3GPP TSG RAN WG1 #117 R1-240xxxx

Fukuoka, Japan, 20 – 24 May, 2024

**Agenda item: 8.1**

**Source: Moderator (Nokia)**

**Title: Feature lead summary 1 on FR2-NTN discussions**

**WI code: NR\_NTN\_enh-Core**

**Release: Rel-18**

**Document for: Discussion and Decision**

# Introduction

Since RAN1#113 where RAN1 received an LS from RAN4 on the potential support of NR over NTN for the frequency bands defined as part of FR2-NTN [1], there has been discussions on how to capture this in RAN1 specifications. At present only one aspect need to be addressed, which is which draft CRs to endorse for TS 38.211, and to check/verify the existing draft CRs for TR 38.213 and TR 38.214.

## Guidelines for the discussion.

The summary is split into two main parts;

* The discussion of the draft CRs is captured in (**Section 2**).
* Please note that two additional draft CRs have been submitted for RAN1#117 which may need to be considered for whether they are considered “technically correct”. The discussion of these is in section 2.1.1 and 2.1.2.
* Discussion on draft CRs for TS 38.211 is in section 2.1.3. Please provide comments (if different from provided in earlier meetings).
* Discussions on draft CRs for TS 38.213 and TS38.214 are in sections 2.2 and 2.3 respectively.

As this topic is expected to have very little time for online discussions it is preferable that the comments are provided already before:

**1st round deadline: Monday 15th of April, 16.00 Local time.**

Companies are encouraged to reach out to moderator ([frank.frederiksen@nokia.com](mailto:frank.frederiksen@nokia.com)) if they want to co-source the final CRs (either the full set or individual CRs).

## Reserved tdoc numbers

This moderator summary is targeted at discussing various aspects related to this topic.

Table to be filled with reserved Tdoc numbers for this contribution when needed:

|  |  |
| --- | --- |
| R1-2405266 | Feature lead summary 1 on FR2-NTN discussions |
| R1-2405267 | Feature lead summary 2 on FR2-NTN discussions |

# Discussion

## Topic 1: Draft CRs for TS 38.211 [open]

Following the discussions after RAN1#116-bis, there was the following conclusion:

**Conclusion**

The draft CRs as provided in R1-2403790 and R1-2403791 are considered to be technically correct.

* **R1-2403790** Draft CR for TS 38.211 for introduction of FR2-NTN Moderator (Nokia), NTT DOCOMO, INC. (rev of R1-2403581)
  + (Rel-18, 38.211, NR\_NTN\_enh-Core, draftCR, Cat B )
* **R1-2403791** Draft CR for 38.211 on Introduction of FR2-NTN Moderator (Nokia), Ericsson, Thales, CATT, ESA, Eutelsat Group, Lockheed Martin, Inmarsat, Sharp (rev of R1-2403739)
  + (Rel-18, 38.211, NR\_NTN\_enh-Core, draftCR, Cat B )

Decision on which of the two draft CRs to adopt for TS 38.211 is expected in RAN1#117.

And guidance from the closing of the email discussion was as follows:

For contributions to RAN1#117, companies can reference these Tdoc numbers from RAN1#116bis. There is no need for companies to re-submit those draft CRs without change.

If a compromise proposal can be reached among companies and submitted to RAN1#117, we can of course still consider such alternative for agreement instead of one of the two CRs above.

Based on the contributions for this meeting, it is observed that a total of four draft CRs are to be considered.

* R1-2403790 (changing the caption of Table 6.3.3.2-4 in TS 38.211)
* R1-2403791 (introducing an additional table which is inspired Table 6.3.3.2-4 in TS 38.211)
* R1-2404218 (introducing an additional table in TS 38.211 with different entries compared to existing tables)

### Draft CR in R1-2404218

Since the R1-2404218 is a new draft CR, companies are encouraged to provide their view with respect to whether the draft CR is technically correct.

