**3GPP TSG-RAN Meeting #103 *RP-240851***

**Maastricht, Netherlands, 18th Mar 2024 - 21st Mar 2024**

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| --- |
| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.101-1** | **CR** | **2191** | **rev** | **2** | **Current version:** | **18.4.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network |  |

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|  |
| ***Title:***  | CR 38.101-1 addition of 2Rx XR exception for REFSENS [2Rx\_XR\_Device] |
|  |  |
| ***Source to WG:*** |  |
| ***Source to TSG:*** | Nokia, Meta, Huawei, Apple |
|  |  |
| ***Work item code:*** | TEI18 |  | ***Date:*** | 2024-03-08 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-18 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | This is a re-submission of endorsed RAN4 CR R4-2403890.Based on the RAN WF on 2Rx for XR RP-232657 there is a need to exempt some XR UE formafactors from mandatory 4Rx REFSENS requirement. These 2Rx XR UEs are identified by RAN2 signaling. XR UEs eligleble for 2Rx only reception are * *Intended to be worn on the human head;*
* *When in use, is intended to be supported only by/behind the ears and by a nose-bridge resulting in a constrained form factor with limited volume available for Rx chains*

RAN pleany WF also asks a feasibility of tightened 2Rx REFSENS requirements, anticipating some change due to this a new table is created. |
|  |  |
| ***Summary of change:*** | Definition, symbols and abreviations sections and REFSENS section are updated and a new table is created for Two antenna port XR UE reference sensitivity allowance. |
|  |  |
| ***Consequences if not approved:*** | 2Rx operation for XR as agreed by RAN not possible. |
|  |  |
| ***Clauses affected:*** | **3.1, 7.3.2** |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **x** |  |  Test specifications | TS 38.521-1 |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** | Was submitted without CR number as it was not received. |
|  |  |
| ***This CR's revision history:*** | Revised based on discussions during RAN#103 on the TBD Refsens value in the original CR. |

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Start of changes \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP 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 3GPP TR 21.905 [1].

**Aggregated Channel Bandwidth**: The RF bandwidth in which a UE transmits and receives multiple contiguously aggregated carriers.

**Carrier aggregation**: Aggregation of two or more component carriers in order to support wider transmission bandwidths.

**Carrier aggregation band**: A set of one or more operating bands across which multiple carriers are aggregated with a specific set of technical requirements.

**Carrier aggregation bandwidth class**: A class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE.

**Carrier aggregation configuration**: A combination of CA operating band(s) and CA bandwidth class(es) supported by a UE.

**Con-current operation**: The simultaneous transmission and reception of sidelink and Uu interfaces while operation is agnostic of the service used on each interface.

**Contiguous carriers**: A set of two or more carriers configured in a spectrum block where there are no RF requirements based on co-existence for un-coordinated operation within the spectrum block.

**Contiguous resource allocation**: A resource allocation of consecutive resource blocks within one carrier or across contiguously aggregated carriers. The gap between contiguously aggregated carriers due to the nominal channel spacing is allowed.

**Contiguous spectrum**: Spectrum consisting of a contiguous block of spectrum with no sub-block gaps.

**Inter-band carrier aggregation:** Carrier aggregation of component carriers in different operating bands.

NOTE: Carriers aggregated in each band can be contiguous or non-contiguous.

**Intra-band contiguous carrier aggregation**: Contiguous carriers aggregated in the same operating band.

**Intra-band non-contiguous carrier aggregation**: Non-contiguous carriers aggregated in the same operating band.

**RedCap UE**: The UE with reduced capabilities as defined in clause 4.2.21.1 from TS38.306 [15].

**Sub-band**: For a UE that supports shared spectrum channel access in wideband operation, a sub-band is the set of RBs within an approximately 20 MHz segment of the channel where the wideband channel is uniformly divided into an integer number of 20 MHz sub-bands. Sub-bands may be separately allocated in uplink and downlink.

**Sub-block**: This is one contiguous allocated block of spectrum for transmission and reception by the same UE. There may be multiple instances of sub-blocks within an RF bandwidth.

**Sub-block bandwidth**: The bandwidth of one sub-block.

**Sub-block gap**: A frequency gap between two consecutive sub-blocks within an RF bandwidth, where the RF requirements in the gap are based on co-existence for un-coordinated operation.

**UE transmission bandwidth configuration**: Set of resource blocks located within the UE channel bandwidth which may be used for transmitting or receiving by the UE.

