.054	0.050	0.054	0.050	0.054	0.050	0.054	0.050	0.054	0.050	0.054
	CDF [s]	50%	0.052	0.056	0.051	0.057	0.100	0.093	0.094	0.110	0.231	0.227	0.371	0.273
	[9]	95%	0.200	0.196	0.319	0.179	3.260	0.925	1.321	0.900	3.837	1.757	4.572	1.541
		Mean	0.153	0.084	0.133	0.099	0.413	0.212	0.348	0.249	0.832	0.493	1.007	0.484
	UL: UPT	5%	8.691	24.543	2.276	23.232	1.364	5.109	4.791	4.106	0.264	1.971	0.193	3.017
	CDF [Mbp	50%	40.088	59.708	39.980	58.156	29.692	31.916	24.888	30.161	10.969	17.435	9.216	16.412
	s]	95%	53.620	73.467	53.514	73.455	54.812	73.199	42.643	73.054	43.156	56.293	40.145	51.652
			39.350	56.899	35.535	56.401		36.432	25.310	35.882	17.170	21.645	14.194	21.738
	UL: Delay	5%	0.050	0.054	0.050	0.054	0.050	0.054	0.050	0.054	0.050	0.055	0.050	0.055
	CDF [s]	50%	0.050	0.060	0.053	0.070	0.094	0.116	0.125	0.131	0.243	0.261	0.391	0.241
	[3]	95%	0.265	0.201	2.338	0.205	2.458	0.741	1.499	0.843	4.341	1.507	4.090	1.390
		Mean	0.089	0.088	0.270	0.091	0.459	0.198	0.364	0.251	0.928	0.430	1.112	0.415
	Qt	DL	0.992	0.992	0.99	1	0.959	0.973	0.993	0.976	0.906	0.967	0.910	0.905
	Qu	UL	0.987	0.996	1	0.995	0.962	0.956	0.975	0.942	0.888	0.915	0.86	0.921
	В	0	0.057	0.061	0.105	0.096	0.244	0.32	0.26	0.321	0.541	0.566	0.572	0.550
	)	1		0.	15			0.	22			0	.3	

## Table B.1.1-6: Wi-Fi/NR-U coexistence when NR-U uses -82 dBm EDT or NR-U enables preamble detection

Additional comments:
- 4ms for both Wi-Fi and NR-U
- No
- For Wi-Fi, PDT = -82 dBm, EDT = -62 dBm; for NR-U, if preamble is enabled PDT = -82
dBm and EDT = -72 dBm; for NR-U with -82 dBm EDT, preamble detection is not enabled
- 256 QAM for both Wi-Fi and NR-U
- NR-U with array radiation pattern according to TR38.802 and max BF gain of 5 dBi; omni-
directional for Wi-Fi
<ul> <li>MPDU size = 3250 bytes by default, 1ms per MPDU</li> </ul>
- 30 kHz
- 0.8 μs
- Capability #1
- Mapping type B in the starting slot of TxOP; per-symbol PDCCH monitoring for flexible
starting position
- No fast link adaptation utilizing multiple switching points within COT for NR-U
- Cross-carrier scheduling in UL

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			Low	load	Mediu	m load	High	n load
	Repo	orted	BO range fo	or Wi-Fi in	BO range f	or Wi-Fi in	BO range f	for Wi-Fi in
ILCE	paran		WiFi+WiFi:		WiFi+WiFi	: 35%~50%		: above 55%
Sol			NR-U in	NR-U in	NR-U in	NR-U in	NR-U in	NR-U in
C /			NR-U+	NR-U+	NR-U+	NR-U+	NR-U+	NR-U+
[] do	parameters		NR-U with -82	NR-U with	NR-U with	NR-U with	NR-U with	NR-U with
			dBm EDT for	preamble for	-82 dBm EDT	preamble for	-82 dBm EDT	preamble for
			NR-U	NR-U	for NR-U	NR-U	for NR-U	NR-U
	DL:	5%	7.381	7.145	7.594	5.92	2.152	0.838
	UPT	50%	64.293	64.227	42.450	41.796	26.792	19.590
	CDF		74.074	74.017	72.321	73.868	73.921	73.523
		Mean	55.454	55.155	41.821	40.578	30.035	25.640
	<u>s]</u>							
	DL:	5%	0.054	0.054	0.054	0.054	0.054	0.054
	Delay		0.056	0.055	0.113	0.118	0.160	0.197
	CDF	95%	0.300	0.277	0.441	0.679	1.233	1.266
		Mean	0.105	0.107	0.162	0.203	0.325	0.344
	UL:	5%	21.794	18.683	12.913	3.75	3.052	2.554
	UPT		55.064	55.591	41.878	41.489	30.016	19.780
	CDF		73.547	73.566	72.849	73.248	72.988	61.286
	[MDp s]	Mean	54.467	53.842	42.875	40.371	30.031	26.182
5	UL:	5%	0.054	0.054	0.054	0.054	0.054	0.054
ILCE	Delay	50%	0.067	0.064	0.085	0.106	0.165	0.164
Sol	CDF	95%	0.175	0.205	0.540	0.910	1.260	1.089
4	[s]	Mean	0.088	0.111	0.149	0.227	0.320	0.321
01	Q	DL	1	1	0.988	0.968	0.985	0.931
R1-1814074 / Source	Q		1	1	0.991	0.992	0.984	0.978
-12	B		0.075	0.081	0.199	0.252	0.395	0.51
R1	1	۱	0.1	15	0.	22	0	.3
			Additional com	iments:	•		•	
			- 4ms					
			- No					
								lBm; for NR-U
					eamble detection	on is not enabl	ed	
			•	M for NR-U				
				ith array radia	tion pattern acc	cording to TR3	88.802 and max	BF gain of 5
			dBi					
			- 30 kHz					
			- Capabili					
						TXOP; per-sy	mbol PDCCH	monitoring for
				starting position		-1		
						ipie switching	points within C	UI for NR-U
			- Cross-ca	arrier scheduli	ng in UL			

## Table B.1.1-7: NR-U/NR-U coexistence when NR-U uses -82 dBm EDT or NR-U enables preamble detection

					D = -82dbm			
	Reno	orted		1	<u>=-82dbm</u>			
	-	neters	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in		
	Purun	letero	WiFi+	WiFi+	WiFi+	NR-U+		
		1	WiFi	NR-U	NR-U	NR-U		
	DL:	5%	16.54	18.31	22.78	23.7		
	UPT	50%	55.92	62.74	60.73	70.72		
	CDF	95%	100.97	101.1	96.67	99.12		
	[Mbps]	Mean	58.21	62.87	62.37	68.40		
	DL:	5%	0.04	0.04	0.04	0.04		
	Delay	50%	0.07	0.06	0.07	0.06		
	CDF	95%	0.24	0.22	0.17	0.17		
	[s]	Mean	0.1	0.09	0.08	0.07		
	UL:	5%	13.05	15.91	11.96	17.21		
	UPT	50%	49.55	54.82	37.97	52.34		
	CDF	95%	90.84	91.08	76.75	84.96		
	[Mbps]	Mean	52.10	55.44	42.26	53.95		
	UL:	5%	0.04	0.04	0.05	0.05		
	Delay	50%	0.08	0.07	0.1	0.08		
e 4	CDF	95%	0.3	0.25	0.33	0.23		
R-1814085(Source 4)	[s]	Mean	0.12	0.1	0.14	0.1		
Sol	Q	DL	99.80%	99.71%	99.87%	99.88%		
85(	Q	JL	99.67%	99.72%	99.63%	99.68%		
40	В	0	23%	25%	20%			
181	j	1	23% 21% 25% 20% 0.3 files/s					
±			Additional	comments:				
				assumption				
				antenna at	UE/STA, clo	ose loop		
				ngle stream				
				mption: 8m				
				56 QAM LD				
				processing ti PDSCH, typ				
				issumption:				
				disabled for				
		on L-SIG; PD=-82dBm/ED=82dBm EDCA; 256 QAM BCC; A-MPDU, 1500B						
		MSDU + 14 B header; Immediate						
		ACK,78.125kHz SCS GI= 0.8us, HE MU						
				DL and HE T				
1								

#### Table B.1.1-8: coexistence results of 11ax and NRU in indoor scenario of scheme 1

		<u>11ax PD=ED= = 72dbm</u> <u>NRU ED=-72dbm</u>						
	eported	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in			
pa	rameters	WiFi+	WiFi+	WiFi+	NR-U+			
		WiFi	NR-U	NR-U	NR-U			
DL:	5%	14.76	18.62	29.88	30.67			
UPT	50%	67.54	72.49	78.04	83.06			
CDF	95%	101.74	101.66	96.79	99.24			
[Mbps	] Mean	65.34	68.89	72.01	75.01			
DL:	5%	0.04	0.04	0.04	0.04			
Delay	50%	0.06	0.06	0.05	0.05			
CDF	95%	0.26	0.21	0.13	0.13			
[s]	Mean	0.11	0.08	0.07	0.06			
UL:	5%	12.77	19.28	18.3	24.58			
UPT	50%	65.55	68.14	54.13	67.12			
CDF	95%	91.73	91.69	76.83	85.02			
[Mbps		60.35	63.39	53.12	62.43			
UL:	5%	0.04	0.04	0.05	0.05			
Delay	50%	0.06	0.06	0.07	0.06			
CDF	95%	0.3	0.21	0.22	0.16			
<b>2</b> [s]	Mean	0.11	0.08	0.09	0.08			
no	$\varrho_{ m DL}$	99.61%	99.73%	99.86%	99.89%			
2(6	$arrho_{ ext{UL}}$	99.68%	99.80%	99.73%	99.74%			
R-1814085(Source 4)	BO	22%	19%	20%	17%			
81	λ	0.3 files/s						
R-1			comments:					
			assumption					
			antenna at	UE/STA, clo	ose loop			
			ngle stream	MOOT -				
			mption: 8n					
			56 QAM LD					
			processing t					
			PDSCH, ty					
		<b>802.11ax assumption:</b> 4ms TXOP; RTS/CTS disabled for WiFi, NAV set based						
			PD=-72dBr	,				
		· · · ·						
	EDCA; 256 QAM BCC; A-MPDU, 1500B MSDU + 14 B header; Immediate							
		ACK,78.125kHz SCS GI= 0.8us, HE MU						
		ACK, 78.125kHz SCS GI= 0.8us, HE MU PPDU in DL and HE TB PPDU in UL.						

#### Table B.1.1-9: coexistence results of 11ax and NRU in indoor scenario of scheme 2

					D- COdhm				
				11ax PD=E	<u> - 62dbm</u>				
	Reported p	arameters	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in			
	Reported p	arameters	WiFi+	WiFi+	WiFi+	NR-U+			
			WiFi	NR-U	NR-U	NR-U			
	DL:	5%	9.13	18.86	30.89	32.71			
	UPT	50%	69.11	74.88	81.65	86.55			
	CDF	95%	101.84	102.03	96.84	99.23			
	[Mbps]	Mean	65.66	70.40	74.14	76.87			
	DL:	5%	0.04	0.04	0.04	0.04			
	Delay	50%	0.06	0.05	0.05	0.05			
	CDF	95%	0.00	0.21	0.13	0.12			
	[s]	Mean	0.13	0.08	0.06	0.06			
	UL:	5%	9.85	19.31	23.09	28.83			
	UPT	50%	68.81	75.71	65.13	76.65			
	CDF	95%	91.8	91.86	76.85	85.04			
	[Mbps]	Mean	61.88	66.62	58.40	66.81			
	UL:	5%	0.04	0.04	0.05	0.05			
	Delay	50%	0.06	0.05	0.06	0.05			
e 4	CDF	95%	0.4	0.2	0.17	0.14			
linc	[s]	Mean	0.13	0.08	0.08	0.07			
Sol	QI	DL	99.52%	99.67%	99.79%	99.88%			
R-1814085(Source 4)	Qu	JL	99.64%	99.67%	99.78%	99.77%			
64	B		24% 18% 18% 16%						
181	λ	ŀ	0.3 files/s						
<b>–</b>			Additional comments:						
			Common assumption: 4 antenna at						
			gNB/AP, 2 antenna at UE/STA, close loop						
			BF with single stream						
			NRU assumption: 8ms MCOT; ED=-						
				56 QAM LD					
				processing ti					
				PDSCH, typ					
			<b>802.11ax assumption:</b> 4ms TXOP;						
			RTS/CTS disabled for WiFi, NAV set based						
			on L-SIG; PD=-62dBm/ED=62dBm						
			EDCA; 256 QAM BCC; A-MPDU, 1500B MSDU + 14 B beader: Immediate						
			MSDU + 14 B header; Immediate ACK,78.125kHz SCS GI= 0.8us, HE MU						
			· · · · ·	DL and HE T	· · · ·				
						01.			

#### Table B.1.1-10: coexistence results of 11ax and NRU in indoor scenario of scheme 3

				<u>x PD=-82db</u>				
	_			<u>U PD=-82db</u>				
	Repo		Wi-Fi in	Wi-Fi in	NR-U in	NR-U in		
	param	ieters	WiFi+	WiFi+	WiFi+	NR-U+		
			WiFi	NR-U	NR-U	NR-U		
	DL:	5%	14.9	17.69	30.39	23.7		
	UPT	50%	57.96	68.55	78.15	70.72		
	CDF	95%	101.19	101.79	96.79	99.12		
	[Mbps]	Mean	59.46	66.85	72.52	68.40		
	DL:	5%	0.04	0.04	0.04	0.04		
	Delay	50%	0.07	0.06	0.05	0.06		
	CDF	95%	0.27	0.22	0.13	0.17		
	[s]	Mean	0.1	0.08	0.06	0.07		
	UL:	5%	14	18.79	22.73	17.21		
	UPT	50%	53.98	65.81	61.76	52.34		
	CDF	95%	91.19	91.74	76.83	84.96		
	[Mbps]	Mean	55.32	62.56	57.11	53.95		
	UL:	5%	0.04	0.04	0.05	0.05		
	Delay	50%	0.07	0.06	0.06	0.08		
(4)	CDF	95%	0.28	0.21	0.17	0.23		
Ce	[s]	Mean	0.11	0.09	0.08	0.1		
R-1814085(Source 4)	$Q_{\rm I}$	DL	99.83%	99.89%	99.99%	99.88%		
(Sc	Qt	JL	99.69%	99.86%	99.78%	99.68%		
<b>)</b> 85	В		23% 19% 18% 20%					
14(	2		0.3 files/s					
-18			Additional comments: <b>Common assumption:</b> 4 antenna at					
R								
				antenna at l	UE/STA, clo	se loop		
				ngle stream		_		
				mption: 8m				
				D=-62dBm;				
				NCP; UE pro				
				#1; NR type	B for PDSC	.H, type A		
			for PUSCH		Ame TYOD			
				ssumption:				
			RTS/CTS disabled for WiFi, NAV set based					
			on L-SIG; PD=-82dBm/ED=62dBm					
			EDCA; 256 QAM BCC; A-MPDU, 1500B					
			MSDU + 14 B header; Immediate ACK,78.125kHz SCS GI= 0.8us, HE MU					
			· · ·	25kHZ SCS DL and HE T	,			

#### Table B.1.1-11: coexistence results of 11ax and NRU in indoor scenario of scheme 4

			<u>11ax:</u>	ED = -62d	<u>bm, PD=-8</u>	2dbm
				<u>NRU: ED</u>	<u> = -72dbm</u>	
	Repo	rted	Wi-Fi	Wi-Fi	NR-U	NR-U
	param	eters	in	in	in	in
			WiFi+	WiFi+	WiFi+	NR-U+
			WiFi	NR-U	NR-U	NR-U
	DL:	5%	14.9	18.99	28.05	30.67
	UPT	50%	57.96	70.27	76.15	83.06
	CDF	95%	101.19	101.89	96.8	99.24
	[Mbps]	Mean	59.46	68.03	70.85	75.01
	DL:	5%	0.04	0.04	0.04	0.04
	Delay	50%	0.07	0.06	0.05	0.05
	CDF	95%	0.27	0.21	0.14	0.13
	[s]	Mean	0.1	0.08	0.07	0.06
	UL:	5%	14	19.78	17.78	24.58
	UPT	50%	53.98	66.55	53.6	67.12
	CDF	95%	91.19	91.39	76.83	85.02
	[Mbps]	Mean	55.32	62.89	52.62	62.43
	UL:	5%	0.04	0.04	0.05	0.05
	Delay	50%	0.07	0.06	0.07	0.06
	CDF	95%	0.28	0.2	0.23	0.16
R-1814085(Source 4)	[s]	Mean	0.11	0.09	0.1	0.08
rce	$Q_{\Gamma}$	L	99.83%	99.68%	99.85%	99.89%
jou	$\varrho_{0}$	L	99.69%	99.72%	99.62%	99.74%
5(5	B	C	23%	19%	20%	17%
108	λ			0.3 f	iles/s	
812			Additiona	l comment	s:	
-1			Common	assumptio	n: 4 anteni	na at
				2 antenna a		close
				vith single s		
				umption: 8		
				256 QAM L		
				processing		
				B for PDSC	H, type A f	or
			PUSCH			<b>О</b> Л.
				assumptio disabled fo		
				L-SIG; PD		
				DCA; 256		
				500B MSE	•	
				e ACK,78.1		
				MU PPDU		
			PPDU in		<u></u>	

#### Table B.1.1-12: coexistence results of 11ax and NRU in indoor scenario of scheme 5

			<u>11ax</u>	<u>: ED = -72d</u>		<u>dbm</u>		
	Repo	orted			<u>= -72dbm</u>	NID LL		
	paran		Wi-Fi in	Wi-Fi in	NR-U in	NR-U in		
			WiFi+	WiFi+	WiFi+	NR-U+		
	DL:	5%	WiFi 15.82	NR-U 18.64	NR-U 29.8	NR-U 30.67		
	UPT	50%	57.3	68.45	77.53	83.06		
	CDF	95%	100.87	101.7	96.86	99.24		
	[Mbps]	Mean	59.38	66.68	71.81	75.01		
	DL:	5%	0.04	0.04	0.04	0.04		
	Delay	50%	0.07	0.04	0.04	0.04		
	CDF	95%	0.25	0.00	0.03	0.13		
	[s]	Mean	0.1	0.08	0.07	0.06		
	UL:	5%	13.02	18	18.16	24.58		
	UPT	50%	52.69	59.95	54.28	67.12		
	CDF	95%	91.05	91.69	76.83	85.02		
	[Mbps]	Mean	54.07	59.82	52.86	62.43		
	UL:	5%	0.04	0.04	0.05	0.05		
	Delay	50%	0.08	0.07	0.07	0.06		
	CDF	95%	0.31	0.22	0.22	0.16		
	[s]	Mean	0.11	0.09	0.09	0.08		
	$Q_{I}$	DL	99.77%	99.60%	99.86%	99.89%		
4)	Qu	JL	99.68%	99.70%	99.65%	99.74%		
rce	В		23%	19%	20%	17%		
Sou	)	l			iles/s			
35(9			Additional	comments:				
R-1814085(Source 4)			Common assumption: 4 antenna at					
R-18			gNB/AP, 2 antenna at UE/STA, close loop					
			BF with single stream <b>NRU assumption:</b> 8ms MCOT; ED=-					
			NRU assu	mption: 8m	s MCOT; E	D=-		
			72dBm; 25	56 QAM LD	PC; 60 kHz	SCS		
			NCP; UE J	processing ti	me capabilit	y #1; NR		
				PDSCH, typ assumption:				
			RTS/CTS	disabled for	WiFi, NAV	set based		
			on L-SIG;	PD=-82dBn	n/ED=72d	Bm		
			EDCA; 25	6 QAM BC	C; A-MPDU	, 1500B		
			MSDU + 14 B header; Immediate					
			ACK,78.125kHz SCS GI= 0.8us, HE MU					
			PPDU in I	DL and HE T	B PPDU in	UL.		

#### Table B1.1-13: coexistence results of 11ax and NRU in indoor scenario of scheme 6

			<u>11ax</u>	<u>:: ED = -62d</u>		<u>dbm</u>				
	Repo	orted		<u>NRU: ED</u>						
	paran		Wi-Fi in	Wi-Fi in	NR-U in	NR-U in				
	P		WiFi+	WiFi+	WiFi+	NR-U+				
		= 0 (	WiFi	NR-U	NR-U	NR-U				
	DL:	5%	14.9	17.72	30.29	32.71				
	UPT	50%	57.96	69.19	80.72	86.55				
	CDF	95%	101.19	101.81	96.87	99.23				
	[Mbps]	Mean	59.46	67.08	73.72	76.87				
	DL:	5%	0.04	0.04	0.04	0.04				
	Delay	50%	0.07 0.27	0.06	0.05	0.05 0.12				
	CDF <u>95%</u> [s] Mean		0.27	0.23	0.15	0.12				
		5%	14	18.74	23.44	28.83				
	UL: UPT	50%	53.98	66.53	64.89	76.65				
	CDF	95%	91.19	91.8	76.85	85.04				
	[Mbps]	Mean	55.33	62.82	58.26	66.81				
	UL:	5%	0.04	02.02	0.05	0.05				
	Delay	50%	0.04	0.04	0.06	0.05				
	CDF	95%	0.28	0.00	0.00	0.14				
	[s]	Mean	0.11	0.09	0.08	0.07				
	Q_1		99.83%	99.85%	99.87%	99.88%				
<del>(</del>	Qu		99.69%	99.70%	99.72%	99.77%				
ė		0	23%	16%						
Inc	7	l		<b>0.3</b> f	iles/s					
<u>S</u>			Additional	comments:						
R-1814085(Source 4)			Common	assumption	: 4 antenna a	at				
R-18			gNB/AP, 2	antenna at l	UE/STA, clo	se loop				
				ngle stream <b>mption:</b> 8m	s MCOT; E	D=-				
			62dBm; 25	56 QAM LD	PC; 60 kHz	SCS				
			NCP; UE I	processing ti	me capabilit	y #1; NR				
			type B for PDSCH, type A for PUSCH <b>802.11ax assumption:</b> 4ms TXOP;							
		RTS/CTS disabled for WiFi, NAV set based								
			on L-SIG; PD=-82dBm/ED=62dBm							
			EDCA; 256 QAM BCC; A-MPDU, 1500B							
			MSDU + 14 B header; Immediate							
			ACK,78.125kHz SCS GI= 0.8us, HE MU							
			PPDU in DL and HE TB PPDU in UL.							