**Proposed Observation 1-1:**

**The draft CR for TS 38.211 in R1-2404218 is considered technically correct.**

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| **Companies** | **Correct/Not correct** | **Comments and Views** |
| Nokia | Not correct | Clause 4.4.4.2 the addition is not tracking the changes correctly (some of the commas in the list are not tracked)  Clause 6.3.3.2 the addition is not tracking the changes correctly (some of the commas are not tracked as additions).  Clause 7.4.3.1 the addition is not tracking the changes correctly (again, some commas seem to be missing as changes) |
| Ericsson |  | This draft CR proposes changes that are much more extensive than those discussed in the post-RAN1#116bis email discussion. We should not open up for general discussions of new PRACH configurations at this late stage but limit the scope to the two draft CRs from RAN1#116bis, and possible compromise solutions based on those two as per guidance from the chairman at the closing of the email discussion. |
| Thales | Yes | The draft CR for TS 38.211 in R1-2404218 is proposing new table for PRACH configuration index, by introducing PRACH config which are more suitable for NTN.  In Table 6.3.3.2-4 of TS 38.211, there are 158 over 256 PRACH configurations with a periodicity of 10ms (one frame) and only 19 configurations with a periodicity of 160ms. While these configurations with lower periodicity could be beneficial for low latency services, we do not think that such configurations are needed in NTN where the beam sweeping cycle and the beam illumination plan with large beam hopping period may not allow such low PRACH periodicity.  It is worth noting also, such new configurations for FR2 FDD NTN will allow such RSI planning method: To reduce the probability of root sequence collision (RSI), the following strategy is preferred: All the cells within the same satellite/gNB are allocated a common Root sequence index but a different combination of a PRACH configuration index and PRACH frequency offset.  Further, for FR2 TDD, PRACH occasion was designed to occupy the end of a semi-static UL/DL configuration period. With new table we are proposing, this constraint is removed for the PRACH configuration for FR2-NTN with FDD duplexing mode. |
| DCM |  | We already confirmed x3791 for table update. Then why do we need to spend time for another alternative? Let’s focus on x3790 vs x3791. |
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### Discussion of candidate Draft CRs

The views provided for this meeting are as follows:

* Companies supporting R1-2403790 are as follows: Huawei, HiSilicon, Spreadtrum Communications, ZTE, OPPO, Nokia
* Companies supporting R1-2403791 are as follows: Ericsson, NTT DOCOMO, INC., Sharp
* Company supporting R1-2404218 is as follows: THALES

Since most companies seem to be supporting R1-2403790 the following is considered as a possible way forward:

**Proposed Agreement 1-3:**

For introduction of FR2-NTN in TS 38.211, R1-2403790 is endorsed.

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| **Companies** | **Comments and Views** |
| Nokia | Support |
| LG | We also support R1-2403790, so fine with the proposal. |
| Ericsson | No. R1-2403790 is not the majority view when the companies co-sourcing the draft CRs are counted. Indeed, R1-2403791 is the CR that overall counts with most companies supporting it. The down-selection will anyway have to be performed online. |
| DCM | We are fine with majority view. As commented by Ericsson, which has more supporters should be checked carefully. |
| Sharp | Not support. The discussion point of this issue is whether to use the room of PRACH slot that has non-zero starting symbol for additional PRACH or PUSCH. In our understanding, the PUSCH allocation in the room of PRACH slot is not prohibited in the specification, but the transmission is restricted such that PUSCH and PRACH cannot be transmitted in the same slot in TS38.213. Further, additional PRACH is useful for FR2 operation as described our contribution. Therefore, we support to extend the number of PRACH (i.e. support R1-2403791). |
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## Topic 2: Draft CRs for TS 38.213 [open]

No comments were provided for the draft CR for TS 38.213 in R1-2403582, the following is proposed:

**Proposed Agreement 2-1:**

For introduction of FR2-NTN in TS 38.213, R1-2403582 is endorsed.

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| **Companies** | **Comments and Views** |
| Nokia | Support |
| LG | Support |
| Ericsson | Support |
| Thales | Support |
| DCM | Support |
| Sharp | Support |
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## Topic 3: Draft CRs for TS 38.214 [open]

One company observed that the draft CR for TS 38.214 in R1-2403737 contains extra/unnecessary copies of “**<unchanged parts omitted>**” at the end of the document. Based on the fact that last meeting (RAN1#116-bis) found

**Proposed Agreement 3-1:**

For introduction of FR2-NTN in TS 38.214, R1-2403737 with removal of unnecessary copies of “**<unchanged parts omitted>**” at the end of the document is endorsed.

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| **Companies** | **Comments and Views** |
| Nokia | Support |
| LG | Support |
| Ericsson | Support |
| Thales | Support |
| DCM | Support |
| Sharp | Support |
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# Summary

To be filled with summary after discussions.