**Two Rx antenna port XR UE:** A non-eRedCap XR UE that is equipped with only two Rx antenna ports in frequency band(s) where 4 Rx antenna ports are required. The UE is intended to be worn on human head. When in use, is intended to be supported only by/behind the ears and by a nose-bridge resulting in a constrained form factor with limited volume available for Rx chains.

**Vehicular UE:** A UE embedded in a vehicle, permanently connected to an embedded antenna system that radiates externally for NR operating bands.

NOTE: Vehicular UE does not refer to other UE form factors placed inside the vehicle.

**Wideband operation:** For a UE that supports shared spectrum channel access, wideband operation refers to operation within a channel larger than 20 MHz in which intra-cell guard bands may be configured to distinguish individual RB-sets

## 3.2 Symbols

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

ΔFGlobal Granularity of the global frequency raster

ΔFRaster Band dependent channel raster granularity

ΔfOOB Δ Frequency of Out Of Band emission

ΔFTX-RX Maximum deviation to the Tx-Rx carrier center frequency separation for asymmetric uplink/downlink channel bandwidth operation

∆MPRc Allowed Maximum Power Reduction relaxation for serving cell *c*

ΔPPowerClass Adjustment to maximum output power for a given power class

RB The starting frequency offset between the allocated RB and the measured non-allocated RB

ΔRIB,c Allowed reference sensitivity relaxation due to support for inter-band CA operation, for serving cell *c*

ΔRIBC Allowed reference sensitivity relaxation due to support for intra-band contiguous CA operation

ΔRIBNC Allowed reference sensitivity relaxation due to support for intra-band non-contiguous CA operation

ΔRIB,4R Reference sensitivity adjustment due to support for 4 antenna ports

ΔRXR,2R Reference sensitivity adjustment for two antenna ports XR UEs on bands defined in Table 7.3.2-2b

ΔR1RReference sensitivity adjustment due to support for 1 antenna ports

ΔShift Channel raster offset

TC Allowed operating band edge transmission power relaxation

TC,*c*Allowed operating band edge transmission power relaxation for serving cell *c*

ΔTIB,c Allowed maximum configured output power relaxation due to support for inter-band CA operation, inter-band NR-DC operation and due to support for SUL operations, for serving cell *c*

BWChannel Channel bandwidth

BWChannel,block Sub-block bandwidth, expressed in MHz. BWChannel,block= Fedge,block,high- Fedge,block,low

BWChannel\_CA Aggregated channel bandwidth, expressed in MHz

BWChannel,max Maximum channel bandwidth supported among all bands in a release

BWGB max( BWGB,Channel(*k*) )

BWGB,Channel(k) Minimum guard band defined in clause 5.3A.1 of carrier *k*

BWDL Channel bandwidth for DL

BWUL Channel bandwidth for UL

BWinterferer Bandwidth of the interferer

Ceil(x) Rounding upwards; ceil(x) is the smallest integer such that ceil(x) ≥ x

Floor(x) Rounding downwards; floor(x) is the greatest integer such that floor(x) ≤ x

FC *RF reference frequency* on the channel raster, given in table 5.4.2.2-1

FC,block, high Fc of the highest transmitted/received carrier in a *sub-block*

FC,block, low Fc of the lowest transmitted/received carrier in a *sub-block*

FC,low The Fc of the lowest carrier, expressed in MHz

FC,high The Fc of the highest carrier, expressed in MHz

FDL\_low The lowest frequency of the downlink *operating band*

FDL\_high The highest frequency of the downlink *operating band*

FUL\_low The lowest frequency of the uplink *operating band*

FUL\_high The highest frequency of the uplink *operating band*

Fedge,block,low The lower *sub-block* edge, where Fedge,block,low = FC,block,low - Foffset, low.

Fedge,block,high The upper *sub-block* edge, where Fedge,block,high = FC,block,high + Foffset, high.

Fedge , low The *lower edge* of *aggregated channel bandwidth*, expressed in MHz. Fedge,low = FC,low - Foffset,low.

Fedge, high The *higher edge* of *aggregated channel bandwidth*, expressed in MHz. Fedge,high = FC,high + Foffset,high.