#### Table B.1.1-14: coexistence results of 11ax and NRU in indoor scenario of scheme 7

# B.1.2 Wi-Fi and NR-U coexistence evaluation with 20MHz and mixed traffic

Tdoc /	Repoi	rted	BO ra	Low load	-Fi in		edium load nge for Wi-			<u>High load</u> 1ge for Wi-	-Fi in		
Source	parame			-WiFi: 10%			WiFi: 35%			WiFi: abov			
	•		Wi-Fi in	Wi-Fi in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in		
			WiFi+	WiFi+	WiFi+	WiFi+	WiFi+	WiFi+	WiFi+	WiFi+	WiFi+		
			WiFi	NR-U	NR-U	WiFi	NR-U	NR-U	WiFi	NR-U	NR-U		
	DL:	5%	11.845	17.576	10.459	1.504	11.294	6.872	0.392	8.180	4.933		
	UPT	50%	48.261	52.692	56.665	30.353	46.675	50.226	14.451	43.011	44.292		
	CDF	95%	61.006	61.163	70.429	56.713	59.760	67.631	50.558	57.934	65.325		
	[Mbps]	Mean	44.053	48.2196	50.420	30.1075	42.783	44.870	18.945	39.168	40.457		
	DL:	5%	0.069	0.069	0.060	0.076	0.070	0.063	0.094	0.074	0.067		
	Delay	50%	0.095	0.083	0.082	0.253	0.104	0.116	1.558	0.129	0.165		
	CDF	95%	1.615	0.442	8.361	18.513	0.782	9.628	37.181	1.296	9.323		
	[s]	Mean	0.559	0.211	2.812	3.816	0.321	2.866	7.723	0.434	3.028		
	UL:	5%	4.112	15.514	0.224	0.057	10.791	0.787	0.003	4.825	0.027		
	UPT CDF	50%	45.472	49.085	40.040	31.349	44.644	32.840	13.472	40.906	24.945		
	[Mbps]	95%	60.703	61.251	57.964	55.631	59.234	54.085	49.442	57.907	50.253		
		Mean	41.35	46.203	35.636	29.192	41.656	29.668	18.145	38.301	24.805		
	UL: Delay	5% 50%	0.069 0.106	0.068	0.072	0.079 0.272	0.071	0.080	0.099	0.074	0.089		
	CDF	95%	7.043	0.090 0.655	43.810	52.377	0.117	0.215		0.143 6.593	0.406 86.192		
	[s]	95% Mean	7.396	7.060	43.810 10.243	11.316	2.011 7.205	30.033 8.287	110.253 15.990	7.411	12.311		
	VoIP ou		0.06	0.01	10.245	0.2	0.01	0.20/	0.39	0.025	12.311		
5	VolP of		0.00	0.01		0.2	0.01		0.39	0.025			
RCE	outage	(DL)											
R1-1812556 / SOURCE	VoI outage		0.05	0.01		0.2	0.01		0.39	0.025			
9 / 3	Q DI		1.00	1.00	0.98	0.96	1.00	0.98	0.90	1.00	0.97		
550	Qui		0.96	0.97	0.92	0.91	0.96	0.90	0.82	0.96	0.87		
812	BC	1	0.17	0.19	0.32	0.38	0.25	0.44	0.61	0.30	0.54		
1-1	λ			0.06			0.11			0.14			
2			Additional	comments	:								
			- TxOP ass NR-U tran		f WiFi and	NR-U: Up	to 4 msec	TxOP for t	oth DL/UL	. Wi-Fi and	DL/UL		
				TS enabled	for WiFi:	No							
						For Wi-Fi,	-82/62 dBr	n PD/ED t	hreshold an	d for NR-U	J, -72		
			dBm ED tl	nreshold	-								
	- Max modulation order supported in each technology: 64 QAM for both Wi-Fi and NR-U												
			- MIMO scheme and number of MIMO layers used for both technologies: 1Tx2Rx antenna										
				ion for both			1		. 000.1	4			
			- WiFi MAC layer A-MPDU/A-MSDU aggregation level, MPDU size: 802.11ac - NR-U SCS: 15 kHz										
					0.0 μερε								
	- WiFi guard interval: 0.8 μsec - NR UE processing time capability (#1 or #2): Processing time capability #1												
			- NR PDSCH/PUSCH mapping type, PDCCH monitoring configuration: For PDSCH, PDSCH										
			mapping type A and B (with 7 symbols), for PUSCH, PUSCH mapping type A with 14 symbols,										
			for PDCCH, PDCCH monitoring every 7 symbols										
			- Link adaptation assumptions: For Wi-Fi, open loop rate adaptation, for NR-U, realistic closed										
			loop link adaptation										
			- Cross-ca	rrier schedu	ling for NI	R-U							

#### Table B.1.2-1: Wi-Fi and NR-U coexistence evaluation with 20MHz and mixed traffic

Tdoc/ Source	_	orted neters		]	30 range		<u>h load :</u> 1 Wi-Fi+Wi-	-Fi: above !	55%			
			base			uration 1	Configu		1	uration 3		
			Wi-Fi	Wi- Fi	Wi-Fi	NR-U	Wi-Fi	NR-U	Wi-Fi	NR-U		
	DL:	5%	5.49	6.15	3.12	9.15	6.75	12.98	7.55	21.21		
	UPT	50%	43.18	45.81	37.95	47.11	42.06	48.27	48.36	60.21		
	CDF	95%	94.95	93.69	94.57	116.18	92.26	112.36	96.47	125.65		
	(Mb ps)	Mea n	49.41	50.15	43.02	57.52	51.01	59.94	57.02	77.07		
	DL:	5%	0.05	0.06	0.06	0.02	0.05	0.03	0.04	0.02		
	Late	50%	0.72	0.81	0.82	0.63	0.71	0.60	0.61	0.55		
	ncy	95%	1.35	1.13	1.74	1.16	1.13	1.04	0.78	0.64		
	CDF (s)	Mea n	0.76	0.72	0.89	0.64	0.74	0.61	0.62	0.50		
	UL:	5%	4.06	4.01	2.14	6.61	4.62	8.09	6.65	12.38		
	UPT	50%	42.43	42.27	25.43	36.01	37.17	35.46	42.74	44.85		
	CDF (Mb	95%	106.4 5	109.8 0	94.42	95.95	94.10	90.43	92.41	87.24		
	ps)	Mea n	50.54	50.99	34.09	42.26	45.00	43.23	51.67	52.72		
•	UL:	5%	0.04	0.04	0.05	0.04	0.05	0.03	0.04	0.02		
Ce (C	Late	50%	0.70	0.70	0.95	0.90	0.75	0.92	0.66	0.70		
unc	ncy	95%	1.61	1.69	2.35	1.21	1.51	1.27	1.54	1.32		
R1-1811460/ Source 9	CDF (s)	Mea n	0.76	0.75	0.97	0.86	0.86	0.87	0.72	0.69		
114	VoIP	outage	9.09	NA	31.18	NA	27.27	NA	18.18	NA		
-18		DL)	0.97	0.97	0.95	0.97	0.97	0.97	0.98	0.99		
R1.		UL)	0.97	0.97	0.94	0.96	0.96	0.95	0.98	0.98		
	В	0	0.56	0.57	0.67	0.58	0.59	0.51	0.48	0.43		
		λ					0.81					
			omments							T sharing		
							dependent ( 02.11ac. Oi					
							sion. Short					
							ciprocity, M					
									· <b>r</b> · · · ·			
		ured and target error, spatial probing and Null Data Packets. <b>nsed Assisted NR-U</b> : UL always transmitted within a shared COT won by the gNB. Th						gNB. The				
	gNB (	B COT won with CAT4 LBT and UL transmissions occur within 16us of the preceding DL										
			n. DRS transmitted with CAT4 LBT with the access priority of Voice.									
		0	<b>ration 1:</b> NR-U LBT is ED-only with ED = -72dBm and no LBT in the 16us gap									
			nsmission within the gNB COT. <b>n 2</b> : NR-ULBT is ED-only with ED = -72dBm and fixed duration LBT with EE									
					is ED-only with ED = -72dBm and fixed duration LBT with ED ore UL transmission within the gNB COT.							
							Sm and PD =		and fixed a	duration		
							ransmission					
							and 8ms fo					
		L/UL for										

#### Table B.1.2-2: Wi-Fi and NR-U coexistence evaluation with 20MHz and mixed traffic

## B.2 Evaluation results for sub7GHz outdoor scenario 1

### B.2.1 Wi-Fi and NR-U coexistence evaluation with 20MHz and FTP traffic

Repo	orted			load		<u>Medium load</u> BO range for Wi-Fi in				High load BO range for Wi-Fi in			
aparan sparan sunos/cop L	neters		) range f										
1 10			Fi+WiFi				iFi+WiFi					above 55	
e/s		Wi-Fi		NR-U								NR-U in	
मु		in	in	in	in NR-	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	in NR-
		WiFi+		WiFi+	U+	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	U+
	=0(	WiFi	NR-U	NR-U	NR-U			1 - 00	10.04	0.00	2.00	0.00	NR-U
		12.65	16.99	27.10	26.11	1.14	8.09	15.33	18.34	0.06	3.89	8.83	13.68
	-	45.79	55.25	78.00	76.88	18.42	40.32	56.81	60.68	10.22	31.13	40.25	50.70
CD]		77.19	77.55	100.88	100.91	68.22	77.05	100.26	100.48	53.68	75.15	98.67	100.18
	os Mean	46.02	52.38	72.04	71.35	24.58	41.90	58.17	61.38	16.28	33.91	46.59	54.64
DL	: 5%	0.05	0.05	0.04	0.04	0.06	0.05	0.04	0.04	0.07	0.05	0.04	0.04
Dela	y 50%	0.09	0.07	0.05	0.05	0.21	0.10	0.07	0.07	0.35	0.13	0.10	0.08
CDI	F 95%	0.31	0.23	0.15	0.15	2.45	0.48	0.26	0.22	5.44	0.93	0.44	0.29
[s]	Mean	0.13	0.10	0.07	0.07	0.59	0.16	0.10	0.09	1.04	0.28	0.15	0.11
UL	: 5%	9.82	15.94	20.73	22.60	0.13	6.04	11.24	15.23	0.00	2.27	5.13	10.83
UP		53.34	61.85	64.43	67.16	21.97	49.45	44.78	51.61	10.85	37.78	32.18	44.13
CDI		78.72	78.94	83.22	83.27	74.24	78.63	82.95	83.10	65.55	78.07	82.45	82.91
¶Mbj   ¥ ]	os Mean	50.04	56.20	59.64	61.19	27.91	46.73	47.22	52.26	19.15	38.77	37.81	46.70
	: 5%	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05
.;{Dela	v 50%	0.07	0.06	0.06	0.06	0.17	0.08	0.09	0.08	0.30	0.10	0.12	0.09
	F 95%	0.39	0.25	0.19	0.18	5.07	0.63	0.35	0.26	8.00	1.51	0.70	0.36
$\left  \frac{1}{2} \right $ [s]	Mean	0.13	0.10	0.08	0.08	0.83	0.19	0.13	0.11	1.39	0.38	0.22	0.13
R1-181 [s] [s]	$Q_{\rm DL}$	100.0 %	100.0%	100.0%	100.0%	99.6%	100.0%	100.0%	100.0%	98.0%	99.9%	100.0%	100.0%
1 1	$arrho_{ m UL}$	100.0 %	100.0%	100.0%	100.0%	97.8%	100.0%	100.0%	100.0%	94.1%	99.6%	100.0%	100.0%
	BO		10.7%	8.5%	8.3%	48.4%	21.0%	15.3%	13.5%	66.6%	33.5%	23.7%	17.7%
	λ			13			0.				0.1		
		Additio	onal com	ments:									
		NRU a	ssumpti	ion: 8ms	5 MCOT	; ED=-7		56 QAM	LDPC; 3			ith single UE proce	
		802	.11ac as	sumptio	<b>on:</b> 4ms	TXOP; F	RTS/CTS	disabled	for WiFi	, NAV set	t based or	ı L-SIG;	PD=-
												der; Imm	
						ACI	K,312.5kl	Hz SCS (	GI= 0.8us				
DL	: 5%	12.65	17.18	28.67	31.65	1.14	9.73	17.90	25.19	0.06	4.72	10.28	20.36
	50%	45.	56.78	85.04	87.18	18.42	41.94	61.98	73.61	10.22	32.83	46.49	65.43
\$CDI	F 95%		77.77	105.64	105.64	68.22	77.20	105.38	105.53	53.68	76.06	104.41	105.45
[/[Mbj   8	os Mean	46.02	53.63	77.18	79.34	24.58	43.43	63.36	71.22	16.28	35.91	52.18	66.05
10 <u>81</u> 108	: 5%	0.05	0.05	0.04	0.04	0.06	0.05	0.04	0.04	0.07	0.05	0.04	0.04
<u>T</u> Dela	y 50%	0.09	0.07	0.05	0.05	0.21	0.10	0.06	0.05	0.35	0.12	0.09	0.06
		0.31	0.23	0.14	0.13	2.45	0.41	0.22	0.16	5.44	0.80	0.37	0.19
[s]		0.13	0.10	0.06	0.06	0.59	0.14	0.09	0.07	1.04	0.25	0.13	0.08
UL	: 5%	9.82	16.08	25.53	29.25	0.13	7.83	14.05	21.25	0.00	2.83	7.07	17.86
UPT	50%	53.34	63.65	76.09	80.89	21.97	50.69	53.75	65.80	10.85	39.49	40.01	58.05
CD		78.72	79.01	93.43	93.45	74.24	78.65	93.29	93.39	65.55	78.36	93.06	93.33
[Mb]	os Mean			68.73	71.52	27.91	47.94	55.80	63.71	19.15	40.20	45.24	58.95