# Collection of observations and proposals submitted for RAN1#116

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| [R1-2403937](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2403937.zip" \t "_parent), Huawei, HiSilicon | ***Observation 1: PRACH table provided in R1-2403791 is further optimization introduced in maintenance phase considering the CR in R1-2403790 which reuses existing Table 6.3.3.2-4 for FR2-NTN is already technically correct.***  ***Observation 2: Although R1-2403791 is concluded to be technically correct, it is not clear whether the PRACH table provided in R1-2403791 can achieve the claimed benefit.***  ***Proposal 1: Reuse Table 6.3.3.2-4 of TS 38.211 without modification for PRACH configuration for operation in FR2-NTN.***  ***Proposal 2: Endorse the draft CR R1-2403790 for TS 38.211.*** |
| [R1-2404014](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404014.zip), Spreadtrum Communications | No observations or proposals.  Draft CR which is suggesting to change caption of Table 6.3.3.2-4 in TS 38.211 such that it includes FR2-NTN (introducing a new table for the PRACH configuration table to be used for operation in frequency bands defined by FR2-NTN: “Random access configurations for FR2 / FR2-NTN and unpaired spectrum.” |
| [R1-2404211](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404211.zip), ZTE | ***Proposal 1:*** *Adopt the CR in R1-2403790 for FR2-NTN, where the PRACH configuration table is not updated except the caption.* |
| [R1-2404218](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404218.zip), THALES | No observations or proposals.  Draft CR which is introducing a new table for the PRACH configuration table to be used for operation in frequency bands defined by FR2-NTN |
| [R1-2404850](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404850.zip), OPPO | **Observation 1: Most of the changes in the 108 PRACH configurations in [3] (Editor: R1-2403791) do not provide additional ROs.**  **Observation 2: Further optimization for PRACH configuration for R18 at this late stage of the maintenance phase is not recommended according to chairman’s guidance.**  **Proposal 1: RAN1 does not pursuit further optimization for PRACH configuration for operation in FR2-NTN, Table 6.3.3.2-4 of TS 38.211 is used without modification.** |
| [R1-2404936](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404936.zip), Ericsson | [Observation 1 An e-mail discussion post RAN1#116 was assigned towards reviewing the correctness of two DRAFT CRs associated with the following approaches: “reuse Table 6.3.3.2-4 of TS 38.211 without modification for NR over NTN for FR2-NTN in Rel-18, or to reuse the table with modifications”. The e-mail discussion concluded with following final draft CRs: R1-2403790 and R1-2403791.](#_Toc166277062)  [Observation 2 On the draft CR in R1-2403790 and the potential utilization of the uplink resources falling into the TDD gap, it has been found that a UE does not transmit PRACH and PUSCH in the same slot (see TS 38.213, clause 8.1).](#_Toc166277063)  [Observation 3 In relation with the previous observation, if a UE other than the one that transmits the PRACH could be claimed to be flexible enough as to be fit into the TDD gap, in our understanding since it is up to the UE to initiate the PRACH transmission, then it is difficult to predict an uplink scheduling for some other UE to occur within the TDD gap. Further, to utilize the TDD gaps for short PUSCH transmissions, the time domain resource allocation list has to contain a set of short allocations in addition to a set of long allocations (i.e., allocating a full UL slot), which is costly both in DL configuration signaling and DCI.](#_Toc166277064)  Based on the discussion in the previous sections we propose the following:  [Proposal 1 Adopt the draft CR in R1-2403791.](#_Toc166277065) |
| [R1-2405024](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2405024.zip), NTT DOCOMO, INC. | **Proposal 1:**   * **For PRACH configuration for operation in FR2-NTN, adopt the draft CR as provided in R1-2403791.** |
| [R1-2405066](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2405066.zip), Sharp | **Observation 1:** In Rel-19 NR-NTN discussion, it is assumed that active time of one DL Tx beam on satellite in FR2 is limited to 1.5 %.  **Observation 2:** The same active time limitations as DL Tx beam due to antenna array structures at the satellite apply to UL Rx beam as well.  **Observation 3:** Enhancement of PRACH configuration in future release will require additional PRACH partitioning which causes the reduction of PRACH capacity for Rel-18 FR2-NTN UEs.  **Proposal 1:** PRACH capacity issue should be considered in Rel-18 FR2-NTN.  **Proposal 2:** The draft CR that PRACH table is modified (i.e. R1-2403791) is adopted. |
| [R1-2405262](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2405262.zip), Nokia | **Observation 1: WID clearly states that parameters for introduction of FR2-NTN are to be taken from existing sets.**  **Observation 2: Other physical layer parameters were chosen from existing sets to support FR2-NTN.**  **Observation 3: The draft CR in R1-2403791 introduces the addition of a new table, and does hence not rely on existing FR1 or FR2 sets.**  **Proposal 1: Select the draft CR which targets using the existing PRACH configuration table for FR2-NTN.**  **Proposal 2: Endorse draft CR in R1-2403790 for TS 38.211.**  **Proposal 3: Endorse draft CR in R1-2403582 for TS 38.213.**  **Proposal 4: Remove duplicate versions of “<unchanged parts omitted>” from R1-2403737 and endorse an updated version of the draft CR.** |
| [R1-2404206](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404206.zip), THALES | **Observation 1:** Compared with FDD, the PRACH configuration tables for TDD FR1 and FR2 considered the downlink resources (e.g. SS/PBCH block, RMSI) and semi-static DL/UL locations, in order to reduce the potential collisions between RACH transmission occasions (ROs) and SS/PBCH block/DL part.  **Observation 2:** For FR2 TDD, PRACH occasion was designed to occupy the end of a semi-static UL/DL configuration period. We propose that this constraint should be removed for the PRACH configuration for FR2-NTN with FDD duplexing mode.  **Observation 3:** In Table 6.3.3.2-4 of TS 38.211, there are 158 over 256 PRACH configurations with a periodicity of 10ms (one frame) and only 19 configurations with a periodicity of 160ms . While these configurations with lower periodicity could be beneficial for low latency services, we do not think that such configurations are needed in NTN where the beam sweeping cycle and the beam illumination plan with large beam hopping period may not allow such low PRACH periodicity.  **Observation 4:** To reduce the probability of root sequence collision (RSI), the following strategy is preferred: All the cells within the same satellite/gNB are allocated a common Root sequence index but a different combination of a PRACH configuration index and PRACH frequency offset. A New PRACH configuration index table for FR2 FDD should be introduced to allow such RSI planning method .  Proposal 1:  Adopt the Draft CR in R1-2404218 for 38.211 |