FInterferer (offset) Frequency offset of the interferer (between the center frequency of the interferer and the carrier frequency of the carrier measured)

FInterferer Frequency of the interferer

FIoffset Frequency offset of the interferer (between the center frequency of the interferer and the closest edge of the carrier measured)

Foffset Frequency offset from FC\_high to the *higher edge* or FC\_low to the *lower edge.*

Foffset,high Frequency offset from FC,high to the upper *UE RF Bandwidth edge*, or from FC,block, high to the upper sub-block edge

Foffset,low Frequency offset from FC,low to the lower *UE RF Bandwidth edge*, or from FC,block, low to the lower sub-block edge

FOOB The boundary between the NR out of band emission and spurious emission domains

FREF RF reference frequency

FREF-Offs Offset used for calculating FREF

FREF, shift RF reference frequency for Supplementary Uplink (SUL) bands, the uplink of all FDD bands, and TDD bands

Fuw (offset) The frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer

GBChannel Minimum guard band defined in clause 5.3.3, expressed in kHz

LCRB Transmission bandwidth which represents the length of a contiguous resource block allocation expressed in units of resources blocks

Max() The largest of given numbers

Min() The smallest of given numbers

 Physical resource block number

NRACLR NR ACLR

NRB Transmission bandwidth configuration, expressed in units of resource blocks

NRB\_agg The number of the aggregated RBs within the fully allocated aggregated channel bandwidth

$N\_{RB\_{\\_agg}}=\sum\_{1}^{j}N\_{RB\_{j}}\*2^{μ\_{j}}$ for carrier 1 to j, where *μ* is defined in TS 38.211 [6]

NRB,c The transmission bandwidth configuration of component carrier c, expressed in units of resource blocks

$N\_{RB,cj}=N\_{RB\_{j}}\*2^{μ\_{j}}$ for carrier j, where *μ* is defined in TS 38.211 [6]

NRB,largest BW The largest transmission bandwidth configuration of the component carriers in the bandwidth combination, expressed in units of resource blocks

NRB,low The transmission bandwidth configurations according to Table 5.3.2-1 for the lowest assigned component carrier in clause 5.3A.1

NRB,high The transmission bandwidth configurations according to Table 5.3.2-1 for the highest assigned component carrier in clause 5.3A.1

NREF NR Absolute Radio Frequency Channel Number (NR-ARFCN)

NREF-Offs Offset used for calculating NREF

PCMAX The configured maximum UE output power

PCMAX, *c* The configured maximum UE output power for serving cell *c*

PCMAX, *f*, *c* The configured maximum UE output power for carrier *f* of serving cell *c* in each slot

PEMAX Maximum allowed UE output power signalled by higher layers

PEMAX, *c* Maximum allowed UE output power signalled by higher layers for serving cell *c*

PInterferer Modulated mean power of the interferer

Plargest BW Power of the largest transmission bandwidth configuration of the component carriers in the bandwidth combination

PPowerClass The nominal UE power (i.e., no tolerance)

P-MPR*c* Power Management Maximum Power Reduction for serving cell *c*

PRB The transmitted power per allocated RB, measured in dBm

PUMAX The measured configured maximum UE output power

Puw Power of an unwanted DL signal

Pw Power of a wanted DL signal

RBstart The lowest RB index of transmitted resource blocks

RBstart\_CA The lowest RB index of transmitted resource blocks for intra-band contiguous CA

SCSc SCS for the component carrier c, expressed in kHz

SCSlargest BW SCS for the largest transmission bandwidth configuration of the component carriers in the bandwidth combination, expressed in kHz

SCSlow SCS for the lowest assigned component carrier in clause 5.3A.1, expressed in kHz

SCShigh SCS for the highest assigned component carrier in clause 5.3A.1, expressed in kHz

*tp* Transient Period value signalled by the UE

*tpstart* Start position of transient period relative to the symbol boundary

T(PCMAX, *f*, *c*) Tolerance for applicable values of PCMAX, *f*, *c* for configured maximum UE output power for carrier *f* of serving cell *c*

TL,c Absolute value of the lower tolerance for the applicable *operating band* as specified in clause 6.2.1

SSREF SS block reference frequency position

UTRAACLR UTRA ACLR

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

ACLR Adjacent Channel Leakage Ratio

ACS Adjacent Channel Selectivity

A-MPR Additional Maximum Power Reduction

BS Base Station

BW Bandwidth

BWP Bandwidth Part

CA Carrier Aggregation

CA\_nX-nY Inter-band CA of component carrier(s) in one sub-block within Band nX and component carrier(s) in one sub-block within Band nY where nX and nY are the applicable NR *operating bands*