Report	ed		Low	load			Mediu	m load			High	load	
gparame		BC	) range f		i in	B	D range f		in	BO	) range fo		n
H			Fi+WiFi				iFi+WiFi				Fi+WiFi:		
Tdoc/Sour		Wi-Fi	1	NR-U	NR-U						Wi-Fi in		
9C/		in	in	in	in NR-	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	in NR-
Τđ		WiFi+	WiFi+	WiFi+	U+	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	U+
-		WiFi	NR-U	NR-U	NR-U	**11 1				****			NR-U
UL:	5%	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.06	0.05	0.04	0.04
Delay		0.07	0.06	0.05	0.05	0.17	0.08	0.07	0.06	0.30	0.10	0.10	0.07
CDF	95%	0.39	0.25	0.16	0.14	5.07	0.50	0.28	0.19	8.00	1.24	0.54	0.22
	Mean	0.13	0.09	0.07	0.07	0.83	0.16	0.11	0.08	1.39	0.34	0.17	0.09
QI		100.0 %	100.0%				100.0%		100.0%	98.0%	100.0%	100.0%	
Qι	UL	100.0 %	100.0%	100.0%	100.0%	97.8%	100.0%	100.0%	100.0%	94.1%	99.8%	100.0%	100.0%
B	0	13.5%	10.4%	7.6%	7.1%	48.4%	19.4%	13.3%	10.9%	66.6%	31.4%	20.5%	13.5%
λ				13			0.	17			0.1	19	
			onal com										
											op BF wi		
		NRU a	ssumpti	ion: 8m	s MCOT	; ED=-7	2dBm; 2	56 QAM	LDPC; 6	0 kHz SO	CS NCP;	UE proce	ssing
		time ca	nahility	#1· NR	tvne B f	or PDSC	H, type A	A for PUS	SCH				
										AV set ha	sed on L-	SIG: PD:	=_
				-									
		82dBm	/ED=-62	2dBm E	DCA: 25	56 OAM	$BCC \cdot A$	MDDII	1500R M	SDII + 1	$4 \mathrm{~R}$ head	ar• Immor	linto
			-		,	50 Q	DCC, 11	WIFDU,	13000 101	500 1	+ D licuu	, minico	liate
		ACK,3				-	DCC, 11	WIT DO,	13000 101	500 . 1	- D liculu	er, miniet	IIdle
		ACK,3	12.5kHz			-	D00, 11	wir DO,	13000 101		+ D licud	er, miniet	liate
DL:	5%	ACK,3 22.15				-	13.69	39.89	73.09	1.48	1.96	25.17	67.11
DL:			12.5kHz	z SCS G	I= 0.8us 80.74								
SCDF	5% 50% 95%	22.15	12.5kHz 26.85 69.04	2 SCS G 65.59	I= 0.8us 80.74 139.14	10.8	13.69	39.89	73.09	1.48	1.96	25.17	67.11
UPT SCDF	5% 50% 95%	22.15 58.38	12.5kHz 26.85 69.04	2 SCS G 65.59 119.83	I= 0.8us 80.74 139.14	10.8 42.64	13.69 53.74	39.89 97.39	73.09 132.23	1.48 28.99	1.96 34.27	25.17 69.27	67.11 123.92
UPT SCDF	5% 50% 95% Mean	22.15 58.38 92.06 57.8	12.5kHz 26.85 69.04 100.73 67.65	2 SCS G 65.59 119.83 146.38	I= 0.8us 80.74 139.14 159.23 133.23	10.8 42.64	13.69 53.74	39.89 97.39	73.09 132.23 155.23 126.75	1.48 28.99	1.96 34.27	25.17 69.27	67.11 123.92
MUPT SCDF Mbps 00 1 01 01 01 01 01	5% 50% 95% Mean 5%	22.15 58.38 92.06 57.8 0.03	12.5kHz 26.85 69.04 100.73	2 SCS G 65.59 119.83 146.38	I= 0.8us 80.74 139.14 159.23	10.8 42.64 71.86	13.69 53.74 86.45	39.89 97.39 135.37	73.09 132.23 155.23	1.48 28.99 55.1	1.96 34.27 66.48	25.17 69.27 113.51	67.11 123.92 149.93
MUPT CDF (Mbps ) <b>DL:</b> TDelay	5% 50% 95% Mean 5%	22.15 58.38 92.06 57.8	12.5kHz 26.85 69.04 100.73 67.65	2 SCS G 65.59 119.83 146.38 115.46	I= 0.8us 80.74 139.14 159.23 133.23	10.8 42.64 71.86 42.17	13.69 53.74 86.45 52.03	39.89 97.39 135.37 93.96	73.09 132.23 155.23 126.75	1.48 28.99 55.1 29	1.96 34.27 66.48 35.01	25.17 69.27 113.51 69.36	67.11 123.92 149.93 119.08
UPT CDF [Mbps DL: Delay CDF	5% 50% 95% Mean 5%	22.15 58.38 92.06 57.8 0.03	12.5kHz 26.85 69.04 100.73 67.65 0.029	2 SCS G 65.59 119.83 146.38 115.46 0.021	I= 0.8us 80.74 139.14 159.23 133.23 0.021	10.8 42.64 71.86 42.17 0.036	13.69 53.74 86.45 52.03 0.034	39.89 97.39 135.37 93.96 0.022	73.09 132.23 155.23 126.75 0.021	1.48 28.99 55.1 29 0.043	1.96 34.27 66.48 35.01 0.039	25.17 69.27 113.51 69.36 0.024	67.11 123.92 149.93 119.08 0.021
UPT SCDF [Mbps] DL: Delay ZCDF	5% 50% 95% Mean 5% 50% 95% Mean	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148	12.5kHz 69.04 100.73 67.65 0.029 0.062 0.305 0.103	2 SCS G 65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026	10.8 42.64 71.86 42.17 0.036 0.126	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928	39.89 97.39 135.37 93.96 0.022 0.043	73.09 132.23 155.23 126.75 0.021 0.028	1.48 28.99 55.1 29 0.043 0.213	1.96 34.27 66.48 35.01 0.039 0.155	25.17 69.27 113.51 69.36 0.024 0.067	67.11 123.92 149.93 119.08 0.021 0.03
UPT SCDF [Mbps] DL: Delay ZCDF	5% 50% 95% Mean 5% 50% 95%	22.15 58.38 92.06 57.8 0.03 0.079 0.414	12.5kHz 69.04 100.73 67.65 0.029 0.062 0.305	65.59 119.83 146.38 115.46 0.021 0.031 0.135	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072	10.8 42.64 71.86 42.17 0.036 0.126 1.049	13.69 53.74 86.45 52.03 0.034 0.09 0.711	39.89 97.39 135.37 93.96 0.022 0.043 0.25	73.09 132.23 155.23 126.75 0.021 0.028 0.085	1.48 28.99 55.1 29 0.043 0.213 16.009	1.96 34.27 66.48 35.01 0.039 0.155 3.592	25.17 69.27 113.51 69.36 0.024 0.067 0.504	67.11 123.92 149.93 119.08 0.021 0.03 0.102
UPT CDF [Mbps] DL: Delay Z CDF [s]	5% 50% 95% Mean 5% 50% 95% Mean	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148 10.66	12.5kHz 26.85 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32	2 SCS G 65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156	67.11 123.92 149.93 119.08 0.021 0.03 0.102 0.042
UPT CDF [Mbps] DL: Delay CDF [s] UL: UPT	5% 50% 95% Mean 5% 50% 95% Mean 5%	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148 10.66 47.54	12.5kHz 26.85 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32	2 SCS G 65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99 4.6	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514 0.1	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78	67.11 123.92 149.93 119.08 0.021 0.03 0.102 0.042 34.84
UPT CDF [Mbps] DL: Delay CDF [s] UL: UPT	5% 50% 95% Mean 5% 95% Mean 5% 50%	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148 10.66 47.54 73.16	12.5kHz 26.85 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32 53.83 84.02	2 SCS G 65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84 116.77	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99 4.6 29.75	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85 35.74	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88 66.55	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08 105.77	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04 18.6	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514 0.1 20.98	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78 36.26	67.11 123.92 149.93 119.08 0.021 0.03 0.102 0.042 34.84 94.6
UPT (Mbps 1 DL: 1 Delay 2 CDF [s] UL: UPT CDF	5% 50% 95% Mean 5% 95% Mean 50% 95% Mean	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148 10.66 47.54 73.16	12.5kHz 26.85 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32 53.83 84.02	2 SCS G 65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84 116.77	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99 4.6 29.75	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85 35.74	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88 66.55	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08 105.77	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04 18.6	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514 0.1 20.98	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78 36.26	67.11 123.92 149.93 119.08 0.021 0.03 0.102 0.042 34.84 94.6
UPT (Mbps 1 DL: 1 Delay 2 CDF [s] UL: UPT CDF	5% 50% 95% Mean 5% 95% Mean 5% 50%	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148 10.66 47.54 73.16	12.5kHz 26.85 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32 53.83 84.02	2 SCS G 65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96 127.68	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84 116.77 146.13	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99 4.6 29.75 58.6	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85 35.74 69.19	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88 66.55 108.39	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08 105.77 138.23	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04 18.6 43.8	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514 0.1 20.98 49.61	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78 36.26 79.79	67.11 123.92 149.93 119.08 0.021 0.03 0.102 0.042 34.84 94.6 129.62
UPT CDF Mbps DL: Delay CDF [s] UL: UPT CDF [Mbps ] UL: Delay	5% 50% 95% Mean 50% 95% Mean 95% 95% 40%	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148 10.66 47.54 73.16 45.26	12.5kHz 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32 53.83 84.02 52.75	65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96 127.68 90.12	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84 116.77 146.13 109.82	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99 4.6 29.75 58.6 30.93	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85 35.74 69.19 37.31	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88 66.55 108.39 65.42	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08 105.77 138.23 100.84	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04 18.6 43.8 19.92	1.96         34.27         66.48         35.01         0.039         0.155         3.592         5.514         0.1         20.98         49.61         23.2	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78 36.26 79.79 39.65	67.11 123.92 149.93 119.08 0.021 0.03 0.102 0.042 34.84 94.6 129.62 91
UPT CDF Mbps DL: Delay CDF [s] UL: UPT CDF [Mbps ] UL: UPT	5% 50% 95% Mean 50% 95% Mean 95% 95% 40%	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148 10.66 47.54 73.16 45.26 0.035	12.5kHz 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32 53.83 84.02 52.75 0.035	5.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96 127.68 90.12 0.022	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84 116.77 146.13 109.82 0.022	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99 4.6 29.75 58.6 30.93 0.042	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85 35.74 69.19 37.31 0.037	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88 66.55 108.39 65.42 0.023	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08 105.77 138.23 100.84 0.022	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04 18.6 43.8 19.92 0.057	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514 0.1 20.98 49.61 23.2 0.052	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78 36.26 79.79 39.65 0.028	67.11 123.92 149.93 119.08 0.021 0.03 0.102 0.042 34.84 94.6 129.62 91 0.022
UPT (Mbps ) Delay 2 CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF [Mbps ] UL: CDF	5% 50% 95% 35% 50% 95% 50% 95% 4000 95% 50% 50%	22.15 58.38 92.06 57.8 0.03 0.414 0.148 10.66 47.54 73.16 45.26 0.035 0.111 0.768	12.5kHz 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32 53.83 84.02 52.75 0.035 0.087	5.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96 127.68 90.12 0.022 0.047	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84 116.77 146.13 109.82 0.022 0.033	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99 4.6 29.75 58.6 30.93 0.042 0.197	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85 35.74 69.19 37.31 0.037 0.147	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88 66.55 108.39 65.42 0.023 0.084	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08 105.77 138.23 100.84 0.022 0.038	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04 18.6 43.8 19.92 0.057 0.338	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514 0.1 20.98 49.61 23.2 0.052 0.263	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78 36.26 79.79 39.65 0.028 0.182	67.11 123.92 149.93 119.08 0.021 0.03 0.102 0.042 34.84 94.6 129.62 129.62 91 0.022 0.046
UPT (Mbps ) Delay 2 CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF [Mbps ] UL: CDF	5% 50% 95% 75% 5% 95% 95% 95% 95% 75% 50% 95% 50% 95%	22.15 58.38 92.06 57.8 0.03 0.414 0.148 10.66 47.54 73.16 45.26 0.035 0.111 0.768	12.5kHz 26.85 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32 53.83 84.02 52.75 0.035 0.087 0.544	2 SCS G 65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96 127.68 90.12 0.022 0.047 0.311	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84 116.77 146.13 109.82 0.022 0.033 0.132	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99 4.6 29.75 58.6 30.93 0.042 0.197 2.332	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85 35.74 69.19 37.31 0.037 0.147 1.638	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88 66.55 108.39 65.42 0.023 0.084 0.736	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08 105.77 138.23 100.84 0.022 0.038 0.168	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04 18.6 43.8 19.92 0.057 0.338 47.548	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514 0.1 20.98 49.61 23.2 0.052 0.263 7.623	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78 36.26 79.79 39.65 0.028 0.182 0.182 1.759	67.11 123.92 149.93 0.021 0.03 0.102 0.042 34.84 94.6 129.62 91 0.022 0.046 0.224
UPT Mbps DL: Delay CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF [s] UL: [s] [s] CDF [s] [s] [s] [s] [s] [s] [s] [s]	5% 50% 95% 50% 50% 95% 50% 95% 40% 50% 50% 50% 50% 50% 50% 50%	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148 10.66 47.54 73.16 45.26 0.035 0.111 0.768 0.241	12.5kHz 26.85 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32 53.83 84.02 52.75 0.035 0.087 0.544 0.167	2 SCS G 65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96 127.68 90.12 0.047 0.311 0.093	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84 116.77 146.13 109.82 0.022 0.033 0.132 0.05	10.8 42.64 71.86 0.036 0.126 1.049 0.99 4.6 29.75 58.6 30.93 0.042 0.197 2.332 2.098	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85 35.74 69.19 37.31 0.037 0.147 1.638 1.097	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88 66.55 108.39 65.42 0.023 0.084 0.736 0.212	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08 105.77 138.23 100.84 0.022 0.038 0.168 0.06	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04 18.6 4.30 18.6 4.30 19.92 0.057 0.338 47.548 12.036	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514 0.1 20.98 49.61 23.2 0.263 7.623 8.295	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78 36.26 79.79 39.65 0.028 0.182 1.759 0.608	67.11 123.92 149.93 0.021 0.021 0.042 34.84 94.6 129.62 91 0.022 0.046 0.224 0.074
UPT CDF Delay CDF [s] UL: UPT CDF [Mbps ] UL: Delay CDF [s] UL: Delay CDF [s] UL: [s] UL: [s] [s] UL: [s] [s] [s] [s] [s] [s] [s] [s]	5% 50% 95% 50% 50% 95% 75% 50% 95% 05% 50% 95% 50% 100000000000000000000000000000000	22.15 58.38 92.06 57.8 0.03 0.079 0.414 0.148 10.66 47.54 73.16 45.26 0.035 0.111 0.768 0.241 1.00	12.5kHz 26.85 69.04 100.73 67.65 0.029 0.062 0.305 0.103 15.32 53.83 84.02 52.75 0.035 0.087 0.544 0.167 1.00	2 SCS G 65.59 119.83 146.38 115.46 0.021 0.031 0.135 0.05 34.56 93.96 127.68 90.12 0.022 0.047 0.311 0.093 1.00	I= 0.8us 80.74 139.14 159.23 133.23 0.021 0.026 0.072 0.034 45.84 116.77 146.13 109.82 0.022 0.033 0.132 0.05 1.00	10.8 42.64 71.86 42.17 0.036 0.126 1.049 0.99 4.6 29.75 58.6 30.93 0.042 0.197 2.332 2.098 1.00	13.69 53.74 86.45 52.03 0.034 0.09 0.711 0.928 6.85 35.74 69.19 37.31 0.037 0.147 1.638 1.097 1.00	39.89 97.39 135.37 93.96 0.022 0.043 0.25 0.081 18.88 66.55 108.39 65.42 0.023 0.084 0.736 0.212 1.00	73.09 132.23 155.23 126.75 0.021 0.028 0.085 0.038 40.08 105.77 138.23 100.84 0.022 0.038 0.168 0.06 1.00	1.48 28.99 55.1 29 0.043 0.213 16.009 6.301 0.04 18.6 43.8 19.92 0.057 0.338 47.548 12.036 0.98	1.96 34.27 66.48 35.01 0.039 0.155 3.592 5.514 0.1 20.98 49.61 23.2 0.052 0.263 7.623 8.295 0.97	25.17 69.27 113.51 69.36 0.024 0.067 0.504 0.156 7.78 36.26 79.79 39.65 0.028 0.182 1.759 0.608 0.99	67.11 123.92 149.93 119.08 0.021 0.03 0.102 0.042 34.84 94.6 129.62 91 0.022 0.046 0.224 0.074 1.00

Report	ed			<u>/ load</u>			Mediu		. —		High			
sparame sparame S/yopp L	eters			for Wi-F			O range f				O range fo			
Ħ		Wi	Fi+WiFi	i: 10%~2	25%		iFi+WiFi				Fi+WiFi:			
Š		Wi-Fi	Wi-Fi	NR-U	NR-U	Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi in	Wi-Fi in	NR-U in	NR-U	
<u>Å</u>		in	in	in	in NR-	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	in NF	
Ĥ		WiFi+	WiFi+	WiFi+	U+	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	U+	
		WiFi	NR-U	NR-U	NR-U								NR-I	
		Additic	nal com	iments:	•						•			
											tial CW b			
		duration: 5.5 ms, Max modulation supported 256 QAM, MIMO scheme with Tx BF upto rank 2. <b>Wi-Fi assumptions:</b> RTS/CTS enabled, ED/PD threshold -62/-82 dBm, A-MPDU size is chosen to g												
		Wi-Fi assumptions: RTS/CTS enabled, ED/PD threshold -62/-82 dBm, A-MPDU size is chosen to												
		MPDU duration of 1ms, Wi-Fi Guard Interval long, Wi-Fi beacons enabled (periodicity 100ms),												
		Minstrel Algorithm for rate prediction												
		NRU assumptions: ED threshold -72 dBm, SCS 30 KHz, UE processing time capability #1, NR												
		PDCCH monitoring is 4 times per slot (slot size = 0.5ms), Link adaptation assumptions : Reciprocit												
		based BF, realistic delays in CSI reports, stand-alone with self-scheduling, DRS enabled (250us, cat-												
		LBT every 250us, 40ms periodicity), asynchronous nodes, UL LBT in gNB acquired COT: Cat-2 LH												
		with granularity of 0.5ms, 1 symbol DMRS overhead, 1 symbol for every ACK/CQI feedback, UL grant. Switching points no longer than than 16 µs every 2ms for CSI feedback, UL grant update.												
-									1					
DL:	5%	22.15	28.73	61.1	76.71	10.8	12.12	37.04	70.95	1.48	0.88	17.93	62.7	
UPT	50%	58.38	70.21	114.44	136	42.64	49.87	91.36	127.98	28.99	30.64	58.8	119.6	
CDF	95%	92.06	100.09	140.99	154.49	71.86	81.22	126.52	150.1	55.1	64.17	104.12	144.5	
[Mbps	Mean	0	66 <b>75</b>	110 54	100.00	10.15	40 5 4	05.50	100.4	20	00.40	60 <b>55</b>		
	=0(	57.8	66.75		129.38	42.17	49.54	87.52	122.4	29	32.19	60.77	114.6	
DL:	5%	0.03	0.03	0.02	0.02	0.036	0.035	0.021	0.02	0.043	0.04	0.026	0.02	
Delay	50%	0.079	0.064	0.033	0.027	0.126	0.097	0.048	0.029	0.213	0.173	0.082	0.03	
CDF	95%	0.414	0.328	0.151	0.076	1.049	0.808	0.308	0.091	16.009	7.014	0.769	0.11	
[s]	Mean	ł	0.109	0.055	0.036	0.99	1.031	0.098	0.04	6.301	7.385	0.217	0.04	
UL:	5%	10.66	14.93	33.54	45.52	4.6	5.43	15.52	39.28	0.04	0.05	5.34	33.6	
UPT	50%	47.54	51.75	92.67	117.9	29.75	34.28	63.25	107.57	18.6	18.99	30.04	94.9	
CDF	95%	73.16	82.6	129.02	148.02	58.6	66.25	107.24	139.89	43.8	49.21	76.47	132.1	
[Mbps	Mean	45.26	51.62	89.82	111.49	30.93	35.36	62.66	101.79	19.92	21.31	35.19	91.2	
Г <u>↓</u> ] Фтп.	5%	0.035	0.035	0.021	0.021	0.042		02.00	0.021	0.057	0.057	0.03	0.02	
g UL: Delay		<u> </u>	0.035	1			0.038		1					
CDF	95%	0.111 0.768	0.601	0.047	0.033 0.136	0.197 2.332	0.155 1.721	0.094	0.038	0.338 47.548	0.293 20.827	0.228 2.622	0.04	
+	Mean		0.001	1			1.721	0.926	0.178		1		0.23	
₹				0.1	0.05	2.098		0.266		12.036	9.764	1.198	0.07	
	DL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	0.97	1.00	1.00	
		1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.96	0.95	0.99	1.00	
<del>4</del> В	0	0.21	0.17	0.10	0.06	0.41	0.36	0.23	0.09	0.67	0.63	0.46	0.12	
/	۹	A 11.		Mbps			1.5 I	Abps			1.8 N	1bps		
			onal com				TDT	C			. 1 0141	1 66 1	100m	
											tial CW b			
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			-								/IPDU siz			
				ithm for			leivai ioi	ig, wi-fi	DeaCOIIS	ellableu	periodici	ty 100ms	),	
							Bm SCS	20 VU7	UE prov	occing ti	mo canab	;];+., #1 T	ND	
		<b>NRU assumptions:</b> ED threshold -72 dBm, SCS 30 KHz, UE processing time capability #1, NR PDCCH monitoring is 4 times per slot (slot size = 0.5ms), Link adaptation assumptions : Reciprocity												
											RS enabl			
		LBT every 250us, 40ms periodicity), asynchronous nodes, UL LBT in gNB acquired COT: Cat-2 LBT with granularity of 0.5ms, 1 symbol DMRS overhead, 1 symbol for every ACK/CQI feedback, UL												
		grant. COT structure includes a preparation stage for CSI exchange leading to total of 2 switching												
		points.		acture III	ciuues d	preparat	ion stage	101 031	cachalige	reauting		∠ swittli	шg	
DL:	5%	26.13	38.54	72.29	84.56	7.82	25.52	56.73	76.19	0.56	17.81	34.62	60.2	
UPT		1		1					1		1		69.3	
		63.27	81.48	1		33.99	63.43	110.67	137.91	24.5	52.16	95.71	133.2	
CDF		93.83	113.44	154.94	103.63	67.76	95.79	140.37	158.94	53.37	86.73	129.68	154.8	
[Mbps	Mean	62 52	70 57	107 00	120 54	25 67	62.40	106 22	121 40		5767	00.24	1775	
	E0/	62.52	78.57	1	139.54	35.67	62.49	106.23	131.48	25.15	52.63	90.34	127.2	
	5%	0.034	0.029	0.02	0.02	0.039	0.034	0.021	0.021	0.05	0.035	0.022	0.02	

