**3GPP TSG-RAN4 Meeting #111 *R4-2410224***

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

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| *CR-Form-v12.3* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **4520** | **rev** | **1** | **Current version:** | **17.13.0** |  |
|  |
| *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 |  | Radio Access Network | **x** | Core Network |  |

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|  |
| ***Title:***  | [NR\_HST\_FR2] CR to 38.133, Cat F on HST FR2 RRM Performance Corrections |
|  |  |
| ***Source to WG:*** | Nokia, Samsung |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_HST\_FR2-Perf |  | ***Date:*** | 2024-05-22 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-17 |
|  | *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-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19) Rel-20 (Release 20)* |
|  |  |
| ***Reason for change:*** | * In test case A.7.5.8.3, units are not the same in the provided one-way differential propagation time ([$\left|T\_{old}-T\_{new}\right|=2.33 μs]$).
* AoA test setup for test case A.7.6.1.5 has not been defined. Some minor typos have been spotted.
* There is a need to correct wrong calculation of the requirements in the test A.7.6.3.5:
	+ TReport is 320 slots, i.e., 40ms,
	+ Then TL1**-RSRP\_Measurement\_Period\_SSB** (Table 9.5.4.1-3) with DRX of 40 ms, shall be max(40, 80) = 80 ms, i.e., not 320 ms.
	+ Then, the total delay in the requirement should be Time period for PSS/SSS detection + 80 ms and equals 400 + 80 = 480 ms, not 720 ms.
* PC6 range of Rx antenna gain (i.e. max gain and mean gain) has not been yet agreed. PC6-specific values should be present in the test case A.7.6.3.5.
 |
|  |  |
| ***Summary of change:*** | * Remove the bracket and corrected the unit of provided one-way differential propagation time in test case A.7.5.8.3.
* Introduced AoA test setup for test case A.7.6.1.5. Typos corrected.
* Changed the value of requirements in A.7.6.5.3.
* Added proposed range of Rx antenna into brackets for test case A.7.6.3.5
 |
|  |  |
| ***Consequences if not approved:*** | * UL timing calculations are not fully defined in test case A.7.5.8.3.
* Test A.7.6.1.5 parameters are not complete.
* Test A.7.6.3.5 measurement reporting requirements do not match the PC6 L1-RSRP reporting requirements.
* Test A.7.6.3.5 requirements may not match the PC6 Rx antenna gain.
 |
|  |  |
| ***Clauses affected:*** | A.7.5.8.3.1, A.7.6.1.5, A.7.6.3.5 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  |  |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 38.533 |
| ***(show related CRs)*** |  |  |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** | Revision of R4-2408647. |

<Start of Change# 1>

A.7.5.8.3 MAC-CE based active TCI state switch for HST FR2 scenario

A.7.5.8.3.1 NR PCell FR2 HST active TCI state switch for a known TCI state

A.7.5.8.3.1.1 Test Purpose and Environment

The purpose of this test is to verify the active TCI state switch delay requirement defined in clause 8.10.3A for FR2 power class 6 UE. Supported test configuration is shown in Table A.7.5.8.3.1.1-1. Furthermore, the purpose of this test is also to verify the one shot large timing adjustment requirement specified in clause 7.1.2.3 provided *highSpeedMeasFlagFR2-r17* is configured and *highSpeedLargeOneStepUL-TimingFR2-r17* is enabled for UE supporting FR2 power class 6 and *largeOneStepUL-timingFR2-r17* capability.

The test scenario comprises of one NR PCell (Cell 1) as given in Table A.7.5.8.3.1.1-2. Cell-specific parameters of NR PCell are specified in Table A.7.5.8.3.1.1-3 below. The OTA related test parameters for FR2 are shown in Table A.7.5.8.3.1.1-4. During the test, *highSpeedMeasFlagFR2-r17* is configured to be *set2* and broadcast to UE.

PDCCHs indicating new transmissions shall be sent continuously on PCell to ensure that the UE would have ACK/NACK sending.

