**3GPP TSG RAN meeting #104 RP-240923**

**Shanghai, China, June 17-21th , 2024**

## Status Report to TSG

**Title: Status report for New WID: Non-Terrestrial Networks (NTN) for NR Phase 3; rapporteur: Thales, CATT**

**Agenda item:** 9.3.2.2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **WI / SI Name** | Rel-19 Non-Terrestrial Networks (NTN) for NR Phase 3 | | | | |
| included in this status report | Study Item:  No | Core part:  Yes | Performance part:  Yes | | Testing part:  No |
| **Acronym** | NR\_NTN\_Ph3 | | | | |
| **Unique ID** | 1020097 | | | | |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-240775 | | | | |
| **Target Completion Date**  **(indicate if changed)** | Study Item:  N/A | Core part:  09/2025 | Performance part: 03/2026 | Testing part: | |
| **Overall Completion level** | Study Item:  N/A | Core part:  Overall: 20%  RAN1: 20%  RAN2: 25%  RAN3: 25%  RAN4: 10% | Performance Part:  Overall: 0%  RAN4: 0% | Testing part: | |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

|  |  |  |
| --- | --- | --- |
| **Leading WG** | | RAN2 |
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## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | No |

*If you answered No: Then please remove the Excel file from the zip file of this status report.*

*If you answered Yes: Then please fill out the attached Excel template to request a modification of the time budgets for your WI /SI. The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI. The basis are the endorsed time budgets of the last RAN meeting. Please highlight all changes of the values.  
 One time unit (TU) corresponds to ~ 2 hours in the meeting.  
 If this status report covers a WI with Core and Performance part, then please have one line for each in the attached Excel table.  
 Note: If no Excel table is attached, then this means no time budget change.*

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## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

NOTE: Agreements and Open issues impacted cross-TSG aspects shall be explicitly highlighted

## 2.1 RAN1

#### 2.1.1 Agreements

#### 2.1.1.1 Decisions during RAN1#116bis

##### 2.1.1.1.1 NR-NTN downlink coverage enhancement

Agreement

For coverage evaluation of PDCCH in NR NTN, the following table is assumed:

|  |  |
| --- | --- |
| Parameter | Value |
| Number of UE receive chains | 2 for 2GHz |
| Aggregation level | 8 |
| Payload | 40 bits |
| CORESET size | 2 symbols, 24 PRBs |
| Tx Diversity | Reported by companies |
| BLER | 1% BLER  optional for 10% BLER |
| Number of SSB for broadcast PDCCH of Msg.2 | Reported by companies |
| Other parameters | Reported by companies |

Agreement

For coverage evaluation of PDSCH in NR NTN, the following table is assumed:

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| BLER | For low data rate service, w/ HARQ, 10% iBLER; w/o HARQ, 10% iBLER.  For VoIP, 2% rBLER. |
| Waveform | CP-OFDM |
| Number of UE receive chains | 2 for 2GHz |
| HARQ configuration | Whether/How HARQ is adopted is reported by companies. |
| DMRS configuration | 3 DMRS symbols is used for PDSCH of Msg.2.  For 3km/h: Type I, 1 or 2 DMRS symbol, no multiplexing with data.  PDSCH mapping Type, the number of DMRS symbols and DMRS position(s) are reported by companies. |
| PRBs/TBS/MCS for data rate service | Any value of PRBs, and corresponding MCS index, reported by companies will be considered in the discussion.  TBS can be calculated based on e.g. the number of PRBs, target data rate, frame structure and overhead.  24 PRBs for SIB1 and SIB19 |
| PRBs/MCS for VoIP | Any value of PRBs reported by companies will be considered in the discussion.  QPSK |
| PDSCH duration | 12 OS |
| Payload size for PDSCH of Msg.2 | 72 bits |
| Payload size for PDSCH of SIB1 | FFS |
| Payload size for PDSCH of Msg.4 | 1040 bits |
| Payload size for PDSCH of SIB19 | FFS |
| Other parameters | Reported by companies. |

Agreement

Antenna gain reduction due to steering loss is not considered in the link level evaluation.

Note: This is aligned with the assumptions made in Rel-18 UL coverage enhancement

**Observation**

The CNRs for the satellite payload parameters Set 1-1, Set 1-2 and Set 1-3 are equal to -1.9 dB, -1.9 dB and -9.9 dB respectively.

Agreement

Confirm the Satellite phased-array antenna parameters for LEO 600km in FR1 defined in RAN1#116.

|  |  |
| --- | --- |
| Satellite phased array antenna Characteristics |  |
| Orbit | LEO-600km |
| Frequency range/band | FR1/S-Band |
| Antenna element pattern | Table7.3-1 in TR 38.901 |
| Horizontal/vertical 3 dB beam width of single element (degree) | 65 for H  65 for V |
| Antenna element spacing | 0.667 lambda |
| Antenna polarization | Circular (RHCP or LHCP) |
| Number of antenna elements | 400 elements (20 x 20) |
| Equivalent satellite antenna aperture | 2m |
| Element maximum gain | 4 dBi |
| Antenna maximum gain | 30 dBi |
| Steering loss at 30° elevation angle | 4 dB |

Al least the above model is considered for SLS to ease the alignment between evaluation results. The model below can be optionally considered:

|  |  |
| --- | --- |
| Satellite phased array antenna Characteristics |  |
| Orbit | LEO-600km |
| Frequency range/band | FR1/S-Band |
| Antenna element pattern | TR38.820 section 7.2.4 |
| Horizontal/vertical 3 dB beam width of single element (degree) | 90 for H  90 for V |
| Antenna element spacing | 0.5 lambda |
| Antenna polarization | Circular (RHCP or LHCP) |
| Number of antenna elements | 676 elements (26 x 26) |
| Equivalent satellite antenna aperture | 2m |
| Element maximum gain | 4 dBi |
| Antenna maximum gain | 30 dBi (Note 1) |
| Steering loss at 30° elevation angle | 2.5 dB |

Note 1: The maximum antenna gain is determined by considering an overall array efficiency [of 50%.]

Agreement

For coverage evaluation of PDSCH in NR NTN, the following payload sizes for PDSCH are assumed:

|  |  |
| --- | --- |
| Payload | value |
| Payload size for PDSCH of SIB1 | Option 1: 800 bits  Option 2: 1280 bits |
| Payload size for PDSCH of SIB19 | 616 bits |

Note: At least the above values are simulated and reported. Other values can be considered.

Note: the values above are not the TBS.

Agreement

For DL coverage study at system level, it is up to companies to report the following parameters for LEO600km Set1-1 FR2:

|  |
| --- |
| Beam size |
| Satellite EIRP density /beam (dBW/MHz) |
| Payload Total DL power level (dBW) |
| Aggregated EIRP (Total) (dBW) |
| Satellite Tx max Gain |
| EIRP per Satellite beam (dBW) |

Agreement

For coverage performance evaluation of DL channels/signals before the SIB19 acquisition, the maximum Doppler frequency drift is assumed to be equal to **0.27** ppm/s based on TR 38.821.

##### 2.1.1.1.2 Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands

**Observation**

To avoid the occurrence of error cases 3 and 4 through network scheduling, there are less resources available for a scheduled HD-FDD RedCap/eRedCap UE in NTN compared to TN when there is TA mismatch between actual TA used by the UE and assumed TA for the UE at the gNB.

**Observation**

For collision cases 1, 2, 5 and 6, when there is TA mismatch between actual TA used by the UE and assumed TA for the UE at the gNB, there might be less resources available for the scheduled HD-FDD RedCap/eRedCap UE in NTN compared to TN if gNB attempts to avoid the collision or there is a loss of DL/UL transmissions due to collision.

**Observation**

When there is TA mismatch between actual TA used by the UE and assumed TA for the UE at the gNB, there may be a BLER performance degradation for the reception of UL transmissions at the gNB for the scheduled HD-FDD RedCap/eRedCap UE in NTN compared to TN if gNB does not attempt to avoid the collision at least in the following cases:

* UL transmission with repetitions due to different available slot counting at UE and gNB when colliding with SSB reception
* PUSCH repetition type B due to different invalid symbol determination at gNB and UE when colliding with DL transmissions
* UL transmission with DMRS bundling due to the different actual TDW determination at gNB and UE when colliding with DL transmissions

Note: the above cases happen at least with one of collision cases 1, 2, 5, 6, and 7.

