**3GPP TSG-RAN WG4 Meeting #112 R4-24xxxxx**

**Maastricht, NL, August 19-23, 2024**

**Agenda item:** 8.8.5

**Source:** Moderator (Xiaomi)

**Title:** Topic summary for [112][216] NR\_IoT\_NTN\_req\_test\_enh

**Document for:** Information

# Introduction

This document is the email discussion summary for [112][216] NR\_IoT\_NTN\_req\_test\_enh with the following topics covered

* Topic 1: RRM core requirements for R19 NR channel BW less than 5MHz for FR1 Phase 2 (AI 8.8.3.4)

And the recommended issues to be discussed in this meeting are listed below with higher to lower priority order.

1. Issue 1-1-1: Clarification on 15KHz SC
2. Issue 1-1-2: CA
3. Issue 1-1-3: CSI-based measurements
4. Issue 1-2-3: On top of which requirements in TS38.133 for NTN less than 5MHz
5. Issue 1-1-4: Other enhanced aspects beyond Rel18
6. Issue 1-1-5: Applicability requirement clarification
7. Issue 1-2-1: Baseline requirement which can be taken as the start point for NTN less than 5MHz requirements
8. Issue 1-2-2-1: Channel bandwidth assumption
9. Issue 1-2-2-2: SSB/PBCH assumption
10. Issue 1-2-2-3: CORRSET

