3GPP TSG-RAN4 Meeting #104-bis-e R4-220xxxx

E-meeting, 10th Oct. – 19th Oct., 2022

**Agenda item:** 4.2.8

**Source:** Moderator (Xiaomi)

**Title:** Email discussion summary for [104-bis-e][202] NR\_NTN\_solutions\_RRM\_2

**Document for:** Information

# Introduction

The scope of this email discussion contains NTN RRM performance requirements (4.2.6). All the submitted TDocs in this agenda were reviewed and the relevant observations and proposals are included in this email discussion.

The timeline for 1st and 2nd round email discussions can be referred in TDoc of “**RAN4#104-bis-e E-meeting Arrangements and Guidelines**”

In providing comments, companies are encouraged to:

* Be concise
* Provide comments on all topics/sub-topics of interest to them
* Ensure that their comments are inserted in the latest version of the document by checking the folder before uploading
* Use “Track changes” to help identify added comments/changes

It is appreciated that the delegates for this topic put their contact information in the table below.

Contact information

|  |  |  |
| --- | --- | --- |
| **Company** | **Name** | **Email address** |
|  |  |  |

Note:

1. Please add your contact information in above table once you make comments on this email thread.
2. If multiple delegates from the same company make comments on single email thread, please add you name as suffix after company name when make comments i.e. Company A (XX, XX)