##### 2.1.1.1.3 NR-NTN uplink capacity/throughput enhancement

Agreement

Support OCC for PUSCH in Rel-19 NR NTN:

* At least PUSCH with Type A repetition
  + FFS PUSCH without Type A repetition for intra-symbol and/or inter-symbol cases
* At least code length 2 or 4, FFS code length 8
* FFS: number of RBs
* Potential OCC techniques listed below are for further down-selection:
  + Inter-slot time-domain OCC with PUSCH repetition Type A
  + Inter-symbol(s) time domain OCC
  + Intra-symbol pre-DFT-s OCC (comb-like structure as in PUCCH format 4)
  + Combinations of OCC techniques
* TBoMS for OCC techniques is FFS

Agreement

RAN1 to at least further study the potential specification aspects on OCC techniques:

* TBS calculation / Rate matching
* UCI multiplexing
* RV cycling across repetitions
* Frequency hopping, e.g. intra /inter slot
* OCC indication/configuration
* Power control
* FFS others aspects

#### 2.1.1.2 Decisions during RAN1#117

##### 2.1.1.2.1 NR-NTN downlink coverage enhancement

**Observation**

Based on LLS results on PDCCH coverage evaluation collected from different sources:

* It is observed that the required SNR for PDCCH is in average equal to -6dB (17 sources)
  + With parameter LEO600km Set1-1 FR1 and 1-2 FR1:
    - 17 sources observed that there is no coverage gap with Set1-1/1-2 FR1.
      * The coverage margin is around 4 dB compared to CNR of -1.9 dB.
  + With parameter LEO600km Set1-3 FR1:
    - 15 sources observed that there is a PDCCH coverage gap of 3.9dB in average compared to CNR of -9.9 dB.
* Note: the results above are obtained independently from the performance of other channels or signals, and it doesn’t imply the successful reception for other channels or signals before or after the detection of PDCCH.

**Observation**

Based on LLS results on PDSCH Msg2 coverage evaluation collected from different sources:

* It is observed that the required SNR for PDSCH carrying Msg2 is in average equal to – 10.9 dB (14 sources)
* With parameter LEO600km Set1-1 FR1 and 1-2 FR1:
  + - 14 sources observed that there is no coverage gap for PDSCH with Msg2:
      * The coverage margin is around 9 dB compared to CNR of -1.9 dB
* With parameter LEO600km Set1-3 FR1:
  + 12 sources observed that there is no coverage gap for PDSCH with Msg2:
    - * The coverage margin is around 1 dB on average compared to CNR of -9.9 dB
* Note: the results above are obtained independently from the performance of other channels or signals, and it doesn’t imply the successful reception for other channels or signals before or after the detection of PDSCH Msg2.

**Observation**

Based on LLS results on PDSCH Msg4 coverage evaluation collected from different sources:

* It is observed that the required SNR for PDSCH carrying Msg4 is in average equal to – 5.2 dB (14 sources)
* With parameter LEO600km Set1-1 FR1 and 1-2 FR1:
  + - 14 sources observed that there is no coverage gap for PDSCH with Msg4:
      * The coverage margin is around 3.3 dB on average compared to CNR of -1.9 dB
* With parameter LEO600km Set1-3 FR1:
  + 11 sources observed that there is a coverage gap for PDSCH with Msg4:
    - The coverage gap is around 4.7 dB on average compared to CNR of -9.9 dB
  + 1 source observed that there is no coverage gap for PDSCH with Msg4 with a coverage margin of 0.3 dB compared to CNR of -9.9 dB
* Note: the results above are obtained independently from the performance of other channels or signals, and it doesn’t imply the successful reception for other channels or signals before or after the detection of PDSCH Msg4.

**Observation**

Based on LLS results on PDSCH SIB1 coverage evaluation collected from different sources:

* For PDSCH carrying SIB1 option 1 (with a payload size of 800bits) it is observed that the required SNR is in average equal to – 5.8 dB (14 sources)
* For PDSCH carrying SIB1 option 2 (with a payload size of 1280bits) it is observed that the required SNR is in average equal to – 3.4 dB (12 sources)
* With parameter LEO600km Set1-1 FR1 and 1-2FR1:
  + 14 sources observed that there is no coverage gap for PDSCH with SIB1 option 1:
    - * The coverage margin is around 3.9 dB on average compared to CNR of -1.9 dB
  + 12 sources observed that there is no coverage gap for PDSCH with SIB1 option 2:
    - * The coverage margin is around 1.5 dB on average compared to CNR of -1.9 dB
* With parameter LEO600km Set1-3 FR1:
  + 11 sources observed that there is a coverage gap for PDSCH with SIB1 option 1:
    - * The coverage gap is around 4.1 dB on average compared to CNR of -9.9 dB
  + 1 source observed that there is no coverage gap for PDSCH with SIB1 option 1:
    - * The coverage margin is 3.4 dB compared to CNR of -9.9 dB
  + 10 sources observed that there is a coverage gap for PDSCH with SIB1 option 2:
    - * The coverage gap is around 6.5 dB on average compared to CNR of -9.9 dB
* Note: some results assumed SIB1 combination (where SIB1 is repeated within 160 ms) and some results assumed no SIB1 combination
* Note: the results above are obtained independently from the performance of other channels or signals, and it doesn’t imply the successful reception for other channels or signals before or after the detection of PDSCH carrying SIB1.

**Observation**

Based on LLS results on PDSCH SIB19 coverage evaluation collected from different sources:

* It is observed that the required SNR for PDSCH carrying SIB19 is in average equal to – 6.9 dB (14 sources)
* With parameter LEO600km Set1-1 FR1 and 1-2 FR1:
  + - 12 sources observed that there is no coverage gap for PDSCH with SIB19:
      * The coverage margin is around 4.2 dB on average compared to CNR of -1.9 dB
* With parameter LEO600km Set1-3 FR1:
  + 10 sources observed that there is a coverage gap for PDSCH with SIB19:
    - * The coverage gap is around 3.5 dB on average compared to CNR of -9.9 dB
* Note: all the results above assumed no SIB19 combination
* Note: the results above are obtained independently from the performance of other channels or signals, and it doesn’t imply the successful reception for other channels or signals before or after the detection of PDSCH carrying SIB19.

**Observation**

Based on the results of DL coverage ratio evaluation at system level collected from 7 sources for all the three LEO600km satellite parameter sets where the beam footprint diameter is 50 km:

* For Set 1-1/1-3, the coverage ratio can be improved from 10% to 100% if the SSB periodicity is increased from 20ms to 80ms and beam hopping is applied
* For Set 1-2, the coverage ratio can be improved from 1.5% to 96.8% if the SSB periodicity is increased from 20ms to 320ms and beam hopping is applied.
* Note: coverage ratio is N2+N3/ total beam footprints
* Note: the baseline assumes no beam hopping. TDM between SIB1 and SIB19 is assumed in those results, following current specs.

Based on the results of DL coverage ratio evaluation at system level collected from 3 sources for a deployment scenario implementing wide beam footprint:

* 1 source reports that with a deployment of wide beam covering 4 narrow (of 50km size) beams, which means Set 1-2 FR1 with additional EIRP reduction of 6dB, using SSB periodicity of 80 ms can provide coverage ratio of 96.8%, and Set 1-1/1-3 FR1 with additional EIRP reduction of 6dB, SSB periodicity of 80 ms can provide coverage of 100%.
* 1 source observed that for Set 1-1, 1-2 and 1-3, the coverage ratio can be improved from 1.5% to 100% using the legacy default SSB periodicity of 20ms during initial access, by choosing a wide beam footprint with beam footprint sizes of 84 km and 56 km respectively.
  + Note: the PDCCH and the PDSCH for SIB19 is assumed to be transmitted within 2 OFDM symbols and 5 MHz bandwidth. the PDSCH for SIB1 is assumed to be transmitted within 3 OFDM symbols and 5 MHz bandwidth. This assumes no SIB1 and SIB19 transmission in N2 beam footprints. This assumes non-aligned SFN timing across different beams.
* 1 source observed, for Set 1-1 with increased beam size, that the legacy SSB periodicity of 20ms during initial access is usable with NTN beam hopping, by choosing a deployment scenario implementing wide beam footprint with beam footprint sizes of 70.7 km and 86.6 km, leading to a total of 529 and 353 beam footprints within the satellite coverage area, respectively, and the coverage ratio is 80% and 90%, respectively, and a ratio of simultaneously active beam footprints to the total number of beam foot prints equal to 20% and 30%.
  + Note: Beam footprint size is increased by increasing only the *adjacent beam spacing* without increasing the 3dB beamwidth.

Note: RAN1 will further investigate the impact of SSB periodicity extension

Note: Any needed clarification “SSB channel enhancement is not considered” in the WID is up to RAN plenary

Note: RAN1 will further investigate the impact of wider beam of SSB and/or other channels on performance (e.g. link budget, capacity...)

**Observation**

Based on LLS results on PDSCH for VoIP coverage evaluation collected from different sources:

* It is observed that the required SNR for PDSCH for VoIP is in average equal to – 11 dB (11 sources)
* With parameter LEO600km Set1-1 and 1-2 FR1:
  + When PDSCH repetition is enabled, 11 sources observed that there is no coverage gap for VoIP:
    - The coverage margin is around 9.1 dB on average, compared to CNR of -1.9 dB
* With parameter LEO600km Set1-3 FR1:
  + When PDSCH repetition is enabled, 9 sources observed that there is no coverage gap for VoIP:
    - The coverage margin is around 2.3 dB on average, compared to CNR of -9.9 dB
  + 1 source observed that even with 8 PDSCH repetitions there is a coverage gap of 1.5 dB compared to CNR of -9.9 dB
* Note: the results above are obtained independently from the performance of other channels or signals, and it doesn’t imply the successful reception for other channels or signals before or after the detection of PDSCH for VoIP.