Before the test starts,

- UE is connected to Cell 1 (PCell) on radio channel 1 (PCC).

- UE is configured with 2 different TCI states for PCell, PDCCH TCI state 0 (QCL’d to SSB0) and TCI state 1 (QCL’d to SSB1), in Cell 1 before starting the test.

- UE is indicated in TCI state 0 as the active PDCCH TCI state

The test consists of two time periods, T1 and T2. Figure A.7.5.8.3.1.1-1 and Figure A.7.5.8.3.1.1-2 show the Time multiplexed (allocation in Frequency is symbolic) downlink transmissions from each Angle of Arrival. During T1 only SSB to which PDCCH-TCI-state0 is QCL’d is transmitted. At the beginning of T2, the SSB corresponding to TCI state 1 starts transmitting, which has the relative timing delay compared to TCI state 0 by the absolute value of the one-way differential propagation time $\left|T\_{old}-T\_{new}\right|T\_{c}=2.33 μs$. The UE is configured to provide periodic L1-RSRP reports. In slot n which is within 1280 ms of UE providing L1-RSRP report with results for both SSB0 and SSB1, UE receives a MAC-CE command indicating a switch to TCI state 1. *tci-PresentInDCI* is not configured in the PDSCH configuration, i.e. TCI state for the PDSCH is identical to the PDCCH TCI state. After the TCI state switch, the UE transmit timing accuracy shall be measured by the test equipment by using the SRS defined in Table A.7.5.8.3.1-5.

The test equipment verifies that

- UE can be scheduled on PCell on TCI state 0 till n+ THARQ +3 ms.

- the TCI state switch time in PCell by scheduling the UE on TCI state 1 after slot n + THARQ + 3 ms + Tfirst-SSB + TSSB-proc + Trs + Trs-proc.

- the UE transmission timing immediately after TCI state switch shall follow the requirements as specified in clause 7.1.2.3.

**Table A.7.5.8.3.1.1-1: Supported test configurations**

|  |  |
| --- | --- |
| **Config** | **Description** |
| 1 | NR 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |

**Table A.7.5.8.3.1.1-2: General test parameters for TCI state switch**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| NR RF Channel Number |  | 1 | One NR radio channel is used for this test |
| Active PCell |  | Cell 1 | PCell on RF channel number 1. |
| CP length |  | Normal |  |
| DRX |  | OFF |  |
| T1 | s | 0.2 |  |
| T2 | s | 0.2 |  |

**Table A.7.5.8.3.1.1-3: NR Cell specific test parameters for TCI state switch**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Cell 1** |
| Frequency Range |  | FR2 |
| Duplex mode |  | TDD |
| TDD configuration |  | TDDConf.3.1 |
| BWchannel |  | 100 MHz: NRB,c = 66 |
| Data RBs allocated |  | 66 |
| Initial DL BWP Configuration |  | DLBWP.0.2 |
| Dedicated DL BWP Configuration |  | DLBWP.1.1 |
| Initial UL BWP Configuration |  | ULBWP.0.2 |
| Dedicated UL BWP Configuration |  | ULBWP.1.1 |
| PDSCH Reference measurement channel |  | SR.3. 2 TDD  |
| RMSI CORESET parameters |  | CR.3.1 TDD  |
| Dedicated CORESET parameters |  | CCR.3.1 TDD  |
| OCNG Patterns |  | OP. 5 |
| SSB Configuration |  | SSB.1 FR2 |
| SMTC Configuration |  | SMTC.1  |
| TCI State 0 |  | TCI.State.0 |
| TCI State 1 |  | TCI.State.1 |
| TRS Configuration |  | TRS.2.1 TDD  |
| Correlation Matrix and Antenna Configuration |  | 1x2 |
| EPRE ratio of PSS to SSS | dB | 0 |
| EPRE ratio of PBCH DMRS to SSS |  |  |
| EPRE ratio of PBCH to PBCH DMRS |  |  |
| EPRE ratio of PDCCH DMRS to SSS |  |  |
| EPRE ratio of PDCCH to PDCCH DMRS |  |  |
| EPRE ratio of PDSCH DMRS to SSS  |  |  |
| EPRE ratio of PDSCH to PDSCH  |  |  |
| EPRE ratio of OCNG DMRS to SSS(Note 1) |  |  |
| EPRE ratio of OCNG to OCNG DMRS (Note 1) |  |  |
| Propagation Condition |  | AOA1: AWGNAOA2: AWGN with 9722 Hz frequency offset |
| Note 1: OCNG shall be used such that a constant total transmitted power spectral density is achieved for all OFDM symbols. |