# Topic #1: Performance requirements for NTN RMM

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2215392 | CATT | ***Proposal 1: It is proposed that same way as in current specification for TN system should be used in test cases for conditional handover for NTN, i.e. the network shall configure a condition implying handover to cell 2 during T1, at a time earlier than TRRC before the beginning of T2.***  ***Proposal 2: It is not necessity of adding test cases in which settings don’t fulfill power based events and time/location based events simultaneously, to examine UE’s behavior in this type of scenario.*** |
| R4-2215449 | Xiaomi | ***Proposal 1: 0.5dB is relaxed based on existing SS-RSRP accuracy requirements for NTN measurement.***  ***Proposal 2: For UE timing requirement, RAN4 to define one test case including both 15 kHz and 30 kHz test configuration.***  ***Proposal 3: RAN4 not to define the SMTC/satellite configuration with 2 SMTC per MO and each SMTC contains 2 SSB/Satellites.***  ***Proposal 4: RAN4 not to define the configuration for measurement gap in clause A.3 RRM test configuration.***  ***Proposal 5: If the measurement delay requirement for FO case is defined, the gap configuration for FO case need to be introduced, e.g. FO case with MGRP = 160ms.*** |
| R4-2215501 | CMCC | ***Proposal 1: No need to define UE timing test configuration for FDD 30kHz SCS scenario.***  ***Proposal 2: At least to introduce the test case of ‘NGSO, two SMTC configured, SMTC partially overlap with each other, 2 satellites measured on 2 SMTC separately’ with scaling factor K\_multi\_SMTC***  ***the length of T2 and T3 and the cell re-selection delay requirements should be multiplied by K\_multi\_SMTC = 2***  ***Proposal 3: The test case of ‘NGSO, one SMTC configured, 2 satellites measured on 1 SMTC’ could be also introduced with scaling factor K\_multi\_SMTC***  ***the length of T2 and T3 should be multiplied by K\_multi\_SMTC = 2***  ***The test requirement should be defined according to UE capability. For UE don’t support parallel measurements on more than 1 NGSO satellites within a SMTC, the cell re-selection delay to a newly detectable cell and an already detected cell should be multiplied by K\_multi\_SMTC. Otherwise, the current test requirement could be reused.***  ***Proposal 4: Add a test case in which test setting don’t fulfill power based events and time/location based events simultaneously.***  ***Set the time instant fulfilling t1-Threshold-r17 at (T2+2\*Tmeasure), and set the time instant fulfilling duration-r17 at (T2+ 3\*Tmeasure ).***  ***Test requirement should be 2\*Tmeasure + Tinterrupt + TCHO\_execution from the start of T2, others shall follow A.6.3.1.2***  ***Proposal 5: The test parameter for GNSS signal power levels defined in B.4.1 is reused in NTN test cases.***  ***Proposal 6: For the test requirement, the reference time should be (N\_"TA" +N\_"TA-offset" +N\_"TA,adj" ^"common" +N\_"TA,adj" ^"UE" )×T\_"c" ±T\_"e\_NTN"***  ***For the N\_"TA,adj" ^"common" and N\_"TA,adj" ^"UE" in the test requirement, the description should at least contain the clarification that UE GNSS estimation error and satellite positioning error from UE calculation are not involved.*** |
| R4-2215752 | MediaTek | ***Observation 1: Although considering propagator model error, no significant impact on measurement accuracy is observed.***  ***Proposal 1: Reuse the legacy TN measurement accuracy requirements for NTN.*** |
| R4-2215819 | OPPO | ***Proposal-1: Define UE transmit timing test case including both 15kHz SCS and 30KHz SCS.***  ***Proposal-2: If the case of multiple satellites in one SMTC is necessary, support 2-SMTC with 2 satellites in one SMTC and 1 satellite in another SMTC.***  ***Proposal-3: For FNO gaps, the associated SMTCs should be pattern 1 and Y defined in clause A.3.11.***  ***Proposal-4: Define test case for FO gaps if the core requirements are defined.*** |
| R4-2216278 | Huawei, HiSilicon | ***Proposal 1: For NTN UE timing test cases, it is suggest to use AT command approach to acquire UE location in order to simplify the test configuration.***  ***Proposal 2: For NTN UE timing testing, it is suggested to define a reference orbit for the serving satellite, and the DL timing shall be adjusted according to the distance change between serving satellite and UE.***  ***Proposal 3: For NTN UE timing test cases, the propagator model to be used for serving satellite position estimation is up to UE implementation, and there is no need to define a reference propagator model.*** |
| R4-2216318 | Huawei, HiSilicon | ***Proposal 1: Re-use TN measurement accuracy requirements for NTN.***  ***Proposal 2: The following TCs are considered for NTN specific requirements***  ***- 1-2 – 1-4, 1-6 – 1-8***  ***- 2-3 – 2-6***  ***- 4-1***  ***- 10-1 – 10-9, 11-1 – 11-9***  ***- 13-1 – 13-8***  ***Proposal 3: RAN4 to define a reference motion trajectory for the virtual satellite, and then generate ephemeris information based on the reference motion trajectory. Inputs from satellite system vendors and test equipment vendors are needed.***  ***Proposal 4: The TE should adjust its transmit timing and frequency based on the reference motion trajectory. The transmit power is adjusted as specified in the test case.***  ***Proposal 5: No differentiation of earth fixed cell or moving cell is made in the test cases.***  ***Proposal 6: At least for test cases other than UE Tx timing, UE GNSS location is set by TE via “Update UE Location Information” procedure. No need to involve GNSS test setup in the NTN tests.***  ***Proposal 7: Include 30kHz SCS for the UE timing TC.*** |
