**3GPP TSG-RAN4 Meeting #111 *R4-240XXXX***

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

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.133** | **CR** | **Draft** | **rev** | **1** | **Current version:** | **18.5.0** |  |
|  | | | | | | | | |
| *For* ***[HE](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)******[LP](http://www.3gpp.org/3G_Specs/CRs.htm" \l "_blank)*** *on using this form: comprehensive instructions can be found at  <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:*** | (NR\_NTN\_enh-Perf) draftCR to TS 38.133: Introduction of satellite switch test cases for NTN enh | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | CMCC | | | | | | | | | |
| ***Source to TSG:*** | RAN4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_NTN\_enh-Perf | | | | |  | ***Date:*** | | | 2024-04-26 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19) Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | In RAN4#110bis meeting, RAN4 agreed that following test case for earth fixed cell will be introduced for R18 NR\_NTN\_enh WI  1. RACH-less for soft satellite switch  2. RACH-based for hard satellite switch | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduce following test case for earth fixed cell for R18 NR\_NTN\_enh WI  1. RACH-less for soft satellite switch  2. RACH-based for hard satellite switch | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The WI is incomplete | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | A.14.2.1.7, A.14.2.1.8 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS 38.533 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Revised from R4-2407933 | | | | | | | | |

**<Start of change#1>**

#### A.14.2.1.7 RACH-based Hard Satellite switching with re-synchronization from FR1 to FR1

##### A.14.2.1.7.1 Test Purpose and Environment

This test is to verify the requirement for RACH-based hard satellite switching with re-synchronization from SAN FR1 to SAN FR1 specified in clause 6.1C.3.

##### A.14.2.1.7.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells with same PCI as given in table A.14.2.1.7.2-1, A.14.2.1.7.2-2, A.14.2.1.7.2-3 and A.14.2.1.7.2-4. Both satellite switching delay and interruption length are tested.

The test consists of two successive time periods, with time durations of T1 and T2 respectively.

At the start of time duration T1, the UE may not have any timing information of cell 2. During T1, The SIB19 implying *t-service-r17* andtarget satellite configuration *SatSwitchWithReSync-r18* shall be sent to UE. The target satellite configuration is in Table A.14.2.1.7.2-3.

At the start of time duration T2, cell 2 becomes detectable and *t-service-r17* of cell 1 is fulfilled.

Table A.14.2.1.7.2-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | NGSO, NR FDD, 15kHz SSB SCS, 10 MHz BW |

Table A.14.2.1.7.2-2: General test parameters for RACH-based Hard Satellite switching with re-synchronization from FR1 to FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | Comment |
| RF Channel Number | |  | 1 | One NR NTN satellite RF channel |
| Initial conditions | Active cell |  | Cell 1 |  |
| Final condition | Active cell |  | Cell 2 |  |
| UE position (N,S, H) | |  | (0, 0, 0) | Set by AT command |
| Access Barring Information | | - | Not barred | No additional delays in random access procedure. |
| Time offset between cells | |  | 3 μs | Synchronous cells |
| T1 | | s | 5 |  |
| T2 | | s | ≤5 |  |

Table A.14.2.1.7.2-3: Target Satellite configuration pattern for hard satellite switching scenario

|  |  |
| --- | --- |
| Parameter | TSC.1 |
| Interval between adjacent epoch time | 2.56s |
| ntn-UlSyncValidityDuration | 5s |
| cellSpecificKoffset | 14 slots |
| ta-Common | 0 |
| ta-CommonDrift | 0 |
| ta-CommonDriftVariant | 0 |
| ntn-PolarizationDL | linear |
| ntn-PolarizationUL | linear |
| ephemerisInfo | Detailed ephemeris information is provided in TS 38.508-1 [38] |
| ssb-TimeOffset | 0 |

Table A.14.2.1.7.2-4: Cell specific test parameters for RACH-based Hard Satellite switching with re-synchronization from FR1 to FR1 test case

