**3GPP TSG-RAN4 Meeting #106 *R4-2303320***

**Athens, Greece, 27th Feb. – 3rd Mar., 2023**

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| --- |
| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **38.133** | **CR** | **xxxx** | **rev** | **-** | **Current version:** | **18.0.0** |  |
|  |
| *For* [***HELP***](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:***  | Big CR for NTN RRM performance requirements (Rel-18) |
|  |  |
| ***Source to WG:*** | MCC, Xiaomi |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_NTN\_solutions-Perf |  | ***Date:*** | 2023-03-07 |
|  |  |  |  |  |
| ***Category:*** | **A** |  | ***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 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)* |
|  |  |
| Reason for change: | This big CR merge the following endorsed draft CRs to introduce the test setup and test cases for NTN RRM. |
|  |  |
| ***Summary of change:*** | Introduce the following draft CRs for test setup and test cases:R4-2300777 CR on timing advance adjustment accuracy test for NTNR4-2302001 CR on UE transmit timing tests for NTN R18R4-2301955 draftCR on setup for NTN RRM test cases R18R4-2301957 draftCR on CHO TCs for NTN R18R4-2302646 CR on TS 38.133 (Rel-18) Corrections on cell reselection test case for intra-frequency in NTN for NTN (CAT. A) |
|  |  |
| ***Consequences if not approved:*** | The test setup and TCs for NTN RRM are incomplete. |
|  |  |
| ***Clauses affected:*** | Section A.3.36, A.14.2 and A.14.3New section B.5 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** | **X** |  |  Test specifications | TS 36.521-3  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

<Start of change#1>

## A.3.36 Testing related to Satellite access

### A.3.36.1 Introduction

In annex A test cases are defined for verifying various type of RRM requirements related to satellite access.

### A.3.36.2 Principle of testing GSO and NGSO scenarios

In Annex A, RRM test cases related to satellite access are defined for both GSO and NGSO. The testing principle for these test cases is as follows:

- A UE capable of GSO only is required to pass the test cases with GSO.

- A UE capable of NGSO only is required to pass the test cases with NGSO.

- A UE capable of both GSO and NGSO is required to pass the test cases with NGSO only.

Support of GSO and NGSO scenario is indicated via *ntn-ScenarioSupport-r17*.

### A.3.36.2 Principle of testing different RRM requirements

In Annex A, RRM test cases related to satellite access are defined for all applicable RRM requirements. The testing principle for these test cases is as follows:

- A UE capable of NTN only is required to pass all the test cases defined in clause A.14.

- A UE capable of both TN and NTN is required to pass the test cases for NTN specific requirements in Table A.3.36.2-1.

Table A.3.36.2-1: Test cases for NTN specific requirements

|  |  |
| --- | --- |
| Clause | Test case slogan |
| A.14.1.2 | Cell reselection to FR1 intra-frequency NR cell for UE configured with [capability for enhanced requirements] |
| A.14.1.3 | Time-based cell reselection to FR1 intra-frequency NR cell |
| A.14.1.4 | Location-based cell reselection to FR1 intra-frequency NR cell |
| A.14.1.7 | Cell reselection to FR1 inter-frequency NR cell for UE configured with [capability for enhanced requirements] |
| A.14.1.8 | Time-based Cell reselection to FR1 inter-frequency NR satellite access case |
| A.14.1.9 | Location-based Cell reselection to FR1 inter-frequency NR satellite access case |
| A.14.2.1.3 | Intra-frequency SAN time-based conditional Handover from FR1 to FR1 |
| A.14.2.1.4 | Inter-frequency SAN time-based conditional Handover from FR1 to FR1 |
| A.14.2.1.5 | Intra-frequency SAN distance-based conditional Handover from FR1 to FR1 |
| A.14.2.1.6 | Inter-frequency SAN distance-based conditional Handover from FR1 to FR1 |
| A.14.3.1.1 | NR UE Transmit Timing Test for FR1 |
| A.14.5.1.1 | SA event triggered reporting tests without gap under non-DRX |
| A.14.5.1.2 | SA event triggered reporting tests without gap under DRX |
| A.14.5.1.3 | SA event triggered reporting tests without gap under non-DRX with SSB index reading |
| A.14.5.1.4 | SA event triggered reporting tests with single measurement gap under non-DRX for satellite access |
| A.14.5.1.5 | SA event triggered reporting tests with FNO concurrent gaps under DRX for satellite access |
| A.14.5.1.6 | SA event triggered reporting tests with PPO concurrent gaps under non-DRX with SSB index reading for satellite access |
| A.14.5.2.1 | Event triggered reporting test without gap under non-DRX |
| A.14.5.2.2 | Event triggered reporting tests without gap under DRX |
| A.14.6.3.1 | SA intra-frequency measurement accuracy with FR1 serving cell and FR1 target cell |
| A.14.6.3.2 | SA Inter-frequency measurement accuracy with FR1 serving cell and FR1 target cell |
| A.14.6.4.1 | SSB based L1-RSRP measurement |
| A.14.6.4.2 | CSI-RS based L1-RSRP measurement on resource set with repetition off |

### A.3.36.3 Principle of testing different ephemeris formats

In Annex A, RRM test cases related to satellite access are defined and satellite ephemeris information are sent to UE in each test case.

