**3GPP TSG RAN meeting #103 RP-240091**

**Maastrich, The Netherlands, March 18-22, 2024**

## Status Report to TSG

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

**Agenda item:** 9.3.2.3

|  |  |
| --- | --- |
| **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-234078 |
| **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: 5%RAN1: 10%RAN2: 0%RAN3: 0%RAN4: 0% | 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#116

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

Agreement

For DL coverage study, consider the following additional reference satellite parameters scenarios for LEO600km Set1 in FR1 (i.e., S-band), referred to as Set1-1 FR1, Set1-2 FR1 and Set1-3 FR1:

|  |
| --- |
|  **LEO600km Set1-1 FR1 (i.e., S-band)** |
| **Maximum Bandwidth per beam** | 5 MHz |
| **SCS** | 15 kHz |
| **Beam size(Note 1)** | 50km |
| **Satellite EIRP density /beam (dBW/MHz)** | 34 |
| **Payload Total DL power level (dBW)** | 31.24 |
| **Aggregated EIRP (Total) (dBW)** | 61.24\* |
| **Satellite Tx max Gain** | 30 dBi |
| **Maximum EIRP per Satellite beam (dBW)** | 41 |
| **Total number of beam footprints\*\*\*** | 1058 |
| **Total number of simultaneously active beams \*\*** | 106 |
| **% simultaneously active beams\*\*** | 10.02 % |
| \***Note: EIRP limit is 61.24 dBm for the reference configuration.** **\*\*Assuming 100 % Resource Block utilization within the same beam at max power. Absolute number of simultaneously active beams is up to 212 (due to limitation of RF)** **\*\*\* For a constellation design at 600km with low elevation angle with 30° and selected (i.e Set 1 parameters) beam size****Note 1: At least this beam size is considered in this scenario, larger beam sizes maybe evaluated and reported by companies** |

|  |
| --- |
| **LEO600km Set1-2 FR1 (i.e., S-band)** |
| **Maximum Bandwidth per beam** | 5 MHz |
| **SCS** | 15 kHz |
| **Beam size (note 1)** | 50km |
| **Satellite EIRP density /beam (dBW/MHz)** | 34 |
| **Payload Total DL power level (dBW)** | 23 |
| **Aggregated EIRP (Total) (dBW)** | 53\* |
| **Satellite Tx max Gain** | 30 dBi |
| **Maximum EIRP per Satellite beam (dBW)** | 41 |
| **Total number of beam footprints** | 1058 |
| **Total number of simultaneously active beams\*\*** | 16 |
| **% simultaneously active beams\*\*** | 1.5 % |
| **\*Note: EIRP limit is 53 dBm for the reference configuration.** **\*\*Absolute number of simultaneously active beams is up to 16 (due to limitation of RF)****Note 1: At least this beam size is considered in this scenario, larger beam sizes maybe evaluated and reported by companies** |

|  |
| --- |
| **LEO600km Set 1-3 FR1 (i.e., S-band)** |
| **Maximum Bandwidth per beam** | 5 MHz |
| **SCS** | 15 kHz |
| **Beam size (note 1)** | 50km |
| **Satellite EIRP density /beam (dBW/MHz)** | 26 |
| **Payload Total DL power level (dBW)** | 23.24 |
| **Aggregated EIRP (Total) (dBW)** | 53.24\* |
| **Satellite Tx max Gain** | 30 dBi |
| **Maximum EIRP per Satellite beam (dBW)** | 33 |
| **Total number of beam footprints** | 1058 |
| **Total number of simultaneously active beams\*\*** | 106 |
| **% simultaneously active beams\*\*** | 10.02 % |
| **\*Note: EIRP limit is 53.24 dBm for the reference configuration.** **\*\*Absolute number of simultaneously active beams is up to 212 (due to limitation of RF)****Note 1: At least this beam size is considered in this scenario, larger beam sizes maybe evaluated and reported by companies** |

Note: RAN1 will aim to identify necessary enhancements for these scenarios in the study phase. At the end of the study phase, RAN1 will further discuss whether the potential enhancements will be specified within Rel-19 framework.

Agreement

For DL coverage study at system level, consider the following additional reference satellite payload parameters for LEO600km in FR2 (i.e., Ka-band):

|  |
| --- |
| **LEO600km Set1-1 FR2 (i.e., Ka-band)** |
| **Maximum Bandwidth per beam** | 400 MHz |
| **SCS** | 120 kHz |
| **Beam size** | TBD in next meeting |
| **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)** |
| **Total number of beam footprints** | 800 (note 1) |
| **Total number of simultaneously active beams** | 12 |
| **% simultaneously active beams** | 1.5 % |
| **Note 1: A typical deployment scenario in FR2 should consider 800 satellites beams per a single satellite coverage area with an absolute number of simultaneously active beams equal to 16 (due to limitation of RF)** |

Agreement

Adopt the following phased array antenna parameters for LEO 600km in FR1:

|  |  |
| --- | --- |
| **Satellite phased array antenna Characteristics** | LEO-600 |
| **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 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**  | [4dB] |

Agreement

RAN1 to consider the following performance metrics for DL Coverage enhancement evaluation at system level:

At least:

* CDF of the received SINR
* The dwell time and revisit time interval for each beam illumination across the coverage
* Periodicity of common control channels (e.g. SSB, CORESET0/SIB1, SIB19) and corresponding coverage ratio

Other metrics may be reported such as

* CDF of the cell throughput
* CDF of user perceived throughput (UPT)
* CDF of Latency
* Ratio of mean served cell throughput and offered cell throughput, denoted by 𝜌 (refer to TR36.889)

For system level study based on analytical evaluation:

* N1 beam footprints are in state “off”
	+ These beam footprints are not served by any signal (no satellite service in this area)
* N2 beam footprints are in state “common messages only”
	+ These beam footprints do not have any active user traffic, and are served the necessary information for cell discovery and initial access.
	+ Optionally, companies may consider user arrival (e.g. RACH access) in this type of cell, and should describe how this is taken into account in the analytical evaluation
* N3 beam footprints are in state “active traffic”
	+ These beam footprints have X active (e.g. VoNR) users each.
	+ These beam footprints are also served the necessary information for cell discovery and initial access
* N1 + N2 + N3 = “Total number of beam footprints “
* N1, N2, N3, X are to be reported by companies.
* Resource utilization obtained under the assumptions above is to be reported by companies.
* Other assumptions made in the evaluation are to be reported by companies, e.g. power sharing scheme, beam hopping scheme, etc.

