**3GPP TSG- Meeting #6 *draft***

**Bengaluru, India, 25th Aug 2025 - 29th Aug 2025**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | [NR\_ENDC\_RF\_Ph4-Core] Draft CR to 38101-1-j20 on introducing the HPUE MSD requirements simplification | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Skyworks Solutions, Inc., , T-Mobile USA, ZTE, Oppo, Samsung, Murata Manufacturing Co Ltd., MediaTek, Vivo, Huawei, Apple, Qualcomm France | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_ENDC\_RF\_Ph4-Core | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | |  |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Refer to agreed WF R4-2505143 and discussion paper R4-2507699for 1UL band 1UL CC HPUE MSD simplification and to WF R4-2507935 for 2UL MSD simplification. 2UL exception rules proposed in [ ] are discussed in R4-2511623. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The following inter-band CA HPUE MSD requirements are introduced in clause 7.3A.2.3:   * New clause 7.3A.2.3.1 introduces the 1UL band 1UL CC MSD simplification look-up tables, * New clause 7.3A.2.3.2 introduces the 2UL band 2UL CCs with 1UL CC in each band MSD simplification look-up tables.   Clause 7.3A.7 is updated accordingly. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Inter-band CA HPUE MSD simplification is not completed. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 7.3A.2.3, 7.3A.7 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<START OF CHANGES>

7.3A.2.3 Reference sensitivity power level for Inter-band CA

For inter-band carrier aggregation with one component carrier per operating band and the uplink assigned to one NR band the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channels as specified in Annexes A.2.2.2, A.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, Table 7.3.2-2a, Table 7.3.2-3, and in Table 7.3F.2-1, Table 7.3F.2-2, Table 7.3F.2-3 for inter-band CA with one shared spectrum channel access band, modified in accordance with clause 7.3A.3.2. The reference sensitivity is defined to be met with all downlink component carriers active and one of the uplink carriers active. Exceptions to reference sensitivity are allowed in accordance with clause 7.3A.4, 7.3A.5 and 7.3A.6.

For the combination of intra-band and inter-band carrier aggregation, the intra-band CA relaxation, ΔRIBC and ΔRIBNC, are also applied according to the clause 7.3A.2.1 and 7.3A.2.2.

The reference sensitivity exceptions due to harmonic, harmonic mixing, cross band isolation and power class 2 or power class 3 CA intermodulation interferences are applicable to the UL aggressor band configured with either one Tx antenna connector or two Tx antenna connectors with UL MIMO or Tx diversity operation.

7.3A.2.3.1 PC2 and PC1.5 MSD requirements with look-up tables for two-band DL CA with 1UL band single CC

The PC2 and the PC1.5 MSD requirements with look-up tables for two-band DL CA reference sensitivity exceptions (MSD) due to 1UL band 1UL CC harmonic, harmonic mixing, and cross band isolation interference shall apply when the following criterias are met:

- A PC3 reference sensitivity exception requirement is specified either in Table 7.3A.4-1, or in Table 7.3A.4-4 or in Table 7.3A.6-1, and,

- PC2 output power achieved with one Tx antenna connector “PC21Tx”, or achieved with two Tx antenna connectors “PC22Tx”, or PC1.5 output power achieved with two Tx antenna connectors “PC1.52Tx” is specified as a valid 1UL band 1UL CC configuration in Table 5.5A.3.1-1a ~ Table 5.5A.3.1-1o, and,

- The PCx aggressor NR UL band is the same aggressor UL band as in case of PC3 MSD, and,

- The aggressor NR UL band is neither band n46, band n96 nor band n102.

For these cases, and where in the following PCx denotes either PC21Tx, PC22Tx or PC1.52Tx, the PCx MSD due to harmonic, harmonic mixing, and cross band isolation is specified as:

PCx MSD = PC3 MSD + ΔMSD

where,

- PCx MSD is the reference sensitivity exception specified for PC21Tx, PC22Tx, or PC1.52Tx,

- PC3 MSD is the reference sensitivity exception specified for PC3 in Table 7.3A.4-1, or in Table 7.3A.4-4 or in Table 7.3A.6-1,

- ΔMSD values are specified in Table 7.3A.2.3.1-1 output columns denoted “ΔMSDmax 3, 6, 9”. These apply to the same uplink/downlink configurations as those specified for the minimum PC3 MSD requirements in Table 7.3A.4-1, or in Table 7.3A.4-4 or in Table 7.3A.6-1,