EphemerisInfo is configured in format of velocity state vector (PositionVelocity) for the following test cases:

* + - * RRC\_IDLE state mobility
				+ A.14.1.3, A.14.1.4, A.14.1.5, A.14.1.6, A.14.1.9 and A.14.1.10
			* Handover
				+ A.14.2.1.3, A.14.2.1.4, A.14.2.1.5 and A.14.2.1.6
			* Timing
				+ A.14.3.1
			* Radio link Monitoring
				+ A.14.4.1.1, A.14.4.1.2, A.14.4.1.5 and A.14.4.1.6
			* Beam Failure Detection and Link recovery procedures
				+ A.14.4.2.1, A.14.4.2.3 and A.14.4.2.5
			* Active BWP switch
				+ A.14.4.3.1
			* UE specific CBW change
				+ A.14.4.4.1
			* Pathloss reference signal switching delay

A.14.4.5.1

* + - * Intra-frequency Measurements
				+ A.14.5.1.1, A.14.5.1.3 and A.14.5.1.5
			* Inter-frequency Measurements
				+ A.14.5.2.1, A.14.5.2.3 and A.14.5.2.7
			* L1-RSRP measurement for beam reporting
				+ A.14.5.3.1 and A.14.5.3.3
			* SS-RSRP
				+ A.14.6.1.1
			* SS-RSRQ
				+ A.14.6.2.1
			* SS-SINR
				+ A.14.6.3.1
			* L1-RSRP measurement for beam reporting
				+ A.14.6.4.1

EphemerisInfo is configured in format of orbital parameters (Orbital) for the following test cases:

* + - * RRC\_IDLE state mobility
				+ A.14.1.1, A.14.1.2, A.14.1.5 and A.14.1.6
			* Handover
				+ A.14.2.1.1, A.14.2.1.2
			* RRC Connection Mobility Control
				+ A.14.2.2.1, A.14.2.2.2 and A.14.2.2.3
			* Timing
				+ A.14.3.2
			* Radio link Monitoring
				+ A.14.4.1.3, A.14.4.1.4, A.14.4.1.7 and A.14.4.1.8
			* Beam Failure Detection and Link recovery procedures
				+ A.14.4.2.2, A.14.4.2.4 and A.14.4.2.6
			* Active BWP switch
				+ A.14.4.3.2
			* Intra-frequency Measurements
				+ A.14.5.1.2, A.14.5.1.4 and A.14.5.1.6
			* Inter-frequency Measurements
				+ A.14.5.2.2, A.14.5.2.4, A.14.5.2.6 and A.14.5.2.8
			* L1-RSRP measurement for beam reporting
				+ A.14.5.3.2 and A.14.5.3.4
			* SS-RSRP
				+ A.14.6.1.2
			* SS-RSRQ
				+ A.14.6.2.2
			* SS-SINR
				+ A.14.6.3.2
			* L1-RSRP measurement for beam reporting
				+ A.14.6.4.2

### A.3.36.4 General setup for SIB19

The general parameters for SIB19 setup is specified in Table A.3.36.4-1.

Table A.3.36.2-1: Test cases for NTN specific requirements

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test 1 |
| Interval between adjacent epoch time | s | LEO: 2.56GEO: 10.24 |
| ntn-UlSyncValidityDuration | s | LEO: 5sGEO: 900s |
| cellSpecificKoffset  | slot | LEO: 8GEO: 256 |
| kmac  | slot | Not configured |
| ta-Common |  | 0 |
| ta-CommonDrift |  | 0 |
| ta-CommonDriftVariant |  | 0 |
| ntn-PolarizationDL |  | linear |
| ntn-PolarizationUL |  | linear |
| ephemerisInfo |  |  |
| ta-Report |  | Not configured |

<End of change#1>

<Start of change#2>

#### A.14.1.1 Cell reselection to FR1 intra-frequency NR case

##### A.14.1.1.1 Test Purpose and Environment

This test is to verify the requirement for the intra frequency NR cell reselection requirements for satellite access specified in clause 4.2C.2.3.

##### A.14.1.1.2 Test Parameters

The test scenario comprises of 2 cells on 1 NR carrier configured each in a different satellite as given in tables A.14.1.1.2-1, A.14.1.1.2-2 and A.14.1.1.2-3. The test consists of three successive time periods, with time duration of T1, T2, and T3 respectively. Only cell 1 is already identified by the UE prior to the start of the test. Cell 1 and cell 2 belong to different tracking areas. Furthermore, UE has not registered with network for the tracking area containing cell 2.

