**3GPP TSG-RAN Meeting #100eR4-2114208**

**Electronic Meeting, August 16 – 27, 2021**

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| *CR-Form-v12.1* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.171** | **CR** | **0013** | **rev** | **-** | **Current version:** | **16.1.0** |  |
|  | | | | | | | | |
| *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:*** | Frequency bands for testing of A-GNSS sensitivity requirements | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Incorporated | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_newRAT-Perf, TEI16 | | | | |  | ***Date:*** | | | 2021-08-06 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | | Rel-16 |
|  | *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-15 (Release 15) Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | In some configurations, the performance of the A-GNSS sensitivity test may be influenced by the bearer band used for the test scenario. However, the A-GNSS test requirements and scenarios do not specify any specific bands or band-combinations in which the test cases should be validated.  RAN5 currently tests the A-GNSS (and A-GPS) sensitivity requirements in each UE supported frequency band of the relevant cellular RAT. However, this is unnecessary and may result in excessive testing time (in particular for EN-DC operation mode) since not all bearer bands affect the GNSS reception bands. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. For NR single carrier, only the frequency bands which can generate 2nd order harmonics and other distortions falling into the GNSS reception bands need to be tested. 2. For EN-DC, only those EN-DC configurations that can generate second or third order intermodulation (IM) products falling into the GNSS reception bands need to be tested. 3. The EN-DC configurations are divided into groups with similar IMD level and risks. For each group, only one of the EN-DC configurations in the group need to be tested. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | It remains unclear which frequency bands and band combinations should be used for verifying A-GNSS sensitivity requirements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | B.1.7, B.1.12 (new) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **x** |  | Other core specifications | | | | TS/TR 36.171 CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS/TR 37.571 CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | | See R4-2100021 for additional background: "LS on Frequency Bands for testing of A-GNSS Sensitivity requirements in NR and LTE" (RAN5).  See R4-2108232 for RAN4 agreements: "WF on frequency bands for testing of A-GNSS Sensitivity requirements in NR and LTE". | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## B.1.7 E-UTRA or NR frequency and frequency error

In all test cases other than Sensitivity in clause 5.1 with E-UTRA frequency, the E-UTRA frequency used shall be the mid-range for the E-UTRA operating band. The E-UTRA frequency with respect to the GNSS carrier frequency shall be offset by +0.025 PPM.

In all test cases other than Sensitivity in clause 5.1 with NR, the NR frequency used shall be as specified in TS 38.508-1 [20], clause 4.3.1. The NR frequency with respect to the GNSS carrier frequency shall be offset by + 0.025 PPM.

Editor's Note: What does this 0.025 ppm offset "with respect to the GNSS carrier frequency" mean? What does "NR frequency" and "GNSS carrier frequency" refer to?

For verifying the sensitivity requirements in clause 5.1 with NR single carrier, the sensitivity tests shall be performed in each frequency band listed in Table B.1.7-1. The NR frequency and channel configuration shall be selected to ensure second order harmonics and other distortion will fall into the GNSS receiver bands as defined in clause B.1.12.2 for the particular GNSS. Table B.1.7-2 defines exemplary test frequencies and RB settings for GPS L1/Galileo E1 for the frequency band listed in Table B.1.7-1.

NOTE : If the DUT does not support any of the frequency bands listed in Table B.1.7-1 the sensitivity tests in clause 5.1 can be performed in any frequency band supported by the DUT.

Table B.1.7-1: NR operating bands for verifying GNSS sensitivity

|  |  |
| --- | --- |
| NR operating bands | n13, n14, n24, n79, n96 |

Table B.1.7-2: Exemplary NR configuration for verifying the sensitivity requirements for GPS L1/Galileo E1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NR Band | Bandwidth (SCS)  [MHz] | UL Fc  [MHz] | UL ARFCN | Total No of UL RB’s | Start UL RB No. |
| n13 | 10 (15 kHz) | 782.00 | 156400 | 52 | 0 |
| n14 | 10 (15 kHz) | 793.00 | 158600 | 52 | 0 |
| n24 | 5 (15 kHz) | 1629.00 | 325800 | 25 | 0 |
| n79 | 100 (30 kHz) | 4744.20 | 716280 | 273 | 0 |
| n96 | 80 (30 kHz) | 6312.70 | 820846 | 217 | 0 |