$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Reported <u>Low load</u> parameters BO range for Wi-Fi i WiFi+WiFi: 10%~25						D		<u>m load</u>		D	High				
WiFi         INR-U         NR-U         NR-U         NR-U         NR-U         NR-U           DL:         50%         0.066         0.066         0.066         0.035         0.027         0.23         0.082         0.046           Delay         95%         0.348         0.208         0.1         0.062         1.862         0.359         0.188         0.075         38.46         0.622         0.354           GLD         FM         1.17         0.075         0.041         0.032         2.353         1.109         0.066         0.033         9.439         1.126         0.132           ULT         5%         16.35         1.124         1.35.32         54.88         82.84         118.07         145.1         40.71         74.52         103.97           Mbps Mean         -1         63.05         1064         118.3         23.83         46.4         80.51         106.99         1.5.86         37.49         62.95           UL:         5%         0.633         0.321         0.036         0.032         0.032         0.037         0.023         0.037         0.023         0.037         0.023         0.042         1.00         1.00         1.00         1.00<	gparame	eters		•												
WiFi         NR-U         NR-U         NR-U         NR-U         NR-U         NR-U           DL:         50%         0.056         0.066         0.065         0.027         0.148         0.066         0.035         0.027         0.23         0.082         0.046           Delay         95%         0.348         0.208         0.1         0.062         1.862         0.359         0.188         0.075         38.46         0.622         0.354           LI:         7%         1.434         22.76         41.74         50.92         2.36         13.09         30.95         41.47         10.33         7.11         15.92           UPT         50%         46.55         63.76         112.64         12.88         12.72         41.32         85.68         11.41         10.33         7.49         62.95           UL:         5%         0.035         0.042         10.02         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.023         0.36         0.36         0.042         1.00         1.00         1.00 <td><u></u></td> <td></td> <td>1</td> <td></td>	<u></u>												1			
WiFi         NR-U         NR-U         NR-U         NR-U         NR-U         NR-U           DL:         50%         0.056         0.066         0.065         0.027         0.148         0.066         0.035         0.027         0.23         0.082         0.046           Delay         95%         0.348         0.208         0.1         0.062         1.862         0.359         0.188         0.075         38.46         0.622         0.354           LI:         7%         1.434         22.76         41.74         50.92         2.36         13.09         30.95         41.47         10.33         7.11         15.92           UPT         50%         46.55         63.76         112.64         12.88         12.72         41.32         85.68         11.41         10.33         7.49         62.95           UL:         5%         0.035         0.042         10.02         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.022         0.023         0.36         0.36         0.042         1.00         1.00         1.00 <td>\$</td> <td></td>	\$															
WiFi         INR-U         NR-U         NR-U         NR-U         NR-U         NR-U           DL:         50%         0.066         0.066         0.066         0.035         0.027         0.23         0.082         0.046           Delay         95%         0.348         0.208         0.1         0.062         1.862         0.359         0.188         0.075         38.46         0.622         0.354           GLD         FM         1.17         0.075         0.041         0.032         2.353         1.109         0.066         0.033         9.439         1.126         0.132           ULT         5%         16.35         1.124         1.35.32         54.88         82.84         118.07         145.1         40.71         74.52         103.97           Mbps Mean         -1         63.05         1064         118.3         23.83         46.4         80.51         106.99         1.5.86         37.49         62.95           UL:         5%         0.633         0.321         0.036         0.032         0.032         0.037         0.023         0.037         0.023         0.037         0.023         0.042         1.00         1.00         1.00         1.00<	<u>P</u>													in NR-		
Dits         50%         0.066         0.047         0.027         0.028         0.148         0.066         0.037         0.23         0.082         0.046           Delay         95%         0.0348         0.208         0.1         0.062         1.862         0.359         0.188         0.075         38.46         0.622         0.334           CDF         Mean         0.117         0.075         0.041         0.033         2.353         0.119         0.066         0.035         9.439         1.126         0.132           UL:         5%         16.3         12.64         125.83         21.72         44.32         25.68         114.1         14.03         35.69         67.15           CDF         95%         0.035         0.034         0.032         0.035         0.032         0.022         0.028         0.035         0.022         0.028         0.021         0.027         0.027         0.037         0.023         0.033         0.031         0.032         0.031         0.032         0.032         0.022         0.028         0.031         0.032         0.023         0.032         0.023         0.032         0.023         0.032         0.023         0.032         0.023	T						W1F1	NR-U	NR-U	NR-U	W1F1	NR-U	NR-U	U+		
Book         0.348         0.208         0.1         0.062         1.862         0.359         0.188         0.075         38.46         0.622         0.334           CDF         Mean         0.117         0.075         0.041         0.031         2.353         0.119         0.066         0.035         9.439         1.126         0.132           UPT         50%         14.34         27.66         12.64         12.38         12.44         23.86         13.09         30.95         44.47         10.03         35.69         67.15           DF         55%         80.98         97.52         141.37         15.532         54.88         82.84         118.07         145.1         40.71         74.52         103.97           Delay         50%         0.035         0.034         0.022         0.037 <th0.037< th=""> <th0.037< th=""> <th0.037< <="" td=""><td>Ner</td><td>=00/</td><td></td><td></td><td></td><td></td><td>0.1.10</td><td>0.000</td><td>0.0D<b>-</b></td><td>0.00.</td><td>0.00</td><td>0.000</td><td>0.040</td><td>NR-U</td></th0.037<></th0.037<></th0.037<>	Ner	=00/					0.1.10	0.000	0.0D <b>-</b>	0.00.	0.00	0.000	0.040	NR-U		
Real         Image         Image <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0.028</td></th<>														0.028		
Is         0.117         0.075         0.041         0.031         2.353         0.119         0.066         0.035         9.439         1.126         0.1359           ULT         59%         14.34         22.76         43.09         30.95         44.87         0.03         7.11         15.92           UPT         50%         46.55         63.76         112.64         128.83         21.72         44.32         85.68         114.1         14.03         35.69         67.15           DED         95%         0.035         0.034         10.22         0.035         0.032         0.026         0.033         0.030         0.28         0.016         0.033         0.030         0.28         0.016         0.033         0.030         0.028         0.016         0.031         0.036         0.041         0.010         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.01         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02         0.02 <td>Delay</td> <td></td> <td>0.348</td> <td>0.208</td> <td>0.1</td> <td>0.062</td> <td>1.862</td> <td>0.359</td> <td>0.188</td> <td>0.075</td> <td>38.46</td> <td>0.622</td> <td>0.354</td> <td>0.083</td>	Delay		0.348	0.208	0.1	0.062	1.862	0.359	0.188	0.075	38.46	0.622	0.354	0.083		
UPT         5%         14.34         22.76         44.74         50.92         2.36         13.09         30.95         44.87         0.03         7.1         15.92           UPT         50%         46.55         63.76         112.64         125.83         21.72         44.32         85.68         114.1         14.03         35.69         67.15           UPT         5%         0.035         0.034         0.022         0.028         0.035         0.022         0.021         0.035         0.022         0.023         0.037         0.023         0.037         0.023         0.037         0.023         0.033         0.032         0.022         0.056         0.034         0.031         0.036         0.042         0.035         0.021         0.031         0.030         0.023         0.031         0.030         0.033         0.031         0.030         0.031         0.030         0.031         0.030         0.031         0.030         0.031         0.03         0.03         0.031         0.030         0.031         0.040         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00         0.00		Mean				0.004			0.000	0 0D <b>-</b>	0.400	1 100	0.400			
Hotp         More         Hoto         Hoto <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>· · · · · · · · · · · · · · · · · · ·</td><td></td><td></td><td></td><td>1</td><td></td><td>0.037</td></t<>								· · · · · · · · · · · · · · · · · · ·				1		0.037		
Hotps         Field         <														41.32		
Hotp         More         Hoto         Hoto <t< td=""><td>HUPT</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td>107.98</td></t<>	HUPT											1		107.98		
Image: Image: https://www.image: https://www.i	TCDF		80.98	97.52	141.37	155.32	54.88	82.84	118.07	145.1	40.71	74.52	103.97	140.52		
UL:         5%         0.035         0.024         0.022         0.035         0.022         0.072         0.037         0.037           Delay         50%         0.036         0.033         0.03         0.258         0.101         0.056         0.034         0.331         0.130         0.031           DEF         95%         0.633         0.337         0.190         0.104         5.15         0.679         0.495         0.133         76.754         1.124         1.192           Isl         Mean         0.198         0.100         1.1.00         1.00         1.0	Mbps	Mean		60 0 <b>-</b>	100.1				00 <b>-</b> 1	100.00			~~~~			
Delay         50%         0.096         0.066         0.033         0.03         0.258         0.101         0.056         0.034         0.331         1.24         1.192           Is1         Mean         0.198         0.109         0.063         0.032         1.030         1.030         1.04         1.04         1.04           QDL         1.00         1.00         0.00         0.021         0.103         0.05         0.072         1.00         1.00         1.00         1.00           QDL         0.09         1.00         0.00         0.99         1.00         0.01         1.00         0.97         1.00		= 0 (												101.59		
CDF         95%         0.633         0.337         0.199         0.104         5.15         0.679         0.495         0.139         78.754         1.24         1.192           [5]         Mean         0.198         0.109         0.063         0.042         4.003         0.21         0.143         0.052         15.221         1.649         0.407           QDL         0.99         1.00         1.09         1.00         1.00         1.00         0.97         1.00         1.00           QUL         0.99         0.10         0.99         1.00         1.01         1.00         0.97         1.00         1.00           QUL         0.99         0.10         0.99         1.01         0.09         1.00         1.00         0.97         1.00         1.00           QUL         0.99         0.10         0.45         0.19         0.13         0.06         0.67         0.30         0.23           A         0.8         0.05         0.04         0.45         0.19         0.13         0.06         0.67         0.30         0.23           A         Additonal comments:         Common assumptions: TSTx, 2Rx, Primary LBT: Cat-4 LBT with exponential CW backoff, N duration: 5.5 ms, Max	- I													0.022		
[s]         Mean         0.198         0.109         0.063         0.042         4.003         0.21         0.143         0.052         15.221         1.649         0.407           QDL         0.09         1.00         1.00         1.00         1.00         1.00         1.00         0.97         1.00         1.00         1.00           BO         0.13         0.08         0.05         0.04         0.45         0.19         0.13         0.06         0.67         0.30         0.23           λ         0.8 Mbps         1.2 Mbps         1.2 Mbps         1.4 Mbps           Additional comments:         Common assumptions: 2Tx, 2Rx, Primary LBT : Cat-4 LBT with exponential CW backoff, N duration: 5.5 ms, Max modulation supported 256 QAM, MIMO scheme with Tx BF upto rank Wi-Fi assumptions: RTS/CTS disabled, Preamble detection enabled. D/PD threshold -62/48           A-MPDU bize is chosen to get MPDU duration of 1ms, Wi-Fi Guard Interval long, Wi-Fi based enabled (periodicity 100ms), Minstrel Algorithm for rate prediction         RCS 30 KHz, UE processing time capability #1, 1           PDCCH monitoring is 4 times per slot (slot size = 0.5ms), Link adaptation assumptions: Recip based BF, realistic delays in CS1 reports, stand-alone with self-scheduling, DRS enabled (250u LBT every 250us, 40ms periodicity), asynchronous nodes, UL LBT in gNB acquired COT: Ca           UPT         50%         70.59         81.99         137.01														0.037		
QDL         1.00 <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0.161</td></th<>														0.161		
Quil.         0.99         1.00         0.99         1.01         0.99         1.00         1.01         1.00         0.94         1.00         1.00           λ         0.03         0.03         0.04         0.45         0.19         0.13         0.06         0.67         0.30         0.23           λ         0.8 <mbps< td="">         1.2<mbps< td="">         1.2<mbps< td="">         1.4<mbps< td="">           Additional comments:         Common assumptions: 2Tx, ZRx, Primary LBT : Cat-4 LBT with exponential CW backoff, N duration: 5.5 ms, Max modulation supported 256 QAM, MIMO scheme with Tx BF upto rank duration: 5.5 ms, Max modulation of 1ms, Wi-Fi Guard Interval long, Wi-Fi beac enabled (periodicity 100ms), Minstrel Algorithm for rate prediction           NRU assumptions: ED threshold         72 dBm, SCS 30 KHz, UE processing time capability #1, 1           PDCCH monitoring is 4 times per slot (slot size = 0.5ms), Link adaptation assumptions : Recip based BF, realistic delays in CSI reports, stand-alone with self-scheduling, DRS enabled (2500 LBT every 250us, 40ms periodicity), asynchronous nodes, UL LBT in gNB acquired COT: Ca with granularity of 0.5ms, 1 symbol DMRS overhead, 1 symbol for every ACK/CQI feedback, grant. Switching points no longer than than 16 ps every 2ms for CSI feedback, UL grant updat           DL:         5%         10.03         1.021         1.021         0.038         0.034         0.021           GDF         55%         10.37         137.91         36.12         58.72</mbps<></mbps<></mbps<></mbps<>	[s]	Mean												0.058		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	$Q_{\Gamma}$	DL	1.00	1.00	1.00	1.01	0.99	1.00	1.00	1.00	0.97	1.00	1.00	0.99		
λ         0.8 Mbps         1.2 Mbps         1.4 Mbps           Additional comments:         Common assumptions: 2Tx, 2Rx, Primary LBT : Cat-4 LBT with exponential CW backoff, N duration: 5.5 ms, Max modulation supported 256 QAM, MIMO scheme with Tx BF upto rank Wi-Fi assumptions: RTS/CTS disabled, Preamble detection enabled, ED/PD threshold -62/-82 A-MPDU size is chosen to get MPDU duration of 1ms, Wi-Fi Guard Interval long, Wi-Fi beac enabled (periodicity 100ms), Minstrel Algorithm for rate prediction           NRU assumptions: ED threshold -72 dBm, SCS 30 KHz, UE processing time capability #1, 1 PDCCH monitoring is 4 times per slot (slot size = 0.5ms), Link adaptation assumptions : Recip based BF, realistic delays in CSI reports, stand-alone with self-scheduling, DRS enabled (250u LBT every 250us, 40ms periodicity), asynchronous nodes, UL LBT in gNB acquired COT: Cat with granularity of 0.5ms, 1 symbol DMRS overhead, 1 symbol for every ACK/CQI feedback, grant. Switching points no longer than than 16 µs every 2ms for CSI feedback, UL grant updat 50% (0.59 81.96 137.01 147.14 47.62 65.55 119.37 137.91 36.12 58.72 107.35 CDF 95% 100.54 113.27 157.14 163.63 77.53 97.46 145.32 158.94 66.91 90.32 138.98 [Mbps Mean 68.46 79.2 129.9 139.54 48.3 65.61 112.96 131.48 37.13 57.97 102.71 DL: 5% 0.03 0.029 0.02 0.02 0.035 0.031 0.021 0.021 0.038 0.034 0.021 10.021 0.038 0.034 0.021 10.021 0.038 0.034 0.021 0.025 0.098 0.064 0.032 0.027 0.143 0.074 0.038 0.041 0.026 0.025 0.098 0.064 0.032 0.027 0.143 0.074 0.038 0.041 0.026 0.025 0.098 0.064 0.032 0.027 0.143 0.074 0.038 1041.155.32 68.23 86.13 124.17 145.1 56.53 79.04 112.83 Mbps Mean 61.15.86 125.83 34.08 50.05 91.38 114.1 24.5 42.25 77.04 CDF 95% 87.93 98.91 144.01 155.32 68.23 86.13 124.17 145.1 56.53 79.04 112.83 Mbps Mean 79.5 57.76 115.86 125.83 34.08 50.05 91.38 114.1 24.5 42.25 77.04 112.83 Mbps Mean 79.5 57.9 (0.34 0.022 0.022 0.044 0.035 0.022 0.022 0.	Qu	ЛL	0.99	1.00	0.99	1.01	0.99	1.00	1.01	1.00	0.94	1.00	1.00	1.00		
Additional comments:         Common assumptions: 2Tx, 2Rx, Primary LBT : Cat-4 LBT with exponential CW backoff, N duration: 5.5 ms, Max modulation supported 256 QAM, MIMO scheme with Tx BF upto rank Wi-Fi assumptions: RTS/CTS disabled, Preamble detection enabled, ED/PD threshold-62/-82           A-MPDU size is chosen to get MPDU duration of 1ms, Wi-Fi Guard Interval long, Wi-Fi beac enabled (periodicity 100ms), Minstrel Algorithm for rate prediction         NRU assumptions: ED threshold -72 dBm, SCS 30 KHz, UE processing time capability #1, 1           PDCCH monitoring is 4 times per slot (slot size = 0.5ms), Link adaptation assumptions : Recip based BF, realistic delays in CSI reports, stand-alone with self-scheduling, DRS enabled (250u LBT every 250us, 40ms periodicity), asynchronous nodes, UL LBT in gNB acquired COT: Ca with granularity of 0.5ms, 1 symbol DMRS overhead, 1 symbol for every ACK/CQI feedback, grant. Switching points no longer than than 16 µs every 2ms for CSI feedback, UL grant updat 10           VPT         5%         29.01         41.01         75.62         84.56         16.74         29.07         61.5         76.19         8.8         20.1         53.08           UPT         5%         29.01         41.01         75.62         84.56         16.74         29.07         61.5         76.19         8.8         20.1         53.08           UPT         5%         00.54         113.27         157.14         47.62         65.55         119.37         137.91         36.12         58.72         107.35      <	B	0	0.13	0.08	0.05	0.04	0.45	0.19	0.13	0.06	0.67	0.30	0.23	0.08		
Additional comments:         Common assumptions: 2Tx, 2Rx, Primary LBT : Cat-4 LBT with exponential CW backoff, N duration: 5.5 ms, Max modulation supported 256 QAM, MIMO scheme with Tx BF upto rank Wi-Fi assumptions: RTS/CTS disabled, Preamble detection enabled, ED/PD threshold-62/-82 A-MPDU size is chosen to get MPDU duration of 1ms, Wi-Fi Guard Interval long, Wi-Fi beac enabled (periodicity 100ms), Minstrel Algorithm for rate prediction           NRU assumptions:         ED threshold -72 dBm, SCS 30 KHz, UE processing time capability #1, 1           PDCCH monitoring is 4 times per slot (slot size = 0.5ms), Link adaptation assumptions : Recip based BF, realistic delays in CSI reports, stand-alone with self-scheduling, DRS enabled (250u LBT every 250us, 40ms periodicity), asynchronous nodes, UL LBT in gNB acquired COT: Ca with granularity of 0.5ms, 1 symbol DMR Soverhead, 1 symbol for every ACK/CQI feedback, UL grant updat 0.5%           UPT         5%         29.01         41.01         75.62         84.56         16.74         29.07         61.5         76.19         8.8         20.1         53.08           UPT         5%         29.01         41.01         75.62         84.56         16.74         29.07         61.5         76.19         8.8         20.1         53.08           UPT         5%         70.59         81.92         13.27         137.01         147.14         47.62         65.55         119.37         137.91         36.12         58.72         107.35           DFby	λ	l	0.8 Mbps 1.2 Mbps 1.4 Mbps													
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$						<b>:</b> 2Tx. 2	Rx. Prin	arv LBT	: Cat-4 I	BT with	exponen	tial CW b	ackoff. N	1COT		
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$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$													1 1 1 Ocuc	5110		
DL:         5%         0.03         0.029         0.02         0.025         0.035         0.031         0.021         0.038         0.034         0.021           Ibits         5%         0.275         0.196         0.025         0.025         0.025         0.025         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.021         0.038         0.021         0.021         0.038         0.021         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.021         0.038         0.031         0.021         0.038         0.034         0.021         0.038         0.034         0.021         0.038         0.034         0.021         0.038         0.031         0.021         0.035         0.024         0.021         0.038         0.031         0.021												me canah	ility #1 I	NR		
Image: biased BF, real:st: dat: biased BF, real:st: dat: biased BF, real:st: dat: biased BF, real:st: dat: biased BF, real:st: biased BF, real																
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with granularity of 0.5ms, 1 symbol DMRS overhead, 1 symbol for every ACK/CQI Feedback, grant. Switching points no longer than the usevery 2ms for CSI feedback, UL granulative updated for the points of the points of the points. Some than the points of the points of the points. Some than the points of the points of the points. Some than the points of the points of the points. Some that the points of the points of the points. Some that the points of the points of the points. Some that the points of the points of the points. Some that the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points. Some the points of the points of the points of the points. Some the points of the points of the points of the points. Some the points of the points of the points of the points. Some the points of the points of the points of the points of the points. Some the points of the points. Some the points of the points. Some the points of the poi																
grant. Switching points witching points witching points         witching points <th co<="" td=""><td></td><td></td><td colspan="9"></td><td></td><td></td></th>	<td></td> <td></td> <td colspan="9"></td> <td></td> <td></td>															
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$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	DL													69.39		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $																
	I F													155.27		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$			100.54	113.27	157.14	102.02	//.55	97.40	143.32	150.94	00.91	90.52	120.90	154.00		
DL:         5%         0.03         0.029         0.02         0.02         0.035         0.031         0.021         0.038         0.034         0.021           Delay         50%         0.06         0.047         0.026         0.025         0.098         0.064         0.032         0.027         0.143         0.074         0.038           CDF         95%         0.275         0.196         0.09         0.062         0.598         0.303         0.131         0.075         1.263         0.424         0.171           [s]         Mean         0.095         0.072         0.038         0.031         0.226         0.102         0.05         0.035         1.625         0.139         0.061           UL:         5%         16.17         22.94         46.12         50.92         7.28         17.06         33.21         44.87         3.69         12.09         27.53           UPT         50%         55.57         67.8         115.86         125.83         34.08         50.05         91.38         114.1         24.55         77.04           Mbps         Mean         -         -         -         -         -         -         -         -	L 1	wiegu	68 46	79.2	170 0	130 5/	<u>⊿8 २</u>	65.61	112 06	131 /19	37 1 2	57 07	102 71	127.29		
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CDF         95%         0.275         0.196         0.09         0.062         0.598         0.303         0.131         0.075         1.263         0.424         0.171           [s]         Mean         0.095         0.072         0.038         0.031         0.226         0.102         0.05         0.035         1.625         0.139         0.061           UL:         5%         16.17         22.94         46.12         50.92         7.28         17.06         33.21         44.87         3.69         12.09         27.53           UPT         50%         55.57         67.8         115.86         125.83         34.08         50.05         91.38         114.1         24.5         42.25         77.04           CDF         95%         87.93         98.91         144.01         155.32         68.23         86.13         124.17         145.1         56.53         79.04         112.83           Mbps         Mean         54.48         65.38         109.12         118.3         35.32         50.67         86.68         106.99         25.98         43.14         73.75           UL:         5%         0.035         0.032         0.03         0.152         0.0	- I											1		0.021		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $																
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $														0.083		
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$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	JUL:													41.32		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $												1		107.98		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	ACDE	95%	87.93	98.91	144.01	155.32	68.23	86.13	124.17	145.1	56.53	79.04	112.83	140.52		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	H Mbps	Mean			100.15	110.0		<b>FO 6</b>	00.00	100.00	75.00	10.1.1	<b>70</b>	101 =-		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $								1				1		101.59		
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													1	0.037		
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Q <sub>UL</sub> 1.00         1.00         0.99         1.01         1.00         1.00         1.00         1.00         0.99         1.00         1.00	[s]	Mean	0.144	0.102	0.057	0.042	0.434	0.162	0.097	0.052	2.821	0.238	0.14	0.058		
	QI	DL	1.00	0.99	0.99	1.01	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99		
	$\varrho_{\mathrm{U}}$	л	1.00	1.00	0.99	1.01	1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00		
BO 0.11 0.08 0.05 0.04 0.27 0.17 0.10 0.06 0.44 0.24 0.15					0.05									0.08		
$\lambda$ 0.8 Mbps 1.2 Mbps 1.4 Mbps																