Table A.14.1.1.2-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |

Table A.14.1.1.2-2: General test parameters for intra frequency NR cell re-selection test case

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
|  |  |
| Initial condition | Active cell |  | Cell1 |  |
| T2 end condition | Active cell |  | Cell2 |  |
|  | Neighbour cells |  | Cell1 |  |
| Final condition | Active cell |  | Cell1 |  |
|  | Neighbour cells |  | Cell2  |  |
| RF Channel Number |  | 1 |  |
| Time offset between cells |  | 3 ms | Asynchronous cells |
| Access Barring Information | - | Not Sent | No additional delays in random access procedure. |
| DRX cycle length | s | 1.28 | The value shall be used for all cells in the test. |
| PRACH configuration index |  | 102 | The detailed configuration is specified in TS 38.211 clause 6.3.3.2 |
| rangeToBestCell |  | Not configured |  |
| T1 | s | >7 | During T1, Cell 2 shall be powered off, and during the off time the physical cell identity shall be changed, The intention is to ensure that Cell 2 has not been detected by the UE prior to the start of period T2 |
| T2 | s | 75 | T2 needs to be defined so that cell re-selection reaction time is taken into account. |
| T3 | s | 30 | T3 needs to be defined so that cell re-selection reaction time is taken into account. |

Table A.14.1.1.2-3: Cell specific test parameters for intra frequency NR cell re-selection test case

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Cell 1 | Cell 2 |
|  |  | T1 | T2 | T3 | T1 | T2 | T3 |
| Satellite information |  | SSC.1 for GSO testSSC.2 for NGSO test | NSC.1 for GSO testNSC.2 for NGSO test |
| PDSCH RMC configuration |  | SR.1.1 FDD | SR.1.1 FDD |
| RMSI CORESET configuration |  | CR.1.1 FDD | CR.1.1 FDD |
| Dedicated CORESET configuration |  | CCR.1.1 FDD | CCR.1.1 FDD |
| OCNG Pattern |  | OP.1 defined in A.3.2.1 | OP.1 defined in A.3.2.1 |
| Initial DL BWP configuration |  | DLBWP.0.1 | DLBWP.0.1 |
| Initial UL BWP configuration |  | ULBWP.0.1 | ULBWP.0.1 |
| SSB configuration |  | SSB.1 FR1 | SSB.5 FR1 |
| SMTC configuration |  | #1: SMTC.1 for Cell 1#2: SMTC.4 for Cell 2 | #1: SMTC.1 for Cell 1#2: SMTC.4 for Cell 2 |
| RLM-RS |  | SSB | SSB |
| Qrxlevmin | dBm/SCS | -130 | -130 |
| Pcompensation | dB | 0 | 0 |
| Qhysts | dB | 0 | 0 |
| Qoffsets, n | dB | 0 | 0 |
| Cell\_selection\_and\_reselection\_quality\_measurement |  | SS-RSRP | SS-RSRP |
|  | dB | 16 | -3.11 | 2.79 | -infinity | 2.79 | -3.11 |
|  Note2 | dBm/SCS | -98 |
|  Note2 | dBm/15 kHz | -98 |
|  | dB | 16 | 13 | 16 | -infinity | 16 | 13 |
| SS-RSRP Note3 | dBm/SCS | -82 | -85 | -82 | -infinity  | -82 | -85 |
| Io | dBm/9.36 MHz | -53.94 | -52.21 | -52.21 | Same as parameters specified in Cell 1 columns- |
| Treselection | s | 0 | 0 | 0 | 0 | 0 | 0 |
| SintrasearchP | dB | 60 | 60 |
| Propagation Condition  |  | AWGN |

##### A.14.1.1.3 Test Requirements

The cell reselection delay to a newly detectable cell is defined as the time from the beginning of time period T2, to the moment when the UE camps on Cell 2, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on Cell 2.

The cell re-selection delay to a newly detectable cell shall be less than [TBD] s.

The cell reselection delay to an already detected cell is defined as the time from the beginning of time period T3, to the moment when the UE camps on cell 1, and starts to send preambles on the PRACH for sending the *RRCSetupRequest* message to perform a Registration procedure for mobility and periodic registration update on cell 1.

The cell re-selection delay to an already detected cell shall be less than [TBD] s.

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

NOTE: The cell re-selection delay to a newly detectable cell can be expressed as: Kmulti\_SMTC \*Tdetect, NR\_Intra + TSI-NR, and to an already detected cell can be expressed as: Kmulti\_SMTC \*Tevaluate, NR\_ intra + TSI-NR,

Where:

Tdetect, NR\_Intra See Table 4.2.2.3-1 in clause 4.2C.2.3

Tevaluate, NR\_ intra See Table 4.2.2.3-1 in clause 4.2C.2.3

Kmulti\_SMTC is described in clause 4.2C.2.3

TSI-NR Maximum repetition period of relevant system info blocks that needs to be received by the UE to camp on a cell; 1280ms is assumed in this test case provided that SIB1 and SIB19 are scheduled with 20ms period and 80 ms period, respectively.

<End of change#2>

<Start of change#3>

#### A.14.2.1.5 Intra-frequency SAN distance-based conditional Handover from FR1 to FR1

##### A.14.2.1.5.1 Test Purpose and Environment

This test is to verify the requirement for intra-frequency SAN distance-based conditional handover from FR1 to FR1 specified in clause 6.1C.2.

##### A.14.2.1.5.2 Test Parameters

The test scenario comprises of 1 NR FDD carrier and 2 cells as given in table A.14.2.1.5.2-1, and A.14.2.1.5.2-2. Both handover 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 UE is configured to measure intra-frequency neighbour cell. The RRC message implying distance-based handover to cell 2 with Event D1 shall be sent to UE, at a time earlier than TRRC (10ms) before the beginning of T2.