[…]

## B.1.12 EN-DC band combinations for testing A-GNSS sensitivity

#### B.1.12.1 EN-DC band combination groups

For the A-GNSS sensitivity requirements in EN-DC operation mode with uplink assigned to E-UTRA and NR frequency bands, the requirements in clause 5.1 can be verified by one EN-DC band combination in each of the applicable Frequency Group Combination specified in Table B.1.12.1-1. The A-GNSS sensitivity requirements for the remaining applicable EN-DC band combinations in each Frequency Group Combination are considered to have been verified by using the one EN-DC band combination in each Frequency Group Combination. The Frequency Groups are defined in Table B.1.12.1-2.

The applicable EN-DC band combinations for verifying A-GNSS sensitivity requirements in EN-DC operation mode are specified in clause B.1.12.2.

Table B.1.12.1-1: EN-DC band combination groups for verifying A-GNSS sensitivity requirements in EN-DC operation mode

|  |  |
| --- | --- |
| Frequency Group Combination | EN-DC Band Combinations |
| Group VHF-VHF | NA |
| Group VHF-LB | NA |
| Group VHF-MLB | NA |
| Group VHF-MB | NA |
| Group VHF-HB | NA |
| Group VHF-UHB1 | NA |
| Group VHF-UHB2 | NA |
| Group LB-VHF | NA |
| Group LB-LB | DC\_5A\_n12A  DC\_5A\_n71A  DC\_8A\_n20A  DC\_8A\_n28A  DC\_12A\_n5A  DC\_20A\_n8A  DC\_20A\_n28A  DC\_28A\_n5A  DC\_28A\_n8A  DC\_71A\_n5A  DC\_20A\_n83A |
| Group LB-MLB | DC\_20A\_n50A  DC\_20A\_n51A  DC\_28A\_n51A  DC\_28A\_n50A |
| Group LB-MB | DC\_5A\_n2A  DC\_5A\_n66A  DC\_8A\_n1A  DC\_8A\_n3A  DC\_8A\_n34A  DC\_8A\_n39A  DC\_12A\_n2A  DC\_12A\_n25A  DC\_12A\_n66A  DC\_18A\_n3A  DC\_20A\_n1A  DC\_20A\_n3A  DC\_26A\_n25A  DC\_28A\_n3A  DC\_71A\_n66A  DC\_8A\_n80A  DC\_20A\_n80A |
| Group LB-HB | DC\_5A\_n7A  DC\_5A\_n38A  DC\_5A\_n40A  DC\_8A\_n40A  DC\_8A\_n41A  DC\_12A\_n7A  DC\_12A\_n38A  DC\_12A\_n41A  DC\_20A\_n7A  DC\_20A\_n38A  DC\_20A\_n41A  DC\_26A\_n41A  DC\_28A\_n7A  DC\_28A\_n40A  DC\_28A\_n41A  DC\_71A\_n38A |
| Group LB-UHB1 | DC\_5A\_n48A  DC\_5A\_n78A  DC\_8A\_n77A  DC\_8A\_n78A  DC\_12A\_n78A  DC\_18A\_n77A  DC\_18A\_n78A  DC\_19A\_n77A  DC\_19A\_n78A  DC\_20A\_n77A  DC\_20A\_n78A  DC\_26A\_n77A  DC\_26A\_n78A  DC\_28A\_n77A  DC\_28A\_n78A  DC\_71A\_n48A  DC\_71A\_n78A |
| Group LB-UHB2 | DC\_5A\_n79A  DC\_8A\_n79A  DC\_18A\_n79A  DC\_19A\_n79A  DC\_26A\_n79A  DC\_28A\_n79A |
| Group MLB-VHF | NA |
| Group MLB-LB | DC\_11A\_n28A |
| Group MLB-MLB | NA |
| Group MLB-MB | DC\_11A\_n3A |
| Group MLB-HB | NA |