**Observation**

Based on LLS results on PDSCH 3kbps coverage evaluation collected from different sources:

* It is observed that the required SNR for PDSCH for low data rate is in average equal to – 11 dB (8 sources)
* With parameter LEO600km Set1-1 FR1 and 1-2 FR1:
  + When PDSCH repetition is enabled, 8 sources observed that there is no coverage gap for PDSCH with 3kbp:
  + The coverage margin is around 9.1 dB on average, compared to CNR of -1.9 dB
* With parameter LEO600km Set1-3 FR1:
  + When PDSCH repetition is enabled, 6 sources observed that there is no coverage gap for PDSCH with 3kbp:
  + The coverage margin is around 1.6 dB on average, compared to CNR of -9.9 dB
* Note: the results above are obtained independently from the performance of other channels or signals, and it doesn’t imply the successful reception for other channels or signals before or after the detection of PDSCH 3kbps.

**Observation**

Based on LLS results on PDSCH 1Mbps coverage evaluation collected from different sources:

* It is observed that the required SNR for PDSCH with 1Mbps data rate is in average equal to – 4.1 dB (7 sources)
* With parameter LEO600km Set1-1 FR1 and 1-2 FR1:
  + 7 sources observed that there is no coverage gap for PDSCH with 1Mbps:
  + The coverage margin is around 2.2 dB on average, compared to CNR of -1.9 dB
* With parameter LEO600km Set1-3 FR1:
  + 5 sources observed that, there is a coverage gap for PDSCH with 1Mbps:
  + The coverage gap is around 5.5 dB on average, compared to CNR of -9.9 dB
* Note: the results above are obtained independently from the performance of other channels or signals, and it doesn’t imply the successful reception for other channels or signals before or after the detection of PDSCH 1Mbps.

##### 2.1.1.2.2 Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands

**Conclusion**

For Rel-19 HD-FDD RedCap/eRedCap UE in NTN, the issues caused by TA mismatch between actual TA used by the UE and assumed TA for the UE at the gNB should be mitigated for collision cases 3 and 4.

* Note: further discussion on other cases is not precluded

**Conclusion**

For collision cases 1, 2, 5 and 6, the existing priority rules can be reused for a HD-FDD (e)RedCap UE in NTN.

**Observation**

TA reporting is beneficial to mitigate the TA mismatch between actual TA used by the UE and assumed TA for the UE at the gNB for HD-FDD RedCap/eRedCap UE in NTN from RAN1 perspective.

* Note: complexity, power consumption and signaling overhead impact of TA reporting for (e)redcap UEs was not investigated in this work item

##### 2.1.1.2.3 NR-NTN uplink capacity/throughput enhancement

Agreement

For the normative phase, at least one of the OCC techniques will be specified:

* Inter-slot time-domain OCC with PUSCH repetition Type A with OCC length 2 or 4
* Inter-symbol(s) time domain OCC with OCC length 2 or 4
* Intra-symbol pre-DFT-s OCC (comb-like structure as in PUCCH format 4) with OCC length 2 or 4
* FFS Combination of OCC techniques including multiplexing of 8 UEs
* FFS Use of OCC techniques with TBoMS
* FFS Backward compatibility with non-Rel-19 UEs

**Conclusion**

OCC with PUSCH can support at least multiplexing of 2 or 4 UEs and achieve up to 2 or 4 times capacity gains respectively, when repetitions are used.

Note: the actual gain may be less due to e.g. intra/inter cell interference.

#### 2.1.2 Remaining Open issues

Definition of necessary physical layer features enabling

* NR-NTN downlink coverage enhancement covering both GSO and NGSO constellations operating in FR1-NTN or FR2-NTN
* Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands
* NR-NTN uplink capacity/throughput enhancement

## 2.2 RAN2

#### 2.2.1 Agreements

#### 2.1.1.1 Decisions during RAN2#125bis

##### 2.1.1.1.1 Downlink coverage enhancement

Agreements:

1. With regard to link level enhancement, RAN2 waits for RAN1 agreement on the DL channels to enhance before starting any RAN2 work.

2. We will continue the discussion on RAN2 aspects of DL coverage enhancements (e.g. cell level / beam level DTX/DRX mechanism, etc.) in the next meetings, trying to identify questions to RAN1 for aspects where we need their input

##### 2.1.1.1.2 Uplink capacity/throughput enhancement

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##### 2.1.1.1.3 Support of Broadcast

Agreements:

1. For MBS broadcast service we don’t restrict the work to any satellite constellation type

2. We prioritize working on a solution for MBS broadcast but we don’t preclude other broadcast services, namely ETWS

3. We will cover at least the case where the indicated intended service area covers a portion of a NTN cell

4. The intended service area can cover the area of more than one NTN cells (or portions thereof)

5. Can discuss next time whether the broadcast transmission can be limited to the intended service area only (i.e. no transmission happens outside of the intended serive area)

6. At least the following geographical area formats to model service area can be further considered (the signalling of other information than the geographical information can be considered):

- Circles (like for TN coverage)

- Geographical area information, e.g. via polygons, to better approximate the intended shape of service area

##### 2.1.1.1.4 Support of Regenerative payload

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#### 2.1.1.2 Decisions during RAN2#126

##### 2.1.1.2.1 Downlink coverage enhancement

Agreements;

1. Based on the solution being investigated in RAN1, RAN2 will further discuss whether/how legacy UEs might operate in a cell supporting DL coverage enhancements.

2. RAN2 assumes that both EFC and EMC are supported

##### 2.1.1.2.2 Uplink capacity/throughput enhancement

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##### 2.1.1.2.3 Support of Broadcast

Agreements:

1. For MBS broadcast service, both EFC and EMC are supported.

2. RAN2 will not define means for the NW to prevent the reception of the content of the service outside of the intended service area.

3. MBS broadcast intended service area is provided via system information

4. For MBS broadcast RAN2 considers the following possibilities for including the service area information: SIB20/ SIB21/ MBSBroadcastConfiguration. FFS for ETWS

5. When intended service area (e.g., geographical area/TN coverage) is provided for MBS broadcast service, it needs to be associated with MBS session (FFS on the details)

##### 2.1.1.2.4 Support of Regenerative payload

Agreements:

1. Regarding potential issues with RRC re-establishment, RAN2 will wait for RAN3 input, if any

2. Regarding potential issues with support of Inactive state, RAN2 will wait for RAN3 input, if any

3. RAN2 aims at supporting RACH-less handover for regenerative architecture. Can further discuss whether any optimization is needed

4. RAN2 assumes that network verified UE positioning is supported for regenerative architecture

5. RAN2 assumes that the typical setting for common TA and kmac would be zero in case of regenerative mode with full gNB on board. FFS whether we capture in the spec that common TA and Kmac shall/should be set to zero.

#### 2.2.2 Remaining Open issues

Definition of necessary access layer features enabling

* NR-NTN downlink coverage enhancement covering both GSO and NGSO constellations operating in FR1-NTN or FR2-NTN
* NR-NTN uplink capacity/throughput enhancement
* Support of Broadcast
* Support of regenerative payload

## 2.3 RAN3

#### 2.3.1 Agreements

#### 2.3.1.1 Decisions during RAN3#123bis

##### 2.3.1.1.1 Support MBS Broadcast service

**RAN3 starts work on MBS broadcast service.**

##### 2.3.1.1.2 Support of Regenerative payload

**There is no consensus to discuss new NTN architecture now; wait for an LS from SA2 on this particular issue.**

**Technical discussion based on current architecture can be discussed in next meeting.**

#### 2.3.1.2 Decisions during RAN3#124

##### 2.3.1.2.1 Support MBS Broadcast service

**WA: The mapped cell ID can be used to define MBS broadcast service in NTN.**

##### 2.3.1.2.2 Support of Regenerative payload

Regenerative Payload Architecture is decided and captured in the BL CR:

* R3-243949 Support for Regenerative Payload in NR NTN (Ericsson, Thales, Deutsche Telekom, Nokia, ESA, CATT, ZTE, Sateliot, Huawei) draftCR

For the incoming LS S2-2405600/R3-243017 on Support of Regenerative-based Satellite Access. RAN3 discussed and replied the LS to SA2, as below:

* R3-243954 Reply LS on Support of Regenerative-based Satellite Access, RAN3(ZTE) To: SA2; Cc: RAN2

For the incoming LS (R3-243023) on Security of IP transport over satellite transport links. RAN3 discussed and replied the LS to SA2 and SA3, as below:

* R3-243955 Reply LS on security of IP transport over satellite transport links, RAN3(Ericsson) To: SA2, SA3

#### 2.3.2 Remaining Open issues

Definition of necessary RAN architecture enhancements enabling

* Support of Broadcast:
  + Confirm the Working Assumption on using mapped Cell ID.
  + The other options can be further checked, e.g. GNSS description.
* Support of regenerative payload:
  + Further discuss solutions for NG maintance, e.g. NG Setup/Removal, Suspend/Resume.
  + The other issues/enhancements to Xn/NG, if any, to be further discussed, e.g. Supported TAI list update over NG, potential Xn enhancement for mobility.