Starting T2, cell 2 becomes detectable and offset better than cell 1 and location condition event condEventD1-r17 is fulfilled.

Table A.14.2.1.5.2-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | GSO, NR FDD, 15kHz SSB SCS, 10 MHz BW |
| 2 | NGSO, NR FDD, 15kHz SSB SCS, 10 MHz BW |
| Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.  |

Table A.14.2.1.5.2-2: General test parameters for Intra-frequency SAN distance-based conditional handover from FR1 to FR1

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| RF Channel Number |  | 1 | One NR NTN satellite RF channel |
| Initial conditions | Active cell |  | Cell 1 | FDD duplex mode cell |
|  | Neighbouring cell |  | Cell 2 | FDD duplex mode cell |
| Final condition | Active cell |  | Cell 2 |  |
| Satellite configuration | Config 1 |  | RMC in [A.x] | For GSO satellite configuration |
| Config 2 |  | RMC in [A.x] | For NGSO satellite configuration |
| UE position (N,S, H) at T1 start |  | [(0, 0, 0)] | Set by AT command |
| UE moving speed | km/h | [(108, 0, 0)] | Set by AT command |
| referenceLocation1-r17.condEventD1-r17 | m | [(-700, 0, 0)] | Reference location for serving cell |
| referenceLocation2-r17.condEventD1-r17 | m | [(1300, 0, 0)] | Reference location for target cell |
| distanceThreshFromReference1-r17.condEventD1-r17 | 50m | [20] | D1-1 Location condition is fulfilled at T2 |
| distanceThreshFromReference2-r17.condEventD1-r17 | 50m | [20] | D1-2 Location condition is fulfilled at T2 |
| hysteresis-r17.condEventD1-r17 | 10m | 0 |  |
| timeToTrigger-r17.condEventD1-r17 | s | 0 |  |
| A3-Offset in condition | dB | 0 |  |
| Hysteresis | dB | 0 |  |
| Time To Trigger | s | 0 |  |
| Filter coefficient |  | 0 | L3 filtering is not used |
| Access Barring Information | - | Not Sent | No additional delays in random access procedure. |
| Time offset between cells |  | 3 μs | Synchronous cells |
| T1 | s | 12 |  |
| T2 | s | ≤ 6 |  |

Table A.14.2.1.5.2-3: Cell specific test parameters for Intra-frequency SAN distance-based conditional handover from FR1 to FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Test configuration | Unit | Cell 1 | Cell 2 |
| T1 | T2 | T1 | T2 |
| NR RF Channel Number | Config 1, 2 |  | 1 | 1 |
| BWchannel | MHz | 10: NRB,c = 52 | 10: NRB,c = 52 |
| BWP BW | MHz | 10: NRB,c = 52 | 10: NRB,c = 52 |
| TACommon | Config 1, 2 | s | 0 | 0 |
| TACommonDrift | s | 0 | 0 |
| TACommonDriftVariation | s | 0 | 0 |
| Koffset | Config 1 | ms | [239] | [239] |
|  | Config 2 | ms | [4] | [4] |
| Kmac | Config 1, 2 | ms | 0 | 0 |
| DRX Cycle | ms | Not Applicable |
| PDSCH Reference measurement channel |  | SR.1.1 FDD |
| CORESET Reference Channel |  | CR.1.1 FDD |
| TRS configuration |  | TRS.1.1 FDD |
| OCNG Patterns |  | OP.1 |
| SMTC Configuration |  | SMTC.1 |
| SSB Configuration |  | SSB.1 FR1 |
| PDSCH/PDCCH subcarrier spacing | kHz | 15 kHz |
| PUCCH/PUSCH subcarrier spacing | kHz | 15 kHz |
| PRACH configuration  |  | FR1 PRACH configuration 1 |
| BWP configuration | Initial DL BWP | Config 1, 2 |  | DLBWP.0.1 |
| Dedicated DL BWP |  | DLBWP.1.1 |
| Initial UL BWP |  | ULBWP.0.1 |
| Dedicated UL BWP |  | ULBWP.1.1 |
| EPRE ratio of PSS to SSS | Config 1, 2 | 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) |
| Note2 | Config 1, 2 | dBm/15kHz | -98 |
| Note2 | dBm/SCS | -98 |
|  | dB | 8 | -3.3 | -Infinity | 2.36 |
|  | dB | 8 | 8 | -Infinity | 11 |
| SSB\_RP | dBm/SCS | -90 | -90 | -Infinity | -87 |
| IoNote3 | dBm/9.36MHz | -61.41 | -57.06 | -61.41 | -57.06 |
| Propagation condition | - | AWGN |
| Note 1: 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.Note 2: 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 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |

##### A.14.2.1.5.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 less than 872 ms from the beginning of time period T2.

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

NOTE: The handover delay is defined in clause 6.1C.2, can be expressed as:

 DCHO = TRRC + TEvent\_DU + Tmeasure + Tinterrupt + TCHO\_execution

where:

RRC procedure delay TRRC = 10 ms and is specified in clause 12 in TS 38.331 [2].

TEvent\_DU = start of T2

UE moving speed, v = (108km/h\*1000/3600) = 30m/s.