| Group MLB-UHB1 | DC\_11A\_n77A  DC\_11A\_n78A  DC\_21A\_n77A  DC\_21A\_n78A |
| Group MLB-UHB2 | DC\_11A\_n79A  DC\_21A\_n79A |
| Group MB-VHF | NA |
| Group MB-LB | DC\_1A\_n5A  DC\_1A\_n8A  DC\_1A\_n20A  DC\_1A\_n28A  DC\_1A\_n71A  DC\_2A\_n5A  DC\_2A\_n12A  DC\_2A\_n71A  DC\_3A\_n5A  DC\_3A\_n8A  DC\_3A\_n20A  DC\_3A\_n28A  DC\_3A\_n71A  DC\_66A\_n5A  DC\_66A\_n12A  DC\_66A\_n71A  DC\_3A\_n82A |
| Group MB-MLB | DC\_1A\_n50A  DC\_1A\_n51A  DC\_3A\_n50A  DC\_3A\_n51A |
| Group MB-MB | DC\_1A\_n3A  DC\_2A\_n66A  DC\_3A\_n1A  DC\_3A\_n34A  DC\_66A\_n2A  DC\_66A\_n25A  DC\_1A\_n80A  DC\_2A\_n2A2  DC\_66A\_n66A2  DC\_3A\_n3A2  DC\_3A\_n84A |
| Group MB-HB | DC\_1A\_n7A  DC\_1A\_n38A  DC\_1A\_n40A  DC\_1A\_n41A  DC\_2A\_n7A  DC\_2A\_n38A  DC\_2A\_n41A  DC\_3A\_n7A  DC\_3A\_n38A  DC\_3A\_n40A  DC\_3A\_n41A  DC\_4A\_n38A  DC\_4A\_n41A  DC\_25A\_n41A  DC\_39A\_n40A  DC\_39A\_n41A  DC\_66A\_n7A  DC\_66A\_n38A  DC\_66A\_n41A |
| Group MB-UHB1 | DC\_1A\_n77A  DC\_1A\_n78A  DC\_2A\_n48A  DC\_2A\_n78A  DC\_3A\_n77A  DC\_3A\_n78A  DC\_4A\_n78A  DC\_39A\_n78A  DC\_66A\_n48A  DC\_66A\_n78A |
| Group MB-UHB2 | DC\_1A\_n79A  DC\_3A\_n79A  DC\_39A\_n79A |
| Group HB-VHF | NA |
| Group HB-LB | DC\_7A\_n5A  DC\_7A\_n8A  DC\_7A\_n20A  DC\_7A\_n28A  DC\_7A\_n71A  DC\_30A\_n5A  DC\_41A\_n28A |
| Group HB-MLB | DC\_7A\_n51A |
| Group HB-MB | DC\_7A\_n1A  DC\_7A\_n3A  DC\_7A\_n66A  DC\_30A\_n2A  DC\_30A\_n66A  DC\_40A\_n1A  DC\_41A\_n3A  DC\_7A\_n80A  DC\_38A\_n3A |
| Group HB-HB | DC\_7A\_n40A  DC\_40A\_n41A  DC\_7A\_n7A2  DC\_41A\_n41A |
| Group HB-UHB1 A(NOTE 1): | DC\_40A\_n77A  DC\_40A\_n78A |
| B(NOTE 2): | DC\_7A\_n78A  DC\_38A\_n78A  DC\_41A\_n78A |
| C(NOTE 3): | DC\_7A\_n77A  DC\_41A\_n77A |
| Group HB-UHB2 | DC\_40A\_n79A  DC\_41A\_n79A |
| Group UHB1-VHF | NA |
| Group UHB1-LB | NA |
| Group UHB1-MLB | NA |
| Group UHB1-MB | NA |
| Group UHB1-HB | NA |
| Group UHB1-UHB1 | NA |
| Group UHB1-UHB2 | NA |
| Group UHB2-VHF | NA |
| Group UHB2-LB | NA |
| Group UHB2-MLB | NA |
| Group UHB2-MB | NA |
| Group UHB2-HB | NA |
| Group UHB2-UHB1 | NA |
| Group UHB2-UHB2 | NA |
| NOTE 1: This sub-group generates IM2.  NOTE 2: This sub-group generates IM3  NOTE 3: This sub-group generates IM2 and IM3. | |

Table B.1.12.1-2: Definition of Frequency Groups

|  |  |
| --- | --- |
| Frequency Group | Frequency Range (MHz) |
| VHF | 400.0 – 458.0 |
| LB | 662.0 – 916.0 |
| MLB | 1426.0 – 1518.0 |
| MB | 1626.0 – 2025.0 |
| HB | 2300.0 – 2690.0 |
| UHB1 | 3300.0 – 4201.0 |
| UHB1 | 4400.0 – 5000.0 |