# Topic #1: RRM requirements for NTN less than 5MHz (AI 8.8.3.4)

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [**R4-2411352**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411352.zip) | CATT | **Observation 1: The requirements for less than 5MHz for NR-NTN in Rel-19 should be based on the requirements defined for NR-NTN in FR1-NTN bands, and then refer to the impact of less than 5MHz in Rel-18.**  **Proposal 1: The requirements listed in Table 1 defined for NR-NTN in FR1-NTN bands should be revised.**  **Table 1 RRM Requirements defined for less than 5MHz in Rel-18**   |  |  | | --- | --- | | **RRC\_CONNECTED state mobility** | * Handover   + NR Handover | | **Signalling characteristics** | * Radio Link Monitoring * Link Recovery Procedures | | **Measurement Procedure** | * NR intra-frequency measurements * NR inter-frequency measurements |   **Proposal 2: The less than 5MHz related requirements can be directly added in the sections defined for NR-NTN in FR1-NTN bands.**  **Proposal 3:RAN4 should define RRM requirements for bands n255, n256, and n254 for less than 5MHz in NR-NTN.**  **Proposal 4: RAN4 should define RRM requirements for 3MHz channel bandwidth for less than 5MHz in NR-NTN.**  **Proposal 5:** **The applicable scenarios for Radio Link Monitoring requirements should consider the case of PCell operating with less than 5MHz BW, and the UE is configured with only PCell, which is served by satellite access node (SAN).**  **Proposal 6: RAN4 need to define PDCCH transmission parameters for out-of-sync/ in-sync evaluation for a UE operating on a cell with less than 5MHz BW in FR1-NTN.**  **Proposal 7:** **RAN4 need to define PDCCH transmission parameters for beam failure instance for a UE operating on a cell with less than 5MHz BW in FR1-NTN.**  **Proposal 8: The time period for time index detection (Frequency range FR1) for a target cell with 12 or 15 PRB SSB need to be defined for the following cases:**   * **NR intra -frequency measurements without measurement gaps for SAN.** * **NR intra -frequency measurements with measurement gaps for SAN.** * **NR inter-frequency measurements with measurement gaps for SAN.**   **NR inter-frequency measurements without measurement gaps for SAN.** |
| [**R4-2411453**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411453.zip) | Apple | ***Proposal 1: the features not specified in R18 TN RRM requirement for less than 5MHz WI shall not be considered for R19 NTN with less than 5MHz BW, e.g., CSI-RS based L1/L3/CBD/BFD/RLM requirement.***  ***Proposal 2: the RRM requirement for TN less than 5MHz shall be used as baseline to design NTN less than 5MHz requirement, e.g.,***   * ***T∆ in HO requirement,*** * ***PDCCH transmission parameters in RLM/BFD requirement,*** * ***time index detection for intra-frequency/inter-frequency cell identification with/without MG.***   ***Proposal 3: Like in TN less than 5MHz WI, an applicability requirement is needed to clarify which R17/R18 NTN requirement can be applied for less than 5MHz band without any change in R19.*** |
| [**R4-2411620**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411620.zip) | Xiaomi | **Observation 1: It is not clear that whether other SC beside 15KHz can be studied in WID.**  ***Proposal 1: To confirm 15KHz will be applied in NTN less than 5MHz only.***  ***Proposal 2: RAN4 can start the RRM impact analysis with the following assumptions at least based on Rel18 TN less than 5MHz WI:***   * ***15RBs maximum transmission bandwidth configuration (NRB) for 3M channel bandwidth [4]*** * ***12RBs for PBCH with 3MHz channel bandwidth [5]*** * ***15RBs forming CORESET 0 with 3MHz channel bandwidth[5]***   **Observation 3: The RRM requirements for NTN in Rel18[2, TS38.133] depending on PBCH allocation will be impacted due to reduced channel bandwidth.**  **Observation 4: No impact on RRM requirements for IDLE/inactivated mode mobility but testing case needs to be updated.**  **Observation 5: The handover requirements in terms of Tinterrup**t **needs to be redefined because of the different** Tsearch **under the reduced PBCH bandwidth.**  ***Proposal 3: The requirements for NTN handover shall be redefined with extended Tsearch.***  **Observation 6: For NTN less than 5MHz, the smaller BW needs to be used as the hypothetical PDCCH transmission parameter.**  ***Proposal 4: The requirements for RLM and RLF (including the hypothetical PDCCH transmission parameter) shall be revisited.***  **Observation 7: NTN CSI-RS based RLM/RLF requirements in TS38.133[2] needs to be reconsidered when the less than 5MHz bandwidth introduced.**  ***Proposal 5: RAN4 can deprioritize CSI-based L1 measurements, RLM, BFD, CBD requirements for NTN with less than 5MHz.***  **Observation 8: the performance degradation with the less PBCH bandwidth is expected when performing intra/inter-frequency measurement in less than 5M Hz NTN.**  ***Proposal 6: The requirements for measurement delay (e.g. time period for time index detection) shall be revisited.***  **Observation 9: The current requirements for NTN timing can be reused for the less than 5MHz NTN.**  Table 1. RRM impacts summary due to spectrum less than 5MHz   |  |  |  | | --- | --- | --- | | **RRM requirements** | **NTN requirements in TS38.133 v18.5.0** | **Possible impacts if BW below 5MHz** | | **IDLE/inactive mode mobility** | 4.2C Cell Re-selection for NR UE for Satellite Access | No impact on the core part but the test cases needs to be updated. | | **Handover** | 6.1C Handover for SAN | FFS | | **UE Tx timing, MTTD/ MRTD, timer accuracy, TA accuracy** | 7.1C, 7.2C, 7.3C | No impact | | **RLM** | 8.1C Radio Link Monitoring for Satellite Access 8.5C Link Recovery Procedures for Satellite Access | FFS on Hypothetical PDCCH transmission parameter | | **Measurement cell identification/measurement delay in RRC connected mode** | 9.2C NR intra-frequency measurements for SAN9.3C NR inter-frequency measurements for SAN | FFS on SSB based Cell identification/measurement delay | |