At start of T2,

distance to source cell reference location is 30 m/s \* 12 s – (-700)m = 1060m, and D1-1 = 1000m

distance to target cell reference location is 30 m/s \* 12 s – 1300m = -940m, and D1-2 = 1000m

i.e. D1-1 and D1-2 conditions are fulfilled at start of T2 with >=50m location margin.

Tmeasure = max(600 + 200 ms, 0) = 800 ms;

Tinterrupt = 62ms; TCHO\_execution = 10ms.

This gives a total of 800ms + 62ms + 10ms = 872 ms.

#### A.14.2.1.6 Inter-frequency SAN distance-based conditional Handover from FR1 to FR1

##### A.14.2.1.6.1 Test Purpose and Environment

This test is to verify the requirement for inter -frequency SAN distance-based conditional handover from FR1 to FR1 specified in clause 6.1C.2.

##### A.14.2.1.6.2 Test Parameters

The test scenario comprises of 2 NR FDD carrier and one cell on each carrier as given in table A.14.2.1.6.2-1, and A.14.2.1.6.2-2. Both handover 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 UE is configured to measure inter-frequency neighbour cell and Gap pattern ID gp0. The RRC message implying distance-based handover to cell 2 with Event D1 shall be sent to UE, at a time earlier than TRRC (10ms) before the beginning of T2.

Starting T2, cell 2 becomes detectable and offset better than cell 1 and after 11670ms of T2, location condition event condEventD1-r17 is fulfilled.

Table A.14.2.1.6.2-1: Supported test configurations

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | GSO, NR FDD, 15kHz SSB SCS, 10 MHz BW |
| 2 | NGSO, NR FDD, 15kHz SSB SCS, 10 MHz BW |
| Note: If UE supports both NGSO and GSO, the GSO-based test cases can be skipped if the UE passes NGSO-based test cases.  |

Table A.14.2.1.6.2-2: General test parameters for Inter -frequency SAN distance-based conditional handover from FR1 to FR1

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | **Comment** |
| RF Channel Number |  | 1, 2 | Two NR NTN satellite RF channel |
| Initial conditions | Active cell |  | Cell 1 | FDD duplex mode cell |
|  | Neighbouring cell |  | Cell 2 | FDD duplex mode cell |
| Final condition | Active cell |  | Cell 2 |  |
| Satellite configuration | Config 1 |  | RMC in [A.x] | For GSO satellite configuration |
| Config 2 |  | RMC in [A.x] | For NGSO satellite configuration |
| UE position (N,S, H) at T2 start |  | [(0, 0, 0)] | Set by AT command |
| UE moving speed | km/h | [(108, 0, 0)] | Set by AT command |
| referenceLocation1-r17.condEventD1-r17 | m | [(-700, 0, 0)] | Reference location for serving cell |
| referenceLocation2-r17.condEventD1-r17 | m | [(1300, 0, 0)] | Reference location for target cell |
| distanceThreshFromReference1-r17.condEventD1-r17 | 50m | [20] | D1-1 Location condition is fulfilled at T2 |
| distanceThreshFromReference2-r17.condEventD1-r17 | 50m | [20] | D1-2 Location condition is fulfilled at T2 |
| hysteresis-r17.condEventD1-r17 | 10m | 0 |  |
| timeToTrigger-r17.condEventD1-r17 | s | 0 |  |
| A3-Offset in condition | dB | 0 |  |
| Hysteresis | dB | 0 |  |
| Time To Trigger | s | 0 |  |
| Filter coefficient |  | 0 | L3 filtering is not used |
| Access Barring Information | - | Not Sent | No additional delays in random access procedure. |
| Time offset between cells |  | 3 μs | Synchronous cells |
| T1 | s | 1 |  |
| T2 | s | 12 |  |

Table A.14.2.1.6.2-3: Cell specific test parameters for Inter-frequency SAN distance-based conditional handover from FR1 to FR1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Test configuration | Unit | Cell 1 | Cell 2 |
| T1 | T2 | T1 | T2 |
| NR RF Channel Number | Config 1, 2 |  | 1 | 2 |
| BWchannel | MHz | 10: NRB,c = 52 | 10: NRB,c = 52 |
| BWP BW | MHz | 10: NRB,c = 52 | 10: NRB,c = 52 |
| TACommon | Config 1, 2 | s | 0 | 0 |
| TACommonDrift | s | 0 | 0 |
| TACommonDriftVariation | s | 0 | 0 |
| Koffset | Config 1 | ms | [239] | [239] |
|  | Config 2 | ms | [4] | [4] |
| Kmac | Config 1, 2 | ms | 0 | 0 |
| DRX Cycle | ms | Not Applicable |
| PDSCH Reference measurement channel |  | SR.1.1 FDD |
| CORESET Reference Channel |  | CR.1.1 FDD |
| TRS configuration |  | TRS.1.1 FDD |
| OCNG Patterns |  | OP.1 |
| SMTC Configuration |  | SMTC.1 |
| SSB Configuration |  | SSB.1 FR1 |
| PDSCH/PDCCH subcarrier spacing | kHz | 15 kHz |
| PUCCH/PUSCH subcarrier spacing | kHz | 15 kHz |
| PRACH configuration  |  | FR1 PRACH configuration 1 |
| BWP configuration | Initial DL BWP | Config 1, 2 |  | DLBWP.0.1 |
| Dedicated DL BWP |  | DLBWP.1.1 |
| Initial UL BWP |  | ULBWP.0.1 |
| Dedicated UL BWP |  | ULBWP.1.1 |
| EPRE ratio of PSS to SSS | Config 1, 2 | 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) |
| Note2 | Config 1, 2 | dBm/15kHz | -98 |
| Note2 | dBm/SCS | -98 |
|  | dB | 4 | 4 | -Infinity | 9 |
|  | dB | 4 | 4 | -Infinity | 9 |
| SSB\_RP | dBm/SCS | -94 | -94 | -Infinity | -89 |
| IoNote3 | dBm/9.36MHz | -64.59 | -64.59 | -70.05 | -60.53 |
| Propagation condition | - | AWGN |
| Note 1: 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.Note 2: 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 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |

##### A.14.2.1.6.3 Test Requirements

The UE shall start to transmit the PRACH to Cell 2 later than 11670ms and less than 11741 ms from the beginning of time period T2.

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

NOTE: The handover delay is defined in clause 6.1C.2, can be expressed as:

 DCHO = TRRC + TEvent\_DU + Tmeasure + Tinterrupt + TCHO\_execution

where:

RRC procedure delay TRRC = 10 ms and is specified in clause 12 in TS 38.331 [2].

TEvent\_DU = start of T2

UE moving speed, v = (108km/h\*1000/3600) = 30m/s.

At 1667ms after start of T2,

distance to source cell reference location is 30 m/s \* 11.67 s – (-700)m = 1050m, and D1-1 = 1000m

distance to target cell reference location is 30 m/s \* 11.67 s – 1300m = -950m, and D1-2 = 1000m

i.e. D1-1 and D1-2 conditions are fulfilled at T2 + 11670ms with >=50m location margin.

Tmeasure = max(600 + 200 ms, 11670ms) = 11670ms;

Tinterrupt = 62ms; TCHO\_execution = 10ms.

This gives a total of 11670ms + 62ms + 10ms = 11741 ms.

<End of change#3>

<Start of change#4>

#### A.14.3.1.1 NR UE Transmit Timing Test for FR1

##### A.14.3.1.1.1 Test Purpose and environment

The purpose of this test is to verify that the UE can follow frame timing change of the reference cell and that the UE initial transmit timing accuracy, maximum amount of timing change in one adjustment, minimum and maximum adjustment rate are within the specified limits. This test will verify the requirements in clause 7.1C.2. Supported test configurations are shown in Table A.14.3.1.1.1-1.

**Table A.14.3.1.1.1-1: Supported test configurations for FR1 PCell**

|  |  |
| --- | --- |
| Configuration | Description |
| 1 | GSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| 2 | NGSO, NR FDD, SSB SCS 15 kHz, data SCS 15 kHz, BW 10 MHz |
| Note: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2.  |

The test consists a single NR cell (PCell). Table A.14.3.1.1.1-2 defines the parameters to be configured and strength of the transmitted signals. The transmit timing is verified by the UE transmitting SRS using the configuration defined in Table A.14.3.1.1.1-3. The test system can emulate and send the GNSS signal to the test UE. The test parameters for GNSS signals are defined in B.4.1.

Table A.14.3.1.1.1-2: Cell Specific Test Parameters for UL Transmit Timing test

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Unit | Config | Test1 | Test2 |
| SSB ARFCN |  | 1,2 | 1 | 1 |
| Serving satellite configuration |  | 1 | SSC.1 |
|  | 2 | SSC.2 |
| BWchannel | MHz | 1,2 | 10: NRB,c = 52 |
| Initial BWP Configuration |  | 1,2 | DLBWP.0.1ULBWP.0.1 |
| Dedicated BWP Configuration |  | 1,2 | DLBWP.1.1ULBWP.1.1 |
| DRX Cycle | ms | 1,2 | N/A | DRX.8Note5 |
| PDSCH Reference measurement channel |  | 1,2 | SR.1.1 FDD |
| RMSI CORESET Reference Channel |  | 1,2 | CR.1.1 FDD |
| Dedicated CORESET Reference Channel |  | 1,2 | CCR.1.1 FDD |
| OCNG Patterns |  | 1,2 | OP.1 |
| SSB configuration |  | 1,2 | SSB.1 FR1 |
| SMTC Configuration |  | 1,2 | SMTC.1 |
| TRS configuration |  | 1,2 | TRS.1.1 FDD |
| EPRE ratio of PSS to SSS | dB | 1,2 | 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/15 kHz | 1,2 | -98 | -98 |
| Note2 | dBm/SCS | 1,2 | -98 | -98 |
|  |  | 1,2 | 3 | 3 |
|  |  | 1,2 | 3 | 3 |
| SS-RSRPNote3 | dBm/SCS | 1,2 | -95 | -95 |
| IoNote3 | dBm/9.36MHz | 1,2 | -65.2 | -65.2 |
| Propagation condition |  | 1,2 | AWGN |
| SRS Config |  | 1,2 | SRSConf.1Note6 | SRSConf.2Note6 |
| Note 1: 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.Note 2: 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 3: SS-RSRP and Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves.Note 4: SS-RSRP minimum requirements are specified assuming independent interference and noise at each receiver antenna port.Note 5: DRX related parameters are given in Table A.3.3.8-1Note 6: SRS configs are given in Table A.14.3.1.1.1-3 |