Report	ed	<u>Low load</u> BO range for Wi-Fi in						<u>m load</u>	:	<u>High load</u> BO range for Wi-Fi in			
gparame Simos/Joop L	eters		•				O range f						
8			Fi+WiFi	1			iFi+WiFi				Fi+WiFi:		
\$		Wi-Fi		NR-U	NR-U				NR-U in				
<u>9</u>		in	in	in	in NR-	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	in NF
.1		WiFi+		WiFi+	U+	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	U+
		WiFi		NR-U	NR-U								NR-
			onal com				T D T	C-+ 4 I					1COT
									LBT with				
									/IMO sch			1	
		<b>Wi-Fi assumptions:</b> RTS/CTS disabled, Preamble detection enabled, ED/PD threshold -72/-82 dBr. A-MPDU size is chosen to get MPDU duration of 1ms, Wi-Fi Guard Interval long, Wi-Fi beacons											
		A-MPDU size is chosen to get MPDU duration of 1ms, Wi-Fi Guard Interval long, Wi-Fi beacons enabled (periodicity 100ms), Minstrel Algorithm for rate prediction											
		enabled (periodicity 100ms), Minstrel Algorithm for rate prediction NRU assumptions: ED threshold -72 dBm, SCS 30 KHz, UE processing time capability #1, NR											
		<b>NRU assumptions:</b> ED threshold -72 dBm, SCS 30 KHz, UE processing time capability #1, NR PDCCH monitoring is 4 times per slot (slot size = 0.5ms), Link adaptation assumptions : Reciprocit											
		PDCCH monitoring is 4 times per slot (slot size = 0.5ms), Link adaptation assumptions : Reciprocity based BF, realistic delays in CSI reports, stand-alone with self-scheduling, DRS enabled (250us, cat-											
		LBT every 250us, 40ms periodicity), asynchronous nodes, UL LBT in gNB acquired COT: Cat-2 LE											
		LBT every 250us, 40ms periodicity), asynchronous nodes, UL LBT in gNB acquired COT: Cat-2 L with granularity of 0.5ms, 1 symbol DMRS overhead, 1 symbol for every ACK/CQI feedback, UL											
									ms for CS				
DL:	5%	17.63		40.63	44.29	6.86	23.71	34.25	39.91	0.94		1	36.9
UPT	5% 50%	61.31	75.90	40.65 93.31	99.31	32.85	67.99	84.77	95.14	11.25	16.34 56.09	21.51 67.55	90.8
CDF	95%		102.08		124.68	63.61	97.22	117.64	122.39	37.92	89.19	105.17	1
[Mbps			73.55	90.68	95.60	34.73	66.77	83.03	91.93	14.94	56.91	68.59	119.9 87.9
1	Mean	59.49	/5.55	90.00	95.00	54.75	00.77	05.05	91.95	14,94	50.91	06.59	07.9
DL:	5%	0.038	0.032	0.028	0.027	0.062	0.034	0.028	0.027	0.087	0.037	0.031	0.02
Delay	50%	0.106	0.050	0.040	0.035	0.462	0.060	0.047	0.038	0.958	0.083	0.081	0.04
CDF	95%		0.122	0.040	0.075	4.481	0.188	0.133	0.085	10.790	0.444	0.480	0.09
[s]	Mean		0.064	0.054	0.042	1.244	0.086	0.064	0.005	2.921	0.176	0.159	0.05
UL:	5%	18.02	23.64	27.71	32.92	5.55	18.96	23.64	27.68	0.80	13.26	14.13	24.3
UPT	50%	54.43	57.44	65.55	70.51	26.87	59.71	57.44	65.11	8.90	46.82	43.75	61.6
CDF	95%		86.22	90.73	93.67	56.83	93.81	86.22	91.60	32.07	83.91	75.56	89.0
[Mbps		54.84	57.55	64.70	68.92	29.53	60.59	57.55	64.66	12.42	49.08	45.34	61.1
∞]	wicun	54.04	57.55	04.70	00.52	23.00	00.55	57.55	04.00	12,72	45.00	-5.54	01.1
UL:	5%	0.042	0.038	0.037	0.037	0.079	0.035	0.038	0.037	0.135	0.041	0.046	0.03
Delay	50%	0.120	0.080	0.061	0.053	0.482	0.075	0.080	0.059	1.004	0.108	0.164	0.06
CDF	95%	0.599	0.228	0.139	0.106	5.409	0.229	0.228	0.123	11.114	0.711	1.058	0.14
[s]	Mean	0.214		0.075	0.062	1.490	0.103	0.103	0.069	3.021	0.236	0.443	0.07
			100%			88%	100%	100%	100%	73%	99%	99%	1009
$\frac{Q_1}{R} = \frac{Q_1}{Q_1}$		99%	100%	100%	100%	93%	100%	100%	100%	86%	99%	98%	1009
⇒ B		10%	4.6%	4.1%	3.6%	35%	7%	6.3%	4.6%	60%	12%	12%	5.8%
1 2				file/s				file/s			0.20		
		Additic	nal com			1							
					-U outdo	oor scena	rio 1. 50/	50 DL/U	L traffics				
									xponentia		k-off. M	COT dura	ation:
									and 2 for				
									or UL, si				
									8dBm, M				
			,63} UL					1					
		Wi-Fi a	assump	tions: R	TS/CTS	disabled	, ED/PD	threshold	1 -62/-820	lBm, A-N	/IPDU fra	ame aggre	egatio
		MPDU	size: 15	500B MS	SDU plu	s 14B he	ader, sho	rt Wi-Fi g	guard inte	erval.			
		MPDU size: 1500B MSDU plus 14B header, short Wi-Fi guard interval. <b>NR-U assumptions:</b> ED threshold -72dBm, SCS 30kHz, UE processing time capability #1, PUSCH											
									itoring ev	ery 10S,	Scheduli	ing: prop	ortiona
		fair, sel	f-schedu	uling, C	OT shari	ing enabl	ed (gNB	initiated	COT).			-	
1		2 606	2 2 2 5	11 100	27 422	0.007	1 0 1 0	2 1 2 2	12.005	0.200	0 525	1 200	D 40
DI	5%	2.686 9.141		11.137		0.897	1.313	2.133	12.965	0.360	0.525	1.368	3.48
DL:	E00/	<u>ч і/іі</u>	111 /43	14/ 6/6	56.850	5.653	7.154	21.888	45.770	3.850	4.780	11.284	23.96
UPT	50%									10 410	10 0 40		C2 C2
UPT CDF	95%	26.689	29.385	73.956	75.709	21.635	24.113	63.013	74.355	15.410	19.642	40.608	62.63
UPT CDF	95%	26.689		73.956	75.709					15.410 5.380	19.642 6.515		62.63 27.25

		a d		T ee	land			Madia	1d			TI:-L	land		
Re	port	ea	DC		<u>load</u>	•••			<u>m load</u>	•	D	<u>High</u>			
Tdoc/Source	rame	ters		) range f				O range f				D range fo			
8				Fi+WiFi				iFi+WiFi				Fi+WiFi:			
CS			Wi-Fi		NR-U					NR-U in				1 1	
			in	in	in	in NR-	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	in NR-	
			WiFi+		WiFi+	U+	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	U+	
	Delay 50%		WiFi	NR-U	NR-U	NR-U								NR-U	
⊔_D∈	Delay 50% CDF 95%		0.267	0.216	0.094	0.066	0.490	0.371	0.186	0.091	0.640	0.528	0.346	0.173	
≝C	CDF 95% [s] Mear		0.876	0.905	0.451	0.179	2.692	1.731	1.039	0.320	3.647	3.015	1.426	0.875	
] <b>%</b> [	s]	Mean	0.348	0.323	0.152	0.090	0.761	0.586	0.311	0.133	1.077	0.899	0.476	0.273	
	Q	,	0.965	0.982	0.973	0.988	0.898	0.910	0.852	0.982	0.786	0.859	0.782	0.918	
	B	С	0.152	0.127	0.078	0.042	0.348	0.299	0.258	0.092	0.547	0.497	0.443	0.260	
R1-1814074/	λ			0	.1			0.	15		0.2				
। मैं			Additio	nal com	ments:										
174			- 4	4ms for	both Wi	-Fi and	NR-U								
			<ul> <li>4ms for both Wi-Fi and NR-U</li> <li>No</li> </ul>												
			- ]												
							i and NR		,			× ×	,		
				-					ng to TR	38.802 ar	nd max B	F gain of	5 dBi: or	nni-	
				direction			F					- 8	,		
			- 1	MPDU	size = $3$	250 byte	s by defa	ult. 1ms	per MPD	U					
				15 kHz			o og acia		per 1.11 2	U I					
- 0.8 μs															
- Capability #1															
<ul> <li>Capability #1</li> <li>Mapping type B in the starting slot of TxOP; per-symbol PDCCH monitoring for flexible</li> </ul>															
				starting			laiting si		per-sy			moning	loi nexio	Ie	
					-		utilizing r	nultiple	witching	pointe	ithin CO	T for ND	TT		
								nuitipie s	witching	points w		1 101 INK-	-0		
			-	U1055-Ca	urrier sci	neduling	mul								

				Low	load			Mediu	ım load			Hig	h load	
و ا	Repo	rted	BC	D range f		in	В	O range t	for Wi-Fi	in	BO		for Wi-F	'i in
Tdoc /Source	param			Fi+Wi-F				0	Fi: 35%~		Wi-	Fi+Wi-l	Fi: above	55%
c /S			Wi-Fi in	Wi-Fi in	NR-U in	NR-U in	Wi-Fi	Wi-Fi in	NR-U in	NR-U in			NR-U in	NR-U in
Γdo			Wi-Fi+	Wi-Fi+	Wi-Fi+	NR-U+	in	Wi-Fi+	Wi-Fi+	NR-U+	in	in	Wi-Fi+	NR-U+
			Wi-Fi	NR-U	NR-U	NR-U	Wi-Fi+ Wi-Fi	NR-U	NR-U	NR-U		Wi-Fi+ NR-U	NR-U	NR-U
	DL	5%	11.891	12.482	27.214	40.856	1.566	4.815	7.408	13.925	0.961	2.345	5.858	8.077
	UPT	50%	63.790	80.543	134.350	142.631	20.597	41.713	69.150	89.247	12.230	18.196	34.205	57.872
	CDF	95%	116.687	127.743	201.932	199.782	98.768	106.480	181.136	198.498	71.163	78.572	117.063	179.804
	[Mbps]	Mean	64.637	73.768	131.201	148.222	31.725	47.200	79.495	104.393	20.757	26.668	46.786	80.682
	DL	5%	0.033	0.030	0.021	0.021	0.042	0.039	0.024	0.021	0.054	0.052	0.038	0.030
	Delay	50%	0.06	0.051	0.031	0.023	0.205	0.145	0.080	0.038	0.325	0.304	0.196	0.116
	CDF	95%	0.355	0.359	0.165	0.162	1.654	1.319	0.612	0.301	2.264	2.700	1.162	0.645
	[s]	Mean	0.116	0.110	0.056	0.050	0.439	0.338	0.163	0.092	0.634	0.612	0.344	0.240
	UL	5%	10.305	10.514	26.193	31.033	1.327	5.022	6.596	12.632	0.737	2.713	3.013	8.462
	UPT	50%	63.356	77.355	119.294	128.471	18.200	35.384	58.210	66.122	11.274	20.049	23.930	32.478
	CDF	95%	110.755	117.296	191.984	194.520	93.601	94.371	160.740	177.824	78.363	81.837	117.751	164.475
1814062 /Source 6	[Mbps]	Mean	64.278	71.860	110.596	118.240	31.913	43.966	69.836	77.030	22.160	28.613	38.368	57.172
Sou	UL	5%						0.041	0.027	0.024	0.050	0.050	0.043	0.033
52 /	Delay	50%								0.110	0.371	0.315	0.291	0.287
140(	CDF	95%	0.308	0.309	0.144	0.144	2.195	1.283	1.101	0.060	3.004	2.988	2.029	1.629
18	[s]	Mean	0.114	0.099	0.059	0.057	0.514	0.362	0.256	0.246	0.752	0.741	0.551	0.367
R1-	$Q_{D}$	L	0.9813	0.9800	0.9800	1.00	0.9280	0.9560	0.9560	1.00	0.8882	0.8880	0.8880	0.9530
	$arrho_{ m U}$	L	0.9740	0.9700	1.00	1.00	0.9285	0.9530	0.9846	1.00	0.9026	0.8950	0.9325	0.9244
	BC	)	10.0	8.7	4.05	3.90	40.0	30.70	17.80	13.65	58.0	54.90	34.80	21.10
	λ			0.086/	/0.086			0.114	/0.114	Į		0.14	3/0.143	
			Addition	al comm	ents: Out	door Sub	-7GHz	deploym	ent Scen	ario 1	1			
				ings: 802				-			•	-	· •	
		2Tx2Rx in UL, 2 streams in both DL and UL. GI:0.8 μs, TXOP=4 ms, LDPC, A-MI RTS/CTS disabled, link adaptation: Minstrel algorithm, CWS: DL{15,63} and UL{												
							MINSTR	algorit	nm, Cws	5: DL{15	,63} an	a UL{1	5,1023},	CCA:
			CS=-82dBm, ED=-62dBm. NR-U settings: 4Tx2Rx in DL, Cross-polarized. MCS=4/16/64/256QAM, scheduling: proportional											
			fair, link adaptation realistic, ED=-72 dBm, CP=Normal, SCS=30KHz, TXOP=4 ms, UE Capability											
							{15,1023}, COT sharing enabled, COT details: flexible DL/UL only needs, 3/11 DL control/data symbols, 3/11 symbols UL control/data							
			mixed D	L/UĹ bas	sed on tra	ittic need	s, 3/11 ]	JL contr	ol/data s	ymbols, 3	3/11 syn	ibols Ul	L control	/data.

						NR-U)	COEXISTENCE II	n outdoor scena	rio I	
1				<u>v load</u>		lium			High loa	h
	Repo	rted		for NR-U in	BO rang				ge for N	
	param									R-U uses $ED =$
e l	P			= -72dBm:			35%~50%		m: abov	
ouro				~25%	_					
Tdoc /Source			NR-U in	NR-U in NR-	NR-U in	NR-	U in NR-U +	NR-U in NR-U	J + NR-	NR-U in NR-U
oc			NR-U + NR-	U + NR-U,	NR-U + NR-	NR-I	U, with NR-U	U, with NR-U		+ NR-U, with
Τd			U, with NR-	with NR-U	U, with NR-	use	es preamble	ED = -72d	Bm	NR-U uses
			U uses ED =	uses preamble	U uses ED =		-			preamble
			-72dBm		-72dBm					
	DL:	5%	38.85	35.91	31.86		26.86	25.32		13.87
	UPT	50%	93.10	88.38	81.68		72.67	71.41		46.15
	CDF	95%	120.45	118.35	116.42	105.82		109.36		83.77
	[Mbps]			85.97	81.00	71.29		71.74		48.95
	DL:	5%	0.027	0.028	0.029	0.034		0.030		0.046
	Delay	50%	0.039	0.042	0.047	0.064		0.058		0.201
	CDF	95%	0.089	0.102	0.118	0.276		0.160		1.441
	[s]	Mean		0.053	0.059		0.110	0.076		0.445
	UL:	5%	25.35	24.11	18.14		15.20	13.69		6.94
	UPT	50%	63.03	59.33	52.18		45.47	42.20		26.70
	CDF	95%	89.95	85.51	82.85		73.39	76.12		55.42
8	[Mbps]			59.12	52.81		46.40	44.45		29.27
ILCE	UL:	5%	0.037	0.040	0.042		0.050	0.045		0.081
Sot	Delay	50%	0.063	0.069	0.083		0.120	0.111		0.423
1/	CDF	95%	0.140	0.155	0.214		0.619	0.310		2.998
R1-1814021 / Source 8	[s]	Mean		0.082	0.101		0.217	0.148		0.880
314	$Q_{\rm D}$	L	100%	100%	99.9%		99.5%	99.9%		96.7%
-12	$Q_{\rm UI}$		99.9%	100%	99.9%		99.4%	99.8%		96.8%
R1	BC		5.4%	5.9%	8.4%		11.6%	12.1%		26.6%
	λ			file/s	0.2	24 fil	e/s	(	).28 file	/s
			Additional co		. 1	1 1				TT / CC
								oexistence, 50/ tial CW back-o		
								or UE, BF sche		
										W, BS transmit
								ver, CW {min,		
			UL{15,1023}		power roubli	,	102 1100 10001		inter j D	L(10,00)
					tv #1, PUSCH	I map	ping Type A, l	PDSCH mappir	ng Type	B, PDCCH
			-	0 1		-	1 0 01	eduling. COT s	0 01	
			initiated COT		011			0	0	
			<u> </u>	1. (			• •	. 1		
	1	E						outdoor scena		
				<u>v load</u>		lium			<u>High loa</u>	
				for NR-U in Fi, with NR-U	BO range				ge for N	R-U in
e l				= -72dBm:			35%~50%		m: aboy	
urc				~25%	ED = -720	IDIII.	5570'~5070	-/2ub		/e 55%
Tdoc /Source	Repo		NR-U in	~25% NR-U in NR-	NR-II in NP	II +	NR-U in NR-	NR-U in NR-	NR-II	in NR-U + Wi-
)c /	param	eters	NR-U + Wi-	U + Wi-Fi,	Wi-Fi, with N			U + Wi-Fi,		th NR-U uses
Tdc			Fi, with NR-	with NR-U	uses ED =		with NR-U	with NR-U		preamble
				uses preamble			uses preamble			
			-72dBm	r			r r	-72dBm		
	DL:	5%	26.29	28.06	8.67		2.15	1.35		0.18
		50%	72.79	73.75	34.89		20.76	11.29		7.05

