3GPP TSG-RAN WG4 Meeting # 111

**Fukuoka City, Fukuoka, Japan, 20th May 2024 - 24th May 2024**

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| *CR-Form-v12.2* | | | | | | | | |
| **draft CHANGE REQUEST** | | | | | | | | |
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|  | **38.101-1** | **CR** | **-** | **rev** |  | **Current version:** | **18.5.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](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:*** | draft CR to TS 38.101-1 Rel-18 PC3 FDD intra-band CA REFSENS | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Skyworks Solutions, Inc., T-Mobile USA, Murata Manufacturing Corp., Qualcomm Inc. | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_CA\_R17\_Intra-Core | | | | |  | | ***Date:*** | | 2024-05-23 |
|  |  | | | |  | | |  | |  |
| ***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 can be 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:*** | | Changes to ΔRIBC and ΔRIBNCare discussed in R4-2400365/R4-2400366 and agreed in WF R4-2403628. New PC3 requirements need to be introduced and PC3 table titles need to be changed due to introduction of PC2 MSD in a separate draftCR. | | | | | | | | |
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| ***Summary of change:*** | | Changes to Symbols: as agreed in WF R4-2403628.  Changes to core requirements:   * 7.3A.2.1: clarified PC3 applicability based on WF R4-2403628. * 7.3A.2.2: clarified PC3 applicability based on WF R4-2403628 and aligned text with clause 7.3A.2.1 for consistency.   Changes to REFSENS Tables:   * Changed title of Table 7.3A.2.1-1 to clarify these are PC3 requirements and to bring consistency with other table titles, * Introduced new Table 7.3A.2.1-2 and Table 7.3A.2.1-3 for PC3 and PC3 intra-band contiguous CA REFSENS requirements for one uplink carrier, * Table 7.3A.2.2-1:   + Changed title to clarify PC3 applicability and align text with table 7.3A.2.1-1   + Added SCC to the title of column ΔRIBNC,   + Reduced the number of CA\_n71(2A) PC3 test points to two test points: One for 15MHz + 10MHz for all UEs, and one test point for 25MHz + 5MHz for BCS4/5 and UEs supporting symmetrical UL/DL CBW. * Changed title of Table 7.3A.2.2-2 to align with title of Table 7.3A.2.1-1. | | | | | | | | |
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| ***Consequences if not approved:*** | | The PC3 REFSENS requirements are not complete. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.2, 7.3A.2.1, 7.3A.2.2. | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |

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| ***This CR's revision history:*** |  |

## << Start of change >>

## 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 relaxation to the power class 3 reference sensitivity level due to support for intra-band contiguous CA operation

ΔRIBNC Allowed relaxation to the power class 3 reference sensitivity level due to support for intra-band non-contiguous CA operation

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

ΔRIB,8R Reference sensitivity adjustment due to support for 8 antenna ports

ΔR1RReference sensitivity adjustment due to support for 1 antenna ports

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

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(GBChannel,low, GBChannel,high)

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 Center frequency of a carrier for a numerology defined by the *RF reference frequency* on the channel raster mapped to the carrier according to sub-clause 5.4.2.2FC,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). For intra-band contiguous CA, the FInterferer (offset) is the frequency separation of the center frequency of the carrier closest to the interferer and the center frequency of the interferer

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

GBChannel(i) Minimum guard band defined in clause 5.3.3 of carrier *i*

GBChannel,low Minimum guard band defined in clause 5.3.3 for the lowest assigned component carrier in clause 5.3A.3

GBChannel,high Minimum guard band defined in clause 5.3.3 for the highest assigned component carrier in clause 5.3A.3

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

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

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

PMaxOutputPower The rated maximum ATG UE output power at maximum modulation order and full PRB configurations which is indicated by ATG UE capability [*RatedMOPATG*]

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

PREFSENS\_SL The REFSENS power for Sidelink

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

#### << Unchanged sections are skipped >>>

### 7.3A.2 Reference sensitivity power level for CA

#### 7.3A.2.1 Reference sensitivity power level for Intra-band contiguous CA

For intra-band contiguous carrier aggregation, the throughput of each component carrier shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2.2, A.3.2, and A.3.3 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) with parameters specified in Table 7.3.2-1a, Table 7.3.2-1b, Table 7.3.2-2, and Table 7.3.2-3.