**Table A.14.3.1.1.1-3: SRS Configuration for Timing Accuracy Test**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Field | SRSConf.1 | SRSConf.2 | Comments |
| SRS- | srs-ResourceSetId | 0 | 0 |  |
| ResourceSet | srs-ResourceIdList | 0 | 0 |  |
|  | resourceType | Periodic | Periodic |  |
|  | Usage | Codebook | Codebook |  |
| SRS-Resource | SRS-ResourceId | 0 | 0 |  |
|  | nrofSRS-Ports | Port1 | Port1 |  |
|  | transmissionComb  | n2 | n2 |  |
|  | combOffset-n2 | 0 | 0 |  |
|  | cyclicShift-n2 | 0 | 0 |  |
|  | resourceMappingstartPosition | 0 | 0 |  |
|  | resourceMappingnrofSymbols  | n1 | n1 |  |
|  | resourceMappingrepetitionFactor | n1 | n1 |  |
|  | freqDomainPosition | 0 | 0 |  |
|  | freqDomainShift | 0 | 0 |  |
|  | freqHoppingc-SRS | 14 | 14 | Matches NRB,c |
|  | freqHoppingb-SRS | 0 | 0 |  |
|  | freqHoppingb-hop | 0 | 0 |  |
|  | groupOrSequenceHopping | Neither | Neither |  |
|  | resourceType | Periodic | Periodic |  |
|  | periodicityAndOffset-p | sl1, 0 | sl320, 3 | Offset to align with DRX periodicity  |
|  | sequenceId | 0 | 0 | Any 10 bit number |

##### A.14.3.1.1.2 Test requirements

The test sequence shall be carried out in RRC\_CONNECTED for every test case.

Following will be the test sequence for this test

1) Set up PCell according to parameters given in Table A.14.3.1.1.1-2.

2) After connection set up with the cell, the test equipment will verify that the timing of the NR cell is within  of the first detected path of DL SSB.

a. The NTA\_offset value (in Tc units) is 25600

b. The value is derived from the higher-layer parameters *TACommon*, *TACommonDrift*, and *TACommonDriftVariation*.

c. The value is computed by the UE based on UE position and serving-satellite-ephemeris-related higher-layers parameters.

d. The values depend on the DL and UL SCS for which the test is being run and are given in Table 7.1C.2-1

e. The value (in Tc units) is [TBD].

3) If the NTN parameters are configured as GSO scenario, the test system shall adjust the timing of the DL path by values given in Table A.14.3.1.1.2-1. If the NTN parameters are configured as NGSO scenario, the test system shall adjust the timing of the DL path according to the serving-satellite-ephemeris-related higher-layers parameters.

Table A.14.3.1.1.2-1: Adjustment Value for DL Timing

|  |  |
| --- | --- |
| SCS of SSB signals (kHz) | Adjustment Value |
|  | Test1 | Test2 |
| 15 | +64\*64Tc | +32\*64Tc |

4) The test system shall verify that the adjustment step size and the adjustment rate shall be according to requirements specified in Clause 7.1C.2 Table 7.1C.2.1-1 until the UE transmit timing offset is within respective to the first detected path (in time) of DL SSB. Skip this step for test 2 with DRX configured.

5) The test system shall verify that the UE transmit timing offset stays within of the first detected path of DL SSB. For Test 2 the UE transmit timing offset shall be verified for the first transmission in the DRX cycle immediately after DL timing adjustment.

<End of change#4>

<Start of change#5>

### A.14.3.2 Timing advance for satellite access

#### A.14.3.2.1 SA FR1 timing advance adjustment accuracy

##### A.14.3.2.1.1 Test Purpose and Environment

The purpose of the test is to verify UE Timing Advance adjustment delay and accuracy requirement defined in clause 7.3C.

##### A.14.3.2.1.2 Test Parameters

Supported test configurations are shown in table A.14.3.2.1.2-1. Both timing advance adjustment delay and accuracy are tested by using the parameters in table A.14.3.2.1.2-2, A.14.3.2.1.2-3 and A.14.3.2.1.2-4.

In all test cases, single cell served by SAN is used. Each test consists of two successive time periods, with time duration of T1 and T2 respectively. In each time period, timing advance commands are sent to the UE and Sounding Reference Signals (SRS), as specified in table A.14.3.2.1.2-4, are sent from the UE and received by the test equipment. By measuring the reception of the SRS, the transmit timing, and hence the timing advance adjustment accuracy, can be measured.

During the test, the test system shall emulate and send the GNSS signal to the test UE by AT command. The UE shall be provided with the valid information about the SAN serving cell before the test.

During time period T1, the test equipment shall send one message with a Timing Advance Command MAC Control Element, as specified in Clause 6.1.3.4 in TS 38.321 [7]. The Timing Advance Command value shall be set to 31, which according to Clause 4.2 in TS 38.213 [3] results in zero adjustment of the Timing Advance. In this way, a reference value for the timing advance used by the UE is established.