#### B.1.12.2 Applicable EN-DC band combinations for verifying A-GNSS sensitivity requirements

The A-GNSS sensitivity requirements in clause 5.1 when in EN-DC operation mode shall be verified for EN-DC band combinations that can generate second or third order intermodulation products falling into the following GNSS receiver bands for the particular GNSS (where supported by the UE):

- GPS L1 C/A: 1574.3970 – 1576.4430 MHz

- Galileo E1 / GPS L1C: 1573.3740 – 1577.4660 MHz

- GLONASS G1: 1597.5515 – 1605.8860 MHz

- BDS B1I: 1559.0520 – 1563.1440 MHz

For each frequency group combination in Table B.1.12.2-1 only one EN-DC band combination need to be tested for the supported GNSS.

Table B.1.12.2-1: EN-DC band combinations for verifying A-GNSS sensitivity requirements

|  |  |  |  |
| --- | --- | --- | --- |
| Frequency Group Combination | EN-DC band combinations | | |
| GPS L1 / Galileo E1 | GLONASS G1 | BDS B1 |
| Group LB-LB | DC\_20A\_n28A  DC\_28A\_n5A  DC\_20A\_n83A | DC\_8A\_n28A  DC\_20A\_n28A  DC\_28A\_n8A  DC\_20A\_n83A | DC\_5A\_n12A  DC\_12A\_n5A  DC\_20A\_n28A  DC\_28A\_n5A  DC\_20A\_n83A |
| Group LB-MLB | NA | NA | NA |
| Group LB-MB | NA | NA | NA |
| Group LB-HB | DC\_5A\_n40A  DC\_28A\_n40A | DC\_8A\_n41A  DC\_28A\_n40A | DC\_5A\_n40A  DC\_28A\_n40A |
| Group LB-UHB1 | DC\_8A\_n77A  DC\_8A\_n78A  DC\_20A\_n77A  DC\_20A\_n78A | DC\_5A\_n78A  DC\_8A\_n77A  DC\_8A\_n78A  DC\_20A\_n77A  DC\_20A\_n78A  DC\_26A\_n77A  DC\_26A\_n78A | DC\_8A\_n77A  DC\_8A\_n78A |
| Group LB-UHB2 | NA | NA | NA |
| Group MLB-LB | NA | NA | NA |
| Group MLB-MLB | NA | NA | NA |
| Group MLB-MB | NA | NA | NA |
| Group MLB-HB | NA | NA | NA |
| Group MLB-UHB1 | NA | NA | NA |
| Group MLB-UHB2 | DC\_11A\_n79A  DC\_21A\_n79A | DC\_11A\_n79A  DC\_21A\_n79A | DC\_11A\_n79A  DC\_21A\_n79A |
| Group MB-LB | NA | NA | NA |
| Group MB-MLB | NA | NA | NA |
| Group MB-MB | DC\_1A\_n3A  DC\_2A\_n66A  DC\_3A\_n1A  DC\_66A\_n2A  DC\_66A\_n25A  DC\_1A\_n80A  DC\_3A\_n84A | DC\_1A\_n3A  DC\_2A\_n66A  DC\_3A\_n1A  DC\_66A\_n2A  DC\_66A\_n25A  DC\_1A\_n80A  DC\_3A\_n84A | DC\_1A\_n3A  DC\_2A\_n66A  DC\_3A\_n1A  DC\_66A\_n2A  DC\_66A\_n25A  DC\_1A\_n80A  DC\_3A\_n84A |
| Group MB-HB | DC\_1A\_n40A | DC\_1A\_n7A | DC\_1A\_n7A |
| Group MB-UHB1 | DC\_1A\_n77A  DC\_1A\_n78A  DC\_2A\_n78A  DC\_3A\_n77A  DC\_3A\_n78A  DC\_4A\_n78A  DC\_39A\_n78A  DC\_66A\_n78A | DC\_1A\_n77A  DC\_1A\_n78A  DC\_2A\_n78A  DC\_3A\_n77A  DC\_3A\_n79A  DC\_4A\_n78A  DC\_39A\_n78A  DC\_66A\_n78A | DC\_1A\_n77A  DC\_1A\_n78A  DC\_2A\_n78A  DC\_3A\_n77A  DC\_3A\_n79A  DC\_4A\_n78A  DC\_39A\_n78A  DC\_66A\_n78A |
| Group MB-UHB2 | DC\_3A\_n79A | NA | DC\_3A\_n79A |
| Group HB-LB | NA | DC\_7A\_n8A | NA |
| Group HB-MLB | NA | NA | NA |
| Group HB-MB | DC\_40A\_n1A | DC\_40A\_n1A | DC\_40A\_n1A |
| Group HB-HB | NA | NA | NA |
| Group HB-UHB1 A: | DC\_40A\_n77A | DC\_40A\_n77A | DC\_40A\_n77A |
| B: | DC\_7A\_n78A  DC\_38A\_n78A  DC\_41A\_n78A | DC\_7A\_n78A  DC\_38A\_n78A  DC\_41A\_n78A | DC\_7A\_n78A  DC\_38A\_n78A  DC\_41A\_n78A |
| C: | DC\_7A\_n77A  DC\_41A\_n77A | DC\_7A\_n77A  DC\_41A\_n77A | DC\_7A\_n77A  DC\_41A\_n77A |
| Group HB-UHB2 | NA | NA | NA |