**Table A.7.5.8.3.1.1-4: OTA related test parameters for TCI state switch**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Cell 1** |
|  |  | **SSB0** | **SSB1** |
|  |  | **T1** | **T2** | **T1** | **T2** |
| Angle of arrival configuration |  | Setup 3 according to clause A.3.15.3 |
|  |  | AoA1 | AoA2 |
| Assumption for UE beams Note 6 |  | Rough |
| Ês | dBm/SCS | -80.6 | -80.6 | -Infinity | -80.6 |
| SS B\_RP Note 2 | dBm/ SCS | -80.6 | -80.6 | -Infinity | -80.6 |
| BB Note 7 | dB | 8.3 | 8.3 | -Infinity | 8.3 |
| IoNote2 | dBm/95.04 MHz Note4 | -56.0 | -56.0 | - Infinity | -56.0 |
| Note 1: VoidNote 2: SS B\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.Note 3: VoidNote 4: Equivalent power received by an antenna with 0 dBi gain at the centre of the quiet zoneNote 5: As observed with 0dBi gain antenna at the center of the quiet zone.Note 6: Information about types of UE beam is given in B.2.1.3 and does not limit UE implementation or test system implementation. Note 7: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.6-4. |

**Table A.7.5.8.3.1.1-5: Sounding Reference Symbol Configuration**

|  |  |  |
| --- | --- | --- |
| **Field** | **Value** | **Comment** |
| c-SRS | 16 | Frequency hopping is disabled |
| b-SRS | 0 |  |
| b-hop | 0 |  |
| freqDomainPosition | 0 | Frequency domain position of SRS |
| freqDomainShift | 0 |  |
| groupOrSequenceHopping | neither | No group or sequence hopping |
| SRS-PeriodicityAndOffset | sl5=0 | Once every 5 slots |
| pathlossReferenceRS | ssb-Index=0 | SSB #0 is used for SRS path loss estimation |
| usage | Codebook | Codebook based UL transmission |
| startPosition | 0 | resourceMapping setting. SRS on last symbol of slot, and 1symbols for SRS without repetition. |
| nrofSymbols | n1 |  |
| repetitionFactor | n1 |  |
| combOffset-n2 | 0 | transmissionComb setting |
| cyclicShift-n2 | 0 |  |
| nrofSRS-Ports | port1 | Number of antenna ports used for SRS transmission |
| Note: For further information see clause 6.3.2 in TS 38.331 [2]. |

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**Figure A.7.5.8.3.1.1-1: Time multiplexed downlink transmissions during T1**

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**Figure A.7.5.8.3.1.1-2: Time multiplexed downlink transmissions during T2**

A.7.5.8.3.1.2 Test Requirements

During T2, UE shall send L1-RSRP report with results for both SSB0 and SSB1.

After the TCI state switch, the UE transmission timing immediately after TCI state switch shall follow the requirements as specified in clause 7.1.2.3.

After receiving MAC-CE command in slot n, UE shall:

- be able to continue to receive on TCI state 0 till n + THARQ + 3 ms

- be able to start receiving on TCI state 1 after n + THARQ +7 ms + Tfirst-SSB + Trs

<End of Change #1>

<Start of Change# 2>

A.7.6.1.5 SA event triggered reporting test without gap under non-DRX for UE configured with *highSpeedMeasFlagFR2-r17*

A.7.6.1.5.1 Test purpose and Environment

The purpose of this test is to verify that the UE makes correct reporting of an event. This test will partly verify the TDD intra-frequency cell search requirements for FR2 power class 6 UE configured with *highSpeedMeasFlagFR2-r17* in clause 9.2.5.1 and 9.2.5.2. Supported test configurations are shown in table A.7.6.1.5.1-1.