CC Component Carriers

CG Carrier Group

CP-OFDM Cyclic Prefix-OFDM

CW Continuous Wave

DC Dual Connectivity

DFT-s-OFDM Discrete Fourier Transform-spread-OFDM

DM-RS Demodulation Reference Signal

DTX Discontinuous Transmission

E-UTRA Evolved UTRA

EIRP Equivalent Isotropically Radiated Power

EVM Error Vector Magnitude

FR Frequency Range

FRC Fixed Reference Channel

FWA Fixed Wireless Access

GSCN Global Synchronization Channel Number

IBB In-band Blocking

IDFT Inverse Discrete Fourier Transformation

ITS Intelligent Transportation System

ITU‑R Radiocommunication Sector of the International Telecommunication Union

MBW Measurement bandwidth defined for the protected band

MCG Master Cell Group

MOP Maximum Output Power

MPR Allowed maximum power reduction

MSD Maximum Sensitivity Degradation

NR New Radio

NR-ARFCN NR Absolute Radio Frequency Channel Number

NS Network Signalling

OCNG OFDMA Channel Noise Generator

OOB Out-of-band

P-MPR Power Management Maximum Power Reduction

PRB Physical Resource Block

PS Public Safety

PSCCH Physical Sidelink Control CHannel

PSSCH Physical Sidelink Shared CHannel

QAM Quadrature Amplitude Modulation

RE Resource Element

REFSENS Reference Sensitivity

RedCap Reduced Capability

RF Radio Frequency

RMS Root Mean Square (value)

RSRP Reference Signal Receiving PowerRx Receiver

Rx Receiver

SC Single Carrier

SCG Secondary Cell Group

SCS Subcarrier spacing

SDL Supplementary Downlink

SEM Spectrum Emission Mask

SL Sidelink

SL-MIMO Sidelink-Multiple Antenna transmission

SNR Signal-to-Noise Ratio

SRS Sounding Reference Symbol

SS Synchronization Symbol

SUL Supplementary uplink

TAE Time Alignment Error

TAG Timing Advance Group

Tx Transmitter

TxD Tx Diversity

UL MIMO Uplink Multiple Antenna transmission

ULFPTx Uplink Full Power Transmission

V2X Vehicle to Everything

XR eXtended Reality

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* No changes \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

### 7.3.2 Reference sensitivity power level

The throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2.2, A3.2 and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.2-1a, Table 7.3.2-1b, Table 7.3.2-1c, Table 7.3.2-1d and Table 7.3.2-2.

Table 7.3.2-1a: Two antenna port reference sensitivity QPSK PREFSENS for FDD bands

