**3GPP TSG- Meeting #**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  |  | **CR** |  | **rev** | **1** | **Current version:** |  |  |
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| *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:***  |  |
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| ***Source to WG:*** |  |
| ***Source to TSG:*** | R4 |
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| ***Work item code:*** |  |  | ***Date:*** |  |
|  |  |  |  |  |
| ***Category:*** |  |  | ***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 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)* |
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| ***Reason for change:*** | Lower MSD and UE 8Rx for CPE/FWA/vehicle/industrial devices is included as an objective of Rel-18 WI on Further RF requirements enhancement for NR and EN-DC in frequency range 1 (FR1) [NR\_ENDC\_RF\_FR1\_enh2].This formal CR is to capture the draft CR endorsed R4-2321786 for lower MSD in RAN4#109, and the draft CR R4-2317620 endorsed in RAN4#108bis for 8Rx. |
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| ***Summary of change:*** | <Lower MSD>A new clause 7.3B.2.3.7 is added to introduce the requirements on Lower MSD for inter-band EN-DC within FR1. More explicitly, the lower-MSD capability classes are defined for a UE to report different levels of MSD performance. The conditions to indicate the [*lowerMSD-r18*] capability are also specified. And an informative note is added for RAN5 to reduce the conformance test burden.<8Rx>To introduce CA/DC requirements for 8Rx in TS 38.101-3.* CA/DC 8Rx requirements
	+ The applicability of the number of Rx antennas for Rx requirements is updated to include 8Rx case.
	+ Add the desscription that the MSD in the applicable bands in CA/DC shall be increased by the absolute value of ΔRIB,8R.
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| ***Consequences if not approved:*** | The new feature of Lower MSD is not implemented.UE 8Rx requirements for CPE/FWA/vehicle/industrial devices are not specified. |
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| ***Clauses affected:*** | 7.1, 7.3B, 7.3B.2.3 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.521-3 |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

**<Unchanged sections are omitted>**

## 7.1 General

Unless otherwise stated the receiver characteristics are specified at the antenna connector(s) of the UE for the bands operating on frequency range 1 and over the air of the UE for the bands operating on frequency range 2. The requirements for frequency range 1 and frequency range 2 can be verified separately. For the carrier in frequency range 1, requirements can be verified with NR FR2 link disabled. For the carrier in frequency range 2, requirements can be verified in OTA mode with E-UTRA connecting to the network by OTA without calibration.

The requirements defined in this clause are the extra requirements compared with the single carrier requirements defined in TS 38.101-1 [2] and TS 38.101-2 [3].

Unless otherwise stated, the UL and DL reference measurement channels are the same with the configurations specified in TS 38.101-1 [2] and TS 38.101-2 [3].

Unless otherwise stated, requirements for NR receiver written in TS 38.101-1 [2] and TS 38.101-2 [3] apply and are assumed anchor agnostic. Requirements are verified under conditions where anchor resources do not interfere NR operation.

For intra-band EN-DC, the output power is configured as follows:

- One E-UTRA uplink carrier with the output power set to 29 dB below PCMAX\_L and the NR band whose downlink is being tested has its uplink carrier output power set to 4 dB below PCMAX\_L,f,c.

- One NR uplink carrier with the output power set to 29 dB below PCMAX\_L,f,c and the E-UTRA band whose downlink is being tested has its uplink carrier output power set to 4 dB below PCMAX\_L,c.

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

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

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

 Wgap ≥ 2∙|FInterferer (offset)| – BWChannel

For the E-UTRA sub-block, the FInterferer (offset), for a sub-block with a single component carrier is the interferer frequency offset with respect to carrier as specified in clause 7.5.1, clause 7.6.1 and clause 7.6.3 for the respective requirement in TS 36.101 [4] and BWChannel. FInterferer (offset) for the E-UTRA sub-block with two or more contiguous component carriers is the interference frequency offset with respect to the carrier adjacent to the gap is specified in clause 7.5.1A, 7.6.1A and 7.6.3A in TS 36.101 [4].

For the NR sub-block, the FInterferer (offset), for a sub-block with a single component carrier is the interferer frequency offset with respect to carrier as specified in clause 7.5.1, clause 7.6.1 and clause 7.6.3 for the respective requirement in TS 38.101-1 [2] and BWChannel.