| R4-2216320 | Huawei, HiSilicon | ***Proposal 1: t-Service is configured in TC 1-3 and 1-7, but not configured in other TCs.***  ***Proposal 2: Use the following SMTC configurations for TC 1-1 – 1-4.***  ***- TC 1-1: serving cell in SMTC1, neighbor cell in SMTC2, SMTC1 and SMTC2 non-overlapping***  ***- TC 1-2: serving cell in SMTC1, neighbor cell in SMTC2, SMTC1 and SMTC2 overlapping***  ***- TC 1-3 and 1-4: serving cell in SMTC1, neighbor cell in SMTC1***  ***- Scaling factor “K\_multi” is taken into account in the testing requirement for TC 1-1 – 1-4.***  ***Proposal 3: Use the same SMTC configuration as in A.6.1.1.2 for TC 1-5- 1-8, and scaling factor “K\_multi” is not taken into account in the testing requirement.***  ***Proposal 4: TC 1-3 and 1-7 consists two time periods T1 and T2:***  ***- Before test: UE camps in cell1, and t-Service is included in SIB19 of cell1***  ***- T1: cell2 is powered off, T1 is long enough to make UE have no information about cell2***  ***- T2: cell2 is powered on, T2 is 40s, t-Service is pointed to the time point (start of T2 + 36s)***  ***- UE should reselect to cell2 before t-Service***  ***Proposal 5: TC 1-4 and 1-8 consists two time periods T1 and T2:***  ***- Before test: UE camps in cell1, and Ref-location is included in SIB19 of cell1***  ***- T1: cell2 is powered off, T1 is long enough to make UE have no information about cell2***  ***- T2: cell2 is powered on, T2 is 40s, UE location is changed at the time point (start of T2 + 4s)***  ***- UE should reselect to cell2 before time point (start of T2 + 36s + Δ), Δ is the response time depending on how UE GNSS location is changed in the test.***  ***Proposal 6: SIB19 reading time should be considered in the testing requirement for TSI-NR, or alternatively SIB19 scheduling period is small enough for the current requirement.*** |
| R4-2216323 | Huawei, HiSilicon | **Proposal 1: Use the following SMTC configurations in the measurement delay TCs.**   * **For intra-frequency TCs (10-x),**    + **Config.1: 2 SMTC per MO, each SMTC contains 1 SSB/Satellites**     - **Config.1a: two SMTCs are overlapping**     - **Config.1b: two SMTCs are non-overlapping**   + **Config.2: 1 SMTC per MO, each SMTC contains 2 SSBs/Satellites** * **For inter-frequency TCs (11-x), use the following SMTC configurations:**   + **Config.0: 1 SMTC per MO, each SMTC contains 1 SSB/Satellites**     - **Config.0a: two SMTCs are overlapping**     - **Config.0b: two SMTCs are non-overlapping**   **Proposal 2: Update the TC list for intra-frequency measurement delay as follows.**   |  |  | | --- | --- | | 10-1 | Event triggered reporting tests without gap under non-DRX | | 10-2 | Event triggered reporting tests without gap under DRX | | 10-3 | Event triggered reporting tests without gap under non-DRX with SSB index reading | | 10-4 | Event triggered reporting tests with single measurement gap under non-DRX | | 10-5 | Event triggered reporting tests with FNO concurrent measurement gap under DRX | | 10-6 | Event triggered reporting tests with PPO concurrent measurement gap under non-DRX with SSB index reading | | ~~10-7~~ | ~~Event triggered reporting tests with FNO concurrent gaps under non-DRX~~ | | ~~10-8~~ | ~~Event triggered reporting tests with FNO concurrent gaps under DRX~~ | | ~~10-9~~ | ~~Event triggered reporting tests with PPO concurrent gaps under non-DRX~~ |   **Proposal 3: Update the TC list for inter-frequency measurement delay as follows.**   |  |  | | --- | --- | | 11-1 | Event triggered reporting tests without gap under non-DRX | | 11-2 | Event triggered reporting tests without gap under DRX | | ~~11-3~~ | ~~Event triggered reporting tests without gap under non-DRX with SSB index reading~~ | | 11-4 | Event triggered reporting tests with measurement gap under non-DRX | | 11-5 | Event triggered reporting tests with measurement gap under DRX | | 11-6 | Event triggered reporting tests with measurement gap under non-DRX with SSB index reading | | 11-7 | Event triggered reporting tests with FNO concurrent gaps under non-DRX | | ~~11-8~~ | ~~Event triggered reporting tests with FNO concurrent gaps under DRX~~ | | 11-9 | Event triggered reporting tests with PPO concurrent gaps under non-DRX | |
| R4-2216465 | Nokia, nokia Shanghai Bell | **Observation 1: Upon receiving the HO command, the UE must stop T430 and wait until the epoch time of the target cell is reached to initiate a new T430.**  **Observation 2: In the NTN HO, additional delay and/or interruption time is introduced by the waiting time until epoch time is reached.**  **Observation 3: In some cases, the epoch time of the target cell falls within the RRC processing time (20 ms), and no additional action is needed by the UE.**    Therefore, based on the observations above, we propose:  **Proposal 1: RAN4 to decide the best way to deal with the additional delay introduced in the HO procedure for NTN caused by the initiation of T430 towards the target cell.**  **Proposal 2:**  **- If the UE can initiate a valid T430 within the processing interval of the HO delay, no additional action is needed.**  **- If the epoch time happens after the processing interval of the HO delay, increase HO interruption time.** |