- The correspondence between the ΔMSDmax specified in Table 7.3A.2.3.1-1, the source of interference and PCx MSD is specified in Table 7.3A.2.3.1-2,

**Table 7.3A.2.3.1-1: ΔMSD per ΔMSDmax look-up table for MSD due to harmonic, harmonic mixing, cross band isolation**

|  |  |  |  |
| --- | --- | --- | --- |
| **PC3 MSD (dB)** | **ΔMSDmax / ΔMSD(dB)** | | |
| **3** | **6** | **9** |
| 0.1≤ PC3 MSD <1.0 | 0.7 | 1.1 | 2.5 |
| 1.0≤ PC3 MSD <3.0 | 1.6 | 2.7 | 5.1 |
| 3.0≤ PC3 MSD <5.0 | 2.0 | 3.8 | 6.5 |
| 5.0≤ PC3 MSD <7.0 | 2.3 | 4.5 | 7.3 |
| 7.0≤ PC3 MSD <9.0 | 2.5 | 5.0 | 7.9 |
| PC3 MSD ≥9.0 | 3 | 6 | 9 |

**Table 7.3A.2.3.1-2: ΔMSDmax correspondence look-up table for source of interference and** **PCx MSD**

|  |  |  |  |
| --- | --- | --- | --- |
| **Source of interference** | **ΔMSDmax** | | |
| **PC21Tx MSD** | **PC22Tx MSD** | **PC1.52Tx MSD** |
| UL harmonic | 3 | 6 | 9 |
| Harmonic mixing | 3 | 6 | 9 |
| Cross band isolation | 3 | 6 | 9 |

As an exception, for cases where:

- The PC21Tx MSD is specified in Table 7.3A.4-2a or in Table 7.3A.4-4a-1 or in Table 7.3A.6-1a-1, and

- The PC3 MSD is not specified in Table 7.3A.4-1, or in Table 7.3A.4-4 or in Table 7.3A.6-1, and

- The PC1.5 MSD is not specified in Table 7.3A.4-4b or in Table 7.3A.6-1b, and

- PC1.5 output power achieved with two Tx antenna connectors “PC1.52Tx” is specified as a valid 1UL band 1UL CC configuration in Table 5.5A.3.1-1a ~ Table 5.5A.3.1-1o, and,

- The aggressor NR UL band is neither band n46, band n96 nor band n102,

then the PC1.52Tx MSD is specified as:

PC1.52Tx MSD = PC21Tx MSD + ΔMSD,

where in the Table 7.3A.2.3.1-1,

- ΔMSD is specified output column denoted “ΔMSDmax 6”,

- The input column uses the specified “PC21Tx MSD” instead of “PC3 MSD”. These apply to the same uplink/downlink configurations as those specified for the minimum PC2 MSD requirements in Table 7.3A.4-2a, or in Table 7.3A.4-4a-1 or in Table 7.3A.6-1a-1.

7.3A.2.3.2 PC2 and PC1.5 MSD requirements with look-up tables for two-band or three-band DL CA with two-band UL CA

The PC2 and the PC1.5 MSD requirements with look-up tables for two-band and three-band DL CA reference sensitivity exceptions (MSD) due to 2UL CA intermodulation interference shall apply when the following criterias are met:

- A PC3 reference sensitivity exception requirement is specified either in Table 7.3A.5-1, or in Table 7.3A.5-2, and,

- PC2 or PC1.5 two-band UL CA for a total of 2Tx or 3Tx and 1CC in each UL band is specified as a valid two-band UL CA configuration in Table 5.5A.3.1-1a ~ Table 5.5A.3.1-1o, or in Table 5.5A.3.2-1a ~ Table 5.5A.3.2-1c, and,

- The PC2 or PC1.5 MSD is caused by the same uplink/downlink configurations as in case of PC3 MSD, and,

- One of the constituent uplink band is neither band n46, band n96 nor band n102.