For aggregation of two or more downlink FDD carriers with two uplink carriers, the reference sensitivity is defined only for the specific uplink and downlink test points which are specified in Table 7.3A.2.1-1 and the power class 3 reference sensitivity power level increased by ΔRIBC. The requirements apply with all downlink carriers active. Unless given by Table 7.3.2-4, the reference sensitivity requirements shall be verified with the network signaling value NS\_01 (Table 6.2.3.1-1) configured.

Table 7.3A.2.1-1: Power class 3 intra-band contiguous CA reference sensitivity with two uplink carriers

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS  (PCC/SCC)  (kHz) | Aggregated channel bandwidth (PCC+SCC) | UL PCC allocation  (LCRB) | UL SCC allocation  (LCRB) | PCC ΔRIBC (dB) | SCC ΔRIBC (dB) | Duplex mode |
| CA\_n5B | 15/15 | 10MHz + 10MHz | 10 (RBstart = 0) | 10 (RBstart = 42) | 30.8 | 26.1 | FDD |
| CA\_n5B5 | 15/15 | 5MHz + 20MHz | 4 (RBSTART = 0) | 16 (RBSTART = 90) | 44.6 | 23.0 | FDD |
| CA\_n7B | 15/15 | 10MHz + 40MHz | 9 (RBstart = 26) | 36 (RBstart = 180) | 34 | 25 | FDD |
| NOTE 1: All combinations of channel bandwidths defined in Table 5.5A.1-1.  NOTE 2: The carrier centre frequency of SCC in the UL operating band is configured closer to the DL operating band.  NOTE 3: The transmitted power over both PCC and SCC shall be set to PUMAX as defined in subclause 6.2A.4.  NOTE 4: The PCC allocation is same as Transmission bandwidth configuration NRB as defined in Table 5.3.2-1.  NOTE 5: Applicable only to BCS 1. | | | | | | | |

For UE(s) supporting one uplink carrier, the uplink configuration of the PCC shall be in accordance with Table 7.3.2-3 and the downlink PCC carrier center frequency shall be configured closer to uplink operating band than any of the downlink SCC center frequency. For power class 3, the reference sensitivity power level is increased by ΔRIBC for specific uplink and downlink test points which are specified in Table 7.3A.2.1-2. The requirements apply with all downlink carriers active. Unless given by Table 7.3.2-4, the reference sensitivity requirements shall be verified with the network signalling value NS\_01 (Table 6.2.3.1-1) configured.

Table 7.3A.2.1-2: Power class 3 intra-band contiguous CA reference sensitivity with one uplink carrier.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CA configuration** | **SCS**  **(PCC/SCC)**  **(kHz)** | **Aggregated channel bandwidth (PCC+SCC)** | **UL PCC allocation**  **(LCRB)** | **SCC**  **ΔRIBC (dB)** | **Duplex mode** |
| CA\_n71B1 | 15/15 | 30MHz + 5MHz | 20 (RBSTART = 0) | 3.8 | FDD |
| NOTE 1: Applicable only to BCS 4 and 5 and for UEs supporting the optional symmetrical UL/DL channel bandwidths. | | | | | |

#### 7.3A.2.2 Reference sensitivity power level for Intra-band non-contiguous CA

For intra-band non-contiguous carrier aggregation with one uplink carrier and two or more downlink sub-blocks, throughput of each downlink component carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) and parameters specified in Table 7.3.2-1a, Table 7.3.2-1b, Table 7.3.2-2, and Table 7.3A.2.2-1.

For aggregation of two or more downlink FDD carriers with one uplink carrier, the power class 3 reference sensitivity is increased by ΔRIBNC only for the specific uplink and downlink test points which are specified in Table 7.3A.2.2-1. The requirements apply with all downlink carriers active. Unless given by Table 7.3.2-4, the reference sensitivity requirements shall be verified with the network signaling value NS\_01 (Table 6.2.3.1-1) configured.