| R4-2216466 | Nokia, nokia Shanghai Bell | **Observation 1: Upon receiving the HO command, the UE must stop T430 and wait until the epoch time of the target cell is reached to initiate a new T430.**  **Observation 2: In the NTN CHO, additional delay and/or interruption time is introduced because the UE may need to re-acquire new ephemeris information.**  **Proposal 1: RAN4 to decide the best way to deal with the additional delay introduced in the CHO procedure for NTN caused by the cases where the UE has to wait for the epoch time to be reached or re-acquire a new ephemeris information.**  **Proposal 2: If the UE needs to re-acquire ephemeris information, the handover delay requirements and the time interruption requirements must be extended to account for that.** |
| R4-2216470 | Nokia, nokia Shanghai Bell | **Observation: The reference timing for UL transmission, must be as close as possible from the UL timing expected by the gNB. The best way to ensure that is selecting a “reference measurement” is as close as the gNB timing as possible.**  **Proposal: RAN4 to select the reference propagator model to be as accurate as possible.** |
| R4-2216471 | Nokia, nokia Shanghai Bell | **Observation 1: Currently, Ttrigger = max(Tdetect,NR\_Intra, Kcarrier\* Tdetect,NR\_Inter) when serving cell is below the search threshold, in order to accommodate the detection time of the serving cell.**  **Observation 2: In the current definition, Ttrigger is only considering the enhanced version of the detection time (used for high speed conditions).**  **Proposal 1: Adapt Ttrigger formulation to use the values of Tdetect,NR\_Intra and Tdetect,NR\_Inter also considering the cases UE is not using the enhanced parameters for high mobility.**  **Proposal 2: For Ttrigger applicability replace the condition:**  **“This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of t-Service is started…”**  **By**  **“This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is first acquired by the UE…”** |
| R4-2216868 | Qualcomm | **Numerology**  **Proposal 1: RAN4 to not define RRM test cases for 30kHz SCS.**  **Acquisition of UE Position**  **Proposal 2: For UE position acquisition in NTN tests, RAN4 to adopt “AT command” based approach. The exact UE position should be defined in such a way that the smallest elevation angle between the UE and satellite(s) is not smaller than 45 deg.**  **Reference Propagator Model**  **Observation 1: A basic Kepler equation-based LEO satellite position estimation can achieve an accuracy of 6.7m error, which is 22.3% of the assumption considered for UE UL transmission timing requirements, when the satellite is on a circular orbit at 600km altitude, and a frequency of ephemeris information update is assumed once every 10.24s. And the estimation error of the satellite’s velocity is insignificant.**  **Proposal 3: RAN4 to adopt a Keplerian propagator model as a reference satellite positioning model in NTN RRM test cases. And RAN4 to not consider additional error margin in terms of timing and frequency with the following assumptions:**   * **The LEO satellite is assumed to be on a circular orbit** * **SIB19 is broadcasted once every 10.24s** * **During the test, an elevation angle between the satellite and UE is not smaller than 45 deg.**   **Reference Time Instances for UL Timing Accuracy Requirements**  **Proposal 4: In RRM test cases, when a test equipment adjusts downlink transmission frame boundary/Doppler shift and UL reception timing, asymmetric propagation delays on DL and UL for the same slot index shall be taken into account. To model the round trip delay over service link (N\_{TA,UE-specific}), the following definitions of reference slot for S3 and S4 (based in Fig. 3) are adopted.**   * **for S3, the slot when the UL transmission is supposed to arrive at the target satellite based on provided valid ephemeris information (no error in the provided ephemeris information will account for UE error) and a reference propagator model** * **for S4, the slot when the DL transmission corresponding to the reference timing of downlink is supposed to arrive at the target satellite based on actual received time of the slot and provided valid ephemeris information (no error in the provided ephemeris information will account for UE error) and a reference propagator model** |
| R4-2216467 | Nokia, Nokia Shanghai Bell | **Observation 1: The application of downlink timing reference, *N*TA-**offset and***N*TA is well defined in the timing advance requirements.**  **Observation 2: The application oflacks the definition of the expected point of application.**  **Observation 3: The application of lacks the definition of the expected point of application.**  **Proposal 1: UE must update the values of using the ephemeris information and using the common delay formula at the beginning of every uplink slot.**  **Proposal 2: RAN 4 to define the requirements for application of the UE autonomous components of the timing advance:**   * **Option 1: UE considers the satellite movement. The timing advance components consider the common delay and UE-satellite distance at the moment the UL signal reaches the satellite** * **Option 2: UE does not consider the satellite movement. The timing advance components consider the common delay and UE-satellite distance at the moment the UE is updating their values.** * **Option 3: Asks RAN 1 to clarify the application of these components.** |