For these cases, and where in the following PCx denotes either PC2 or PC1.5, the PCx MSD due to 2UL CA intermodulation interference is specified as:

PCx MSD = PC3 MSD + ΔMSD

where,

- PCx MSD is the reference sensitivity exception specified for PC2 or PC1.5 with 2UL band CA for a total of 2Tx or 3Tx and with 1UL CC in each UL band,

- PC3 MSD is the reference sensitivity exception specified for PC3 in Table 7.3A.5-1, or in Table 7.3A.5-2,

- ΔMSD values are specified in Table 7.3A.2.3.2-1 output columns denoted “ΔMSDmax 6, 9, 12, 15, 18, 24, 30”. These apply for the same uplink/downlink configurations as those specified for the minimum PC3 MSD requirements in Table 7.3A.5-1, or in Table 7.3A.5-2, and,

- The correspondence between the ΔMSDmax specified in Table 7.3A.2.3.2-1, the IMD order and PCx MSD is specified in Table 7.3A.2.3.2-2,

**Table 7.3A.2.3.2-1: ΔMSD per ΔMSDmax look-up table for MSD due to 2UL CA intermodulation interference**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **PC3 MSD (dB)** | **ΔMSDmax / ΔMSD(dB)** | | | | | | |
| **6** | **9** | **12** | **15** | **18** | **24** | **30** |
| 0.1≤ PC3 MSD <0.5 | 1.2 | 2.4 | 3.9 | 5.8 | 7.9 | 13.2 | 18.8 |
| 0.5≤ PC3 MSD <1.0 | 1.7 | 3.5 | 5.4 | 7.5 | 10.0 | 15.6 | 21.4 |
| 1.0≤ PC3 MSD <2.0 | 2.8 | 4.8 | 7.1 | 9.6 | 12.4 | 18.0 | 24.1 |
| 2.0≤ PC3 MSD <3.0 | 3.5 | 5.7 | 8.2 | 10.9 | 13.7 | 19.5 | 25.5 |
| 3.0≤ PC3 MSD <4.0 | 3.9 | 6.3 | 8.9 | 11.7 | 14.5 | 20.5 | 26.5 |
| 4.0≤ PC3 MSD <5.0 | 4.3 | 6.8 | 9.4 | 12.4 | 15.2 | 21.2 | 27.2 |
| 5.0≤ PC3 MSD <6.0 | 4.5 | 7.1 | 9.9 | 12.8 | 15.8 | 21.7 | 27.7 |
| 6.0≤ PC3 MSD <7.0 | 4.8 | 7.6 | 10.4 | 13.3 | 16.2 | 22.3 | 28.2 |
| 7.0≤ PC3 MSD <8.0 | 5.0 | 7.8 | 10.7 | 13.6 | 16.6 | 22.5 | 28.5 |
| 8.0≤ PC3 MSD <9.0 | 5.2 | 8.1 | 11.0 | 14.0 | 16.9 | 22.8 | 28.8 |
| PC3 MSD ≥9.0 | 6 | 9 | 12 | 15 | 18 | 24 | 30 |

**Table 7.3A.2.3.2-2: ΔMSDmax correspondence look-up table for IMD order and PCx MSD**

|  |  |  |
| --- | --- | --- |
| **IMD order** | **ΔMSDmax** | |
| **PC2 MSD** | **PC1.5 MSD** |
| IMD2 | 6 | 12 |
| IMD3 | 9 | 18 |
| IMD4 | 12 | 24 |
| IMD5 | 15 | 30 |

As an exception, for cases where:

- The PC2 MSD is specified in Table 7.3A.5-1a or in Table 7.3A.5-2a, and,

- The PC3 MSD is not specified in Table 7.3A.5-1 or in Table 7.3A.5-2, and,

- The PC1.5 MSD is not specified in Table 7.3A.5-1b or in Table 7.3A.5-2b, and,

- PC2 or PC1.5 two-band UL CA for a total of 2Tx or 3Tx and 1CC in each UL band is specified as a valid two-band UL CA configuration in Table 5.5A.3.1-1a ~ Table 5.5A.3.1-1o, or in Table 5.5A.3.2-1a ~ Table 5.5A.3.2-1c, and,

- One of the constituent uplink band is neither band n46, band n96 nor band n102,

then the PC1.5 MSD is specified as:

PC1.5 MSD = PC2 MSD + ΔMSD,

where,

- In the Table 7.3A.2.3.2-1, ΔMSD is specified with output columns denoted “ΔMSDmax 6, 9, 12, 15” and where the input column uses the specified PC2 MSD specified in Table 7.3A.5-1a or in Table 7.3A.5-2a instead of the PC3 MSD, and

- In the Table 7.3A.2.3.2-2, the correspondence between the ΔMSDmax and the IMD order is specified using the column specified for “PC2 MSD”, and

- These PC1.5 MSD requirements apply for the same uplink/downlink configurations as those specified in the PC2 MSD requirements of Table 7.3A.5-1a or Table 7.3A.5-2a.