## 2.4 RAN4

#### 2.4.1 Agreements

#### 2.4.1.1 Decisions during RAN4#110bis

##### 2.4.1.1.1 UE RF requirements

**Issue 1-1: Work plan for RF Core part, UE RF impact from DL coverage enhancement and regenerative payload**

**Agreement:**

* Wait for RAN1 progress before concluding whether there is RAN4 spec impact.

**Issue 1-2: Work plan for RF Core part, UL capacity enhancements (OCC)**

**Agreement:**

* Wait for RAN1 progress before concluding whether there is RAN4 spec impact.

**Issue 1-3: Work plan for RF Core part, HD-FDD RedCap**

**Agreement:**

* Start the discussions on the RF requirements for NTN RedCap with HD-FDD in the next meeting.

**Issue 1-4: Work plan for RF Core part, 1Rx vs. 2Rx for RedCap**

**Agreement:**

* Consider both 1Rx and 2Rx for requirements

**Issue 1-5: Work plan for RF Core part, eRedCap BW reduction**

**Agreement:**

* Specify both variants, i.e. with and without bandwidth reduction

**Issue 2-1: Target power class**

**Agreement:**

* Target power class is PC3.

**Issue 2-2: Channel bandwidts and SCS**

**Agreement:**

* Adopt the same bandwidth as well as SCS as TN RedCap and TN eRedCap UE.

**Issue 2-4: Operating bands**

**Agreement:**

* All the NR-NTN FR1-NTN bands will be considered.

**Issue 2-5: 2 Rx FD-FDD Refsens**

**Agreement:**

* Re-use non-RedCap NTN UE refsens for 2Rx FD-FDD NTN (e)RedCap UE

Documents approved

* R4-2406610 “WF on NR\_NTN\_Ph3\_UERF” Qualcomm
* R4-2406109 “Way Forward for [110bis][315] NR\_NTN\_Ph3” Thales

##### 2.4.1.1.2 SAN RF requirements

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#### 2.4.1.2 Decisions during RAN4#111

##### 2.4.1.2.1 UE RF requirements

**Issue 1-1: UL RB allocation for HD-FDD Refsens, both for 1Rx and 2Rx**

**Agreement:**

* Full allocation.

**Issue 1-2: HD-FDD refsens for 2 Rx**

**Agreement:**

* [0.5] dB tightening for n254 and n256, FFS on n255

**Issue 1-3: HD-FDD refsens for 1 Rx**

**Agreement:**

* 2.5 dB relaxation compared to 2Rx HD-FDD

Documents approved

* R4-2410574 “WF on Rel-19 phase 3 NR-NTN UE RF requirements” Qualcomm

##### 2.4.1.2.2 SAN RF requirements

Documents approved or endorsed

* R4-2410007 “Draft CR to TS 38.108: Introduction of regenerative payload” Huawei, HiSilicon
* R4-2410009 “Way Forward for [111][315] NR\_NTN\_Ph3” Thales

#### 2.4.2 Remaining Open issues

Definition of RF and RRM requirements enabling

* NR-NTN downlink coverage enhancement covering both GSO and NGSO constellations operating in FR1-NTN or FR2-NTN
* NR-NTN uplink capacity/throughput enhancement
* Support of regenerative payload
* Support of Rel-17 RedCap and Rel-18 eRedCap UEs with NR NTN operating in FR1-NTN bands

## 3. Detailed progress in SA/CT WGs since last TSG meeting (for all involved WGs)

NOTE: This section only needs to be filled in for WI/SIs where there is a corresponding relevant WI/SI in SA/CT.

## 3.1 SA2

#### 3.1.1 Agreements with cross-TSG impacts

#### 3.1.2 Remaining Open issues with cross-TSG impacts

NOTE: This section should also flag any critical dependencies that need TSG attention.

## 4. References

## 4.1 RAN1

**RAN2#116bis meeting, Changsha, China, April 15 - 19, 2024:**

* R1-2401990 Work Plan Work plan for Rel-19 NR\_NTN\_Ph3 THALES
* R1-2403666 other Session notes for 9.11 (Non-Terrestrial Networks for NR Phase 3 and Internet of Things Phase 3) Ad-Hoc Chair (Huawei)
* R1-2403412 discussion Downlink Coverage Enhancements for NR NTN CEWiT
* R1-2403403 discussion On the SAN phased-array antenna characteristics ESA
* R1-2403387 discussion Discussion on NR-NTN DL coverage enhancement Inmarsat, Viasat
* R1-2403283 discussion NR-NTN Downlink Coverage Enhancement Panasonic
* R1-2401991 discussion FL Summary #1: NR-NTN downlink coverage enhancements THALES
* R1-2401992 discussion FL Summary #2: NR-NTN downlink coverage enhancements THALES
* R1-2401993 discussion FL Summary #3: NR-NTN downlink coverage enhancements THALES
* R1-2401988 discussion Discussion on NR NTN Downlink coverage enhancements THALES
* R1-2402003 discussion Discussion on downlink coverage enhancements for NR NTN Huawei, HiSilicon
* R1-2402078 discussion On NR-NTN downlink coverage enhancement Ericsson
* R1-2402259 discussion Discussion on NR-NTN downlink coverage enhancement vivo
* R1-2402120 discussion Discussion on NR-NTN downlink coverage enhancement Spreadtrum Communications
* R1-2402173 discussion NR-NTN downlink coverage enhancement InterDigital, Inc.
* R1-2402343 discussion Discussion on NR-NTN downlink coverage enhancement OPPO
* R1-2402483 discussion Discussion on downlink coverage enhancement for NR-NTN Samsung
* R1-2402372 discussion Performance evaluation of downlink coverage enhancement for NR NTN CATT
* R1-2402286 discussion Downlink Coverage Enhancement for NR NTN Google
* R1-2402580 discussion Discussion on NR-NTN DL coverage enhancement CMCC
* R1-2402934 discussion Discussion on NR-NTN downlink coverage enhancement MediaTek
* R1-2402916 discussion NR-NTN downlink coverage enhancement with beam groups Sharp
* R1-2402902 discussion On NR-NTN Downlink Coverage Enhancement Apple
* R1-2403029 discussion Discussion on NR-NTN downlink coverage enhancement ETRI
* R1-2403067 discussion Downlink Coverage Enhancements for NR NTN CEWiT
* R1-2403258 discussion Discussion on DL coverage enhancement for NR-NTN NTT DOCOMO, INC.
* R1-2403211 discussion Downlink coverage enhancement for NR NTN Qualcomm Incorporated
* R1-2403139 discussion Discussion on DL coverage enhancements for NR-NTN NICT
* R1-2403080 discussion Downlink coverage enhancements for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2402772 discussion NR-NTN downlink coverage enhancement NEC
* R1-2402752 discussion Discussion on downlink coverage enhancement for NR NTN Baicells
* R1-2402811 discussion Discussion on NR-NTN downlink coverage enhancement LG Electronics
* R1-2402845 discussion Discussion on downlink coverage enhancement for NR-NTN CSCN
* R1-2402589 discussion Discussion on downlink coverage enhancement for NR NTN Lenovo
* R1-2402655 discussion Discussion on NR-NTN downlink coverage enhancement Xiaomi
* R1-2402622 discussion Discussion on DL coverage enhancement for NR NTN ZTE
* R1-2402623 discussion Discussion on support of RedCap/eRedCap UEs for NR NTN ZTE
* R1-2402656 discussion Discussion on the support of Redcap UE for NTN operating on FR1 bands Xiaomi
* R1-2402729 discussion Discussion on support of RedCap/eRedCap UEs in NR NTN Honor
* R1-2402812 discussion Discussion on support of (e)RedCap UEs with NR-NTN operating in FR1-NTN bands LG Electronics
* R1-2403081 discussion Considerations for RedCap HD-FDD operation for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2403212 discussion Support of Redcap and eRedcap UEs in NR NTN Qualcomm Incorporated
* R1-2403259 discussion Discussion on support of RedCap and eRedCap UEs in FR1-NTN NTT DOCOMO, INC.
* R1-2403039 discussion Discussion on HD-FDD RedCap UEs and eRedCap UEs for FR1-NTN TCL
* R1-2403004 discussion On HD-FDD Redcap UEs for NTN Ericsson
* R1-2403030 discussion Discussion on HD UEs with NR NTN ETRI
* R1-2402903 discussion On support of RedCap UEs with NR NTN operation Apple
* R1-2402935 discussion Discussion on support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands MediaTek
* R1-2402581 discussion Discussion on the collision issues of HD-FDD Redcap UE in FR1-NTN CMCC
* R1-2402524 discussion Discussion on Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands China Telecom
* R1-2402373 discussion Discussion on the operation of RedCap and eRedCap UEs In NTN CATT
* R1-2402484 discussion Discussion on support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Samsung
* R1-2402344 discussion Discussion on supporting of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands OPPO
* R1-2402174 discussion Discussion on half-duplex RedCap issues for NTN FR1 operation InterDigital, Inc.
* R1-2402121 discussion Discussion on support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Spreadtrum Communications
* R1-2402260 discussion Discussion on support of RedCap and eRedCap UEs with NR-NTN vivo
* R1-2402004 discussion Discussion on HD-FDD RedCap UEs and eRedCap UEs for FR1-NTN Huawei, HiSilicon
* R1-2403161 discussion Discussion on support of RedCap/eRedCap UEs in NTN CAICT
* R1-2403787 discussion Summary #3 for Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Moderator (CATT)
* R1-2403633 discussion Summary #1 for Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Moderator (CATT)
* R1-2403743 discussion Summary #2 for Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Moderator (CATT)
* R1-2403721 discussion Feature lead summary #3 of AI 9.11.3 on NR-NTN uplink capacity and throughput Moderator (MediaTek)
* R1-2403388 discussion Discussion on NR-NTN UL capacity-throughput enhancements Inmarsat, Viasat
* R1-2403422 discussion Feature lead summary #1 of AI 9.11.3 on NR-NTN uplink capacity and throughput Moderator (MediaTek)
* R1-2403423 discussion Feature lead summary #2 of AI 9.11.3 on NR-NTN uplink capacity and throughput Moderator (MediaTek)
* R1-2403402 discussion Views on NR-NTN PUSCH capacity enhancement Mitsubishi Electric RCE
* R1-2402005 discussion Discussion on uplink capacity/throughput enhancement for FR1-NTN Huawei, HiSilicon
* R1-2402261 discussion Discussion on NR-NTN uplink capacity enhancement vivo
* R1-2402122 discussion Discussion on NR-NTN uplink capacity/throughput enhancement Spreadtrum Communications
* R1-2402175 discussion NR-NTN uplink capacity/throughput enhancement InterDigital, Inc.
* R1-2402345 discussion Discussion on NR-NTN uplink capacity/throughput enhancement OPPO
* R1-2402485 discussion Discussion on uplink capacity/throughput enhancement for NR-NTN Samsung
* R1-2402374 discussion Discussion on UL capacity enhancement for NR NTN CATT
* R1-2402287 discussion Uplink Capacity Enhancement for NR NTN Google
* R1-2402525 discussion Discussion on NR-NTN uplink enhancement China Telecom
* R1-2402534 discussion Discussion on Uplink Capacity/Throughput Enhancement for NR-NTN Langbo
* R1-2402582 discussion Discussion on the NR-NTN uplink capacity/throughput enhancements CMCC
* R1-2402936 discussion Discussion on NR-NTN uplink capacity and throughput MediaTek
* R1-2402904 discussion On NR-NTN Uplink Capacity Enhancement Apple
* R1-2403031 discussion Discussion on NR-NTN uplink capacity/throughput enhancement ETRI
* R1-2402995 discussion Uplink capacity/throughput enhancement for NR-NTN Panasonic
* R1-2403040 discussion Discussion on NR-NTN uplink capacity/throughput enhancement TCL
* R1-2403260 discussion Discussion on NR-NTN uplink capacity/throughput enhancement NTT DOCOMO, INC.
* R1-2403213 discussion NR-NTN uplink capacity - throughput enhancement Qualcomm Incorporated
* R1-2403082 discussion Uplink capacity enhancement considerations for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2403077 discussion Discussion on uplink capacity/throughput enhancement for NR-NTN Lenovo
* R1-2403140 discussion Discussion on NR-NTN uplink capacity/throughput enhancement NICT
* R1-2402813 discussion Discussion on NR-NTN uplink capacity/throughput enhancement LG Electronics
* R1-2402773 discussion NR-NTN uplink capacity/throughput enhancement NEC
* R1-2402657 discussion Discussion on NR-NTN PUSCH capacity enhancement Xiaomi
* R1-2402624 discussion Discussion on UL capacity enhancement for NR NTN ZTE
* R1-2402594 discussion On uplink capacity/throughput enhancement for NR NTN Ericsson