# References

1. [R1-2304309](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_113/Docs/R1-2304309.zip)/R4-230592: LS on the system parameters for NTN above 10 GHz, May 2023

1. [R1-2403937](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2403937.zip" \t "_parent), “Discussion on FR2-NTN PRACH Table for NTN above 10GHz”, Huawei, HiSilicon
2. [R1-2404014](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404014.zip), “Maintenance of NTN above 10GHz”, Spreadtrum Communications
3. [R1-2404211](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404211.zip), “Further discussion on LS on the system parameters for NTN above 10 GHz”, ZTE
4. [R1-2404218](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404218.zip), “Draft CR for 38.211 on Introduction of FR2-NTN”, THALES
5. [R1-2404850](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404850.zip), “Discussion on remaining issue for FR2 NTN”, OPPO
6. [R1-2404936](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404936.zip), “Discussion of PRACH configurations for FR2-NTN in paired spectrum”, Ericsson
7. [R1-2405024](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2405024.zip), “Discussion on FR2-NTN”, NTT DOCOMO, INC.
8. [R1-2405066](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2405066.zip), “Discussion on RAN4 LS on FR2-NTN aspects”, Sharp
9. [R1-2405262](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2405262.zip), “On FR2-NTN inclusion to specifications”, Nokia
10. [R1-2404206](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_117/Docs/R1-2404206.zip), “On RAN4 LS on the system parameters for FR2-NTN”, THALES
11. [R1-2403582](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_116b/Docs/R1-2403582.zip), “Draft CR for TS 38.213 for introduction of FR2-NTN”, Moderator (Nokia), NTT DOCOMO, INC.
12. [R1-2403737](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_116b/Docs/R1-2403737.zip), “Draft CR for TS 38.214 for introduction of FR2-NTN”, Moderator (Nokia), NTT DOCOMO, INC.

1. [R1-2403790](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_116b/Docs/R1-2403790.zip), “Draft CR for TS 38.211 for introduction of FR2-NTN”, Moderator (Nokia), NTT DOCOMO
2. R1-[2403791](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_116b/Docs/R1-2403791.zip), “Draft CR for 38.211 on Introduction of FR2-NTN”, Moderator (Nokia), Ericsson, Thales, CATT, ESA, Eutelsat Group, Lockheed Martin, Inmarsat, Sharp

# Agreements from past meeting(s)

## RAN1#114-bis:

Working assumption

For PRACH configuration for operation in FR2-NTN, Table 6.3.3.2-4 of TS 38.211 is used as baseline.

FFS: Whether further modifications would be needed

**Conclusion**

For operation in FR2-NTN, the value range in ms for K\_offset and K-MAC shall be the same as for Rel-17 NR over NTN.