Table 7.3A.2.2-1: Power class 3 intra-band non-contiguous CA reference sensitivity with one uplink carrier.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CA configuration | SCS  (PCC/SCC)  (kHz) | Aggregated channel bandwidth (PCC+SCC) | Wgap / [MHz] | UL PCC allocation  (LCRB) | SCC  ΔRIBNC (dB) | Duplex mode |
| CA\_n1(2A) | 15/15 | 5MHz + 5MHz | 0.0 < Wgap ≤ 50.0 | 25 | 0.5 | FDD |
| CA\_n2(2A) | 15/15 | 5MHz + 5MHz | Wgap = 55.0 | 105 | 5.0 | FDD |
|  |  |  | Wgap = 30.0 | 25 | 0.0 |  |
| CA\_n3(2A) | 15/15 | 5MHz + 5MHz | Wgap = 65.0 | 125 | 4.7 | FDD |
|  |  |  | Wgap = 45.0 | 255 | 0.0 |  |
| CA\_n5(2A) | 15/15 | 15MHz + 5MHz | Wgap = 5.0 | 55 | 6.3 | FDD |
| CA\_n7(2A) | 15/15 | 10MHz + 5MHz | Wgap = 55 | 325 | 0.0 | FDD |
|  |  |  | Wgap = 30 | 505 | 0.0 |  |
| CA\_n12(2A) | 15/15 | 5MHz + 5MHz | 0.0 < Wgap ≤ 7.0 | 5(RBstart=12) | 3 | FDD |
| CA\_n25(2A) 9 | 15/15 | 5MHz + 5MHz | Wgap = 55.0 | 105 | 5.0 | FDD |
|  |  |  | Wgap = 30.0 | 25 | 0.0 |  |
| CA\_n25(2A) 10 CA\_n25(3A) | 15/15 | 40MHz + 5MHz | Wgap = 20.0 | 40 (RBstart = 176) | [24.6] 8 | FDD |
| CA\_n26(2A) | 15/15 | 15MHz + 10MHz | Wgap = 10.0 | 5 (RBstart = 74) | 25.2 | FDD |
| CA\_n66(2A)  CA\_n66(3A) | N/A | NOTE 1 | NOTE 2 | NOTE 3, NOTE 4 | 0.0 | FDD |
| CA\_n71(2A) | 15/15 | 15MHz + 10MHz | Wgap = 10.0 | 5 (RBstart = 2) | 22.2 | FDD |
|  |  | 25MHz + 5MHz11 | Wgap = 5.0 | 20 (RBstart = 8) | 25 |  |
| NOTE 1: All combinations of channel bandwidths defined in Table 5.5A.2-1.  NOTE 2: All applicable sub-block gap sizes.  NOTE 3: The PCC allocation is same as Transmission bandwidth configuration NRB as defined in Table 5.3.2-1.  NOTE 4: The carrier center frequency of PCC in the DL operating band is configured closer to the UL operating band.  NOTE 5: Refers to the UL resource blocks shall be located as close as possible to the downlink operating band but confined within the transmission.  NOTE 6: Wgap is the sub-block gap between the two sub-blocks.  NOTE 7: The carrier centre frequency of SCC in the DL operating band is configured closer to the UL operating band.  NOTE 8: For operation with three or more non-contiguous component carriers, ΔRIBNC applies to all secondary component carriers.  NOTE 9: Bandwidth Combination Set 0.  NOTE 10: Bandwidth Combination Set 1.  NOTE 11: Applicable only to Bandwidth Combination Set 4 and 5 and for UEs supporting the symmetrical UL/DL channel bandwidths. | | | | | | |

For intra-band non-contiguous carrier aggregation with two uplink carriers and two or more downlink sub-blocks, throughput of each downlink component carrier shall be ≥ 95% of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2 and A.3.2 (with one sided dynamic OCNG Pattern OP.1 FDD/TDD for the DL-signal as described in Annex A.5.1.1/A.5.2.1) and parameters specified in Table 7.3.2-1a, Table 7.3.2-1b, Table 7.3.2-2, and Table 7.3A.2.2-2 with the power class 3 reference sensitivity power level increased by ΔRIBNC only for the specific uplink and downlink test points which are specified in Table 7.3A.2.2-2. The requirements apply with all downlink carriers and two uplink carriers active. The reference sensitivity requirements shall be verified with the network signaling value NS\_01 (Table 6.2.3.1-1) configured.

Table 7.3A.2.2-2: Power class 3 intra-band non-contiguous CA reference sensitivity with two uplink carriers.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| CA configuration | PCC/SCC  (SCS, BW) | PCC/SCC UL Fc (MHz) | UL PCC/SCC allocation  (LCRB) | PCC/SCC DL Fc (MHz) | PCC ΔRIBNC (dB) | SCC ΔRIBNC (dB) | Duplex mode |
| CA\_n26(2A) | (15kHz, 5MHz)/ (15kHz, 5MHz) | 816.5 / 839 | 12 (RBSTART = 0) / 12 (RBSTART = 3) | 861.5 / 884 | 38.0 | 13.0 | FDD |

## << End of change >>