**RAN2#117 meeting, Fukuoka city, Japan, May 20 - 24, 2024:**

* R1-2404205 Work Plan Work plan for Rel-19 NR\_NTN\_Ph3 THALES
* R1-2404201 discussion Discussion on NR NTN Downlink coverage enhancements THALES
* R1-2404202 discussion FL Summary #1: NR-NTN downlink coverage enhancements THALES
* R1-2404203 discussion FL Summary #2: NR-NTN downlink coverage enhancements THALES
* R1-2404204 discussion FL Summary #3: NR-NTN downlink coverage enhancements THALES
* R1-2404214 discussion Discussion on DL coverage enhancement for NR NTN ZTE
* R1-2404194 discussion Discussion on NR-NTN downlink coverage enhancement vivo
* R1-2404307 discussion Discussion on NR-NTN Downlink Coverage Enhancement Apple
* R1-2404261 discussion NR-NTN downlink coverage enhancement InterDigital, Inc.
* R1-2404471 discussion Discussion on NR-NTN DL coverage enhancement CMCC
* R1-2404390 discussion Performance evaluation of downlink coverage enhancement for NR NTN CATT
* R1-2404323 discussion Discussion on NR-NTN downlink coverage enhancement LG Electronics
* R1-2404132 discussion Discussion on downlink coverage enhancement for NR-NTN Samsung
* R1-2404041 discussion Discussion on NR-NTN downlink coverage enhancement Spreadtrum Communications
* R1-2403993 discussion Further considerations on FR2-NTN analysis assumptions Eutelsat Group
* R1-2404003 discussion Discussion on downlink coverage enhancements for NR NTN Fraunhofer IIS, Fraunhofer HHI
* R1-2403989 discussion On NR-NTN downlink coverage enhancement Ericsson
* R1-2403938 discussion Discussion on downlink coverage enhancements for NR NTN Huawei, HiSilicon
* R1-2404670 discussion NR-NTN downlink coverage enhancement NEC
* R1-2404692 discussion Downlink Coverage Enhancement for NR NTN Google
* R1-2405057 discussion Discussion on DL coverage enhancement for NR-NTN NTT DOCOMO, INC.
* R1-2405172 discussion Downlink coverage enhancement for NR NTN Qualcomm Incorporated
* R1-2405090 discussion Discussion on NR-NTN downlink coverage enhancement MediaTek Inc.
* R1-2404694 discussion Beam group for NR-NTN downlink coverage enhancement Sharp
* R1-2404607 discussion Discussion on NR-NTN downlink coverage enhancement Xiaomi
* R1-2404861 discussion Discussion on NR-NTN downlink coverage enhancement OPPO
* R1-2404916 discussion Discussion on NR NTN Downlink Coverage Enhancements IIT Kharagpur, CEWIT
* R1-2404441 discussion Discussion on downlink coverage enhancement for NR NTN Lenovo
* R1-2404789 discussion Discussion on downlink coverage enhancement for NR NTN Baicells
* R1-2404784 discussion Discussion on NR-NTN downlink coverage enhancement ETRI
* R1-2405117 discussion NR-NTN Downlink Coverage Enhancement Panasonic
* R1-2405226 discussion Discussion on DL coverage enhancements for NR-NTN NICT
* R1-2405251 discussion Downlink Coverage Enhancements for NR NTN CEWiT
* R1-2405257 discussion Discussion on downlink coverage enhancement for NR-NTN CSCN
* R1-2405263 discussion Downlink coverage enhancements for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2405342 discussion Discussion on NR NTN Downlink coverage enhancements THALES, Magister
* R1-2405421 discussion Discussion on downlink coverage enhancements for NR NTN Huawei, HiSilicon
* R1-2405516 discussion Summary #1 for Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Moderator (CATT)
* R1-2405517 discussion Summary #2 for Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Moderator (CATT)
* R1-2405264 discussion Considerations on (e)RedCap operation in NR over NTN Nokia, Nokia Shanghai Bell
* R1-2404785 discussion Discussion on HD UEs with NR NTN ETRI
* R1-2404736 discussion Discussion on HD-FDD RedCap UEs and eRedCap UEs for FR1-NTN TCL
* R1-2404725 discussion Discussion on support of RedCap/eRedCap UEs in NTN CAICT
* R1-2404862 discussion Discussion on supporting of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands OPPO
* R1-2404608 discussion Discussion on the support of Redcap UE for NTN operating on FR1 bands Xiaomi
* R1-2404580 discussion Discussion on support of RedCap/eRedCap UEs in NR NTN HONOR
* R1-2404533 discussion On HD-FDD Redcap UEs for NTN Ericsson
* R1-2405091 discussion Discussion on support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands MediaTek Inc.
* R1-2405173 discussion Support of Redcap and eRedcap UEs in NR NTN Qualcomm Incorporated
* R1-2405058 discussion Discussion on support of RedCap and eRedCap UEs in FR1-NTN NTT DOCOMO, INC.
* R1-2403939 discussion Discussion on HD-FDD RedCap UEs and eRedCap UEs for FR1-NTN Huawei, HiSilicon
* R1-2404042 discussion Discussion on support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Spreadtrum Communications
* R1-2404133 discussion Discussion on support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Samsung
* R1-2404324 discussion Discussion on support of (e)RedCap UEs with NR-NTN operating in FR1-NTN bands LG Electronics
* R1-2404391 discussion Discussion on the operation of RedCap and eRedCap UEs In NTN CATT
* R1-2404472 discussion Discussion on the collision issues of HD-FDD Redcap UE in FR1-NTN CMCC
* R1-2404438 discussion Discussion on Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands China Telecom
* R1-2404262 discussion Discussion on half-duplex RedCap issues for NTN FR1 operation InterDigital, Inc.
* R1-2404308 discussion Discussion on support of RedCap UEs with NR NTN operation Apple
* R1-2404195 discussion Discussion on support of RedCap and eRedCap UEs with NR-NTN vivo
* R1-2404215 discussion Discussion on support of RedCap/eRedCap UEs for NR NTN ZTE
* R1-2404216 discussion Discussion on UL capacity enhancement for NR NTN ZTE
* R1-2404196 discussion Discussion on NR-NTN uplink capacity enhancement vivo
* R1-2404309 discussion Discussion on NR-NTN Uplink Capacity Enhancement Apple
* R1-2404263 discussion NR-NTN uplink capacity/throughput enhancement InterDigital, Inc.
* R1-2404439 discussion Discussion on NR-NTN uplink enhancement China Telecom
* R1-2404473 discussion Discussion on the NR-NTN uplink capacity/throughput enhancements CMCC
* R1-2404392 discussion Discussion on UL capacity enhancement for NR NTN CATT
* R1-2404325 discussion Discussion on NR-NTN uplink capacity/throughput enhancement LG Electronics
* R1-2404319 discussion NTN NR uplink capacity enhancement Sharp
* R1-2404315 discussion Views on NR-NTN PUSCH capacity enhancement Mitsubishi Electric RCE
* R1-2404134 discussion Discussion on uplink capacity/throughput enhancement for NR-NTN Samsung
* R1-2404043 discussion Discussion on NR-NTN uplink capacity/throughput enhancement Spreadtrum Communications
* R1-2403940 discussion Discussion on uplink capacity/throughput enhancement for FR1-NTN Huawei, HiSilicon
* R1-2405059 discussion Discussion on NR-NTN uplink capacity/throughput enhancement NTT DOCOMO, INC.
* R1-2404693 discussion Uplink Capacity Enhancement for NR NTN Google
* R1-2404671 discussion NR-NTN uplink capacity/throughput enhancement NEC
* R1-2405174 discussion NR-NTN uplink capacity / throughput enhancement Qualcomm Incorporated
* R1-2405092 discussion Discussion on NR-NTN uplink capacity and throughput MediaTek Inc.
* R1-2405011 discussion Uplink capacity/throughput enhancement for NR-NTN Panasonic
* R1-2404976 discussion Discussion on the NR-NTN uplink capacity/throughput enhancements TCL
* R1-2404609 discussion Discussion on NR-NTN PUSCH capacity enhancement Xiaomi
* R1-2404863 discussion Discussion on NR-NTN uplink capacity/throughput enhancement OPPO
* R1-2404418 discussion On uplink capacity/throughput enhancement for NR NTN Ericsson
* R1-2404786 discussion Discussion on NR-NTN uplink capacity/throughput enhancement ETRI
* R1-2404801 discussion Discussion on uplink capacity/throughput enhancement for NR-NTN Lenovo
* R1-2404806 discussion Discussion on uplink capacity/throughput enhancement for FR1-NTN Fujitsu
* R1-2405265 discussion Uplink capacity enhancement considerations for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2405227 discussion Discussion on NR-NTN uplink capacity/throughput enhancement NICT
* R1-2405506 discussion Feature lead summary #1 of AI 9.11.3 on NR-NTN uplink capacity and throughput Moderator (MediaTek)
* R1-2405507 discussion Feature lead summary #2 of AI 9.11.3 on NR-NTN uplink capacity and throughput Moderator (MediaTek)
* R1-2405550 discussion Discussion on uplink capacity/throughput enhancement for FR1-NTN Huawei, HiSilicon