| Operating band / SCS / Channel bandwidth |
| --- |
| Operating Band | SCS kHz | 3MHz(dBm) | 5MHz(dBm) | 10MHz(dBm) | 15MHz(dBm) | 20MHz(dBm) | 25MHz(dBm) | 30 MHz (dBm) | 35 MHz (dBm) | 40MHz(dBm) | 45 MHz (dBm) | 50MHz(dBm) |
| n1 | 15 |  | -100.0 | -96.8 | -95.0 | -93.8 | -92.7 | -91.9 |  | -90.6 | -90.1 | -89.6 |
| 30 |  |  | -97.1 | -95.1 | -94.0 | -92.8 | -92.0 |  | -90.7 | -90.2 | -89.7 |
| 60 |  |  | -97.5 | -95.4 | -94.2 | -93.0 | -92.1 |  | -90.9 | -90.3 | -89.7 |
| n2 | 15 |  | -98 | -94.8 | -93 | -91.8 | -90.7 | -84.1 | -83.6 | -81.5 |  |  |
| 30 |  |  | -95.1 | -93.1 | -92 | -90.8 | -84.2 | -83.7 | -81.6 |  |  |
| 60 |  |  | -95.5 | -93.4 | -92.2 | -90.9 | -84.3 | -83.8 | -81.7 |  |  |
| n3 | 15 |  | -97.0 | -93.8 | -92.0 | -90.8 | -89.7 | -88.9 | -86.2 | -82.3 | -81.3 | -79.7 |
| 30 |  |  | -94.1 | -92.1 | -91.0 | -89.8 | -89.0 | -86.3 | -82.4 | -81.4 | -79.8 |
| 60 |  |  | -94.5 | -92.4 | -91.2 | -90.0 | -89.1 | -86.4 | -82.6 | -81.5 | -79.9 |
| n5 | 15 |  | -98.0 | -94.8 | -93.0 | -86.8 | -84.8 |  |  |  |  |  |
| 30 |  |  | -95.1 | -93.1 | -88.6 | -84.9 |  |  |  |  |  |
| n71 | 15 |  | -98.0 | -94.8 | -93.0 | -91.8 | -90.7 | -89.9 | -89.2 | -88.6 |  | -81.5 |
| 30 |  |  | -95.1 | -93.1 | -92.0 | -90.8 | -90.0 | -89.3 | -88.7 |  | -81.5 |
| 60 |  |  | -95.5 | -93.4 | -92.2 | -91.0 | -90.1 | -89.4 | -88.9 |  | -81.5 |
| n8 | 15 |  | -97.0 | -93.8 | -91.4 | -85.8 | -83.6 |  | -78.4 |  |  |  |
| 30 |  |  | -94.1 | -91.7 | -87.2 | -84.7 |  | -78.5 |  |  |  |
| n12 | 15 |  | -97.0 | -93.8 | -84.0 |  |  |  |  |  |  |  |
| 30 |  |  | -94.1 | -84.1 |  |  |  |  |  |  |  |
| n13 | 15 |  | -97.0 | -93.8 |  |  |  |  |  |  |  |  |
| 30 |  |  | -94.1 |  |  |  |  |  |  |  |  |
| n14 | 15 |  | -97.0 | -93.8 |  |  |  |  |  |  |  |  |
| 30 |  |  | -94.1 |  |  |  |  |  |  |  |  |
| n18 | 15 |  | -100.0 | -96.8 | -95.0 |  |  |  |  |  |  |  |
| 30 |  |  | -97.1 | -95.1 |  |  |  |  |  |  |  |
| n20 | 15 |  | -97.0 | -93.8 | -91.0 | -89.8 |  |  |  |  |  |  |
| 30 |  |  | -94.1 | -91.1 | -90.0 |  |  |  |  |  |  |
| n24 | 15 |  | -100.0 | -96.8 |  |  |  |  |  |  |  |  |
| 30 |  |  | -97.1 |  |  |  |  |  |  |  |  |
| 60 |  |  | -97.5 |  |  |  |  |  |  |  |  |
| n25 | 15 |  | -96.5 | -93.3 | -91.5 | -90.3 | -89.3 | -82.2 | -81.7 | -79.5 | -77.6 |  |
| 30 |  |  | -93.6 | -91.6 | -90.5 | -89.4 | -82.3 | -81.8 | -79.6 | -77.7 |  |
| 60 |  |  | -94.0 | -91.9 | -90.7 | -89.6 | -82.4 | -81.9 | -79.7 | -77.8 |  |
| n26 | 15 | -99.7 | -97.56 | -94.56 | -92.76 | -87.6 | -84.5 | -81.7 |  |  |  |  |