In all cases, the MSD requirements specified in Table 7.3A.2.3.2-1 and in Table 7.3A.2.3.2-2 do not apply to 2UL band CA configurations with 3UL CCs, e.g. a combination of intra-band and inter-band carrier aggregation.

<UNCHANGED SECTIONS ARE SKIPPED>

7.3A.7 Lower-MSD requirements for inter-band CA

A UE can report better MSD performance than the minimum requirements as specified in clause 7.3A.4, 7.3A.5, 7.3A.6, 7.3A.2.3.1 and in clause 7.3A.2.3.2 by *lowerMSD-r18* capability, except that the reporting for MSD caused by IMD with order higher than 5, IMD of UL intra-band CA or triple-beat is not supported in this release of the specification. The MSD performance after improvement is categorized into different lower-MSD capability classes, which are defined in Table 7.3A.7-1.

**Table 7.3A.7-1: Lower-MSD capability classes**

| **Lower-MSD capability class** | **Maximum allowed actual MSD**  **(i.e. Threshold)** | **Remark** |
| --- | --- | --- |
| I | 0 dB | Actual MSD ≤ 0dB |
| II | 3 dB | Actual MSD ≤ 3dB |
| III | 6 dB | Actual MSD ≤ 6dB |
| IV | 9 dB | Actual MSD ≤ 9dB |
| V | 12 dB | Actual MSD ≤ 12dB |
| VI | 15 dB | Actual MSD ≤ 15dB |
| VII | 18 dB | Actual MSD ≤ 18dB |
| VIII | 22 dB | Actual MSD ≤ 22dB |

The reported lower-MSD capability classes are subject to the same uplink/downlink configurations as defined for the minimum MSD requirements in clause 7.3A.4, 7.3A.5, 7.3A.6, 7.3A.2.3.1 and 7.3A.2.3.2. If a UE can support more than one test points for a given REFSENS exception case, the reported lower-MSD capability class is applicable for the test point having the largest specified MSD value. Otherwise, it’s only applicable for the test point which can be supported by the UE. If one or multiple power classes are requested by the network, the UE can, if supported, report *lowerMSD-r18* capability for the requested power classes; otherwise, the UE shall report *lowerMSD-r18* capability for the highest supported power class for the given CA configuration.

The UE shall meet one of the following conditions in order to report *lowerMSD-r18* capability for a given REFSENS exception case:

- If the specified minimum requirement is tightly bounded by the range of a lower-MSD capability class (i.e, Thresholdi-1 < MSD ≤ Thresholdi, where i and (i-1) are two adjacent lower-MSD capability classes), the actual MSD shall be at least one-level lower (i.e., actual MSD ≤ Thresholdi-1); or

- If the specified minimum requirement is larger than the maximum threshold (corresponding to lower-MSD capability class VIII), the actual MSD shall be no more than the maximum threshold.

Otherwise, the UE shall not report *lowerMSD-r18* capability for this REFSENS exception case.

If the special MSD type “ALL” is indicated in the *lowerMSD-r18* capability, the reporting conditions as specified above shall be met for each MSD type that has been specified in this release for the given CA configuration.

NOTE 1: The *lowerMSD-r18* capability is verified by reusing the MSD test point parameters and only replacing the minimum MSD requirement value by the threshold of the reported lower-MSD capability class. UE supporting lower MSD shall indicate the lower MSD capability for the requested power class if supported. If no power class is explicitly requested, the UE supporting lower MSD shall indicate the lower MSD capability for the highest supported power class of the band combination including victim band and aggressor band(s). And, similar to the specified MSD minimum requirements, only the highest supported power class or the power class required by the certification/regulation body per UL configuration is verified.

NOTE 2: If the UE is equipped with four or eight Rx antenna ports for the victim band of the BC, the *lowerMSD-r18* capability is verified with four or eight Rx antenna ports according to clause 7.2 under the condition mentioned above, but with the increased MSD values by the absolute value of ΔRIB,4R or ΔRIB,8R applied for the requirement based on the description in clause 7.3A.1.

<END OF CHANGES>