## 4.2 RAN2

**RAN2#125bis meeting, Changsha, China, April 15 - 19, 2024:**

* R2-2402357 Work Plan Work plan for Rel-19 NR\_NTN\_Ph3 CATT, Thales
* R2-2403638 discussion NR NTN phase 3 scope Ericsson
* R2-2402219 discussion RAN2 Aspects For Downlink Coverage Enhancements vivo
* R2-2402547 discussion Downlink coverage enhancement for NR NTN CMCC,CSPG
* R2-2402702 discussion Discussion on downlink coverage enhancements for NTN Xiaomi
* R2-2402712 discussion Network energy saving for downlink coverage enhancement in NTN Lenovo
* R2-2402805 discussion Downlink Coverage Enhancement Samsung
* R2-2402825 discussion Discussion on downlink coverage enhancements Huawei, HiSilicon, Turkcell
* R2-2402883 discussion DL coverage enhancement in NTN Apple
* R2-2403034 discussion DL coverage enhancements Nokia, Nokia Shanghai Bell
* R2-2403071 discussion Consideration on downlink coverage enhancements ZTE Corporation, Sanechips
* R2-2403276 discussion Discussion on RAN2 Aspects for Downlink Coverage Enhancements in NR NTN evolution THALES
* R2-2403319 discussion Downlink coverage enhancement for NTN InterDigital
* R2-2403649 discussion Discussion for DL coverage enhancement Sharp
* R2-2402152 discussion Signaling of indicating service area in NR NTN China Telecom
* R2-2402199 discussion Discussion on providing MBS service area in NTN network OPPO
* R2-2402220 discussion Discussion on MBS Broadcast Provision in NTN vivo
* R2-2402280 discussion Discussions on signaling of the intended service area of a broadcast service Fujitsu
* R2-2402284 discussion Discussion on the support of broadcast service in NTN ETRI
* R2-2402355 discussion Discussion on support of broadcast service via NR NTN CATT, China Broadnet
* R2-2402544 discussion Discussion on MBS broadcast enhancements for NTN CMCC
* R2-2402695 discussion Discussion on the support of Broadcast service HONOR
* R2-2402708 discussion Discussion on MBS service in NTN system CAICT
* R2-2402713 discussion On support of MBS broadcast in NTN Lenovo
* R2-2402806 discussion MBS Broadcast Service Area in NTN Samsung
* R2-2402807 discussion MBS broadcast service area information Qualcomm Incorporated
* R2-2402826 discussion Discussion on MBS over NTN Huawei, HiSilicon, Turkcell
* R2-2402833 discussion Discussion on the service area of a broadcast service Xiaomi
* R2-2402884 discussion Broadcast service support over NTN Apple
* R2-2403072 discussion Consideration on broadcast service enhancements ZTE Corporation, Sanechips
* R2-2403093 discussion Discussion on MBS Broadcasting Control over NTN access TCL
* R2-2403121 discussion Discussion on support of broadcast service in NTN LG Electronics France
* R2-2403275 discussion Discussion on MBS broadcast additional features for NR NTN Evolution THALES
* R2-2403306 discussion On MBS Service Area Signalling in Rel-19 NTN Nokia
* R2-2403320 discussion Support for broadcast service in NTN InterDigital
* R2-2403587 discussion Discussion on support of broadcast service ITL
* R2-2403648 discussion Discussion on Intended Service Area for NTN-MBS NTT DOCOMO INC.
* R2-2403650 discussion Discussion on MBS service support for NR NTN Sharp
* R2-2402153 discussion Stage-2 impact of regenerative payload in NR NTN China Telecom
* R2-2402196 discussion Discussion on stage-2 update on the support of regenerative payload OPPO
* R2-2402356 discussion Discussion on support of regenerative payload in Rel-19 NR NTN CATT, China Broadnet
* R2-2402714 discussion On support of regenerative payload in NTN Lenovo
* R2-2402808 discussion Discussion on regenerative payload Qualcomm Incorporated
* R2-2402818 discussion Support of regenerative payload NEC
* R2-2403092 discussion Discussion on Regenerative NTN Architecture TCL
* R2-2403409 discussion Discussion on Regenerative NTN Payload Architecture TCL
* R2-2403606 discussion Regenerative NTN payload support in NR NTN Evolution THALES, CATT, Huawei, ZTE, Inmarsat, Viasat
* R2-2403639 discussion Stage 2 updates for regenerative payload Ericsson