## Open issues summary and Companies views’ collection for 1st round

### Measurement Accuracy requirement for NTN

**Issue 1-1: Measurement accuracy.**

* Option 1: (Xiaomi)
  + 0.5dB is relaxed based on existing SS-RSRP accuracy requirements for NTN measurement.
* Option 2: (MTK, Huawei)
  + Reuse the legacy TN measurement accuracy requirements for NTN.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Test case coverage, design and configuration

**Issue 2-1: Test cases for NTN specific requirements.**

* Option 1: (Huawei)
  + The following TCs are considered for NTN specific requirements
    - 1-2 – 1-4, 1-6 – 1-8
    - 2-3 – 2-6
    - 4-1
    - 10-1 – 10-9, 11-1 – 11-9
    - 13-1 – 13-8
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-2: Serving and Neighbour Satellite configurations.**

* Option 1: (Huawei)
  + RAN4 to define a reference motion trajectory for the virtual satellite, and then generate ephemeris information based on the reference motion trajectory. Inputs from satellite system vendors and test equipment vendors are needed.
  + The TE should adjust its transmit timing and frequency based on the reference motion trajectory. The transmit power is adjusted as specified in the test case.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-3: Test case for earth-fixed cell and earth-moving cell.**

* Option 1: (Huawei)
  + No differentiation of earth fixed cell or moving cell is made in the test cases.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-4: Acquisition of UE location in RRM TCs.**

* Option 1: (Huawei)
  + At least for test cases other than UE Tx timing, UE GNSS location is set by TE via “Update UE Location Information” procedure. No need to involve GNSS test setup in the NTN tests.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 2-5: Reference propagator model.**

* Option 1: (Nokia)
  + RAN4 to select the reference propagator model to be as accurate as possible.
* Option 2: (QC)
  + RAN4 to adopt a Keplerian propagator model as a reference satellite positioning model in NTN RRM test cases. And RAN4 to not consider additional error margin in terms of timing and frequency with the following assumptions:
    - The LEO satellite is assumed to be on a circular orbit
    - SIB19 is broadcasted once every 10.24s
    - During the test, an elevation angle between the satellite and UE is not smaller than 45 deg.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Test case design for Cell reselection

**Issue 3-1: SMTC setup and scaling factor K\_multi” in cell reselection tests.**

* Option 1: (CMCC)
  + At least to introduce the test case of ‘NGSO, two SMTC configured, SMTC partially overlap with each other, 2 satellites measured on 2 SMTC separately’ with scaling factor K\_multi\_SMTC
    - the length of T2 and T3 and the cell re-selection delay requirements should be multiplied by K\_multi\_SMTC = 2
  + The test case of ‘NGSO, one SMTC configured, 2 satellites measured on 1 SMTC’ could be also introduced with scaling factor K\_multi\_SMTC
    - the length of T2 and T3 should be multiplied by K\_multi\_SMTC = 2
    - The test requirement should be defined according to UE capability. For UE don’t support parallel measurements on more than 1 NGSO satellites within a SMTC, the cell re-selection delay to a newly detectable cell and an already detected cell should be multiplied by K\_multi\_SMTC. Otherwise, the current test requirement could be reused.
* Option 2: (Huawei)
  + Use the following SMTC configurations for TC 1-1 – 1-4.
    - TC 1-1: serving cell in SMTC1, neighbor cell in SMTC2, SMTC1 and SMTC2 non-overlapping
    - TC 1-2: serving cell in SMTC1, neighbor cell in SMTC2, SMTC1 and SMTC2 overlapping
    - TC 1-3 and 1-4: serving cell in SMTC1, neighbor cell in SMTC1
    - Scaling factor “K\_multi” is taken into account in the testing requirement for TC 1-1 – 1-4.
  + Use the same SMTC configuration as in A.6.1.1.2 for TC 1-5- 1-8, and scaling factor “K\_multi” is not taken into account in the testing requirement.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3-2: “t-Service” configuration in test case.**

* Option 1: (Huawei)
  + t-Service is configured in TC 1-3 and 1-7, but not configured in other TCs.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3-3: Test setup for intra/inter-frequency cell reselection with timer trigger.**

* Option 1: (Huawei)
  + TC 1-3 and 1-7 consists two time periods T1 and T2:
    - Before test: UE camps in cell1, and t-Service is included in SIB19 of cell1
    - T1: cell2 is powered off, T1 is long enough to make UE have no information about cell2
    - T2: cell2 is powered on, T2 is 40s, t-Service is pointed to the time point (start of T2 + 36s)
    - UE should reselect to cell2 before t-Service
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3-4: Test setup for intra/inter-frequency cell reselection with location trigger.**