**Table A.7.6.1.5.1-1: supported test configurations**

|  |  |
| --- | --- |
| **Configuration** | **Description** |
| 1 | 120 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| 2 | 240 kHz SSB SCS, 100 MHz bandwidth, TDD duplex mode |
| Note: The UE is only required to be tested in one of the supported test configurations. |

There are two cells in the test, PCell (Cell 1) and a FR2 neighbour cell (Cell 2) on the same frequency as the PCell. The test parameters for the Cell 1 and Cell 2 are given in Table A.7.6.1.5.1-2, A.7.6.1.5.1-3 and A.7.6.1.5.1-4 below.

In the measurement control information, a measurement object is configured for the frequency of the PCell, and it is indicated to the UE that event-triggered reporting with Event A3 is used.

The test consists of two successive time periods, with time duration of T1, and T2 respectively. During time duration T1, the UE shall not have any timing information of Cell 2.

**Table A.7.6.1.5.1-2: General test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Config** | **Value** | **Comment** |
| *highSpeedMeasFlagFR2-r17* |  | 1,2  | Set2 | *highSpeedMeasFlagFR2-r17* = set2 is configured |
| Active cell |  | 1, 2 | PCell (Cell 1) |  |
| Neighbour cell |  | 1, 2 | Cell 2 | Cell to be identified. |
| RF Channel Number |  | 1, 2 | 1: Cell 1 and Cell 2 | One TDD carrier frequency is used for the NR cells. |
| SMTC configuration |  | 1, 2 | SMTC.1  |  |
| A3-Offset | dB | 1, 2 | -11 |  |
| CP length |  | 1, 2 | Normal |  |
| Hysteresis | dB | 1, 2 | 0 |  |
| Time To Trigger | s | 1, 2 | 0 |  |
| Filter coefficient |  | 1, 2 | 0 | L3 filtering is not used |
| DRX |  | 1, 2 | OFF |  |
| Time offset between Cell 1 and Cell 2 |  | 1, 2 | 3 μs | Synchronous cells |
| T1 | s | 1, 2 | 1 |  |
| T2 | s | 1, 2 | 2 |  |

**Table A.7.6.1.5.1-3: NR Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Config** | **Cell 1** | **Cell 2** |
|  |  |  | **T1** | **T2** | **T1** | **T2** |
| TDD configuration  |  | 1, 2 | TDDConf.3.1 | TDDConf.3.1 |
| BWchannel | MHz | 1, 2 | 100: NRB,c = 66 | 100: NRB,c = 66 |
| Data RBs allocated |  | 1 | 24 | 24 |
| 2 | 48 | 48 |
| Intial BWP configuration |  | 1, 2 | DLBWP.0.1ULBWP.0.1 | DLBWP.0.1ULBWP.0.1 |
| Active DL BWP configuration |  | 1, 2 | DLBWP.1.1 | DLBWP.1.1 |
| Active UL BWP configuration |  | 1, 2 | ULBWP.1.1 | ULBWP.1.1 |
| RLM-RS |  | 1, 2 | SSB | SSB |
| PDSCH RMC configuration |  | 1 | SR.3.2 TDD  | N/A |
| 2 | SR.3.3 TDD |
| RMSI CORESET RMC configuration |  | 1 | CR.3.1 TDD | N/A |
| 2 | CR.3.2 TDD | N/A |
| Dedicated CORESET RMC configuration |  | 1 | CCR.3.1 TDD | N/A |
| 2 | CCR.3.7 TDD | N/A |
| TRS configuration |  | 1, 2 | TRS.2.1 TDD | N/A |
| PDSCH/PDCCH TCI states |  | 1, 2 | TCI.State.2 | N/A |
| PDSCH/PDCCH subcarrier spacing | kHz | 1, 2 | 120 | 120 |
| OCNG Patterns |  | 1, 2 | OP.5 | N/A |
| cellIndividualOffset | dB | 1~2 | N/A | 16 |
| SSB  |  | 1 | SSB.1 FR2 | SSB.7 FR2 |
|  |  | 2 | SSB.2 FR2 | SSB.8 FR2 |
| Propagation Condition  |  | 1, 2 | AWGN | AWGN 19444Hz Note 1 |
| Note 1: The AWGN 19444 Hz condition is a non fading propagation channel with one tap. Doppler shift is a constant 19444 Hz. |