**RAN2#126 meeting, Fukuoka city, Japan, May 20 - 24, 2024:**

* R2-2404137 LS in LS on Support of Regenerative-based Satellite Access (S2-2405600; contact: vivo) SA2
* R2-2404207 Work Plan Updated work plan for NR NTN Ph3 CATT, Thales
* R2-2404204 discussion Discussion on downlink coverage enhancements CATT
* R2-2404159 discussion Discussion on Downlink Coverage Enhancements vivo
* R2-2404354 discussion Discussions on beam and cell level DTX DRX Fujitsu
* R2-2404582 discussion Discussion on DL coverage enhancement in NTN OPPO
* R2-2404739 discussion Discussion on system level enhancement for downlink coverage enhancements for NTN Xiaomi
* R2-2404654 discussion DL coverage enhancement in NTN Apple
* R2-2404682 discussion Discussion on cell DTX/DRX Qualcomm Incorporated
* R2-2404797 discussion Downlink coverage enhancement in NTN Lenovo
* R2-2405081 discussion Consideration on downlink coverage enhancements ZTE Corporation, Sanechips
* R2-2405229 discussion On the applicability of downlink coverage enhancements Nokia, Nokia Shanghai Bell
* R2-2405240 discussion Discussion on RAN2 Aspects for Downlink Coverage Enhancements in NR NTN evolution THALES
* R2-2405124 discussion Discussion on DL coverage enhancements Huawei, HiSilicon, Turkcell
* R2-2405173 discussion Discussion on Downlink Coverage Enhancement Samsung
* R2-2405299 discussion Questions identified to RAN1 on Downlink Coverage Enhancement CMCC
* R2-2405312 discussion Downlink Coverage in NR NTN China Telecom
* R2-2405320 discussion Consideration on downlink coverage enhancement NEC Corporation.
* R2-2405375 discussion Downlink coverage enhancement for NTN InterDigital
* R2-2405376 LS out [Draft] LS on DL coverage enhancements InterDigital
* R2-2405449 discussion Downlink coverage enhancements Ericsson
* R2-2405600 discussion Downlink coverage enhancements for NTN NERCDTV
* R2-2405613 discussion Downlink coverage enhancements for NTN NERCDTV
* R2-2405636 discussion Discussion on downlink coverage enhancements in NR NTN ETRI
* R2-2405626 discussion Discussion for DL coverage enhancement Sharp
* R2-2405627 discussion Discussion on MBS service support for NR NTN Sharp
* R2-2405525 discussion Discussion on support of broadcast service ITL
* R2-2405377 discussion Support for broadcast service in NTN InterDigital
* R2-2405277 discussion Clarification on intended service area NEC Telecom MODUS Ltd.
* R2-2405147 discussion On the Signalling Aspects of MBS over Rel-19 NR NTN Nokia
* R2-2405211 discussion Discussion on support of broadcast service in NTN LG Electronics France
* R2-2405174 discussion Discussion on Broadcast Service Area in NTN Samsung
* R2-2405125 discussion Discussion on supporting MBS broadcast over NTN Huawei, HiSilicon, Turkcell
* R2-2405239 discussion Discussion on MBS broadcast additional features for NR NTN Evolution THALES
* R2-2405204 discussion Discussions on MBS in Rel-19 NTN TOYOTA Info Technology Center
* R2-2404982 discussion Discussion on the support of broadcast service HONOR
* R2-2405082 discussion Consideration on broadcast service enhancements ZTE Corporation, Sanechips
* R2-2405099 discussion Discussion on the service area of a broadcast service Xiaomi
* R2-2404853 discussion Discussions on the configuration of intended service areas ITRI
* R2-2404854 discussion Discussions on limiting broadcast service in the intended service areas ITRI
* R2-2405020 discussion Support of MBS broadcast service for NTN CMCC
* R2-2404798 discussion On broadcast service area indication in NTN Lenovo
* R2-2404916 discussion Broadcast service area signaling Sony
* R2-2404841 discussion Support for broadcast services in NR NTN Ericsson
* R2-2404679 discussion MBS broadcast service area information Qualcomm Incorporated
* R2-2404655 discussion Broadcast service support over NTN Apple
* R2-2404621 discussion Discussion on MBS Broadcasting Control over NTN access TCL
* R2-2404580 discussion Discussion on providing MBS service area in NTN network OPPO
* R2-2404429 discussion Discussion on support of broadband services Continental Automotive
* R2-2404355 discussion Discussions on signaling of the intended service area of a broadcast service Fujitsu
* R2-2404282 discussion Discussion on support of a broadcast service in NR NTN ETRI
* R2-2404160 discussion Discussion on MBS Broadcast Provision in NTN vivo
* R2-2404206 discussion Discussion on support of broadcast service via NR NTN CATT
* R2-2404205 discussion Further discussion on regenerative payload CATT
* R2-2404161 discussion Discussion on Mobility with Regenerative Payload vivo
* R2-2404256 discussion Further discussion on regenerative payload for satellite switch with resync NTU
* R2-2404622 discussion Discussion on Support of NTN Regenerative Architecture TCL
* R2-2404590 discussion Discussion on satellite switch with resynch for regenerative payload OPPO
* R2-2404680 discussion Discussion on regenerative payload Qualcomm Incorporated
* R2-2404917 discussion Satellite switch with re-sync in regenerative payload Sony
* R2-2404799 discussion Considerations on regenerative payload in NTN Lenovo
* R2-2405021 discussion Support of regenerative payload CMCC
* R2-2405100 discussion Discussion on the support of regenerative payload Xiaomi
* R2-2405083 discussion Consideration on support of regenerative payload ZTE Corporation, Sanechips
* R2-2405196 discussion Support Regenerative Payload NEC
* R2-2405241 discussion Regenerative NTN payload support in NR NTN Evolution THALES
* R2-2405148 discussion On the feasibility of the existing NTN features over regenerative architecture Nokia
* R2-2405126 discussion Discussion on support of regenerative payload Huawei, HiSilicon, Turkcell
* R2-2405156 discussion Regenerative payload for NR NTN Samsung
* R2-2405313 discussion Stage-2 updates for regenerative payload China Telecom
* R2-2405448 discussion Stage 2 updates for regenerative payload Ericsson
* R2-2405629 discussion Discussion for regenerative payload Sharp

## 4.3 RAN3

**RAN3#123bis meeting, Changsha, China, April 15 - 19, 2024:**

* R3-241930 Work Plan Work plan for Rel-19 NR\_NTN\_Ph3 CATT, Thales
* R3-241908 other (TP for TS 38.413 and TS 38.300) Support MBS broadcast service Huawei
* R3-242080 discussion Discussion on NTN MBS supporting ZTE
* R3-242043 discussion Service Area for a Broadcast Service in NR NTN Ericsson, Thales
* R3-241606 discussion Discussion on Support for NR NTN MBS Broadcast Service Qualcomm Incorporated
* R3-241562 discussion Discussion on MBS service in NTN system CAICT
* R3-241568 discussion MBS support in NR NTN China Telecommunication
* R3-241617 discussion Discussion on Support of MBS Broadcast over NTN access TCL
* R3-241749 other (TP to TS 38.413) Support of Broadcast service Xiaomi
* R3-241805 discussion On support of MBS broadcast in NTN Lenovo
* R3-241931 discussion Discussion on MBS broadcast service for NR NTN system CATT, CBN, China Broadnet
* R3-241946 discussion Discussion on Supporting MBS broadcast service for NR NTN CMCC
* R3-242036 discussion Discussion on support MBS broadcast service for NR NTN Samsung
* R3-241932 discussion Discussion on support of regenerative payload CATT
* R3-241607 discussion Discussion on NG Signaling impacts for NR NTN Regenerative Payload Qualcomm Incorporated
* R3-241569 discussion Consideration on regenerative payload in Rel-19 NTN China Telecommunication
* R3-241582 discussion Discussion on support of Regenerative payload NEC
* R3-241616 discussion Discussion on Support of NTN Regenerative Architecture TCL
* R3-241750 discussion Discussion on Support of Regenerative Payload Xiaomi
* R3-241770 discussion Initial Considerations on Support of Regenerative Payload ZTE
* R3-241806 discussion On support of regenerative payload in NTN Lenovo
* R3-241909 discussion Support of Regenerative payload Huawei
* R3-241947 discussion Discussion on Support of regenerative payload for NR NTN CMCC
* R3-242000 discussion Discussion on the support of Regenerative payload Nokia, Nokia Shanghai Bell
* R3-242001 CR Support Regenerative NTN Nokia, Nokia Shanghai Bell
* R3-242037 discussion Discussion on support of regenerative payload for NR NTN Samsung
* R3-242044 draftCR Support for Regenerative Payload in NR NTN Ericsson, Thales, Deutsche Telekom, Nokia
* R3-242045 discussion NTN Regenerative Payload in Rel-19 Ericsson LM
* R3-242099 discussion Satellite on-board gNB identification in 5G system LG Electronics Inc.
* R3-242100 CR CR for Satellite on-board gNB identification in 5G system LG Electronics Inc.
* R3-242172 discussion CB:#NRNTN\_Archtecture Ericsson
* R3-242232 discussion CB:#NRNTN\_Archtecture Ericsson