Working assumption

For operation in FR2-NTN, use a reference SCS of 15 kHz for the indication of K\_offset and K\_MAC.

Working assumption:

For operation in FR2-NTN, for cell search procedure, at least Case D in TS 38.213 is used to allow FDD operation in bands defined by FR2-NTN without any update to SSB pattern.

FFS: whether Case E can also be used

**Conclusion**

For operation in FR2-NTN and for Rel-18, no additional MAC CE TCI application delay is introduced to facilitate mechanical beam steering with VSAT.

Working assumption

From RAN1 perspective, for operation in FR2-NTN, the granularity used for TA reporting is the same as corresponding to the reference subcarrier spacing applied for K\_offset.

## RAN1#115:

Agreement

Confirm working assumption from RAN1#114-bis on reference SCS for K\_offset and K\_MAC.

Agreement

Confirm working assumption from RAN1#114-bis on the TA reporting granularity.

Agreement

The working assumption for cell search procedure is replaced with the following, and confirmed:

* For operation in FR2-NTN, for cell search procedure, Case D and Case E in TS 38.213 are used to allow FDD operation in bands defined by FR2-NTN without any update to SSB pattern.

Agreement

Confirm the working assumption from RAN1#114-bis on the PRACH configuration.

Working assumption

For PRACH configuration for operation in FR2-NTN, Table 6.3.3.2-4 of TS 38.211 is used as baseline.

FFS: Whether further modifications to the PRACH configuration Table would be needed

Agreement

Create an LS response for RAN4 with the following text, and copy the relevant RAN1 agreements and conclusions made for FR2-NTN in the LS:

**Overall description**

RAN1 would like to thank RAN4 for their LS R4-2305926 (R1-2304309) on the operation of NR over NTN in frequency bands above 10 GHz.

RAN1 have had discussion on the topic over the past meetings and have reached a number of agreements, but some topics are still under consideration. The topics still under consideration are mainly related to the timing requirements associated to operation in bands defined by FR2-NTN. To help RAN1 progressing on the topic, it would be appreciated if RAN4 could provide the timing requirements for supporting NR over NTN in bands defined by FR2-NTN.

**Actions:**

RAN1 respectfully asks RAN4 to provide a response to the above question in order to aid the RAN1 discussions related to timing accuracy requirements.

**R1-2312553**

Final LS is agreed in R1-2312553.

## RAN1#116:

**Conclusion**

RAN1 does not pursue the aspects on negative timing advance indication through TAC in MAC RAR for FR2-NTN unless specifically requested by RAN4.

**Conclusion**

For frequency bands defined by FR2-NTN, RAN1 will not consider expanding the scope of extended cyclic prefix to cover SCS other than 60 kHz in Rel-18.

**Conclusion**

RAN1 will decide at RAN1#116bis on whether to reuse Table 6.3.3.2-4 of TS 38.211 without modification for NR over NTN for FR2-NTN in Rel-18, or to reuse the table with modifications.

## RAN1#116-bis:

**Conclusion**

There is no consensus on any enhancements to the Common TA modelling for operation in FR2-NTN in Rel-18.

**Conclusion**

For FR2-NTN in Rel-18, RAN1 cannot reach consensus on additional actions related to N\_TA for cases where a UE receives and applies updated information from SIB19.

**Conclusion**

The draft CRs in R1-2403582 for TS 38.213 and R1-2403693 for TS 38.214 are technically endorsed with the following change to R1-2403693:

* FR2-NTN Frequency Range 2 for Non-terrestrial networks as defined in TS 38.101-5 [~~15~~21]

R1-2403693 is revised in R1-2403737 to reflect the above.

(and from post-meeting email discussion):

**Conclusion**

The draft CRs as provided in R1-2403790 and R1-2403791 are considered to be technically correct.

* **R1-2403790** Draft CR for TS 38.211 for introduction of FR2-NTN Moderator (Nokia), NTT DOCOMO, INC. (rev of R1-2403581)
  + (Rel-18, 38.211, NR\_NTN\_enh-Core, draftCR, Cat B )
* **R1-2403791** Draft CR for 38.211 on Introduction of FR2-NTN Moderator (Nokia), Ericsson, Thales, CATT, ESA, Eutelsat Group, Lockheed Martin, Inmarsat, Sharp (rev of R1-2403739)
  + (Rel-18, 38.211, NR\_NTN\_enh-Core, draftCR, Cat B )

Decision on which of the two draft CRs to adopt for TS 38.211 is expected in RAN1#117.