# Table B.2.1-2: Wi-Fi and NR-U coexistence evaluation (20MHz/FTP traffic) with & without NR-U PD (@- 82)

8	TIDT	0=0/	440.00	100.00			=0	~-		22.00
Ce	UPT	95%		106.60		72.10	53.		2.05	33.89
R1-1814021 / Source		Mean	73.48	71.96		37.92	25.	20	5.87	11.64
/ N	[Mbps] DL:	5%	0.029	0.031		0.072	0.0	65 (	).138	0.091
21	DL. Delay	50%		0.031		0.498	0.0		417	1.416
[40	CDF	95%		0.531		3.807	7.3		3.852	10.218
181		Mean		0.170		1.064	2.0		2.716	3.120
4	UL:	5%	16.25	15.63		3.93	2.0		0.27	0.08
	UPT	50%	48.19	44.63		19.37	10.		4.89	2.56
	CDF	95%	79.28	75.77		45.48	31.		2.92	17.22
	[Mbps]			46.61		+3.40 22.07	13.		8.02	5.10
	UL:	5%	0.043	0.049		0.087	0.1		).150	0.260
	Delay	50%	0.123	0.179		1.030	2.0		2.888	3.048
	CDF	95%	0.607	0.748		9.170	12.6		1.958	18.534
		Mean		0.286		2.537	3.8		5.157	5.826
	QDI		99.9%	99.3%		)6.2%	83.8		5.7%	71%
	QUI		99.4%	99.2%		35.8%	80.0		2.1%	65.6%
	BC		10%	10.6%		35%	50.2		60%	69%
	$\frac{DC}{\lambda}$	,		file/s		0.24 fil		270		file/s
	<i>1</i> ,		Additional co			0,24 111	C/3		0.20	1110/3
				etup: NR-U ou	tdoor s	cenario 1 5	0/50 DI	L/UL traffics	1	
										f, MCOT duration:
										scheme: Tx and
										er with 20MHz
										C receiver. CW
				L{15,63} UL{				•		
			Wi-Fi assum	ptions: RTS/C	TS disa	abled, ED/P	D thresh	nold -62/-82	lBm, A-MPD	U frame
				MPDU size: 15						
				ptions: SCS 30						
				oing Type B, PI					ing: proportic	onal fair, self-
				OT sharing ena						
	1	ł		ults of Wi-Fi in	an NR					_
			-	Low load						
				ge for NR-U in	l		ledium 1			ligh load
			NR-U + W1		r		nge for l	NR-U in	BO rang	ge for NR-U in
				-Fi, with NR-U		NR-U + W	nge for l i-Fi, wit	NR-U in th NR-U use	BO rang s NR-U + V	ge for NR-U in Vi-Fi, with NR-U
Ce				-Fi, with NR-U 2dBm: 10%~25		NR-U + W	nge for l i-Fi, wit	NR-U in	BO rang s NR-U + V	ge for NR-U in Vi-Fi, with NR-U = -72dBm: above
ource	Dana	wood	ED = -72	2dBm: 10%~25	%	NR-U + W ED = -7	nge for 1 i-Fi, wit 2dBm:	NR-U in th NR-U use 35%~50%	BO ranş s NR-U + V uses ED =	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55%
/Source	Repo		ED = -72 Wi-Fi in NR-	2dBm: 10%~25 Wi-Fi in NR-U	9% J + Wi-	NR-U + W ED = -7 Wi-Fi in N	nge for l i-Fi, wit 2dBm: R-U +	NR-U in th NR-U use 35%~50% Wi-Fi in NF	BO ranş s NR-U + V uses ED = - Wi-Fi in	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U +
loc /Source	Repor param		ED = -72 Wi-Fi in NR- U + Wi-Fi,	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with	nge for l i-Fi, wit 2dBm: R-U + I NR-U	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi,	BO rang NR-U + V uses ED = - Wi-Fi in NR-U +	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U
Tdoc /Source	-		ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U	2dBm: 10%~25 Wi-Fi in NR-U	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI	nge for l i-Fi, wit 2dBm: R-U + NR-U D =	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi with NR-U	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U
Tdoc /Source	-		ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED =	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with	nge for l i-Fi, wit 2dBm: R-U + NR-U D =	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses	s NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U
Tdoc /Source	-		ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI	nge for l i-Fi, wit 2dBm: R-U + NR-U D =	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi with NR-U	BO rang NR-U + V uses ED = - - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED =	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U
Tdoc /Source	-		ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED =	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI	nge for l i-Fi, wit 2dBm: R-U + NR-U D =	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses	s NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U
Tdoc /Source	param	eters	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB	nge for 1 i-Fi, wit 2dBm: R-U + NR-U NR-U D = m	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble
Tdoc /Sourc	param DL:	eters	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB	nge for 1 i-Fi, wit 2dBm: R-U + NR-U D = m	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21
Tdoc /Sourc	param DL: UPT	eters 5% 50%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39 60.32	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.10	nge for 1 i-Fi, wit 2dBm: R-U + NR-U ) = m	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble <u>1.84</u> 16.85	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53
Tdoc /Sourc	DL: UPT CDF	eters 5% 50% 95%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39 60.32 92.65	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.16 69.59	nge for 1 i-Fi, wit 2dBm: R-U + NR-U D = m 5	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble <u>1.84</u> 16.85 50.32	BO rang NR-U + V uses ED = 	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60
Tdoc /Sourc	param DL: UPT CDF [Mbps]	eters 5% 50% 95% Mean	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39 60.32 92.65 60.23	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.16 69.59 35.26	nge for 1 i-Fi, wit 2dBm: R-U + NR-U NR-U D = m 5 5 5	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65 54.04 21.26	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97
Tdoc /Sourc	DL: UPT CDF [Mbps] DL:	5% 50% 95% Mean 5%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39 60.32 92.65 60.23 0.036	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96 0.037	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.16 69.55 35.26 0.053	nge for 1 i-Fi, wit 2dBm: 2dBm: R-U + NR-U D = m 5 5 5 3	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53 0.069	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65 54.04 21.26 0.066	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97 0.098
Tdoc /Sourc	DL: UPT CDF [Mbps] DL: Delay	eters 5% 50% 95% Mean 5% 50%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39 60.32 92.65 60.23 0.036 0.075	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96 0.037 0.084	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.16 69.59 35.26 0.053 0.216	nge for 1 i-Fi, wit 2dBm: 2dBm: R-U + NR-U D = m 5 5 5 5 5 5 5	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53 0.069 0.514	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65 54.04 21.26 0.066 0.405	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97 0.098 1.005
Tdoc /Sourc	param DL: UPT CDF [Mbps] DL: Delay CDF	5% 50% 95% 50% 50% 95%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39 60.32 92.65 60.23 0.036 0.075 0.335	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96 0.037 0.084 0.386	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.10 69.55 35.20 0.053 0.216 2.110	nge for 1 i-Fi, wit 2dBm: 2dBm: R-U + NR-U D = m 5 5 5 5 5 5 5 5 0	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53 0.069 0.514 7.152	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65 54.04 21.26 0.066 0.405 4.478	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97 0.098 1.005 10.134
R1-1814021 / Source 8 Tdoc /Source	param DL: UPT CDF [Mbps] DL: Delay CDF [s]	5% 50% 95% Mean 5% 50% 95% Mean	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39 60.32 92.65 60.23 0.036 0.075 0.335 0.145	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96 0.037 0.084 0.386 0.145	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.16 69.59 35.26 0.053 0.216 2.110 0.63	nge for 1 i-Fi, wit 2dBm: 2dBm: R-U + NR-U ) = m 5 5 5 5 5 1	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53 0.069 0.514 7.152 1.773	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65 54.04 21.26 0.066 0.405 4.478 1.239	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97 0.098 1.005 10.134 2.664
Tdoc /Sourc	param DL: UPT CDF [Mbps] DL: Delay CDF [s] UL:	5% 50% 95% Mean 5% 95% Mean 5%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39 60.32 92.65 60.23 0.036 0.075 0.335 0.145 14.46	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96 0.037 0.084 0.386 0.145 14.49	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.16 69.59 35.26 0.053 0.216 2.110 0.631 5.31	nge for 1 i-Fi, wit 2dBm: R-U + NR-U D = m 5 5 5 5 5 5 5 5 1	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53 0.069 0.514 7.152 1.773 1.53	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm - 1.24 15.65 54.04 21.26 0.066 0.405 4.478 1.239 0.99	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97 0.098 1.005 10.134 2.664 0.19
Tdoc /Sourc	param DL: UPT CDF [Mbps] DL: Delay CDF [s] UL: UPT	eters 5% 50% 95% Mean 5% 95% Mean 5% 50%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses $ED =$ -72dBm 18.39 60.32 92.65 60.23 0.036 0.075 0.335 0.145 14.46 51.17	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96 0.037 0.084 0.386 0.145 14.49 49.31	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 60.03 31.16 69.59 35.26 0.053 0.216 2.110 0.633 5.31 24.26	nge for 1 i-Fi, wit 2dBm: R-U + NR-U D = m 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53 0.069 0.514 7.152 1.773 1.53 12.87	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65 54.04 21.26 0.066 0.405 4.478 1.239 0.99 11.73	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97 0.098 1.005 10.134 2.664 0.19 5.46
Tdoc /Sourc	param DL: UPT CDF [Mbps] DL: Delay CDF [s] UL: UPT CDF	eters 5% 50% 95% Mean 5% 50% 95% 50% 95%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses $ED =$ -72dBm 18.39 60.32 92.65 60.23 0.036 0.075 0.335 0.145 14.46 51.17 88.77	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96 0.037 0.084 0.386 0.145 14.49 49.31 87.53	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.16 69.59 35.26 0.053 0.216 2.110 0.633 5.31 24.28 59.90	nge for 1 i-Fi, wit 2dBm: 2dBm: R-U + NR-U D = m 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53 0.069 0.514 7.152 1.773 1.53 12.87 43.87	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65 54.04 21.26 0.066 0.405 4.478 1.239 0.99 11.73 43.83	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97 0.098 1.005 10.134 2.664 0.19 5.46 27.64
Tdoc /Sourc	param DL: UPT CDF [Mbps] DL: Delay CDF [s] UL: UPT CDF [Mbps]	eters 5% 50% 95% Mean 5% 50% 95% Mean 5% 50% 95%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses $ED =$ -72dBm 18.39 60.32 92.65 60.23 0.036 0.075 0.335 0.145 14.46 51.17 88.77 52.77	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96 0.037 0.084 0.386 0.145 14.49 49.31 87.53 51.46	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.16 69.59 35.26 0.053 0.216 2.110 0.631 5.31 24.28 59.90 28.71	nge for 1 i-Fi, wit 2dBm: 2dBm: R-U + NR-U ) = m 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 1 1 1 1	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53 0.069 0.514 7.152 1.773 1.53 12.87 43.87 17.56	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65 54.04 21.26 0.066 0.405 4.478 1.239 0.99 11.73 43.83 16.78	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97 0.098 1.005 10.134 2.664 0.19 5.46 27.64 9.38
Tdoc /Sourc	param DL: UPT CDF [Mbps] DL: Delay CDF [s] UL: UPT CDF	eters 5% 50% 95% Mean 5% 50% 95% 50% 95%	ED = -72 Wi-Fi in NR- U + Wi-Fi, with NR-U uses ED = -72dBm 18.39 60.32 92.65 60.23 0.036 0.075 0.335 0.145 14.46 51.17 88.77 52.77 0.038	2dBm: 10%~25 Wi-Fi in NR-U Fi, with NR-U preamble 19.46 60.98 91.97 59.96 0.037 0.084 0.386 0.145 14.49 49.31 87.53	9% J + Wi- J uses	NR-U + W ED = -7 Wi-Fi in N Wi-Fi, with uses EI -72dB 6.03 31.16 69.59 35.26 0.053 0.216 2.110 0.633 5.31 24.28 59.90	nge for 1 i-Fi, wit 2dBm: 2dBm: R-U + NR-U D = m 5 5 5 5 5 5 5 5 5 5 5 5 5 1 1 1 1 1 1	NR-U in th NR-U use 35%~50% Wi-Fi in NF U + Wi-Fi, with NR-U uses preamble 1.84 16.85 50.32 21.53 0.069 0.514 7.152 1.773 1.53 12.87 43.87	BO rang NR-U + V uses ED = - Wi-Fi in NR-U + Wi-Fi, with NR-U uses ED = -72dBm 1.24 15.65 54.04 21.26 0.066 0.405 4.478 1.239 0.99 11.73 43.83	ge for NR-U in Wi-Fi, with NR-U = -72dBm: above 55% Wi-Fi in NR-U + Wi-Fi, with NR-U uses preamble 0.21 6.53 32.60 10.97 0.098 1.005 10.134 2.664 0.19 5.46 27.64

Delay	95%	0.492	0.586	1.731	6.791	3.975	9.463						
CDF			0.203	0.607	1.680	1.160	2.500						
[s]													
$Q_{\rm D}$	QDL 99.8%		99.2%	97.2%	84.5%	93.1%	74.3%						
QUL		99.7%	99.4%	98.1%	93.2%	96.4%	89%						
BO		10.3%	11%	28.2%	50.5%	45.1%	67.3%						
λ		0	.19 file/s	0.24 fil	e/s	0	.28 file/s						
		Additional co	mments:										
			<b>imulation setup:</b> NR-U indoor scenario, 50/50 DL/UL traffics.										
			ommon assumptions: Primary LBT: Cat-4 LBT with exponential CW back-off, MCOT duration:										
		6ms, Max mo	ms, Max modulation: 256 QAM, Antennas: 4 for BS/AP and 2 for UE/STA, BF scheme: Tx and										
		Rx BF at BS/	6/AP, Maximal number of layers: 2 for DL and 2 for UL, single carrier with 20MHz										
		BW, BS/AP ti	7, BS/AP transmit power 20dBm, UE/STA transmit power 18dBm, MMSE-IRC receiver. CW										
			L{15,63} UL{15,102										
			ptions: RTS/CTS disa										
			MPDU size: 1500B M										
			<b>ptions:</b> SCS 30kHz, U										
			oing Type B, PDCCH			ng: proportio	nal fair, self-						
		scheduling. C	OT sharing enabled (g	gNB initiated COT	).								

## B.3 Evaluation results for sub7GHz outdoor scenario 2

### B.3.1 Wi-Fi and NR-U coexistence evaluation with 20MHz and FTP traffic

6	Reporte	d	BC		<u>r <b>load</b></u> for Wi-Fi	i in	B	<u>Mediu</u> D range f		in	B	High O range f		n
LC	narame	:u ters			i: 10%~2			iFi+WiFi				iFi+WiFi:		
S S	parame	leis	Wi-Fi		NR-U							Wi-Fi in		
			in	in	in	in NR-	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+
P H			WiFi+	WiFi+		U+	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U
			WiFi	NR-U		NR-U			_			_	_	_
	DL:	5%	12.99	15.17	29.74	27.96	2.75	9.54	20.96	21.64	0.61	5.25	17.28	16.80
	UPT	50%	49.24	53.40	80.19	78.03	26.27	42.85	64.26	64.80	14.38	33.25	52.21	56.83
	CDF	95%	77.43	77.62	101.02	100.93	72.25	77.20	100.91	100.84	60.86	76.54	100.52	100.66
	[Mbps]	Mean	47.95	51.31	73.89	72.61	30.52	43.38	65.34	65.35	20.58	36.64	57.39	59.65
	DL:	5%	0.05	0.05	0.04	0.04	0.06	0.05	0.04	0.04	0.07	0.05	0.04	0.04
	Delay	50%	0.08	0.07	0.05	0.05	0.15	0.09	0.06	0.06	0.26	0.12	0.08	0.07
	CDF	95%	0.30	0.26	0.13	0.14	1.17	0.41	0.19	0.18	2.81	0.66	0.23	0.23
	[s]	Mean		0.10	0.06	0.07	0.34	0.15	0.08	0.08	0.69	0.21	0.10	0.09
	UL:	5%	10.36	14.29	22.31	22.70	0.65	6.25	15.30	16.50	0.00	2.92	11.63	12.52
	UPT	50%	53.43	57.96	67.92	70.26	27.47	44.33	54.11	56.26	13.01	35.75	42.02	46.68
	CDF	95%	78.74	78.88	83.49	83.41	77.26	78.85	83.19	83.20	67.14	78.43	83.00	83.16
4	[Mbps]			53.56	61.30	62.22	31.68	44.15	53.33	54.73	21.15	37.92	46.27	49.64
e g	UL:	5%	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05
	Delay	50%	0.07	0.07	0.06	0.06	0.14	0.09	0.07	0.07	0.26	0.11	0.09	0.09
5/S	CDF [s]	95% Mean	0.38	0.27 0.10	0.18	0.18	2.51 0.54	0.60	0.26	0.24 0.10	8.00	1.16 0.30	0.33	0.31 0.12
108	[3]		100.0	0.10	0.00	0.06	0.54	0.17	0.10	0.10	1,24	0.50	0.13	0.12
R1-1814085/Source 4	Q	DL	100.0 %	100.0%	100.0%	100.0%	99.9%	100.0%	100.0%	100.0%	99.4%	100.0%	100.0%	100.0%
R			100.0 %				99.3%			100.0%	95.5%	100.0%		100.0%
	В		13.1%	11.4%		8.2%	38.2%	20.7%	12.9%	12.7%	61.3%	30.5%	17.3%	16.3%
	λ	,			.13			0.	17			0.	19	
				onal Cor				_ /						
												oop BF wi CS NCP;		
			time ca	nability	#1· NR	tvne B f	or PDSC	H, type A	A for PUS	SCH				
											AV set ba	sed on L-	SIG: PD	=_
					-									
							-	BCC; A-	MPDU,		SDU + 1	4 B heade	er; minee	nate
			ACK,3	12.5kHz	z SCS G	I= 0.8us								
4	DL:	5%	12.99	16.74	32.07	33.77	2.75	10.44	23.45	28.06	0.61	6.04	18.44	24.52
Source	UPT	50%	49.24	55.91	85.60	86.91	26.27	45.01	70.72	76.77	14.38	35.56	57.75	70.73
Sc	CDF	95%	77.43	77.67	105.66	105.66	72.25	77.45	105.63	105.65	60.86	76.94	105.42	105.60
			47.95	52.65	78.98	80.07	30.52	44.85	70.09	74.29	20.58	38.31	61.77	70.66
40	DL:	5%	0.05	0.05	0.04	0.04	0.06	0.05	0.04	0.04	0.07	0.05	0.04	0.04
181	Delay	50%	0.08	0.07	0.05	0.05	0.15	0.09	0.06	0.05	0.26	0.11	0.07	0.06
R1-1814085.	CDF	95%	0.30	0.23	0.12	0.12	1.17	0.38	0.17	0.14	2.81	0.61	0.21	0.16
4	[5]	Mean	0.12	0.10	0.06	0.06	0.34	0.14	0.07	0.07	0.69	0.19	0.09	0.07
	UL:	5%	10.36	15.45	26.17	31.08	0.65	7.69	19.20	24.99	0.00	3.35	13.76	21.39
	UPT	50%	53.43	59.34	79.22	83.40	27.47	46.83	63.13	72.74	13.01	36.87	50.52	66.67
	CDF	95%	78.74	79.01	93.44	93.44	77.26	78.82	93.37	93.41	67.14	78.61	93.25	93.37
	[Mbps]		49.79	54.60	70.25	73.51	31.68	45.66	61.59	67.37	21.15	39.12	53.76	63.78
	UL:	5%	0.05	0.05	0.04	0.04	0.05	0.05	0.04	0.04	0.06	0.05	0.04	0.04
	Delay	50%	0.07	0.07	0.05	0.05	0.14	0.09	0.06	0.05	0.26	0.11	0.08	0.06

				τ	11			N				TT! _1	11	]		
a	Reporte	Ч	BC		<u>load</u> or Wi-F	i in	B	<u>Mediu</u> D range f		in	<u>High load</u> BO range for Wi-Fi in					
	narame	:u ters			i: 10%~2			iFi+WiFi				iFi+WiFi:				
	parame	leis	Wi-Fi		NR-U	NR-U						Wi-Fi in				
			in	in	in	in NR-	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+		
Ε			WiFi+	WiFi+	WiFi+	U+	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U		
			WiFi	NR-U	NR-U	NR-U										
	CDF	95%	0.38	0.26	0.15	0.13	2.51	0.48	0.21	0.16	8.00	1.05	0.28	0.19		
	[s]	Mean	0.13	0.10	0.07	0.06	0.54	0.15	0.09	0.07	1.24	0.27	0.11	0.08		
	$Q_{I}$	DL	100.0	100.0%	100.0%	100.0%	99.9%	100.0%	100.0%	100.0%	99.4%	100.0%	100.0%	100.0%		
			%													
	Qu	JL	100.0	100.0%	100.0%	100.0%	99.3%	100.0%	100.0%	100.0%	95.5%	100.0%	100.0%	100.0%		
	B	0	% 13.1%	10.9%	7.4%	6.9%	38.2%	19.2%	11.5%	10.1%	61.3%	28.4%	15.5%	12.3%		
	λ		13.170		13	0.570	50.270	0.		10.170	01.570	0.		12.570		
			Additic	onal Con				0.	1/			0.	15			
						4 anten	na at gN	B/AP, 2 a	intenna a	t UE/STA	, close lo	op BF w	ith single	stream		
			<b>Common assumption:</b> 4 antenna at gNB/AP, 2 antenna at UE/STA, close loop BF with single stream <b>NRU assumption:</b> 8ms MCOT; ED=-72dBm; 256 QAM LDPC; 60 kHz SCS NCP; UE processing													
			time ca	nahility	#1· NR	tvne B f	or PDSC	H, type A	A for PUS	SCH						
											AV set ba	sed on L-	SIG: PD	=_		
												4 B head				
			ACK,3	12.5kHz	z SCS G	I= 0.8us	-									
	DL:	5%	16.06		52.83	62.56	9.41	14.19	39.03	59.09	0.52	3.1	25.12	53.42		
	UPT	50%	54.85	62.45		132.3	41.38	46.29	99.83	126.88	31.67	34.31	76.09	119.36		
	CDF	95%	90.83	93.26		163.9	78.41	85.02	145.77	160.43	69.85	77.01	132.15	157.06		
	[Mbps]			60.02	111.99		42.24	49.26	97.24	120.68	32.62	37.05	77.82	114.94		
	DL:	5%	0.034	0.034	0.021	0.021	0.036	0.035	0.021	0.021	0.04	0.037	0.023	0.021		
	Delay	50%	0.085	0.072	0.032	0.028	0.124	0.095	0.04	0.03	0.173	0.143	0.058	0.032		
	CDF [s]	95%	0.463	0.341	0.138	0.08	1.103	0.613	0.211	0.092	34.405	2.524	0.389	0.108		
	UL:	Mean 5%	0.16	0.117 8.86	0.051 28.49	0.037 32.51	1.469 3.18	0.212 5.53	0.072	0.04 29.72	9.289 0.05	5.248 0.28	0.123 9.6	0.045 26.68		
	UPT	50%	36.71	40.29	86.67	105.44	26.09	31.37	65.57	96.89	18.49	20.23	45.02	88.92		
	CDF	95%	77.26	83.32	138.06		64.74	73.95	125.2	148.87	55.13	60.19	106.54	141.95		
	[Mbps]		39.7	44.24	85.8	100.69	29.15	34.06	68.42	94.05	21.67	24.36	49.33	86.96		
	UL:	5%	0.036	0.035	0.022	0.022	0.042	0.039	0.022	0.022	0.05	0.047	0.025	0.022		
	Delay	50%	0.136	0.115	0.05	0.038	0.212	0.165	0.076	0.042	0.302	0.259	0.13	0.049		
	CDF	95%	0.962	0.674	0.302	0.152	2.602	1.4	0.559	0.182	84.716	10.972	1.158	0.231		
6	[s]	Mean		0.207	0.093	0.057	2.502	0.462	0.159	0.065	15.042	8.563	0.334	0.078		
340	$Q_{I}$	DL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.97	0.98	1.00	1.00		
R1-1813409 / S	Qι		1.00	1.00	1.00	1.00	0.99	0.99	1.00	1.00	0.95	0.96	1.00	0.99		
	B		0.24	0.20	0.10	0.07	0.43	0.34	0.17	0.09	0.65	0.57	0.31	0.12		
	λ		• ۲۰۰۰،		Mbps			1.5N	1bps			1.8 M	Abps			
				onal com		• <b>)</b> T <sub>V</sub> )	Dv Drin	ary I BT	• Cat_4 I	BT with	ovpopop	tial CW b	ackoff N			
												n Tx BF u				
												APDU siz				
				-								(periodici		0		
						rate pre			0.				0			
												me capab				
												ssumption				
												ORS enabl				
												acquired CK/CQI f				
												ck, UL gr				
	DL:	5%	16.06		49.88	59.68	9.41	12.27	35.44	55.47	0.52	1.28	23.03	50.53		
	UPT	50%	54.85		113.38		41.38	45.95	93.74	123.69	31.67	33.86	71.75	117.47		
	CDF	95%	90.83		150.83		78.41	86.7	140.54	155.38	69.85	77.11	128.07	152.05		
	[Mbps]		53.99		108.96		42.24	47.7	92.09	116.97	32.62	35.58	73.15	111.64		
1		5%	0.034	0.034	0.02	0.02	0.036	0.035	0.021	0.02	0.04	0.038	0.024	0.02		