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1Note1 | | Cell 2Note1 | |
| T1 | T2 | T1 | T2 |
| Satellite configurationNote2 | |  | SSC.2 | N/A | N/A | SSC.2 |
| BWchannel | | MHz | 10: NRB,c = 52 |  |  | 10: NRB,c = 52 |
| BWP BW | | MHz | 10: NRB,c = 52 |  |  | 10: NRB,c = 52 |
| Kmac | | ms | 0 |  |  | 0 |
| DRX Cycle | | ms | Not Applicable |  |  | Not Applicable |
| PDSCH Reference measurement channel | |  | SR.1.1 FDD |  |  | SR.1.1 FDD |
| CORESET Reference Channel | |  | CR.1.1 FDD |  |  | CR.1.1 FDD |
| TRS configuration | |  | TRS.1.1 FDD |  |  | TRS.1.1 FDD |
| OCNG Patterns | |  | OP.1 |  |  | OP.1 |
| SMTC Configuration | |  | SMTC.1 |  |  | SMTC.1 |
| SSB Configuration | |  | SSB.1 FR1 |  |  | SSB.1 FR1 |
| PDSCH/PDCCH subcarrier spacing | | kHz | 15 kHz |  |  | 15 kHz |
| PUCCH/PUSCH subcarrier spacing | | kHz | 15 kHz |  |  | 15 kHz |
| PRACH configuration | |  | FR1 PRACH configuration 1 |  |  | FR1 PRACH configuration 1 |
| BWP configuration | Initial DL BWP |  | DLBWP.0.1 |  |  | DLBWP.0.1 |
| Dedicated DL BWP |  | DLBWP.1.1 |  |  | DLBWP.1.1 |
| Initial UL BWP |  | ULBWP.0.1 |  |  | ULBWP.0.1 |
| Dedicated UL BWP |  | ULBWP.1.1 |  |  | ULBWP.1.1 |
| EPRE ratio of PSS to SSS | | dB | 0 |  |  | 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) | |  |  |  |  |
| Note3 | | dBm/ 15kHz | -98 | | | |
| Note3 | | dBm/ SCS | -98 | | | |
|  | | dB | 8 | -Infinity | -Infinity | 8 |
|  | | dB | 8 | -Infinity | -Infinity | 8 |
| SSB\_RP | | dBm/ SCS | -90 | -Infinity | -Infinity | -90 |
| IoNote4 | | dBm/ 9.36MHz | -61.41 | -61.41 | -61.41 | -61.41 |
| Propagation condition | | - | AWGN | | | |
| Note 1: Cell 1 and Cell 2 have same PCI. Satellite serving for Cell 1 and Satellite serving for Cell 2 are two different NGSO satellites.  Note 2: SSB transmit timing from TE should fit the SSB-timeOffset and the nominal propagation delay difference between serving satellite and target satellite. The nominal propagation delay is counted from the SSB-TimeOffset reference point to UE, which based on satellite locations and UE location known to the TE in this test case.  Note 3: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 4: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 5: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | | | | |

##### A.14.2.1.7.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 52.5 ms from the beginning of time period T2.

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

NOTE: The hard satellite switch with re-sync delay Dswitch\_unchangedPCI can be expressed as: Tinterrupt, where:

Tinterrupt is defined in clause 6.1C.3.2.2.

Dswitch\_unchangedPCI = Tinterrupt = Tsearch + TIU + Tprocessing + T∆ + Tmargin ms

Here: Tsearch = Tfirst\_SSB = 0.5ms; TIU = 20ms; Tprocessing = 10ms; T∆ = 20ms; Tmargin = 2ms.

This gives a total of 52.5 ms.

#### A.14.2.1.8 RACH-less Soft Satellite switching with re-synchronization from FR1 to FR1

##### A.14.2.1.8.1 Test Purpose and Environment

This test is to verify the requirement for RACH-less soft satellite switching with re-synchronization from SAN FR1 to SAN FR1 specified in clause 6.1C.3.

##### A.14.2.1.8.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells with same PCI as given in table A.14.2.1.8.2-1, A.14.2.1.8.2-2, A.14.2.1.8.2-3 and A.14.2.1.8.2-4. Satellite switching delay is tested.

The test consists of three successive time periods, with time durations of T1 T2 and T3 respectively.

At the start of time duration T1, the UE may not have any timing information of cell 2. During T1, The SIB19 implying *t-service-r17* andtarget satellite configuration *SatSwitchWithReSync-r18* shall be sent to UE. The target satellite configuration is in Table A.14.2.1.8.2-3. The configured grant PUSCH transmission in the cell2 is configured in the RRC message from cell1.

At the start of time duration T2, cell 2 becomes detectable and *t-ServiceStart-r18* is fulfilled.

At the start of time duration T3, *t-service-r17* of cell 1 is fulfilled.

Table A.14.2.1.8.2-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | NGSO, NR FDD, 15kHz SSB SCS, 10 MHz BW |

Table A.14.2.1.8.2-2: General test parameters for RACH-less Soft Satellite switching with re-synchronization from FR1 to FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | Comment |
| RF Channel Number | |  | 1 | One NR NTN satellite RF channel |
| Initial conditions | Active cell |  | Cell 1 |  |
| Final condition | Active cell |  | Cell 2 |  |
| UE position (N,S, H) | |  | (0, 0, 0) | Set by AT command |
| Access Barring Information | | - | Not barred | No additional delays in random access procedure. |
| timeDomainOffset | |  | 0 |  |
| mappingType | |  | Type A |  |
| startSymbolAndLength | |  | 42 | *startSymbol S=0*  *Length* L=4 |
| timeReferenceSFN-r16 | |  | sfn512 |  |
| Periodcity | |  | sym10x14 |  |
| Time offset between cells | |  | 3 μs | Synchronous cells |
| T1 | | s | 5 |  |
| T2 | | ms | 100 |  |
| T3 | | s | ≤5 |  |