| [**R4-2412111**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412111.zip) | Samsung | **Observation 1: In Rel-18, in 3MHz bandwidth system, only 15kHz SCS is supported.**  **Observation 2: In Rel-18, in 3MHz bandwidth system, number of PBCH is punctured to 12 PRBs.**  **Proposal 1: RAN4 to discuss the RRM requirements based on Rel-18 3MHz design: SCS is only for 15kHz. PBC is punctured to 12 PRBs.**  **Proposal 2: No RRM impacts for RRM requirements in RRC\_IDLE/RRC\_INACTIVE modes by introducing 3MHz in FR1-NTN.**  **Proposal 3: RAN4 to evaluate and define new requirements for HO (RACH-based and RACH-less HO) to consider the update of Tsearch or T∆ (time for fine time tracking and acquiring full timing information) by introducing 3MHz in FR1-NTN.**  **Proposal 4: In 3MHz for FR1-NTN, for Time/location-based CHO with L3 measurement handover delay, the impacts by affected by punctured PBCH can be discussed for Tmeasure and T∆.**  **Proposal 5: In 3MHz for FR1-NTN, for Time/location-based CHO without L3 handover delay, the impacts by affected by punctured PBCH can be defined if Tsearch andT∆ is concluded to be updated in P3.**  **Proposal 6: In 3MHz for FR1-NTN, for satellite switching with re-synchronization including hard switch and soft switch, RAN4 should discuss the satellite switch time including Tmeasure and T∆ should be impacted or not. In addition, RAN4 should discuss whether to use the same update in handover or not if any.**  **Proposal 7: In 3MHz for FR1-NTN, For RRC Re-establishment/RRC connection Release with re-direction, no RRM impacts.**  **Proposal 8: In 3MHz for FR1-NTN, for timing requirements, no RRM impacts.**  **Proposal 9: For RLM/BFD/CBD requirements, in 3MHz for FR1-NTN:**   * **RAN4 to define the new requirements for SSB based. TN 3MHz can be used as baseline.** * **SSB based RLM/BFD/CBD can be prioritized. FFS on whether to define RLM/BFD/CBD based on CSI-RS because the number of PRB is 48 which is larger than 3MHz.**   **Proposal 10: For Scell/PSCell/Interruption, no RRM impacts because NTN only supports single carrier.**  **Proposal 11: RAN4 to evaluate and define SSB based measurement including intra-/inter frequency measurement in 3MHz FR1-NTN.**  **Proposal 12: For CSI-RS based L3 measurement, in 3MHz for FR1-NTN, no RRM impacts.**  **Proposal 13: For L1-RSRP measurement, in 3MHz for FR1-NTN:**   * **For SSB-based, no RRM impacts.** * **For CSI-RS based, L1-RSRP based on CSI-RS has impacts by reducing bandwidth to 3MHz because the side condition of CSI-RS is 48PRBs which is larger than 3MHz. FFS on whether to define L1-RSRP based on CSI-RS if time allowed.** |
| [**R4-2412235**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412235.zip) | Ericsson | **Observation 1: In the WI, only the objective: less than 5MHz for NTN has a definite demand to update RRM requirements.**  **Proposal 1: Studying RRM requirements for UE operating on a cell with less than 5MHz BW in NTN can be started from referring to the content in TN, and checking if further requirements may be impacted. As reference, below requirements contains the dedicated ones for UE operating on a cell with less than 5MHz BW in TN.**   * **Handover, Tsearch for interruption time** * **Radio Link Monitoring, PDCCH transmission parameters** * **Intra/inter-frequency measurements, time period for time index detection**   **Proposal 2: The requirements and enhancements for NR NTN in Rel-17 and Rel-18 shall be introduced and applicable for UE operating on a cell with less than 5MHz BW in NTN.** |
| [**R4-2412668**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412668.zip) | Huawei, HiSilicon | **Proposal: As starting point, the changes to TN requirements for less than 5MHz in R18 are re-used to update the requirements for NTN to support less than 5MHz.**   * **HO interruption** * **SSB index reading in L3 measurement** * **Hypothetical PDCCH parameters for RLM/BFD** |
| [**R4-2412867**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412867.zip) | Nokia | [**Proposal 1: Decide whether the time to detect an unknown cell is increased when a punctured SSB is used in less than 5 MHz.**](#_Toc174113995)  [**Proposal 2: Investigate whether RLM/BFD thresholds need to be updated for operation with less than 5 MHz in NTN.**](#_Toc174113996) |
| [**R4-2413043**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413043.zip) | ZTE  Sanechips | **Observation 1: In legacy discussion of less than 5MHz in TN, RAN4 did not define the CSI-RS based requirements and only the SSB based requirements have been considered.**  **Proposal 1: RAN4 shall follow the same principle as legacy and only define the SSB based requirements. Also, the legacy L1 and L3 measurement requirements can be the baseline.**  **Observation 2: For 3MHz, dowlink transmission BW is 12PRBs and 15PRBs. For 5MHz, downlink transmission BW is 20PRBs.**  **Observation 3: The legacy NR NTN evaluation is the same as legacy TN and the downlink transmission bandwidth is only 24PRBs. As for less than 5MHz, RAN4 defined different requirements for different channel bandwidth.**  **Proposal 2: The legacy evaluation/requirements for less than 5MHz in TN shall be reused or be the baseline when RAN4 considers defining the evaluation/requirements for less than 5MHz in NTN scenario.