* Option 1: (Huawei)
  + TC 1-4 and 1-8 consists two time periods T1 and T2:
    - Before test: UE camps in cell1, and Ref-location is included in SIB19 of cell1
    - T1: cell2 is powered off, T1 is long enough to make UE have no information about cell2
    - T2: cell2 is powered on, T2 is 40s, UE location is changed at the time point (start of T2 + 4s)
    - UE should reselect to cell2 before time point (start of T2 + 36s + Δ), Δ is the response time depending on how UE GNSS location is changed in the test.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3-5: SIB19 reading time in test requirement.**

* Option 1: (Huawei)
  + SIB19 reading time should be considered in the testing requirement for TSI-NR, or alternatively SIB19 scheduling period is small enough for the current requirement.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 3-6: Clarification on Ttrigger.**

* Option 1: (Nokia)
  + Adapt Ttrigger formulation to use the values of Tdetect,NR\_Intra and Tdetect,NR\_Inter also considering the cases UE is not using the enhanced parameters for high mobility.
  + For Ttrigger applicability replace the condition:
    - “This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of t-Service is started…”
    - By
    - “This requirement does not apply when the time span from the last slot of SI transmission within SI modification period where the broadcasting of the last updated value for t-Service is first acquired by the UE…”
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Test case design for handover

**Issue 4-1: Test setup for CHO TC.**

* Option 1: (CATT)
  + It is proposed that same way as in current specification for TN system should be used in test cases for conditional handover for NTN, i.e. the network shall configure a condition implying handover to cell 2 during T1, at a time earlier than TRRC before the beginning of T2.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 4-2: Test case for CHO with time/location-based condition.**

* Option 1: (CATT)
  + It is not necessity of adding test cases in which settings don’t fulfill power based events and time/location based events simultaneously, to examine UE’s behavior in this type of scenario.
* Option 2: (CMCC)
  + Add a test case in which test setting don’t fulfill power based events and time/location based events simultaneously.
    - Set the time instant fulfilling t1-Threshold-r17 at (T2+2\*Tmeasure), and set the time instant fulfilling duration-r17 at (T2+ 3\*Tmeasure ).
    - Test requirement should be 2\*Tmeasure + Tinterrupt + TCHO\_execution from the start of T2, others shall follow A.6.3.1.2
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 4-3: Configuration of HO aspects for HO TC.**

* Option 1: (Nokia)
  + RAN4 to decide the best way to deal with the additional delay introduced in the HO procedure for NTN caused by the initiation of T430 towards the target cell.
  + If the UE can initiate a valid T430 within the processing interval of the HO delay, no additional action is needed.
  + If the epoch time happens after the processing interval of the HO delay, increase HO interruption time.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 4-4: Configuration of CHO aspects for CHO TC.**

* Option 1: (Nokia)
  + RAN4 to decide the best way to deal with the additional delay introduced in the CHO procedure for NTN caused by the cases where the UE has to wait for the epoch time to be reached or re-acquire a new ephemeris information.
  + If the UE needs to re-acquire ephemeris information, the handover delay requirements and the time interruption requirements must be extended to account for that.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Test case design for UE timing requirements

**Issue 5-1: UE timing TC for 30 kHz SCS scenario.**

* Option 1: (Xiaomi, OPPO, Huawei)
  + RAN4 to define one test case including both 15 kHz and 30 kHz test configuration.
* Option 2: (CMCC, QC)
  + No need to define UE timing test configuration for FDD 30kHz SCS scenario
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 5-2: Acquisition of UE location in UE timing test cases.**

* Option 1: (CMCC, Nokia)
  + UE location is acquired by GNSS positioning, and the test parameter for GNSS signal power levels defined in B.4.1 is reused.
* Option 2: (Huawei)
  + Use AT command approach to acquire UE location
    - AT command approach: Use existing defined AT command: “Update UE Location Information”, defined in TS 38.509 to provide the UE with location coordinates.
* Option 2a: (QC)
  + For UE position acquisition in NTN tests, RAN4 to adopt “AT command” based approach. The exact UE position should be defined in such a way that the smallest elevation angle between the UE and satellite(s) is not smaller than 45 deg.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 5-3: Reference timing for uplink transmission in test cases.**