Reporte	he	BC		<mark>r load</mark> or Wi-F	i in	B	<u>Mediu</u> D range f	m load or Wi-Fi	in	B	<u><b>High</b></u> O range f		in	
Hoarame	ters			: 10%~2			iFi+WiFi				Fi+WiFi:			
iparame S/Op L	ici 5	Wi-Fi			NR-U		1				Wi-Fi in			
00		in	in	in	in NR-	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U-	
П П		WiFi+	WiFi+	WiFi+	U+	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U	
		WiFi	NR-U	NR-U	NR-U	*****	1		1		1.11.0	1111 0	1111 0	
DL:	50%	0.085	0.072	0.033	0.029	0.124	0.101	0.044	0.031	0.173	0.148	0.063	0.033	
<b>DL: DL: D</b> elay CDF	95%	0.463	0.353	0.146	0.085	1.103	0.747	0.248	0.099	34.405	4.087	0.457	0.115	
🖁 CDF	Mean													
[s]		0.16	0.12	0.054	0.039	1.469	0.335	0.082	0.043	9.289	6.583	0.144	0.047	
쥑 UL:	5%	7.17	8.86	27.71	34.11	3.18	5.27	15.56	30.2	0.05	0.11	7.71	26.19	
607 UL: UPT CDF	50%	36.71	40.32	86.39	106.33	26.09	29.54	64.09	98.62	18.49	19.43	41.66	89.33	
CDF	95%	77.26	83.14		156.57	64.74	73.01	127.52	150.31	55.13	58.78	106.36	143.48	
$\mathbb{Z}[Mbps]$		39.7	43.59	86.29	102.15	29.15	33.17	67.07	94.89	21.67	23.46	47.69	87.64	
UL:	5%	0.036	0.035	0.021	0.021	0.042	0.04	0.022	0.021	0.05	0.048	0.025	0.022	
Delay	50%	0.136	0.117	0.051	0.037	0.212	0.173	0.081	0.043	0.302	0.27	0.142	0.049	
CDF	95%	0.962	0.697	0.32	0.156	2.602	1.702	0.661	0.193	84.716	36.709	1.361	0.242	
[s]	Mean	0.292	0.214	0.097	0.058	2.502	0.832	0.184	0.068	15.042	10.457	0.383	0.081	
$Q_{\Gamma}$	DL	1.00	0.99	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.96	0.99	1.00	
Qu		1.00	1.00	1.00	1.00	0.99	1.00	1.00	1.00	0.95	0.96	1.00	1.00	
B		0.24	0.20	0.10	0.07	0.43	0.36	0.19	0.09	0.65	0.59	0.33	0.13	
λ	l	1.2 Mbps         1.5 Mbps         1.8 Mbps												
		Additional comments: Common assumptions: 2Tx, 2Rx, Primary LBT : Cat-4 LBT with exponential CW backoff, MCOT												
		duration: 5.5 ms, Max modulation supported 256 QAM, MIMO scheme with Tx BF upto rank 2.												
		<b>Wi-Fi assumptions:</b> RTS/CTS enabled, ED/PD threshold -62/-82 dBm, A-MPDU size is chosen to get MPDU duration of 1ms, Wi-Fi Guard Interval long, Wi-Fi beacons enabled (periodicity 100ms),												
		MPDU	duratio	n of 1ms	s, Wi-Fi	Guard In								
		MPDU Minstre	duration el Algori	n of 1ms ithm for	s, Wi-Fi rate pre	Guard In diction	terval loi	ng, Wi-Fi	beacons	enabled (	periodici	ty 100ms	),	
		MPDU Minstre <b>NRU a</b>	duration el Algori ssumpti	n of 1ms ithm for <b>ions:</b> EI	s, Wi-Fi rate pre O thresho	Guard In diction old -72 d	terval loi IBm, SCS	ng, Wi-Fi 5 30 KHz	beacons	enabled (	(periodici me capab	ty 100ms ility #1, I	), NR	
		MPDU Minstre <b>NRU a</b> PDCCH	duration el Algori ssumpt H monito	n of 1ms ithm for <b>ions:</b> EI oring is 4	s, Wi-Fi rate pre O thresho 4 times j	Guard In diction old -72 d per slot (s	terval loı IBm, SCS slot size =	ng, Wi-Fi 5 30 KHz = 0.5ms),	beacons , UE proo Link ada	enabled ( cessing timestation as	(periodici me capab ssumption	ty 100ms ility #1, 1 ns : Recip	), NR procity	
		MPDU Minstre <b>NRU a</b> PDCCH based F	duration el Algori ssumpt H monito 3F, realis	n of 1ms ithm for ions: EI oring is stic dela	s, Wi-Fi rate pre 0 thresho 4 times j ys in CS	Guard In diction old -72 d per slot (s I reports	terval loı IBm, SCS slot size = , stand-al	ng, Wi-Fi 5 30 KHz = 0.5ms), one with	beacons , UE proo Link ada self-sche	enabled ( cessing tin ptation as duling, D	(periodici me capab ssumption DRS enabl	ty 100ms ility #1, M ns : Recip led (250u	), NR procity s, cat-2	
		MPDU Minstre <b>NRU a</b> PDCCI based E LBT ev	duration el Algori ssumpt H monito 3F, realis very 250	n of 1ms ithm for <b>ions:</b> EI oring is stic dela us, 40m	s, Wi-Fi rate pree 0 thresho 4 times p ys in CS s period	Guard In diction old -72 d per slot (s I reports icity), as	terval loi IBm, SCS slot size = , stand-al ynchrono	ng, Wi-Fi 5 30 KHz = 0.5ms), one with ous nodes	beacons , UE proc Link ada self-sche , UL LBT	enabled ( cessing tin ptation as duling, D in gNB	(periodici me capab ssumption DRS enabl acquired	ty 100ms ility #1, M ns : Recip led (250u COT: Cat	), NR procity s, cat-2 t-2 LB7	
		MPDU Minstre <b>NRU a</b> PDCCH based E LBT ev with gr	duration el Algori ssumpti H monito 3F, realis very 250 anularity	n of 1ms ithm for ions: EI oring is stic dela us, 40m y of 0.5r	s, Wi-Fi rate pre- D thresho 4 times J ys in CS s period ns, 1 syn	Guard In diction old -72 d per slot (s I reports icity), as nbol DM	terval loi IBm, SCS slot size = , stand-al ynchrono IRS overl	ng, Wi-Fi 5 30 KHz = 0.5ms), one with us nodes head, 1 sy	beacons , UE proo Link ada self-sche , UL LBT ymbol for	enabled ( cessing tin ptation a duling, D in gNB every A	(periodici me capab ssumption DRS enabl acquired CK/CQI f	ty 100ms ility #1, M ns : Recip led (250u COT: Cat Seedback,	), NR procity s, cat-2 :-2 LBT UL	
		MPDU Minstre <b>NRU a</b> PDCCH based E LBT ev with gr	duration el Algori ssumpti H monito 3F, realis very 250 anularity	n of 1ms ithm for ions: EI oring is stic dela us, 40m y of 0.5r	s, Wi-Fi rate pre- D thresho 4 times J ys in CS s period ns, 1 syn	Guard In diction old -72 d per slot (s I reports icity), as nbol DM	terval loi IBm, SCS slot size = , stand-al ynchrono IRS overl	ng, Wi-Fi 5 30 KHz = 0.5ms), one with us nodes head, 1 sy	beacons , UE proo Link ada self-sche , UL LBT ymbol for	enabled ( cessing tin ptation a duling, D in gNB every A	(periodici me capab ssumption DRS enabl acquired	ty 100ms ility #1, M ns : Recip led (250u COT: Cat Seedback,	), NR procity s, cat-2 :-2 LBT UL	
<sup>®</sup> DL:		MPDU Minstre <b>NRU a</b> PDCCI based E LBT ev with gr grant. (	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru	n of 1ms ithm for ions: EI oring is stic dela us, 40m y of 0.5r	s, Wi-Fi rate pre- D thresho 4 times J ys in CS s period ns, 1 syn	Guard In diction old -72 d per slot (s I reports icity), as nbol DM	terval loi IBm, SCS slot size = , stand-al ynchrono IRS overl	ng, Wi-Fi 5 30 KHz = 0.5ms), one with us nodes head, 1 sy	beacons , UE proo Link ada self-sche , UL LBT ymbol for	enabled ( cessing tin ptation a duling, D in gNB every A	(periodici me capab ssumption DRS enabl acquired CK/CQI f	ty 100ms ility #1, M ns : Recip led (250u COT: Cat Seedback,	), NR procity s, cat-2 :-2 LBT UL ing	
a		MPDU Minstre <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points.	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72	n of 1ms ithm for ions: EI oring is stic dela us, 40m y of 0.5r icture in 25.49	s, Wi-Fi rate pree 0 thresho 4 times j ys in CS s period ns, 1 syn cludes a 27.70	Guard In diction old -72 d per slot (s I reports icity), asy nbol DM preparat	terval loi IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage	ng, Wi-Fi 5 30 KHz = 0.5ms), one with ous nodes head, 1 sy for CSI	beacons , UE proo Link ada self-sche , UL LBT ymbol for exchange	enabled ( cessing tin ptation as duling, D in gNB every AC leading t	periodici me capab ssumption RS enabl acquired CK/CQI f co total of	ty 100ms ility #1, M ns : Recip led (250u COT: Cat reedback, 2 switch	), NR procity s, cat-2 t-2 LBT UL ing 24.32	
S CDF	5% 50% 95%	MPDU Minstre <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63	n of 1ms ithm for ions: EI oring is stic dela us, 40m y of 0.5r icture in 25.49	5, Wi-Fi rate pred 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92	Guard In diction old -72 d per slot (s I reports icity), as nbol DM preparat	terval loi IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32	ng, Wi-Fi 5 30 KHz = 0.5ms), one with ous nodes head, 1 sy for CSI 21.61	beacons , UE proo Link ada self-sche , UL LBT ymbol for exchange 27.47	enabled ( cessing tin ptation as duling, D in gNB every AC leading t 1.77	periodici me capab ssumption PRS enabl acquired CK/CQI f CK/CQI f co total of 8.38	ty 100ms ility #1, M ns : Recip ed (250u COT: Cat Ceedback, 2 switch 13.87	), NR procity s, cat-2 t-2 LBT UL ing 24.32 77.29	
S CDF	5% 50% 95%	MPDU Minstre <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63	n of 1ms ithm for ions: EI oring is stic dela us, 40m y of 0.5r icture in 25.49 76.60	5, Wi-Fi rate pred 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92	Guard In diction old -72 d per slot (s I reports icity), as mbol DM preparat 5.87 30.94	terval loi IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31	ng, Wi-Fi 5 30 KHz = 0.5ms), one with ous nodes head, 1 sy for CSI 21.61 70.24	beacons , UE proo Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53	enabled ( cessing tin ptation a duling, D r in gNB r every A0 leading t <u>1.77</u> 12.84	(periodici me capab ssumption DRS enabl acquired CK/CQI f CK/CQI f to total of 8.38 40.51	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat ceedback, 2 switch 13.87 50.60	), NR procity s, cat-2 LBT UL ing 24.32 77.29 121.1	
CDF [Mbps]	5% 50% 95%	MPDU Minstre <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05	n of 1ms ithm for ions: EI oring is stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49	5, Wi-Fi rate pred 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92 124.26	Guard In diction old -72 d per slot (s I reports icity), asy mbol DM preparat 5.87 30.94 67.71	terval loi IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99	ng, Wi-Fi 5 30 KHz = 0.5ms), one with ous nodes head, 1 sy for CSI 21.61 70.24 118.81	beacons , UE proo Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52	enabled ( cessing tin ptation a duling, D r in gNB every A0 leading t 1.77 12.84 41.40	(periodici me capab ssumption PRS enabl acquired CK/CQI f co total of 8.38 40.51 85.31	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat feedback, 2 switch 13.87 50.60 102.27	), NR procity s, cat-2 :-2 LBT UL ing 24.32 77.29 121.1 77.16	
CDF [Mbps]	5% 50% 95% Mean	MPDU Minstre NRU a PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56	n of 1ms ithm for ions: EI oring is stic dela us, 40m y of 0.5r acture in 25.49 76.60 121.49 78.11	5, Wi-Fi rate pre- 0 thresho 4 times p ys in CS s period ns, 1 syr cludes a 27.70 82.92 124.26 82.79	Guard In diction old -72 d per slot (s I reports icity), asy nbol DM preparat 5.87 30.94 67.71 34.39	terval lor IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78	ng, Wi-Fi 5 30 KHz = 0.5ms), one with ous nodes head, 1 sy for CSI 21.61 70.24 118.81 72.92	beacons , UE prod Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52 81.23	enabled ( cessing tin ptation as duling, D in gNB every AC leading t 1.77 12.84 41.40 16.70	periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67	ty 100ms ility #1, 1 ns : Recip led (250u COT: Cat ceedback, 2 switch 13.87 50.60 102.27 55.47	), NR procity s, cat-2 :-2 LBT UL ing 24.32 77.29 121.1 77.16 0.028	
CDF [Mbps] [000] <b>DL:</b> [000] <b>DL:</b> [000] <b></b>	5% 50% 95% Mean 5%	MPDU Minstre <b>NRU a</b> PDCCF based F LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r acture in 25.49 76.60 121.49 78.11 0.027	5, Wi-Fi rate pred 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92 124.26 82.79 0.027	Guard In diction old -72 d per slot (s I reports icity), asy nbol DM preparat 5.87 30.94 67.71 34.39 0.054	terval lor IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033	ng, Wi-Fi 3 30 KHz = 0.5ms), one with us nodes head, 1 sy for CSI 21.61 70.24 118.81 72.92 0.027	beacons , UE proo Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52 81.23 0.027	enabled ( cessing tin ptation as duling, D r in gNB every AC leading t 1.77 12.84 41.40 16.70 0.067	periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040	ty 100ms ility #1, 1 ns : Recip led (250u COT: Cat reedback, 2 switch 13.87 50.60 102.27 55.47 0.035	), VR procity s, cat-2 t-2 LBT UL ing 24.32 77.29 121.1 77.16 0.028 0.046	
CDF CDF [Mbps] Delay	5% 50% 95% Mean 5% 50%	MPDU Minstree <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060	n of 1ms ithm for ions: EI oring is a stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047	5, Wi-Fi rate pred 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92 124.26 82.79 0.027 0.041	Guard In diction old -72 d per slot (s I reports icity), as preparat 5.87 30.94 67.71 34.39 0.054 0.520	terval lon IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071	ng, Wi-Fi 5 30 KHz = 0.5ms), one with us nodes head, 1 sy for CSI 21.61 70.24 118.81 72.92 0.027 0.056	beacons , UE prod Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043	enabled ( cessing tin ptation as duling, D r in gNB every AG leading t 1.77 12.84 41.40 16.70 0.067 0.865	(periodici me capab ssumption DRS enabl acquired CK/CQI f co total of 8.38 40.51 85.31 44.67 0.040 0.151	ty 100ms ility #1, M ns : Recip ed (250u COT: Cat ceedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124	), VR procity s, cat-2 LBT UL ing 24.32 77.29 121.11 77.16 0.028 0.046 0.132	
CDF [Mbps] [000] <b>DL:</b> [000] <b>DL:</b> [000] <b></b>	5% 50% 95% Mean 5% 50% 95%	MPDU Minstree <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096 0.467	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226	n of 1ms ithm for ions: EI oring is a stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153	5, Wi-Fi rate pred 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109	Guard In diction old -72 d per slot (s I reports icity), asy mbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633	terval loi IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324	ng, Wi-Fi 30 KHz = 0.5ms), one with us nodes head, 1 sy for CSI 21.61 70.24 118.81 72.92 0.027 0.056 0.292	beacons , UE prod Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118	enabled ( cessing tin ptation a duling, D in gNB every Ad leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329	(periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040 0.151 1.468	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat ceedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156	), NR procity s, cat-2 LBT UL ing 24.32 77.29 121.11 77.16 0.028 0.046 0.132 0.060	
MUPI CDF [Mbps] DL: Delay [s] UL: UPT	5% 50% 95% Mean 5% 50% 95% Mean	MPDU Minstree <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096 0.467 0.182	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.093	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069	5, Wi-Fi rate pre- 0 thresho 4 times j ys in CS s period ns, 1 syr cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109 0.054	Guard In diction old -72 d per slot (s I reports icity), asy mbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497	terval lon IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120	ng, Wi-Fi 30 KHz = 0.5ms), one with us nodes head, 1 se for CSI 21.61 70.24 118.81 72.92 0.027 0.056 0.292 0.094	beacons , UE prod Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055	enabled ( cessing tin ptation a: duling, D r in gNB r every A0 leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005	(periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040 0.151 1.468 0.434	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat reedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319	), NR procity s, cat-2 -2 LBT UL ing 24.32 77.29 121.1 77.16 0.028 0.046 0.132 0.060 19.05	
MUPI CDF [Mbps] DL: CDF [s] UL: UPT CDF	5% 50% 95% Mean 5% 95% Mean 5% 50% 95%	MPDU Minstree <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096 0.467 0.182 13.06	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.093 12.68	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069 16.29	5, Wi-Fi rate pre- 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109 0.054 25.54	Guard In diction old -72 d per slot (s I reports icity), asy mbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497 5.98	terval lor Bm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120 10.44	ng, Wi-Fi 3 30 KHz = 0.5ms), one with us nodes head, 1 sy = for CSI 21.61 70.24 118.81 72.92 0.027 0.056 0.292 0.094 13.53	beacons , UE prod Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055 22.38	enabled ( cessing tin ptation a: duling, D in gNB o every AC leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005 1.67	(periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040 0.151 1.468 0.434 5.75	ty 100ms ility #1, M ns : Recip ed (250u COT: Cat feedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319 7.37	), VR procity s, cat-2 -2 LBT UL ing 24.32 77.29 121.1 77.16 0.028 0.046 0.132 0.060 19.05 58.47	
MUPI CDF [Mbps] DL: Delay [s] UL: UPT	5% 50% 95% Mean 5% 95% Mean 5% 50% 95%	MPDU Minstree <b>NRU a</b> PDCCF based F LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096 0.467 0.182 13.06 49.67	duration el Algori ssumpti d'monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.093 12.68 51.40	n of 1ms ithm for ions: EI oring is - stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069 16.29 51.62	5, Wi-Fi rate pre- 0 thresho 4 times p ys in CS s period ns, 1 syr cludes a 27.70 82.92 124.26 82.79 0.027 0.027 0.041 0.109 0.054 25.54 64.61	Guard In diction old -72 d per slot (s I reports icity), asy nbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497 5.98 27.39	terval lor IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120 10.44 45.25	ng, Wi-Fi 3 30 KHz = 0.5ms), one with us nodes head, 1 sy = for CSI 21.61 70.24 118.81 72.92 0.027 0.026 0.292 0.094 13.53 48.13	beacons , UE prod Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055 22.38 61.60	enabled ( cessing tin ptation a: duling, D in gNB of every AC leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005 1.67 11.32	(periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040 0.151 1.468 0.434 5.75 32.11	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat ceedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319 7.37 32.02	), NR procity s, cat-2 -2 LBT UL ing 24.32 77.29 121.11 77.16 0.028 0.046 0.132 0.060 19.05 58.47 90.19	
MUPI CDF [Mbps] DL: CDF [s] UL: UPT CDF	5% 50% 95% 50% 50% 95% Mean 50% 95% Mean 5%	MPDU Minstree <b>NRU a</b> PDCCF based F LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096 0.467 0.182 13.06 49.67 90.43	duration el Algori ssumpti d'monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.093 12.68 51.40 96.95	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069 16.29 51.62 91.32	5, Wi-Fi rate pre- 0 thresho 4 times p ys in CS s period ns, 1 syr cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109 0.054 25.54 64.61 96.40	Guard In diction old -72 d per slot (s I reports icity), asy nbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497 5.98 27.39 64.76	terval lor Bm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120 10.44 45.25 95.53	ng, Wi-Fi 30 KHz = 0.5ms), one with us nodes head, 1 sy for CSI 21.61 70.24 118.81 72.92 0.027 0.027 0.026 0.292 0.094 13.53 48.13 86.72	beacons , UE prod Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055 22.38 61.60 93.96	enabled ( cessing tin ptation a: duling, D in gNB of every AC leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005 1.67 11.32 37.94	periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040 0.151 1.468 0.434 5.75 32.11 77.49	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat reedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319 7.37 32.02 74.19	), NR procity s, cat-2 -2 LBT UL ing 24.32 77.29 121.1 77.16 0.028 0.046 0.132 0.060 19.05 58.47 90.19 58.07	
MUPI CDF [Mbps] DL: Delay [S] UL: UPT CDF [Mbps] UL: Delay	5% 50% 95% Mean 5% 95% Mean 5% 95% 95% Mean	MPDU Minstree <b>NRU a</b> PDCCF based F LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096 0.467 0.182 13.06 49.67 90.43 51.50	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.093 12.68 51.40 96.95 54.34	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069 16.29 51.62 91.32 54.27	5, Wi-Fi rate pre- 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109 0.054 25.54 64.61 96.40 64.59	Guard In diction old -72 d per slot (s I reports icity), asy nbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497 5.98 27.39 64.76 31.32	terval lor IBm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120 10.44 45.25 95.53 50.52	ng, Wi-Fi 30 KHz = 0.5ms), one with us nodes head, 1 sy for CSI 21.61 70.24 118.81 72.92 0.027 0.026 0.292 0.094 13.53 48.13 86.72 50.18	beacons , UE prod Link ada self-sche , UL LBT ymbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055 22.38 61.60 93.96 61.93	enabled ( cessing tin ptation a: duling, D in gNB every AC leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005 1.67 11.32 37.94 15.31	(periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040 0.151 1.468 0.434 5.75 32.11 77.49 36.89	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat feedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319 7.37 32.02 74.19 36.13	), NR procity s, cat-2 LBT UL ing 24.32 77.29 121.1 77.16 0.028 0.046 0.132 0.060 19.05 58.47 90.15 58.07 0.037	
UPI CDF [Mbps] DL: Delay UL: [S] UL: [Mbps] UL: Delay CDF	5% 50% 95% 50% 50% 95% Mean 50% 95% Mean 5%	MPDU Minstree <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096 0.467 0.182 13.06 49.67 90.43 51.50 0.039	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.093 12.68 51.40 96.95 54.34 0.034	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069 16.29 51.62 91.32 54.27 0.037	5, Wi-Fi rate pred 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109 0.054 25.54 64.61 96.40 64.59 0.036	Guard In diction old -72 d per slot (s I reports icity), asy mbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497 5.98 27.39 64.76 31.32 0.070	terval lon Bm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120 10.44 45.25 95.53 50.52 0.034	ng, Wi-Fi 30 KHz = 0.5ms), one with us nodes head, 1 sy for CSI 21.61 70.24 118.81 72.92 0.027 0.056 0.292 0.094 13.53 48.13 86.72 50.18 0.038	beacons , UE prod Link ada self-sche , UL LBT mbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055 22.38 61.60 93.96 61.93 0.036	enabled ( ptation a: duling, D in gNB o every A0 leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005 1.67 11.32 37.94 15.31 0.100	(periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040 0.151 1.468 0.434 5.75 32.11 77.49 36.89 0.040	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat reedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319 7.37 32.02 74.19 36.13 0.050	), VR procity s, cat-2 LBT UL ing 24.32 77.29 121.1 77.16 0.028 0.046 0.132 0.060 19.05 58.47 90.19 58.07 0.037 0.068	
MUPI CDF [Mbps] DL: Delay [S] UL: UPT CDF [Mbps] UL: Delay	5% 50% 95% Mean 50% 95% Mean 5% 50% 95% Mean 5%	MPDU Minstree <b>NRU a</b> PDCCH based E LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.467 0.467 0.467 0.467 13.06 49.67 90.43 51.50 0.039 0.117	duration el Algori ssumpti H monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.093 12.68 51.40 96.95 54.34 0.034 0.077	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069 16.29 51.62 91.32 54.27 0.037 0.076	5, Wi-Fi rate pre- 0 thresho 4 times j ys in CS s period ns, 1 syr cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109 0.054 25.54 64.61 96.40 64.59 0.036 0.057	Guard In diction old -72 d per slot (s I reports icity), asy mbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497 5.98 27.39 64.76 31.32 0.070 0.574	terval lor Bm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120 10.44 45.25 95.53 50.52 0.034 0.093	ng, Wi-Fi 30 KHz = 0.5ms), one with us nodes head, 1 sy for CSI 21.61 70.24 118.81 72.92 0.027 0.025 0.292 0.094 13.53 48.13 86.72 50.18 0.038 0.096	beacons , UE prod Link ada self-sche , UL LBT mbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055 22.38 61.60 93.96 61.93 0.036 0.059	enabled ( cessing tin ptation a: duling, D r in gNB o every A0 leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005 1.67 11.32 37.94 15.31 0.100 1.139	periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040 0.151 1.468 0.434 5.75 32.11 77.49 36.89 0.040 0.174	ty 100ms ility #1, M ns : Recip ed (250u COT: Cat feedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319 7.37 32.02 74.19 36.13 0.050 0.278	), VR procity s, cat-2 -2 LBT UL ing 24.32 77.29 121.1 77.16 0.028 0.046 0.132 0.060 19.05 58.47 90.19 58.07 0.037 0.068 0.182	
UPI CDF [Mbps] DL: Delay UL: [S] UL: [Mbps] UL: Delay CDF	55% 50% 95% Mean 5% 95% Mean 5% 95% Mean 50% 95% Mean 50%	MPDU Minstree <b>NRU a</b> PDCCH based F LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.467 0.182 13.06 49.67 90.43 51.50 0.039 0.117 0.620	duration el Algori ssumpti d' monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.093 12.68 51.40 96.95 54.34 0.034 0.077 0.286	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069 16.29 51.62 91.32 54.27 0.037 0.076 0.226	5, Wi-Fi rate pre- 0 thresho 4 times p ys in CS s period ns, 1 syn cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109 0.054 25.54 64.61 96.40 64.59 0.036 0.057 0.131	Guard In diction old -72 d per slot (s I reports icity), asy mbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497 5.98 27.39 64.76 31.32 0.070 0.574 6.804	terval lor Bm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120 10.44 45.25 95.53 50.52 0.034 0.093 0.438	ng, Wi-Fi 30 KHz = 0.5ms), one with us nodes head, 1 sy = for CSI 21.61 70.24 118.81 72.92 0.027 0.056 0.292 0.094 13.53 48.13 86.72 50.18 0.038 0.096 0.423	beacons , UE prod Link ada self-sche , UL LBT mbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055 22.38 61.60 93.96 61.93 0.036 0.059 0.152	enabled ( cessing tin ptation a: duling, D in gNB ( every AC leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005 1.67 11.32 37.94 15.31 0.100 1.139 12.704	periodici me capab ssumption PRS enabl acquired CK/CQI f to total of 8.38 40.51 85.31 44.67 0.040 0.151 1.468 0.434 5.75 32.11 77.49 36.89 0.040 0.174 1.421	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat feedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319 7.37 32.02 74.19 36.13 0.050 0.278 2.288	), NR procity s, cat-2 -2 LBT UL ing 24.32 77.29 121.11 77.16 0.028 0.046 0.132 0.060 19.05 58.47 90.19 58.07 0.037 0.068 0.182 0.066	
UPI CDF [Mbps] DL: CDF [s] UL: UPT CDF [Mbps] UL: Delay CDF [s]	5% 50% 95% 95% 95% 95% 95% 95% Mean 5% 50% 95% Mean	MPDU Minstree <b>NRU a</b> PDCCF based F LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096 0.467 0.182 13.06 49.67 90.43 51.50 0.039 0.117 0.620 0.220	duration el Algori ssumpti d' monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.093 12.68 51.40 96.95 54.34 0.034 0.077 0.286 0.114	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069 16.29 51.62 91.32 54.27 0.037 0.076 0.226 0.102	5, Wi-Fi rate pre- 0 thresho 4 times p ys in CS s period ns, 1 syr cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109 0.054 25.54 64.61 96.40 64.59 0.036 0.057 0.131 0.068	Guard In diction old -72 d per slot (s I reports icity), asy mbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497 5.98 27.39 64.76 31.32 0.070 0.574 6.804 1.719	terval lon Bm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120 10.44 45.25 95.53 50.52 0.034 0.093 0.438 0.150	ng, Wi-Fi 30 KHz = 0.5ms), one with us nodes head, 1 sy = for CSI 21.61 70.24 118.81 72.92 0.027 0.056 0.292 0.094 13.53 48.13 86.72 50.18 0.038 0.096 0.423 0.154	beacons , UE prod Link ada self-sche UL LBT mbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055 22.38 61.60 93.96 61.93 0.036 0.059 0.152 0.074	enabled ( ptation a: duling, D in gNB ( every AC leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005 1.67 11.32 37.94 15.31 0.100 1.139 12.704 3.526	(periodici         me capab         ssumption         DRS enable         acquired         CK/CQI f         co total of         8.38         40.51         85.31         44.67         0.040         0.151         1.468         0.434         5.75         32.11         77.49         36.89         0.040         0.174         1.421         0.409	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat ceedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319 7.37 32.02 74.19 36.13 0.050 0.278 2.288 0.635	), NR procity s, cat-2 -2 LBT UL ing 24.32 77.29 121.11 77.16 0.028 0.046 0.132 0.060 19.05 58.47 90.19 58.07 0.037 0.068 0.182 0.066 100%	
INFIGURATION COPTING CDF [Mbps] DL: CDF [S] UL: UPT CDF [Mbps] UL: Delay CDF [s] QT	5% 50% 95% 95% 95% 95% 95% 95% Меап 5% 50% 95% Меап	MPDU Minstree <b>NRU a</b> PDCCF based F LBT ev with gr grant. C points. 12.44 52.52 92.08 54.47 0.035 0.096 0.467 0.182 13.06 49.67 90.43 51.50 0.039 0.117 0.620 0.220 98%	duration el Algori ssumpti d' monito 3F, realis very 250 anularity COT stru 16.72 62.63 100.05 62.56 0.033 0.060 0.226 0.033 12.68 51.40 96.95 54.34 0.034 0.077 0.286 0.114 100%	n of 1ms ithm for ions: EI oring is 4 stic dela us, 40m y of 0.5r icture in 25.49 76.60 121.49 78.11 0.027 0.047 0.153 0.069 16.29 51.62 91.32 54.27 0.037 0.076 0.226 0.102 100%	5, Wi-Fi rate pre- 0 thresho 4 times p ys in CS s period ns, 1 syr cludes a 27.70 82.92 124.26 82.79 0.027 0.041 0.109 0.054 25.54 64.61 96.40 64.59 0.036 0.057 0.131 0.068 100%	Guard In diction old -72 d per slot (s I reports icity), asy nbol DM preparat 5.87 30.94 67.71 34.39 0.054 0.520 5.633 1.497 5.98 27.39 64.76 31.32 0.070 0.574 6.804 1.719 84%	terval lor Bm, SCS slot size = , stand-al ynchrono IRS overl ion stage 15.32 56.31 99.99 58.78 0.033 0.071 0.324 0.120 10.44 45.25 95.53 50.52 0.034 0.093 0.438 0.150 100%	ng, Wi-Fi 30 KHz = 0.5ms), one with us nodes head, 1 sy for CSI 21.61 70.24 118.81 72.92 0.027 0.056 0.292 0.094 13.53 48.13 86.72 50.18 0.038 0.096 0.423 0.154 100%	beacons , UE prod Link ada self-sche UL LBT mbol for exchange 27.47 81.53 123.52 81.23 0.027 0.043 0.118 0.055 22.38 61.60 93.96 61.93 0.036 0.059 0.152 0.074 100%	enabled ( cessing tin ptation a: duling, D in gNB ( every AC leading t every AC leading t 1.77 12.84 41.40 16.70 0.067 0.865 12.329 3.005 1.67 11.32 37.94 15.31 0.100 1.139 12.704 3.526 67%	(periodici         me capab         ssumption         DRS enabla         acquired         CK/CQI f         co total of         8.38         40.51         85.31         44.67         0.040         0.151         1.468         0.434         5.75         32.11         77.49         36.89         0.040         0.174         1.421         0.409         98%	ty 100ms ility #1, 1 ns : Recip ed (250u COT: Cat reedback, 2 switch 13.87 50.60 102.27 55.47 0.035 0.124 1.156 0.319 7.37 32.02 74.19 36.13 0.050 0.278 2.288 0.635 99%	), NR procity s, cat-2 :-2 LBT UL	