**  **Observation 4: In legacy, RAN4 kept all the existing SSB related RLM evaluation period for CBW less than 5MHz whatever for RLM OOS or RLM IS.**  **Proposal 3: The legacy RLM OOS/IS evaluation period can be reused or be the baseline when defining the related requirements for less than 5MHz in NTN scenario.**  **Observation 5: There is no CGI requirements for less than 5MHz.**  **Proposal 4: RAN4 shall not define the CGI requirements for less than 5MHz in NTN scenario.**  **Observation 6: In legacy, RAN4 kept all the existing SSB related BFD and CBD evaluation period for CBW less than 5MHz.**  **Proposal 5: The legacy BFD and CBD evaluation period can be the baseline when defining the related requirements for less than 5MHz in NTN scenario.**  **Observation 7: Compared to legacy SSB with 20PRBs, the 12PRBs SSB can guarantee the transmission of PSS/SSS but part of PRBs of PBCH are punched.**  **Observation 8: The measurement samples were increased based on 12PRBs SSB in order to compensate the impact of punching for unknown cell searching, and the relevant requirements have been captured in the existing TS38.133.**  **Proposal 6: RAN4 shall define the related requirements for less than 5MHz in NTN scenario with considering Klayer1\_measurement , Kmulti\_SMTC and Kgap (intra-frequency with/without measurement gap as an example):**  Time period for time index detection for a UE operating on a target cell with 12 PRB SSB (Frequency range FR1) for intra-frequency without measurement gap   |  |  | | --- | --- | | DRX cycle | TSSB\_time\_index\_intra\_less\_than\_5Mhz | | No DRX | max(120ms, 7 x max(MGRP, SMTC period))x Klayer1\_measurement x Kmulti\_SMTC x SMTC period)Note 1 x CSSFintra\_less\_than\_5Mhz | | DRX cycle≤ 320ms | max(120ms, ceil(1.5 x 7) x Klayer1\_measurement x Kmulti\_SMTC x max(MGRP, SMTC period,DRX cycle) x CSSFintra\_less\_than\_5Mhz) | | DRX cycle>320ms | 7 x max(MGRP, DRX cycle) x Kmulti\_SMTC x CSSFintra\_less\_than\_5Mhz | | NOTE 1: FFS When highSpeedMeasInterFreq-r17  NOTE 2: If different SMTC periodicities are configured for different cells, the SMTC period in the requirement is the one used by the cell being identified | |   Time period for time index detection for a UE operating on a target cell with 12 PRB SSB (Frequency range FR1) (Frequency range FR1) for intra-frequency with measurement gap   |  |  | | --- | --- | | DRX cycle | TSSB\_time\_index\_intra\_less\_than\_5Mhz | | No DRX | max(120ms, 7 x Kgap x Kmulti\_SMTC x max(MGRP, SMTC period)) x CSSFintra\_less\_than\_5Mhz | | DRX cycle≤ 320ms | max(120ms, ceil(1.5 x 7) x Kgap x Kmulti\_SMTC x max(MGRP, SMTC period,DRX cycle) x CSSFintra\_less\_than\_5Mhz) | | DRX cycle>320ms | 7 x Kgap x Kmulti\_SMTC x max(MGRP, DRX cycle) x CSSFintra\_less\_than\_5Mhz | | Note 1: CSSFintra\_less\_than\_5Mhz is 1  NOTE 2: FFS When *highSpeedMeasInterFreq-r17* | |   **Observation 9: In legacy, the TΔin legacy NTN is the same as legacy known and unknown target cells operating with 20PRB or 24PRB SSB BW. However, compared with the legacy TΔwith 20 or 24 PRBs, the TΔ for both known and unknown target cells operating with 12 PRB SSB BW are three times as large under certain side conditions.**  **Proposal 7: When considering defining requirements for less than 5MHz in NTN, the legacy less than 5MHz side conditions for unknown inter-/intra-frequency target cells can be reused and the values of TΔ can be reused.** |
| [**R4-2413189**](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413189.zip) | Qualcomm | **Requirements/Features not applicable for Rel-18 Less than 5MHz NR WI**  **Proposal 1: For less than 5MHz FR1 NTN support, RAN4 to not consider following scenarios and requirements:**   * **CA/DC, Positioning, mTRP, L1-SINR, CGI reading, CSI-RS based L3 RRM** * **FFS on RedCap**   **RLM and BFD**  **Proposal 2: For less than 5MHz FR1 NTN RLM and BFD requirements, RAN4 to adopt the set of PDCCH parameters for hypothetical PDCCH BLER for RLM and BFD introduced in Rel-18 less than 5MHz NR WI for the same CBW and CORESET0 size.**  **Cell identification and report**  **Proposal 3: For less than 5MHz FR1 NTN cell identification and report requirements, RAN4 to add the same number of additional SSB sample as Rel-18 less than 5MHz NR WI for ‘3MHz CBW & 15PRBs CORESET0’ and ‘3MHz CBW & 12PRBs CORESET0.’ The number of the additional SSB samples are 4 and 3 for intra-frequency and inter-frequency cell identification, respectively.**  **NR FR1 - NR FR1 Handover**   1. **RRC-based handover**   **Proposal 4: For less than 5MHz FR1 NTN RRC-based handover delay requirements, RAN4 to add the same number of additional Trs as Rel-18 less than 5MHz NR WI for ‘3MHz CBW & 12PRBs CORESET0.’**   1. **Conditional handover**   **Proposal 5: For less than 5MHz FR1 NTN conditional handover delay requirements, RAN4 not to make changes directly to the FR1 NTN conditional handover delay requirements. The different requirements will be indirectly applied by differently defined Tidentify intra with index and Tidentify\_inter\_with\_index in different clauses for ‘3MHz CBW & 12PRB CORESET0.’**   1. **Satellite switch with re-sync**   **Proposal 6: For less than 5MHz FR1 NTN satellite switch with re-sync delay requirements, the existing satellite switch re-sync requirement can be reused.** |
| **R4-2411467** | MediaTek Inc | **Proposal 1: RAN4 to revisit the following NR NTN RRM requirements, for the impact from “less than 5MHz”:**   * **HO delay requirements for SSB BW of 12PRBs** * **SSB RLM/BFD: PDCCH transmission parameters** * **Measurement Procedure: Time period for time index detection** |