#### B.1.12.3 Test frequencies for EN-DC band combinations

For verifying the sensitivity requirements in clause 5.1 in EN-DC operation mode, the E-UTRA and NR frequency and channel configuration shall be selected to ensure the intermodulation products fall into the GNSS receiver bands as defined in clause B.1.12.2 for the particular GNSS.

Table B.1.12.3-1 shows exemplary test frequencies and RB settings for GPS L1/Galileo E1 for one EN-DC band combination in each of the Frequency Group Combinations defined in clause B1.12.2.

Table B.1.12.3-1: Exemplary EN-DC Test Configuration for GPS L1/Galileo E1 for one EN-DC Band Combination per Frequency Group Combination

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Frequency Group Combination | EN-DC Band Combination | Bandwidth  LTE / NR (SCS)  [MHz] | UL Fc  LTE / NR  [MHz] | UL ARFCN  LTE / NR | No. of UL RBs  LTE / NR | Start UL RB  LTE / NR |
| LB-LB | DC\_20A\_n28A | 5 / 5 (15 kHz) | 834.50 / 740.50 | 24175 / 148100 | 6 / 6 | 9 / 9 |
| LB-HB | DC\_5A\_n40A | 5 / 5 (15 kHz) | 826.50 / 2397.50 | 20425 / 479500 | 6 / 6 | 0 / 19 |
| LB-UHB1 | DC\_8A\_n77A | 3 / 10 (30 kHz) | 881.50 / 3337.50 | 21465 / 622500 | 6 / 3 | 0 / 10 |
| MLB-UHB2 | DC\_11A\_n79A | 5 / 40 (30 kHz) | 1429.40 / 4434.50 | 22765 / 695633 | 6 / 3 | 9 /51 |
| MB-MB | DC\_1A\_n3A | 5 / 5 (15 kHz) | 1922.50 / 1747.50 | 18025 / 349500 | 6 / 6 | 0 / 9 |
| MB-HB | DC\_1A\_n40A | 5 / 5 (15 kHz) | 1939.50 / 2305.50 | 18195 / 460900 | 6 / 6 | 9 / 9 |
| MB-UHB1 | DC\_1A\_n77A | 5 / 10 (30 kHz) | 1922.50 / 3497.50 | 18025 / 633166 | 6 / 3 | 9 / 10 |
| MB-UHB2 | DC\_3A\_n79A | 3 / 40 (30 kHz) | 1711.50 / 4980.00 | 19215 / 732000 | 6 / 3 | 4 / 101 |
| HB-MB | DC\_40A\_n1A | 5 / 5 (15 kHz) | 2340.50 / 1939.50 | 38695 / 387900 | 6 / 6 | 9 / 9 |
| HB-UHB1 | DC\_7A\_n78A | 5 / 10 (30 kHz) | 2502.50 / 3427.50 | 20775 / 628500 | 6 / 3 | 3 / 10 |
| HB-UHB1 | DC\_7A\_n77A | 5 / 10 (30 kHz) | 2502.50 / 4077.50 | 20775 / 671833 | 6 / 3 | 9 / 10 |