During time period T2, the test equipment shall send a sequence of messages with Timing Advance Command MAC Control Elements, with Timing Advance Command value specified in table A.14.3.2.1.2-2. This value shall result in changes of the timing advance used by the UE, and the accuracy of the change shall then be measured, using the SRS sent from the UE.

As specified in Clause 7.3C.2.1, the UE adjusts its uplink timing at slot n+k*+1+2µ* for a timing advance command received in slot n. This delay must be taken into account when measuring the timing advance adjustment accuracy, via the SRS sent from the UE.

The UE Time Alignment Timer, described in Clause 5.2 in TS 38.321 [7], shall be configured so that it does not expire in the duration of the test.

Table A.14.3.2.1.2-1: Timing advance supported test configurations

|  |  |
| --- | --- |
| Config | Description |
| 1 | GSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| 2 | NGSO, NR 15 kHz SSB SCS, 10 MHz bandwidth, FDD duplex mode |
| Note: If UE supports both NGSO and GSO, the test case Config 1 can be skipped if the UE passes test case Config 2. |

Table A.14.3.2.1.2-2: General test parameters for timing advance

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Value | Comment |
| RF channel number |  | 1 |  |
| Initial DL BWP |  | DLBWP.0.1 | As specified in Table A.3.9.2.1-1 |
| Dedicated DL BWP |  | DLBWP.1.1 | As specified in Table A.3.9.2.2-1 |
| Initial UL BWP |  | ULBWP.0.1 | As specified in Table A.3.9.3.1-1 |
| Dedicated UL BWP |  | ULBWP.1.1 | As specified in Table A.3.9.3.2-1 |
| Timing Advance Command (*TA*) value during T1 |  | 31 | *NTA\_new = NTA\_old* for the purpose of establishing a reference value from which the timing advance adjustment accuracy can be measured during T2 |
| Timing Advance Command (*TA*) value during T2 |  | 39 | For 15 kHz SCS *NTA\_new = NTA\_old + 8192\*Tc* (based on equation in clause 4.2 of TS 38.213 [3]) |
| T1 | s | 5 |  |
| T2 | s | 5 |  |

Table A.14.3.2.1.2-3: Cell specific test parameters for timing advance

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Test1 |
|  |  | T1 | T2 |
| Duplex mode | Config 1,2 |  | FDD |
| Satellite information  | Config 1 |  | SSC.1 |
|  | Config 2 |  | SSC.2 |
|  |  |  |  |
|  |  |  |  |
| BWchannel | Config 1,2 | MHz | 10: NRB,c = 52 |
| BWP BW | Config 1,2 | MHz | 10: NRB,c = 52 |
| DRX Cycle | ms | Not Applicable |
| PDSCH Reference measurement channel  | Config 1,2 |  | SR.1.1 FDD |
| RMSI CORESET Reference Channel | Config 1,2 |  | CR.1.1 FDD |
| Dedicated CORESET Reference Channel | Config 1,2 |  | CCR.1.1 FDD  |
| TRS configuration | Config 1,2 |  | TRS.1.1 FDD |
| OCNG Patterns |  | OCNG pattern 1 |
| SMTC configuration | Config 1,2 |  | SMTC.1 FR1 |
| SSB configuration | Config 1,2 |  | SSB.1 FR1 |
| PDSCH/PDCCH subcarrier spacing | Config 1,2 | kHz | 15 kHz |
| PUCCH/PUSCH subcarrier spacing | Config 1,2 | kHz | 15 kHz |
| 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) |  |  |
| Note2 | dBm/15kHz | -98 |
| Note2 | Config 1,2 | dBm/SCS | -98 |
|  | dB | 3 |
|  | dB | 3 |
| IoNote3 | Config 1,2 | dBm/9.36MHz | -67.57 |
| Propagation condition | - | AWGN |
| Note 1: 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.Note 2: 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 3: Io levels have been derived from other parameters for information purposes. They are not settable parameters themselves. |

Table A.14.3.2.1.2-4: Sounding Reference Symbol Configuration for timing advance

|  |  |  |
| --- | --- | --- |
| Field | Value | Comment |
| c-SRS | Config 1,2 | 12 | 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=2 for SCS 15kHz | 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]. |

<End of change#5>

<Start of change#6>

# B.5 High level test procedure for SAN RRM tests

The following high level steps are conducted for test cases for SAN defined in clause A.14.

- A set of ephemeris information are pre-defined for each satellite corresponding to different epoch times in [TS TBD].

- For GEO an altitude of 35,786km is considered. an elevation angle relative to a UE position shall not be smaller than 30 deg during entire test time

- For LEO an altitude of 600km on a circular orbit is considered.

- A motion trajectory is generated for each satellite based on the ephemeris using Eckstein-Hechler model.

- UE location is determined for the test. The ephemeris and the the UE location should be designed such that elevation angle relative to the UE position shall not be smaller than 30 deg during entire test time.

- Test equipment adjusts the time and frequency of transmission based on the satellite motion trajectory and UE location during test time to emulate the position and velocity change of the satellite relative to the UE.

<End of change#6>