| 30 |  |  | -94.86 | -92.76 | -87.7 | -84.6 | -81.8 |  |  |  |  |
| n28 | 15 | -100.2 | -98.5 | -95.5 | -93.5 | -90.8 | -84.2 | -78.5 |  |  |  |  |
| 30 |  |  | -95.6 | -93.6 | -91.0 | -84.2 | -78.6 |  |  |  |  |
| n30 | 15 |  | -99.0 | -95.8 |  |  |  |  |  |  |  |  |
| 30 |  |  | -96.1 |  |  |  |  |  |  |  |  |
| n65 | 15 |  | -99.5 | -96.3 | -94.5 | -93.3 |  |  |  |  |  | -89.2 |
| 30 |  |  | -96.6 | -94.6 | -93.5 |  |  |  |  |  | -89.3 |
| 60 |  |  | -97.0 | -94.9 | -93.7 |  |  |  |  |  | -89.4 |
| n66 | 15 |  | -99.5 | -96.3 | -94.5 | -93.3 | -92.2 | -91.4 | -90.7 | -90.1 | -89.6 |  |
| 30 |  |  | -96.6 | -94.6 | -93.5 | -92.3 | -91.5 | -90.8 | -90.2 | -89.7 |  |
| 60 |  |  | -97.0 | -94.9 | -93.7 | -92.5 | -91.6 | -90.9 | -90.4 | -89.8 |  |
|  | 15 |  | -100.0 | -96.8 | -95.0 | -93.8 | -92.7 |  |  |  |  |  |
| n70 | 30 |  |  | -97.1 | -95.1 | -94.0 | -92.8 |  |  |  |  |  |
|  | 60 |  |  | -97.5 | -95.4 | -94.2 | -93.0 |  |  |  |  |  |
| n71 | 15 |  | -97.2 | -94.0 | -91.6 | -86.0 | -84.19-74.810 | -82.59-67.110 | -80.79-64.010 |  |  |  |
| 30 |  |  | -94.3 | -91.9 | -87.4 | -84.29-74.910 | -82.69-67.210 | -80.89-64.110 |  |  |  |
| n74 | 15 |  | -99.53 | -96.33 | -94.53 | -89.33 |  |  |  |  |  |  |
| 30 |  |  | -96.63 | -94.63 | -89.53 |  |  |  |  |  |  |
| 60 |  |  | -97.03 | -94.93 | -89.63 |  |  |  |  |  |  |
| n85 | 15 | -99.2 | -97.0 | -93.8 | -84.0 |  |  |  |  |  |  |  |
|  | 30 |  |  | -94.1 | -84.1 |  |  |  |  |  |  |  |
| n100 | 15 | -102.2 | -100 |  |  |  |  |  |  |  |  |  |
| n105 | 15 |  | -97.28 | -94.0 | -91.6 | -86.9 | -85.1 | -83.8 | -82.5 |  |  |  |
|  | 30 |  |  | -94.3 | -91.9 | -87.9 | -85.5 | -84.3 | -82.6 |  |  |  |
| NOTE 1: Four Rx antenna ports shall be the baseline for this operating band except for two Rx vehicular UE and two Rx antenna port XR UEs indicating UE capability [2Rx XR]. Four Rx antenna ports for RedCap UE is not supported for this operating band.NOTE 2: The transmitter shall be set to PUMAX as defined in clause 6.2.4NOTE 3: The requirement is modified by -0.5 dB when the assigned NR channel bandwidth is confined within 1475.9 - 1510.9 MHz.NOTE 4: VoidNOTE 5: VoidNOTE 6: Values are modified by -0.5dB when carrier channel BW is between 865MHz and 894MHz.NOTE 7: Void.NOTE 8: DL channels overlapping the 612-617MHz range have 0.5dB added to the REFSENSNOTE 9: Applies to UEs that support a maximum uplink BW of 20 MHz in this band.NOTE 10: Applies to UEs that support optional symmetric UL/DL for this BW. |