* Option 1: (CMCC)
  + For the test requirement, the reference time should be (NTA + NTA\_offset + NTA,common + NTA,UE-specific) ×Tc ±T\_e\_NTN
    - For the NTA,common and NTA,UE-specific in the test requirement, the description should at least contain the clarification that UE GNSS estimation error and satellite positioning error from UE calculation are not involved.
* Option 2: (Huawei)
  + For NTN UE timing testing, it is suggested to define a reference orbit for the serving satellite, and the DL timing shall be adjusted according to the distance change between serving satellite and UE.
  + For NTN UE timing test cases, the propagator model to be used for serving satellite position estimation is up to UE implementation, and there is no need to define a reference propagator model.
* Option 3: (Qualcomm)
  + In RRM test cases, when a test equipment adjusts downlink transmission frame boundary/Doppler shift and UL reception timing, asymmetric propagation delays on DL and UL for the same slot index shall be taken into account. To model the round trip delay over service link (N\_{TA,UE-specific}), the following definitions of reference slot for S3 and S4 (based in Fig. 3) are adopted.
    - for S3, the slot when the UL transmission is supposed to arrive at the target satellite based on provided valid ephemeris information (no error in the provided ephemeris information will account for UE error) and a reference propagator model
    - for S4, the slot when the DL transmission corresponding to the reference timing of downlink is supposed to arrive at the target satellite based on actual received time of the slot and provided valid ephemeris information (no error in the provided ephemeris information will account for UE error) and a reference propagator model

Graphical user interface

Description automatically generated

* Option 4: (Nokia)
  + UE must update the values of using the ephemeris information and using the common delay formula at the beginning of every uplink slot.
  + Define the requirements for application of the UE autonomous components of the timing advance:
    - Option 1: UE considers the satellite movement. The timing advance components consider the common delay and UE-satellite distance at the moment the UL signal reaches the satellite
    - Option 2: UE does not consider the satellite movement. The timing advance components consider the common delay and UE-satellite distance at the moment the UE is updating their values.
    - Option 3: Asks RAN 1 to clarify the application of these components.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

### Test case design for measurement requirements

**Issue 6-1: SMTC configuration for measurement delay TCs.**

* Option 1: (Huawei)
  + For intra-frequency TCs (10-x),
    - Config.1: 2 SMTC per MO, each SMTC contains 1 SSB/Satellites
      * Config.1a: two SMTCs are overlapping
      * Config.1b: two SMTCs are non-overlapping
    - Config.2: 1 SMTC per MO, each SMTC contains 2 SSBs/Satellites
  + For inter-frequency TCs (11-x):
    - Config.0: 1 SMTC per MO, each SMTC contains 1 SSB/Satellites
      * Config.0a: two SMTCs are overlapping
      * Config.0b: two SMTCs are non-overlapping
* Option 2: (Xiaomi)
  + RAN4 not to define the SMTC/satellite configuration with 2 SMTC per MO and each SMTC contains 2 SSB/Satellites.
* Option 3: (OPPO)
  + If the case of multiple satellites in one SMTC is necessary, support 2-SMTC with 2 satellites in one SMTC and 1 satellite in another SMTC.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 6-2: MG configuration for measurement delay TCs.**

* Option 1: (Xiaomi)
  + RAN4 not to define the configuration for measurement gap in clause A.3 RRM test configuration.
  + If the measurement delay requirement for FO case is defined, the gap configuration for FO case need to be introduced, e.g. FO case with MGRP = 160ms.
* Option 2: (OPPO)
  + For FNO gaps, the associated SMTCs should be pattern 1 and Y defined in clause A.3.11.
  + Define test case for FO gaps if the core requirements are defined.
* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 6-3: TC list for intra-frequency measurement delay.**

* Option 1: (Huawei)
  + Update the TC list for intra-frequency measurement delay as follows.