Table A.14.2.1.8.2-3: Target Satellite configuration pattern for soft satellite switching scenario

|  |  |
| --- | --- |
| Parameter | TSC.2 |
| Interval between adjacent epoch time | 2.56s |
| ntn-UlSyncValidityDuration | 5s |
| cellSpecificKoffset | 14 slots |
| ta-Common | 0 |
| ta-CommonDrift | 0 |
| ta-CommonDriftVariant | 0 |
| ntn-PolarizationDL | linear |
| ntn-PolarizationUL | linear |
| ephemerisInfo | Detailed ephemeris information is provided in TS 38.508-1 [38] |
| ssb-TimeOffset | 10 |
| t-ServiceStart | T2 |

Table A.14.2.1.8.2-4: Cell specific test parameters for Inter frequency SAN handover test case

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1Note1 | | | Cell 2Note1 | | |
| T1 | T2 | T3 | T1 | T2 | T3 |
| Satellite configurationNote2 | |  | SSC.2 | | N/A | N/A | SSC.2 | |
| BWchannel | | MHz | 10: NRB,c = 52 | |  |  | 10: NRB,c = 52 | |
| BWP BW | | MHz | 10: NRB,c = 52 | |  |  | 10: NRB,c = 52 | |
| Kmac | | ms | 0 | |  |  | 0 | |
| DRx Cycle | | ms | Not Applicable | |  |  | Not Applicable | |
| PDSCH Reference measurement channel | |  | SR.1.1 FDD | |  |  | SR.1.1 FDD | |
| CORESET Reference Channel | |  | CR.1.1 FDD | |  |  | CR.1.1 FDD | |
| TRS configuration | |  | TRS.1.1 FDD | |  |  | TRS.1.1 FDD | |
| OCNG Patterns | |  | OP.1 | |  |  | OP.1 | |
| SMTC Configuration | |  | SMTC.1 | |  |  | SMTC.5 | |
| SSB Configuration | |  | SSB.1 FR1 | |  |  | SSB.5 FR1 | |
| PDSCH/PDCCH subcarrier spacing | | kHz | 15 kHz | |  |  | 15 kHz | |
| PUCCH/PUSCH subcarrier spacing | | kHz | 15 kHz | |  |  | 15 kHz | |
| PRACH configuration | |  | FR1 PRACH configuration 1 | |  |  | N/A | |
| BWP configuration | Initial DL BWP |  | DLBWP.0.1 | |  |  | DLBWP.0.1 | |
| Dedicated DL BWP |  | DLBWP.1.1 | |  |  | DLBWP.1.1 | |
| Initial UL BWP |  | ULBWP.0.1 | |  |  | ULBWP.0.1 | |
| Dedicated UL BWP |  | ULBWP.1.1 | |  |  | ULBWP.1.1 | |
| EPRE ratio of PSS to SSS | | dB | 0 | |  |  | 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) | |  | |  |  |  | |
| Note2 | | dBm/ 15kHz | -98 | | | | | |
| Note2 | | dBm/ SCS | -98 | | | | | |
|  | | dB | 4 | 4 | -Infinity | -Infinity | 9 | 9 |
|  | | dB | 4 | 4 | -Infinity | -Infinity | 9 | 9 |
| SSB\_RP | | dBm/ SCS | -94 | -94 | -Infinity | -Infinity | -89 | -89 |
| IoNote3 | | dBm/ 9.36MHz | -64.59 | -64.59 | -70.05 | -70.05 | -60.53 | -60.53 |
| Propagation condition | | - | AWGN | | | | | |
| Note 1: Cell 1 and Cell 2 have same PCI. Satellite serving for Cell 1 and Satellite serving for Cell 2 are two different NGSO satellites.  Note 2: SSB transmit timing from TE should fit the SSB-timeOffset and the nominal propagation delay difference between serving satellite and target satellite. The nominal propagation delay is counted from the SSB-TimeOffset reference point to UE, which based on satellite locations and UE location known to the TE in this test case.  Note 3: Interference from other cells and noise sources not specified in the test is assumed to be constant over subcarriers and time and shall be modelled as AWGN of appropriate power for  to be fulfilled.  Note 4: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.  Note 5: OCNG shall be used such that both cells are fully allocated and a constant total transmitted power spectral density is achieved for all OFDM symbols. | | | | | | | | |

##### A.14.2.1.8.3 Test Requirements

The UE shall start to transmit the PUSCH to Cell 2 less than 130 ms from the beginning of time period T2.

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

NOTE: The satellite switch with re-sync delay Dswitch\_unchangedPCI can be expressed as: Tsoft\_switch, where:

Tsoft\_switch = max(*t-service*-*t-seviceStart*, Tsearch + T∆ + Tmargin) + TIU + Tprocessing ms

Here: *t-service*-*t-seviceStart=* 100ms*;* Tsearch = 10.5ms; T∆ = 20ms; Tmargin = 2ms, TIU = 20ms; Tprocessing = 10ms.

This gives a total of 130 ms.

**<End of change#1>**