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

For sub-clauses with suffix A or B: the minimum requirements for band combinations including Band n41 also apply for the corresponding band combinations with Band n90 replacing Band n41 but with otherwise identical parameters. For brevity the said band combinations with Band n90 are not listed in the tables below but are covered by this specification.

For the requirements of FR1 in this clause, the UE shall be verified with four Rx antenna ports and skip two Rx antenna ports requirements in operating bands where the UE is equipped with four Rx antenna ports, the UE shall be verified with eight antenna ports and skip both two and four Rx antenna ports requirements in operating bands where the UE is equipped with eight Rx antenna ports unless UE is not supporting 8Rx ports for band(s) in band combination in which case those band(s) shall be verified with four Rx antenna ports in that band combination, otherwise, the UE shall be verified with two Rx antenna ports.

**<Unchanged sections are omitted>**

### 7.3B.1 General

For EN-DC, E-UTRA and NR single carrier, CA, and MIMO operation of REFSENS requirements defined in TS 38.101-1 [2], TS 38.101-2 [3] and TS 36.101 [4] apply to all downlink bands of EN-DC configurations listed in clause 5.5B, unless sensitivity degradation exception is allowed in this clause of this specification, clause 7.3 in TS 38.101-1 [2], clause 7.3 in TS 38.101-2 [3] or clause 7.3 in TS 36.101 [4]. Allowed exceptions specified in this clause of the specification, clause 7.3 in TS 38.101-1 [2], clause 7.3 in TS 38.101-2 [3] or clause 7.3 in TS 36.101 [4] also apply to any higher order EN-DC configuration combination containing one of the band combinations that exception is allowed for. Reference sensitivity exceptions are specified by applying maximum sensitivity degradation (MSD) into applicable REFSENS requirement. EN-DC REFSENS requirements shall be met for NR uplink transmissions using QPSK DFT-s-OFDM waveforms as defined in clause 7.3.2 [2]. Unless otherwise specified UL allocation uses the lowest SCS allowable for a given channel BW. Limits on configured maximum output power for the uplink according to clause 6.2B.4 shall apply.

In case of interband EN-DC the receiver REFSENS requirements in this clause do not apply for 1.4 and 3 MHz E-UTRA carriers. For the case of inter-band EN-DC with a single carrier per cell group and multi carrier per cell group, in addition to the E-UTRA and NR single carrier, CA, and MIMO operation of REFSENS requirements defined in TS 38.101-1 [2], TS 38.101-2 [3], and TS 36.101 [4], the REFSENS requirements specified therein also apply with both downlink carriers and both uplink carriers active unless sensitivity exceptions are allowed in this clause of this specification, clause 7.3 in TS 38.101-1 [2] or clause 7.3 in TS 36.101 [4].

For reference sensitivity exception test points where the specified carrier frequency does not correspond to a valid NR-ARFCN, the closest NR-ARFCN as specified in clause 5.4.2 applies.

For operations with 4 or 8 Rx antenna ports in an E-UTRA band or an NR band, the MSD in the applicable bands shall be increased by the absolute value of ΔRIB,4R in Table 7.3.1-1a or ΔRIB,8R in Table 7.3.1-1aa of TS 36.101[4] for the E-UTRA band or ΔRIB,4R in Table 7.3.2-2 or ΔRIB,8R in Table 7.3.2-2a of TS 38.101-1 for the NR band when MSD > 0.

NOTE: For inter-band EN-DC, the reference sensitivity requirement with both uplink carriers active is allowed to be verified for only a single inter-band EN-DC configuration per NR band.

**<Unchanged sections are omitted>**

### 7.3B.2.3.7 Lower-MSD requirements for inter-band EN-DC within FR1

A UE can report better MSD performance than the minimum requirements as specified in clause 7.3B.2.3.1, 7.3B.2.3.2, 7.3B.2.3.4 and 7.3B.2.3.5 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 of TS 38.101-1 [2].

The reported lower-MSD capability classes are subject to the same uplink/downlink configurations as defined for the minimum MSD requirements in clause 7.3B.2.3. 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 DC 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 cannot 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 DC configuration.

NOTE: 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. And, similar to the specified MSD, only the highest supported power class or the power class required by the certification/regulation body per UL configuration is verified.

**<Unchanged sections are omitted>**