|  |  |
| --- | --- |
| 10-1 | Event triggered reporting tests without gap under non-DRX |
| 10-2 | Event triggered reporting tests without gap under DRX |
| 10-3 | Event triggered reporting tests without gap under non-DRX with SSB index reading |
| 10-4 | Event triggered reporting tests with single measurement gap under non-DRX |
| 10-5 | Event triggered reporting tests with FNO concurrent measurement gap under DRX |
| 10-6 | Event triggered reporting tests with PPO concurrent measurement gap under non-DRX with SSB index reading |
| ~~10-7~~ | ~~Event triggered reporting tests with FNO concurrent gaps under non-DRX~~ |
| ~~10-8~~ | ~~Event triggered reporting tests with FNO concurrent gaps under DRX~~ |
| ~~10-9~~ | ~~Event triggered reporting tests with PPO concurrent gaps under non-DRX~~ |

* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

**Issue 6-4: TC list for inter-frequency measurement delay.**

* Option 1: (Huawei)
  + Update the TC list for inter-frequency measurement delay as follows.

|  |  |
| --- | --- |
| 11-1 | Event triggered reporting tests without gap under non-DRX |
| 11-2 | Event triggered reporting tests without gap under DRX |
| ~~11-3~~ | ~~Event triggered reporting tests without gap under non-DRX with SSB index reading~~ |
| 11-4 | Event triggered reporting tests with measurement gap under non-DRX |
| 11-5 | Event triggered reporting tests with measurement gap under DRX |
| 11-6 | Event triggered reporting tests with measurement gap under non-DRX with SSB index reading |
| 11-7 | Event triggered reporting tests with FNO concurrent gaps under non-DRX |
| ~~11-8~~ | ~~Event triggered reporting tests with FNO concurrent gaps under DRX~~ |
| 11-9 | Event triggered reporting tests with PPO concurrent gaps under non-DRX |

* Recommended WF
  + Companies are encouraged to provide the views on this issue.

|  |  |
| --- | --- |
| **Company** | **Comments** |
| XXX |  |

## CRs comments collection for 1st round

|  |  |  |
| --- | --- | --- |
| **CRs** | **Company** | **Comments collection** |
| R4-2215393 | CATT | Company A |
|  |
| R4-2215394 | CATT | Company A |
|  |
| R4-2215450 | Xiaomi | Company A |
|  |
| R4-2215451 | Xiaomi | Company A |
|  |
| R4-2215452 | Xiaomi | Company A |
|  |
| R4-2215453 | Xiaomi | Company A |
|  |
| R4-2215454 | Xiaomi | Company A |
|  |
| R4-2215455 | Xiaomi | Company A |
|  |
| R4-2215502 | CMCC | Company A |
|  |
| R4-2215503 | CMCC | Company A |
|  |
| R4-2215820 | OPPO | Company A |
|  |
| R4-2215936 | LG Electronics UK | Company A |
|  |
| R4-2216279 | Huawei, HiSilicon | Company A |
|  |
| R4-2216319 | Huawei, HiSilicon | Company A |
| Company B |
| R4-2216321 | Huawei, HiSilicon | Company A |
|  |
| R4-2216322 | Huawei, HiSilicon | Company A |
|  |
| R4-2216324 | Huawei, HiSilicon | Company A |
|  |
| R4-2216325 | Huawei, HiSilicon | Company A |
|  |
| R4-2216503 | Ericsson | Company A |
|  |
| R4-2216863 | Qualcomm Incorporated | Company A |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic #1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

## Discussion on 2nd round (if applicable)

# Recommendations for Tdocs

## 1st round

**New tdocs**

|  |  |  |
| --- | --- | --- |
| **Title** | **Source** | **Comments** |
| WF on … | YYY |  |
| LS on … | ZZZ | To: RAN\_X; Cc: RAN\_Y |
|  |  |  |

**Existing tdocs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics incl. existing and new tdocs.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. For new LS documents, please include information on To/Cc WGs in the comments column
4. Do not include hyper-links in the documents

## 2nd round

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tdoc number** | **Title** | **Source** | **Recommendation** | **Comments** |
| R4-210xxxx | CR on … | XXX | Agreeable, Revised, Merged, Postponed, Not Pursued |  |
| R4-210xxxx | WF on … | YYY | Agreeable, Revised, Noted |  |
| R4-210xxxx | LS on … | ZZZ | Agreeable, Revised, Noted |  |
|  |  |  |  |  |

Notes:

1. Please include the summary of recommendations for all tdocs across all sub-topics.
2. For the Recommendation column please include one of the following:
   1. CRs/TPs: Agreeable, Revised, Merged, Postponed, Not Pursued
   2. Other documents: Agreeable, Revised, Noted
3. Do not include hyper-links in the documents