**Table 7.3.2-1b: Two antenna port reference sensitivity QPSK PREFSENS for TDD, SDL and FDD with variable duplex operation bands**

|  |
| --- |
| **Operating band / SCS / Channel bandwidth / REFSENS** |
| **Operating band** | **SCS****kHz** | **Channel bandwidth (MHz)** | **REFSENS (dBm)8** | **Duplex Mode** |
| n297 | 15 | 5,10 | -97 + 10log10(NRB/25) | SDL |
| 30 | 10 | -94.1 + 10log10(NRB/24) |
| n34 | 15 | 5, 10, 15 | -100 + 10log10(NRB/25) | TDD |
| 30 | 10, 15 | -97.1 + 10log10(NRB/24) |
| 60 | 10, 15 | -97.5 + 10log10(NRB/11) |
| n381 | 15 | 5, 10, 15, 20, 25, 30, 40 | -100 + 10log10(NRB/25) | TDD |
| 30 | 10, 15, 20, 25, 30, 40 | -97.1 + 10log10(NRB/24) |
| 60 | 10, 15, 20, 25, 30, 40 | -97.5 + 10log10(NRB/11) |
| n39 | 15 | 5, 10, 15, 20, 25, 30, 35, 40 | -100 + 10log10(NRB/25) | TDD |
| 30 | 10, 15, 20, 25, 30, 35, 40 | -97.1 + 10log10(NRB/24) |
| 60 | 10, 15, 20, 25, 30, 35, 40 | -97.5 + 10log10(NRB/11) |
| n40 | 15 | 5, 10, 15, 20, 25, 30, 40, 50 | -100 + 10log10(NRB/25) | TDD |
| 30 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | -97.1 + 10log10(NRB/24) |
| 60 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | -97.5 + 10log10(NRB/11) |
| n411, n901 | 15 | 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 | -94.8 + 10log10(NRB/52) | TDD |
| 30 | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | -95.1 + 10log10(NRB/24) |
| 60 | 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100 | -95.5 + 10log10(NRB/11) |
| n481 | 15 | 5, 10, 15, 20, 30, 40, 505 | -99 + 10log10(NRB/25) | TDD |
| 30 | 10, 15, 20, 30, 40, 505, 605, 705, 805, 905, 1005 | -96.1 + 10log10(NRB/24) |
| 60 | 10, 15, 20, 30, 40, 505, 605, 705, 805, 905, 1005 | -96.5 + 10log10(NRB/11) |
| n50 | 15 | 5, 10, 15, 20, 30, 40, 50 | -100 + 10log10(NRB/25) | TDD |
| 30 | 10, 15, 20, 30, 40, 50, 60, 80 | -97.1 + 10log10(NRB/24) |
| 60 | 10, 15, 20, 30, 40, 50, 60, 80 | -97.5 + 10log10(NRB/11) |
| n51 | 15 | 5 | -100 | TDD |
| n53 | 15 | 5, 10 | -100 + 10log10(NRB/25) | TDD |
| 30 | 10 | -97.1 |
| 60 | 10 | -97.5 |
| n54 | 15 | 5 | -100 | TDD |
| n677 | 15 | 5, 10, 15, 20 | -100 + 10log10(NRB/25) | SDL |
|  | 30 | 10, 15, 20 | -97.1 + 10log10(NRB/24) |  |
| n757 | 15 | 5,10,15,20,25,30,40,50 | -100 + 10log10(NRB/25) | SDL |
| 30 | 10,15,20,25,30,40,50 | -97.1 + 10log10(NRB/24) |
| 60 | 10,15,20,25,30,40,50 | -97.5 + 10log10(NRB/11) |
| n767 | 15 | 5 | -95.3 + 10log10(NRB/52) | SDL |
| n771,4 | 15 | 10, 15, 20, 25, 30, 40, 50 | -95.3 + 10log10(NRB/52) | TDD |
| 30 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | -95.6 + 10log10(NRB/24) |
| 60 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | -96.0 + 10log10(NRB/11) |
| n781 | 15 | 10, 15, 20, 25, 30, 40, 50 | -95.8 + 10log10(NRB/52) | TDD |
| 30 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | -96.1 + 10log10(NRB/24) |
| 60 | 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100 | -96.5 + 10log10(NRB/11) |
| n791 | 15 | 10, 20, 30, 40, 50 | -95.8 + 10log10(NRB/52) | TDD |
| 30 | 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 | -96.1 + 10log10(NRB/24) |
| 60 | 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 | -96.5 + 10log10(NRB/11) |
| n91 | 15 | 5 | -100 | FDD |
| n92 | 15 | 5,10,15,20 | -100 + 10log10(NRB/25) | FDD |
| 30 | 10,15,20 | -97.1 + 10log10(NRB/24) |
| n93 | 15 | 5 | -100 | FDD |
| n94 | 15 | 5,10,15,20 | -100 + 10log10(NRB/25) | FDD |
|  | 30 | 10,15,20 | -97.1 + 10log10(NRB/24) |
| n101 | 15 | 5, 10 | -100 + 10log10(NRB/25) | TDD |
|  | 30 | 10 | -97.1 + 10log10(NRB/24) |  |
| n1041,10 | 15 | 20, 30, 40, 50 | -90.7 + 10log10(NRB/106) | TDD |
|  | 30 | 20, 30, 40, 50, 60, 70, 80, 90, 100 | -90.8 + 10log10(NRB/51) |  |
|  | 60 | 20, 30, 40, 50, 60, 70, 80, 90, 100 | -91.1 + 10log10(NRB/24) |  |
| NOTE 1: Four Rx antenna ports shall be the baseline for this operating band except for two Rx vehicular UE and two Rx antenna port XR UEs indicating UE capability [2Rx XR]. Four Rx antenna ports for RedCap UE is not supported for this operating band.NOTE 2: The transmitter shall be set to PUMAX as defined in clause 6.2.4.NOTE 3: VoidNOTE 4: The requirement is modified by -0.5 dB when the assigned UE channel bandwidth is confined within 3300 - 3800 MHz.NOTE 5: For these bandwidths, the minimum requirements are restricted to operation when carrier is configured as a downlink carrier part of CA configuration.NOTE 6: VoidNOTE 7: For SDL bands, the reference sensitivity requirements shall be verified by inter-band CA combinations with SDL band, which are supported by UE.NOTE 8: The REFSENS value is rounded to the nearest number down to one decimal point. “NRB” in REFSENS formula is the maximum transmission bandwidth configuration as defined in Table 5.3.2-1.NOTE 9: Void.NOTE 10: A UE may implement two RX antenna ports for band n104 when conditions are met. The exact conditions are FFS. |

For power class 2 UEs, certain degradation of the reference sensitivity in Table 7.3.2-1a is allowed. The maximum amount of degradation is specified in Table 7.3.2-1c, and in Table 7.3.2-1d for a UE that indicates *txDiversity-r16* [15].