*The moderator can suggest a limited number of papers which could be presented.*

## Open issues summary

*Before f2f meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions..*

### Sub Topic 1-1: General scenarios to be considered for RRM

#### Issue 1-1-1: Clarification on 15KHz SC

Main proposals:

* ***Proposal 1: (Xiaomi, Samsung)***
  + ***Only consider 15KHz SC for RRM requirements under NTN less than 5MHz***

Recommended WF:

*According to TN channel bandwidth of 3MHz, only 15Hz SCS is supported. Thus, we can agree that:*

* **To confirm only 15KHz SC needs to be considered.**

#### Issue 1-1-2: CA

Main proposals:

* ***Proposal 1: (Samsung, Qualcomm)***
  + ***Not consider RRM requirements for CA operation in NTN less than 5MHz***

Recommended WF:

[*Moderator note: so far in NTN, only single carrier operation is supported but not CA. We can check the following tentative agreement online.*]

* **Not define any CA related RRM requirements for NTN less than 5MHz. e.g. SCell activation, e.t.c.**

#### Issue 1-1-3: CSI-based measurements

Main proposals:

* ***Proposal 1: (CATT, ZTE)***
  + ***Not consider CSI-RS based RLM/L3 measurement/L1 measurement for NTN less than 5MHz***
* ***Proposal 1a: (Xiaomi, Samsung)***
  + ***Deprioritize on CSI-RS based RLM and L1 measurement for NTN less than 5MHz***

Recommended WF:

[*Moderator note: According to the TN with less than 5MHz bandwidth, actually the RRM impacts on RLM/L1 measurement were identified. But due to the timeline limitation, RAN4 decided to skip these works. Thus, we suggest to firstly focus on SSB-based measurement. We can further check whether CSI-RS based measurement requirement in NTN less than 5MHz . So we suggest companies can check the following tentative agreements during meeting.* ]

* **Deprioritize on CSI-RS based RLM and L1 measurement for NTN less than 5MHz**

#### Issue 1-1-4: Other enhanced aspects beyond Rel18

Main proposals:

* ***Proposal 1: (Qualcomm)***
  + ***Not consider positioning***
* ***Proposal 2: (ZTE，Qualcomm)***
  + ***Not consider CGI***
* ***Proposal 3:（Qualcomm)***
  + ***Not consider mTRP***
* ***Proposal 3: (Qualcomm)***
  + ***FFS on Redcap***