**RAN3#124 meeting, Fukuoka city, Japan, May 20 - 24, 2024:**

* R3-243671 Work Plan Updated work plan for NR\_NTN\_Ph3 CATT, Thales
* R3-243672 other (TP for BL CRs) Support of MBS broadcast service for NR NTN CATT
* R3-243617 discussion Further discussion on support MBS broadcast service for NR NTN Samsung
* R3-243628 discussion Discussion on support MBS broadcast service for NTN China Telecommunication
* R3-243553 discussion Discussion on MBS broadcast additional features for NR NTN Evolution THALES
* R3-243557 other (TP for TS38.300) Discussion on Support for NR NTN MBS Broadcast Service Qualcomm Incorporated
* R3-243433 other (TP for TS 38.413 and TS 38.300) Support MBS broadcast service Huawei
* R3-243464 CR Broadcast Service Area for NR NTN Ericsson
* R3-243398 discussion Support of broadcast service in NTN Lenovo
* R3-243354 other (TP for TS 38.300) Discussion on the support of MBS Broadcast Service Nokia, Nokia Shanghai Bell
* R3-243298 other (TP to TS 38.413) Support of Intended area Xiaomi
* R3-243242 discussion Discussion on NR NTN supporting MBS broadcast service NEC
* R3-243220 discussion Discussion on Support of MBS Broadcasting over NTN access TCL
* R3-243654 other Discussion on NTN broadcast service supporting with TP to TS 38.300 ZTE
* R3-243723 discussion Discussion on Supporting MBS broadcast service for NR NTN CMCC
* R3-243412 discussion MBS Service Area in NR NTN Ericsson, Eutelsat Group, SES, Thales
* R3-243413 draftCR Support for Regenerative Payload in NR NTN Ericsson, Thales, Deutsche Telekom, Nokia, ESA, CATT, ZTE, Sateliot, Huawei
* R3-243414 discussion NTN Regenerative Payload in Rel-19 Ericsson, Sateliot
* R3-243531 CR CR for Satellite on-board gNB identification in 5G system LG Electronics Inc.
* R3-243530 discussion Satellite on-board gNB identification in 5G system LG Electronics Inc.
* R3-243724 discussion Discussion on Support of regenerative payload for NR NTN CMCC
* R3-243221 discussion Discussion on Regenerative NTN Architecture TCL
* R3-243243 discussion Discussion on NR NTN supporting the regenerative payload NEC
* R3-243299 other (TPs to TS 38.300 and 38.413) support of regenerative payload Xiaomi
* R3-243023 LS in Reply LS on security of IP transport over satellite transport links (S3-240950 / S2-240390) SA2(Ericsson)
* R3-243017 LS in LS on Support of Regenerative-based Satellite Access SA2(VIVO)
* R3-243355 other (TP for TS 38.300 and TS 38.413) Discussion on the support of Regenerative payload Nokia, Nokia Shanghai Bell
* R3-243399 discussion Mobility issues for regenerative payload in NTN Lenovo
* R3-243415 LS out [DRAFT] Reply LS on security of IP transport over satellite transport links Ericsson LM
* R3-243432 discussion Support of regenerative payload (including LS responses) Huawei
* R3-243556 discussion Discussion on NG Signaling impacts for NR NTN Regenerative Payload Qualcomm Incorporated
* R3-243573 discussion Discussion on support of regenerative payload ZTE
* R3-243567 discussion Support of regenerative payload (including LS responses) Huawei
* R3-243629 discussion On support of regenerative payload in NR NTN China Telecommunication
* R3-243618 discussion Further discussion on support of regenerative payload for NR NTN Samsung
* R3-243673 discussion Discussion on support of regenerative payload CATT
* R3-243949 Support for Regenerative Payload in NR NTN (Ericsson, Thales, Deutsche Telekom, Nokia, ESA, CATT, ZTE, Sateliot, Huawei) draftCR
* R3-243954 Reply LS on Support of Regenerative-based Satellite Access, RAN3(ZTE) To: SA2; Cc: RAN2
* R3-243955 Reply LS on security of IP transport over satellite transport links, RAN3(Ericsson) To: SA2, SA3

## 4.4 RAN4

**RAN4#110bis meeting, Changsha, China, April 15 - 19, 2024:**

* R4-2404869 other General overview on RAN4 RF scope Ericsson
* R4-2404870 other RedCap UE RF impact overview Ericsson
* R4-2405316 discussion Discussions on NTN Phase3 UE requirements Samsung
* R4-2405346 other General discussion on Rel-19 NTN RedCap UE Huawei, HiSilicon
* R4-2405063 other Discussion on UE RF requirements for NR NTN phase3 ZTE Corporation
* R4-2404253 other UE RF requirement for NTN Redcap and eRedcap Sony
* R4-2404264 other RedCap NTN UEs Nokia
* R4-2404185 other On NTN for RedCap UE Apple
* R4-2404437 other Discussion on support of NTN full-duplex FDD RedCap UE CATT
* R4-2404585 discussion Discussion on RF requirement for redcap UE in FR1 NTN band. Xiaomi
* R4-2404670 other Discussion on support of Rel-17 RedCap and Rel-18 eRedCap UEs with NR NTN operating in FR1-NTN bands vivo
* R4-2405713 other UE RF impacts from NR NTN Phase 3 Qualcomm Inc.
* R4-2405646 other Discussion on RF requirement for NTN SAN in Rel-19 ZTE Corporation
* R4-2405647 draftCR draft CR to TS 38.108 the introduction of regenerative SAN ZTE Corporation
* R4-2405922 discussion Non-Terrestrial Networks (NTN) for NR Phase 3: Support of regenerative payload Huawei, HiSilicon
* R4-2405082 other SAN RF requirements Nokia
* R4-2405317 discussion Initial view on SAN RF impact for Rel-19 NTN Phase 3 WI Samsung
* R4-2404871 other SAN RF impact overview Ericsson
* R4-2405291 other Topic summary for [110bis][138] NR\_NTN\_Ph3\_UERF Moderator(Qualcomm)
* R4-2406109 other Way Forward for [110bis][315] NR\_NTN\_Ph3 Thales
* R4-2406610 other WF on NR\_NTN\_Ph3\_UERF Qualcomm
* R4-2405835 other Topic summary for [110bis][315] NR\_NTN\_Ph3 Moderator (Thales)

**RAN4#111 meeting, Fukuoka city, Japan, May 20 - 24, 2024:**

* R4-2409105 other General issue for NTN RedCap Ericsson
* R4-2409108 other RedCap UE RF impact on HD-FDD Ericsson
* R4-2409046 other On NTN Phase3 RedCap UE RF Samsung
* R4-2409336 other Discussion on the other potential impacts for Rel-19 NTN RedCap UE Huawei, HiSilicon
* R4-2408816 draftCR draft CR to TS 38.101-5: Addition of RedCap and eRedCap Qualcomm Inc.
* R4-2408799 other Discussion on UE RF requirements for NR NTN phase3 ZTE Corporation, Sanechips
* R4-2408617 discussion Discussion on NTN (e)Redcap UE RF requirements Spreadtrum Communications
* R4-2408067 other RedCap NTN UEs Nokia Poland
* R4-2408128 other Discussion on RF requirements for RedCap and eRedCap UE supporting FR1-NTN in Half Duplex mode vivo
* R4-2407413 other UE RF requirement for NTN Redcap and eRedcap Sony
* R4-2407995 other Discussion on (e)Redcap UE introduction for NTN operation China Telecomunication Corp.
* R4-2407757 discussion Discussion on UE RF requirements for NTN RedCap with HD-FDD Mediatek India Technology Pvt.
* R4-2407513 other Discussion on RF requirement for NTN RedCap UE CATT
* R4-2407558 other On NR NTN for (e)RedCap UE REFSENS requirements Apple
* R4-2409106 other Other NTN UE RF requirment Ericsson
* R4-2409107 other SAN RF impact overview Ericsson
* R4-2409543 discussion Further discussion on regenerative payload introduction in SAN RF specification Huawei, HiSilicon
* R4-2409544 draftCR Draft CR to TS 38.108: Introduction of regenerative payload Huawei, HiSilicon
* R4-2407511 other Discussion on definition of regenerative payload CATT
* R4-2407512 CR CR for TS 38.108, Introduction on definition of NTN regenerative payload CATT
* R4-2408071 discussion SAN RF requirements impact under Rel-19 NTN Phase 3 WI SAMSUNG R&D INSTITUTE JAPAN
* R4-2409622 other Discussion on RF requirements for NTN SAN in Rel-19 ZTE Corporation, Sanechips
* R4-2410110 other Topic summary for [111][315] NR\_NTN\_Ph3 Moderator (Thales)
* R4-2410574 other WF on Rel-19 phase 3 NR-NTN UE RF requirements Qualcomm
* R4-2408948 other Topic summary for [111][137] NR\_NTN\_Ph3\_UERF Moderator(Qualcomm)

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