				Low	load			Mediu	m load			High	load			
٩	Reporte	ed	BO	range fo	or Wi-Fi	in 🛛	BC	) range f	or Wi-Fi	in	В	O range f	or Wi-Fi	in		
	parame	ters	WiF	'i+WiFi	10%~2	5%	Wi	Fi+WiFi	: 35%~5	60%	W	iFi+WiFi:	above 55	5%		
Š,	parame		Wi-Fi	Wi-Fi	NR-U	NR-U	<i>N</i> i-Fi in	Wi-Fi in	NR-U ii	nNR-U i	ı Wi-Fi in	Wi-Fi in	NR-U in	NR-U ir		
J			in	in	in i	n NR-	WiFi+	WiFi+	WiFi+	NR-U+	WiFi+	WiFi+	WiFi+	NR-U+		
E	4		WiFi+	WiFi+	WiFi+	U+	WiFi	NR-U	NR-U	NR-U	WiFi	NR-U	NR-U	NR-U		
			WiFi	NR-U	NR-U	NR-U										
			Additio	nal com	ments:											
			Simulat	ion setu	ip: NR-U	J outdo	or scena	rio 2, 50/	50 DL/U	JL traffic	s.					
											al CW ba	ck-off, M	COT dura	tion:		
			6ms, Ma	ax modu	ilation: 2	56 QAN	/I, Anter	nnas: 4 fo	or BS/AI	and 2 fo	r UE/STA	, BF sche	eme: Tx a	nd Rx		
			BF at B	S/AP, M	laximal r	umber (	of layers	: 2 for D	L and 2	for UL, s	ingle carr	ier with 2	0MHz B	W,		
			BS/AP t	ransmit	power 2	0dBm, ۱	JE/STA	transmit	power 1	8dBm, N	1MSE-IR	C receive	r. CW {m	in,max}		
			DL{15,6	transmit power 20dBm, UE/STA transmit power 18dBm, MMSE-IRC receiver. CW {min,max},63} UL{15,1023}.												
											dBm, A-N	APDU fra	me aggre	gation,		
										guard in						
											cessing tir					
											very 10S	Scheduli	ng: propo	ortional		
			fair, self	-schedu	ling, CO	T sharir	ıg enabl	ed (gNB	initiated	COT).						
	DL:	5%	3.519	4.356	12.183	3 19.40	4 1.59	7 2.19	1 5.38	38 5.99	9 0.696	6 0.663	0.567	1.845		
	UPT	50%	11.330	13.595	5 52.143	3 57.89	9 8.11	7 9.77	9 29.3	97 31.2	73 5.940	6.412	18.017	19.871		
	CDF	95%	34.731	36.983	3 75.486	6 75.60	7 29.02	71 31.30	67.3	17 69.6	02 28.15	8 27.612	52.986	62.053		
	[Mbps	Mean	14.302	16.122	2 49.356	5 53.81		î	54 31.8	64 33.5			20.917	23.771		
	]															
	DL:	5%	0.066	0.057			_					3 0.082	0.063	0.058		
	Delay	50%	0.187	0.167	0.076		5 0.33	4 0.27	9 0.13	36 0.12	0.454	0.410	0.204	0.193		
	CDF	95%	0.641	0.506	_	_						2.478	1.174	1.196		
	[s]	Mean	0.256	0.217	0.132	0.10	3 0.51	8 0.44	3 0.21	15 0.20	6 0.747	0.709	0.343	0.342		
ſ		2	0.982	0.986	0.985	0.97	1 0.93	5 0.96	6 0.89	98 0.89	0 0.847	0.877	0.782	0.836		
R1-1814074 / Source	B	0	0.106	0.096	0.06	0.06	0.32	3 0.26	5 0.21	17 0.22	3 0.509	0.470	0.442	0.389		
ē	)				0.1				0.175			0	.25			
0			Additio	nal com	ments:											
74			- 4	ms for l	ooth Wi-	Fi and N	IR-U									
140				lo												
2									3m; for 1	NR-U EI	T = -72 d	Bm (base	line)			
2					A for bot						_		_			
_							n patteri	1 accordi	ng to TF	R38.802 a	nd max B	F gain of	5 dBi; or	nni-		
					al for W											
					ize = 32	50 bytes	by defa	ult, 1ms	per MPI	50						
				5 kHz												
<ul> <li>- 0.8 μs</li> <li>- Capability #1</li> <li>- Mapping type B in the starting slot of TxOP; per-symbol PDCCH monitor</li> </ul>																
									•. •							
						n the sta	arting slo	ot of TxC	)P; per-s	ymbol P	DCCH mo	onitoring f	for flexib	le		
				01	osition								••			
								nultiple s	switching	g points v	vithin CO	1 for NR-	·U			
			- (	ross-ca	rrier sch	eduling	in UL									

				Low	load			Mediu	m load			Higl	1 load	
	Dama	ام م طب	BC		or Wi-Fi	in	BC		or Wi-Fi	in	B	O range f		i in
Tdoc /Source	Repo param				i: 10%~2			0	'i: 35%~5			·Fi+Wi-F		
/S	•		Wi-Fi in	Wi-Fi in	NR-U	NR-U	Wi-Fi in	Wi-Fi in	NR-U	NR-U	Wi-Fi	Wi-Fi in	NR-U	NR-U
doc			Wi-Fi+	Wi-Fi+	in	in	Wi-Fi+	Wi-Fi+	in	in	in	Wi-Fi+	in	in
E			Wi-Fi	NR-U	Wi-Fi+	NR-U+	Wi-Fi	NR-U	Wi-Fi+	NR-U+		NR-U	Wi-Fi+	NR-U+
					NR-U	NR-U			NR-U	NR-U	Wi-Fi		NR-U	NR-U
	DL	5%	3.714	4.364	30.880	37.545	1.541	3.672	16.983	18.597	0.707	1.552	6.490	12.252
	UPT	50%	43.175	62.566	123.093	147.561	23.461	37.345	100.256	109.054	15.120	22.544	46.490	52.998
	CDF	95%	105.741	117.282	201.034	191.196	102.653	112.321	181.664	182.641	96.035	101.527	180.281	188.214
	[Mbps]	Mean	53.272	61.646	126.294	135.740	37.662	52.038	107.190	124.808	27.231	35.182	69.630	89.052
	DL	5%	0.039	0.033	0.021	0.022	0.035	0.034	0.021	0.020	0.042	0.041	0.023	0.021
	Delay	50%	0.091	0.060	0.035	0.031	0.164	0.088	0.046	0.040	0.277	0.161	0.106	0.097
	CDF	95%	1.032	0.581	0.126	0.120	1.840	0.990	0.260	0.240	3.313	3.001	1.054	0.797
	[s]	Mean	0.276	0.198	0.054	0.053	0.458	0.262	0.086	0.068	0.690	0.594	0.253	0.171
	UL	5%	4.938	11.565	14.560	32.995	1.879	5.905	7.896	26.318	0.310	1.703	3.515	15.488
	UPT	50%	57.731	84.192	110.640	121.620	24.350	62.856	75.543	80.462	13.294	22.741	35.754	49.990
	CDF	95%	106.614	114.090	190.409	190.086	91.471	111.718	168.420	170.992	73.424	92.983	133.636	137.900
Le 6	[Mbps]	Mean	57.767	70.590	103.105	106.134	34.531	59.456	84.700	87.968	20.858	33.784	49.572	65.205
Jour	UL	5%	0.036	0.032	0.021	0.021	0.040	0.034	0.022	0.021	0.047	0.040	0.031	0.300
2 /6	Delay	50%	0.074	0.049	0.041	0.037	0.176	0.073	0.062	0.060	0.363	0.200	0.167	0.127
406	CDF	95%	0.737	0.369	0.360	0.184	1.809	0.604	0.528	0.163	2.641	2.254	1.533	0.377
- 1814062 /Source 6	[s]	Mean	0.198	0.108	0.082	0.080	0.443	0.178	0.144	0.142	0.786	0.544	0.402	0.273
R1-	$Q_{\rm E}$	L	0.9716	0.9716	0.9714	1.00	0.9130	0.9371	0.9371	1.00	0.9107	0.9102	0.9102	1.00
	Qu	L	0.9662	0.9736	1.00	1.00	0.9467	0.9670	1.00	1.00	0.8828	0.9373	0.9735	1.00
	B	)	13.0	8.44	3.02	3.00	35.0	16.48	7.90	5.60	59.0	40.40	22.40	15.60
	λ			0.06/	/0.06			0.086	/0.086			0.114	/0.114	
			Addition	al comm	ents: Ou	tdoor Su	b-7GHz	deploym	ent Scen	ario 2	•			
			WiFi set	tings: 80	2.11ac M	ICS table	includir	ig 256 Q	AM, 2Tx	2Rx in I	DL (cros	s-polariz	zed, oper	ı loop),
						in both I								
						daptation	: Minstre	el algorit	hm, CW	S: DL{15	5,63} an	d UL{15	5,1023},	CCA:
			CS=-82dBm, ED=-62dBm.											
			NR-U settings: 4Tx2Rx in DL, Cross-polarized. MCS=4/16/64/256QAM, scheduling: proportional											
		fair, link adaptation realistic, ED=-72 dBm, CP=Normal, SCS=30KHz, TXOP=4 ms, UE Capability #1, MCS: DL{15,63} and UL{15,1023}, COT sharing enabled, COT details: flexible DL/UL only and												
						affic nee								
					-	-		-		. ,-	5			

## Annex C: Change history

Change	history						
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2018-02	RAN1#92	R1-1803272				First version of TR	0.0.1
2018-05	RAN1#93	R1-1807383				Update to capture the agreements reached in RAN1 #92 and #92bis	0.0.2
2018-08	RAN1#94	R1-1809795				Update to capture the agreements reached in RAN1 #93	0.0.3
2018-08	RAN1#94	R1-1810047				MCC clean-up based on endorsed R1-1809795	0.1.0
2018-10	RAN1#94b	R1-1811910				Update to capture the agreements reached in RAN1 #94	0.1.1
2018-10	RAN1#94b	R1-1812049				Update to capture the agreements reached in RAN1 #94bis, and RAN2 TPs	0.1.2
2018-10	RAN1#94b	R1-1812080				MCC clean-up based on endorsed R1-1812049	0.2.0
2018-11	RAN1#95	R1-1814346				Update to capture the agreemensts reached in RAN1 #95, evaluation results, and RAN2 inputs	0.2.1
2018-11	RAN1#95	R1-1814385				Merge in RAN4 imput	0.3.0
2018-11	RAN1#95	R1-1814386				MCC clean-up based on endorsed R1-1814385 – for one-step approval by plenary	1.0.0
2018-12	RAN1#95	R1-1814408				Remove outdated tables	1.1.0
2018-12	RAN#82					Following RAN#82 decision, Rel-16 specification goes under change control	16.0.0