**Table 7.3.2-1c Reference Sensitivity Degradation from PC3 to PC2 for FDD bands for UE not supporting Tx Diversity**

| Operating Band | 5MHz(dB) | 10MHz(dB) | 15MHz(dB) | 20MHz(dB) | 25MHz(dB) | 30 MHz (dB) | 35 MHz (dB) | 40MHz(dB) | 45 MHz (dB) | 50MHz(dB) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n1 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 |
| n3 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.8 | 1.1 | 1.5 | 2.3 | 2.8 |
| n25 | 0.8 | 0.8 | 0.9 | 1.1 | 1.3 | 2.7 | 2.8 | 3.5 | 3.7 |  |
| n66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| n71 | 0.5 | 0.9 | 0.9 | 2.2 | 2.422.53 | 2.522.43 | 2.92 3.13 |  |  |  |
| n70 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2.4NOTE 2: Applies to UEs that support a maximum uplink BW of 20 MHz in this band.NOTE 3: Applies to UEs that support optional symmetric UL/DL for this BW. |

**Table 7.3.2-1d Reference Sensitivity Degradation from PC3 to PC2** **for** **FDD bands for UE supporting Tx Diversity**

| Operating Band | 5MHz(dB) | 10MHz(dB) | 15MHz(dB) | 20MHz(dB) | 25MHz(dB) | 30 MHz (dB) | 35 MHz (dB) | 40MHz(dB) | 45 MHz (dB) | 50MHz(dB) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n1 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 |
| n3 | 1.4 | 1.5 | 1.5 | 1.5 | 1.6 | 1.7 | 2.8 | 5 | 5.5 | 6.0 |
| n25 | 1.5 | 1.5 | 1.6 | 1.6 | 1.7 | 6.0 | 6.2 | 6.7 | 7.1 |  |
| n66 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |  |
| n71 | 1.1 | 1.1 | 1.7 | 5.5 | 5.92 6.93 | 6.22 7.23 | 6.52 7.33 |  |  |  |
| n70 | 0 | 0 | 0 | 0 | 0 |  |  |  |  |  |
| NOTE 1: The transmitter shall be set to PUMAX as defined in clause 6.2G.4NOTE 2: Applies to UEs that support a maximum uplink BW of 20 MHz in this band.NOTE 3: Applies to UEs that support optional symmetric UL/DL for this BW. |

Table 7.3.2-2: Four antenna port reference sensitivity allowance ΔRIB,4R

|  |  |
| --- | --- |
| Operating band | ΔRIB,4R (dB) |
| n5, n8, n13, n28, n71, n85, n105 | -2.71 |
| n5, n8, n28, n71, n20, n26 | -2.42 |
| n1, n2, n3, n25, n30, n40, n7, n34, n38, n39, n41, n66, n70 | -2.7 |
| n48, n77, n78, n79, n104 | -2.2 |
| NOTE 1: When 4 Rx operation is supported by FWA form factorNOTE 2: When 4Rx operation is supported by handheld UE. |

For UE(s) equipped with 8 Rx antenna ports, reference sensitivity for 2Rx antenna ports in Table 7.3.2-1a and in Table 7.3.2-1b shall be modified by the amount given in ΔRIB,8R in Table 7.3.2-2a for the applicable operating bands.

Table 7.3.2-2a: Eight antenna port reference sensitivity allowance ΔRIB,8R

|  |  |
| --- | --- |
| Operating band | ΔRIB,8R (dB) |
| n7 | -4.5 |
| n41 | -4.3 |
| n77, n78, n79 | -4.0 |
| NOTE 1: 8 Rx operation is targeted for FWA/CPE/Vehicle/Industrial devices form factor. |

For two Rx antenna port XR UE(s) indicating UE capability [2Rx XR], reference sensitivity for two Rx antenna ports in Table 7.3.2-1a and in Table 7.3.2-1b shall be modified by the amount given in ΔRXR,2R in Table 7.3.2-2b for the applicable operating bands.

Table 7.3.2-2b: Two antenna port XR UE reference sensitivity allowance ΔRXR,2R

|  |  |
| --- | --- |
| Operating band | ΔRXR,2R (dB) |
| n7, n38, n41, n48, n77, n78, n79 | -1.0 |

The reference receive sensitivity (REFSENS) requirement specified in Table 7.3.2-1a, Table 7.3.2-1b, Table 7.3.2-1c, Table 7.3.2-1d, Table 7.3.2-2, Table 7.3.2-2a and Table 7.3.2-2b shall be met with uplink transmission bandwidth less than or equal to that specified in Table 7.3.2-3.

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* End of changes \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*