**Table A.7.6.1.5.1-4: NR OTA Cell specific test parameters for intra-frequency event triggered reporting for SA with TDD PCell in FR2 without gap without DRX**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Config** | **Cell 1** | **Cell 2** |
|  |  |  | **T1** | **T2** | **T1** | **T2** |
| AoA setup |  | 1, 2 | Setup 3 defined in A.3.15.3 |
|  |  |  | AoA1 | AoA2 |
| Beam assumptionNote 4 |  | 1,2 | Rough | Rough |
|  Es | dBm/SCS | 1 | -89 | -89 | -Infinity | -89 |
|  |  | 2 | -86 | -86 | -Infinity | -86 |
|  BB Note 5 | dB | 1, 2 | -0.12 | -0.12 | -Infinity | -0.12 |
| SSB\_RP | dBm/SCS | 1 | -89 | -89 | -Infinity | -89 |
|  |  | 2 | -86 | -86 | -Infinity | -86 |
|  | dBm/95.04MHz | 1 | -64.41 | -64.41 | -Infinity | -64.41 |
| 2 | -61.41 | -61.41 | -Infinity | -61.41 |
| Time multiplexing of the downlink transmissions from each AoA | 1, 2 | Defined in Figure A.7.6.1.1.1-1 |
| Note 1: The resources for uplink transmission are assigned to the UE prior to the start of time period T2.Note 2: VoidNote 3: Es/Iot, SSB\_RP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.Note 4: Information about types of UE beam is given in B.2.1.3, and does not limit UE implementation or test system implementationNote 5: Calculation of Es/IotBB includes the effect of UE internal noise up to the value assumed for the associated Refsens requirement in clause 7.3.2 of TS 38.101-2 [19], and an allowance of 1dB for UE multi-band relaxation factor ΔMBP from TS 38.101-2 [19] Table 6.2.1.3-4. |

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**Figure A.7.6.1.5.1-1: Time multiplexed downlink transmissions (Config 1 example)**

A.7.6.1.5.2 Test Requirements

In the test, the UE shall send one Event A3 triggered measurement report, with a measurement reporting delay less than 1140 ms from the beginning of time period T2.

The UE is not required to read the neighbour cell SSB index in this test.

The UE shall not send event triggered measurement reports, as long as the reporting criteria are not fulfilled.

The rate of correct events observed during repeated tests shall be at least 90%.

NOTE: The actual overall delays measured in the test may be up to 2xTTIDCCH higher than the measurement reporting delays above because of TTI insertion uncertainty of the measurement report in DCCH.

<End of Change #2>

<Start of Change# 3>

A.7.6.3.5 SSB based L1-RSRP measurement when DRX is used for power class 6 UE configured with *highSpeedMeasFlagFR2-r17*

Editor’s note: The text of the clause is fully omitted due to no changes in it.

A.7.6.3.5.3 Test Requirements

The UE shall send L1-RSRP report every 320 slots. No later than 480 ms plus 320 slots from the beginning of time period T2, UE shall send L1-RSRP report including the results for both SSB#0 and SSB#1 while meeting the accuracy requirements defined in clause 10.1.20.1.

The reported L1-RSRP value shall include the Rx antenna gain in the range of -5 to [+44] dB.

The rate of correct events observed during repeated tests shall be at least 90%.

<End of Change # 3>