Recommended WF: *According to moderator understanding,* ***RAN4 needs to define the NTN less than 5MHz requirements on top of NTN requirements in TS38.133****. That is if in Rel17/R18 requirements for NTN there is not any requirements for positioning, such aspects shall be precluded. But if the interesting companies can also brought further investigation on the necessary and feasible enhancements. Thus we suggest that:*

* **Not consider poisoning, CGI, mTRP**
* **FFS on Redcap**

#### Issue 1-1-5: Applicability requirement clarificaiton

Main proposals:

* ***Proposal 1: (Apple)***
  + ***An applicability requirement is needed to clarify which R17/R18 NTN requirement can be applied for less than 5MHz band without any change in R19.***

Recommended WF: FFS

### Sub Topic 1-2: General Prinicples

#### Issue 1-2-1: Baseline requirement which can be taken as the start point for NTN less than 5MHz requirements

Main proposals:

* ***Option 1: (CATT, Apple, Xiaomi, Samsung, Ericsson, Huawei, ZTE, Qualcomm)***
  + ***the RRM requirement for TN less than 5MHz shall be used as baseline to design NTN less than 5MHz requirement***

Recommended WF:

[*Moderator note: Most of companies explicitly or implicitly expressed that the impacts on TN because of less channel bandwidth shall be most likely same as these on NTN. From moderator perspective, this general principle can be agreeable. But we would like split such general discussion into more detailed aspects in issue 1-2-2 below.* ]

* **Agree that “RRM requirement for TN less than 5MHz shall be used as baseline to design NTN less than 5MHz requirement”**

#### Issue 1-2-2: Baseline assumption

##### Issue 1-2-2-1: Channel bandwidth assumption

Main proposals:

* ***Option 1: (Xiaomi, Samsung, CATT, ZTE)***
  + ***3MHz***

Recommended WF:

* FFS

##### Issue 1-2-2-2: SSB/PBCH assumption

Main proposals:

* ***Option 1: (Xiaomi, Samsung)***
  + ***12 PRBs***

Recommended WF:

* FFS

##### Issue 1-2-2-3: CORRSET

Main proposals:

* ***Option 1: (Xiaomi)***
  + ***15 PRBs***
* ***Option 2: (Qualcomm)***
  + ***12 PRBs & 15 PRBs***

Recommended WF:

* **FFS**

#### Issue 1-2-3: On top of which requirements in TS38.133 for NTN less than 5MHz

Main proposals:

* ***Option 1: (CATT, Xiaomi, Ericsson, ZTE)***
  + ***The current requirements for NTN in TS38.133 can be used as the baseline to define the new requirements for NTN less than 5MHz***

Recommended WF:

*It is obviously the further specification works and changes shall be based on NTN context. But as mentioned in sub-topic 1-1, basically we can check which of clause/sub-clause for NTN requirements defined in TS38.133 shall be updated or revisited due to the reduced channel bandwidth. For an example, in order to clearly aligned RAN4’s further work contents on this WI, we can* ***agree the table below before we dive to the detailed discussion on the specific requirements.***

Table 1. RRM impacts summary due to spectrum less than 5MHz

|  |  |  |
| --- | --- | --- |
| **RRM requirements** | **NTN requirements in TS38.133 v18.5.0** | **Possible impacts if BW below 5MHz** |
| **IDLE/inactive mode mobility** | 4.2C Cell Re-selection for NR UE for Satellite Access | TBD |
| **RRC connection mobility control** | 6.2C RRC Connection Mobility Control for Satellite Access | TBD |
| **Handover** | 6.1C Handover for SAN | TBD |
| **UE Tx timing, MTTD/ MRTD, timer accuracy, TA accuracy** | 7.1C, 7.2C, 7.3C | TBD |
| **RLM** | 8.1C Radio Link Monitoring for Satellite Access 8.5C Link Recovery Procedures for Satellite Access | TBD |
| **others** |  |  |

### Sub Topic 1-3: Specific NTN RRM impacts

#### Issue 1-3-1: whether IDLE/INACTIVE RRM requirement for NTN in current TS38.133 will be impacted becasue of less than 5MHz bandwidth

Main proposals:

* ***Option 1: (Xiaomi, Samsung, MediaTek)***
  + ***No impacts***
* ***Option 1a: (Xiaomi)***
  + ***No impacts but the corresponding test case parameters shall be updated***

Recommended WF:

* **FFS**

#### Issue 1-3-2: Handover

Main proposals:

* ***Proposal 1: (CATT, Apple, Xiaomi, Samsung, Ericsson, Huawei, MediaTek, ZTE)***
  + ***HO requirement shall be redefined***
* ***Proposal 1a: (CATT, Apple, Samsung, Huawei, ZTE)***
  + ***T∆ in HO requirement shall be redefined*** 
    - ***based on TN less than 5MHz requirements***
* ***Proposal 1b: (Xiaomi, Samsung, Ericsson, Huawei, Nokia)***
  + *Tsearch* ***under the reduced PBCH bandwidth needs to be defined*.**
* ***Proposal 2: (Samsung, Qualcomm)***
  + ***Time/location-based CHO with L3 measurement handover delay can be impacted***
* ***Proposal 3: (Samsung, Qualcomm)***
  + ***RAN4 should discuss the satellite switch time including Tmeasure and T∆ should be impacted or not.***

Recommended WF:

[*Moderator note: the proposals on NTN HO here are not exclusive each other. Proposal 1 seems can be supported by most companies. Proposal 1a,1b can be FFS when defining the new requirements for NTN less than 5MHz.* ]

* **Agree Proposal 1 and FFS on others**

#### Issue 1-3-3: whether timing requirements for NTN in current TS38.133 will be impacted becasue of less than 5MHz bandwidth

Main proposals:

* ***Option 1: (Xiaomi, Samsung, MediaTek)***
  + ***No impacts***

Recommended WF:

* **FFS**

#### Issue 1-3-4: RLF/BFD/CBD

Main proposals:

* ***Proposal 1: whether RAN4 need to define hypothetical PDCCH transmission parameter for RLF/BFD/CBD***
  + ***Yes (CATT, Apple, Xiaomi, Samsung, Ericsson, Huawei, ZTE, Qualcomm, MediaTek)***
  + ***FFS (Nokia)***
* ***Proposal 2: (ZTE)***
  + **T*he legacy RLM OOS/IS evaluation period can be reused or be the baseline when defining the related requirements for less than 5MHz in NTN scenario***

Recommended WF:

[*Moderator note: For RLF/BFD/CBD requirements, there are two key aspects to be discussed in RAN4. One is the evaluation period requirements, the other hypothetical PDCCH transmission parameter. For the evaluation period, only one company provide explicit proposal on this issue. For hypothesis parameters, most companies can agree to redefine them but how to do it is highly dependent with the discussion issue 1-2-1-3 Thus from the moderator perspective, we suggested that FFS on them*]

* **RLF/BFD/CBD hypothetical PDCCH transmission parameters shall be redefined.**
  + **FFS on how to specify these new parameters.**
* **FFS on RLF/BFD/CBD evaluation period**

#### Issue 1-3-5: Measurement(SSB index detection requirements)

Main proposals:

* ***Proposal 1: Whether the time period for time index detection within NTN intra/inter-frequency measurements with/without MG shall be redefined.*** 
  + ***Option 1: Yes(CATT, Apple, Xiaomi, Samsung, Ericsson, Huawei, ZTE, Qualcomm, MediaTek)***
  + *Option 2: FFS (Nokia)*
* ***Proposal 2a: Qualcomm)***
  + ***The new SSB index detection requirements can be defined by add number of SSB samples as Rel18 TN with less than 5MHz.***
* ***Proposal 2b: (ZTE)***
  + ***RAN4 shall define the related requirements for less than 5MHz in NTN scenario with considering Klayer1\_measurement , Kmulti\_SMTC and Kgap***

Recommended WF:

[*Moderator note: For the measurement requirements for both intra-frequency and inter-frequency, the main factors to be impacted is the cell and SSB index detection because it depends on the PBCH detection directly. Hence, we can also focus on this aspect also.* ]

* **The time period for time index detection within NTN intra/inter-frequency measurements with/without MG shall be redefined**
  + **FFS on how to define these new requirements.**

#### Issue 1-3-6: L1-RSRP Measurement

Main proposals:

* ***Proposal 1: (Samsung)****.*
  + **For L1-RSRP measurement based on SSB there is no RRM impacts,**

Recommended WF: **FFS**