Agreement

For NR NTN Rel-19 DL coverage evaluation, UE characteristics for handheld terminals in Table 6.1.1.1-3 in TR 38.821 can be reused, with the following:

* -5.5 dBi antenna gain is assumed
* at least 2Rx are considered at the UE
	+ 4Rx can be optionally considered and reported

Note: Redcap device is not considered in the scope of DL coverage study

Agreement

The following traffic models are considered for system level evaluation of DL coverage:

* FTP3: as in Table 6.1.1.1-7 of TR 38.821: 0.5MB as packet size, 200ms as mean inter-arrival time
* FTP3 IM: 0.1MB as packet size, 2s as mean inter-arrival time
* VoIP can be considered in the evaluation.

It is up to company report which traffic model is used among the discussed traffic models in their evaluations.

* Other models may be used as well, and parameter (e.g. packet size and arrival rate) adjustment can be optionally considered and reported.

|  |  |  |  |
| --- | --- | --- | --- |
| **Traffic type** | **FTP** | **IM** | **VoIP** |
| **Model** | FTP model 3 | FTP model 3 | As defined in Rel-18 NTN CE. |
| **Packet size** | 0.5 Mbytes | 0.1 Mbytes |
| **Mean inter-arrival time** | 200 ms | 2 sec |

Agreement

For NR NTN Rel-19 DL coverage evaluation, Beam layout defined in Table 6.1.1.1-4 in TR 38.821 can be reused.

* Using other beam layouts is not precluded, and should be reported by companies

Agreement

For NR NTN Rel-19 DL coverage evaluation, a value of beam steering latency equal to 0 at least if phase array antenna is assumed.

Values different from 0 can be optionally reported

Agreement

DL coverage is evaluated at link level with the following considerations:

* NGSO at LEO-600 operating in FR1 is considered in priority
* Additional satellite payload parameters defined for system level evaluation are used
* FFS: Antenna gain reduction due to steering loss can be considered

Agreement

For the evaluation of NTN downlink coverage at link level, reuse the target data rate from Rel-18 NTN Coverage enhancements:

* For VoIP: AMR 4.75 kbps (TBS of 184 bits without CRC in physical layer) with 20 ms data arriving interval
* For data rate service: both 3 kbps and 1Mbps can be considered
	+ Companies can also use the data rates corresponding to the traffic types used for system level evaluations

Agreement

For link-level study, downlink coverage performance in NR NTN is evaluated according to the following steps.

Step 1: CNR is calculated as defined in 6.1.3.1 of TR 38.821

Step 2: Required SNR of target service is evaluated by LLS

Step 3: The CNR and the required SNR are compared

Agreement

For link-level study, for NR NTN DL coverage enhancement, the following channels/signals can be considered for evaluations:

* PDSCH for VoIP
* PDSCH for low data rate service
* PDSCH Msg.2
* PDSCH Msg.4
* PDSCH carry SIB, e.g., SIB1, SIB 19
* PDSCH for paging
* PDCCH
* Broadcast PDCCH (e.g. PDCCH of Msg.2, paging)
* SSB

Note: RAN1 will aim to identify necessary link-level enhancements for these channels in the study phase. At the end of the study phase, RAN1 will further discuss whether the potential link-level enhancements will be specified within Rel-19 framework.

Agreement

For DL coverage performance evaluation, the following are assumed for all channels/signals

* Channel model/Delay spread:
	+ Channel model as in Table 6.1.2-4 of TR38.821, NTN-TDL-C (LOS)
* Evaluation scenario:
	+ Rural (LOS)
* Channel estimation: Realistic estimation:
	+ Companies are encouraged to report channel estimation method.
* SCS:
	+ 15 kHz only
* UE speed: 3 km/h
* Frequency drift: TBD
* Frequency offset: 0.1 ppm

Agreement

For link budget calculation, parameters in the following table are assumed:

|  |  |
| --- | --- |
| **Parameters** |  |
| **Carrier frequency** | 2 GHz for DL (S-band) |
| **Satellite altitude** | 600 km |
| **Target elevation angle** | 30° (LEO) |
| **Atmospheric loss** | Equation (6.6-8) in [38.811] |
| **Shadowing margin** | 3 dB |
| **Scintillation loss** | Section 6.6.6 in [38.811]Ionospheric loss: = 2.2 dBTropospheric loss: Table 6.6.6.2.1-1 of [38.811] |
| **Additional loss** | 0 dB  |
| **Clear sky conditions** | Yes |
| **Satellite antenna polarization** | Circular polarization |
| **Terminal type** | [S band: (M, N, P) = (1,1,2)] |
| **UE antenna gain** | -5.5dBi |
| **Free space path loss** | Equation (6.6-2) in [38.811] |
| **Polarization loss** | 3dB |
| **Outcome** | CNR |

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

Agreement

Study at least the following scenarios for (e)RedCap HD-FDD UEs for NTN:

* Whether existing handling rules for the following cases should be reused or updated when taking into account TA mismatch between actual TA used by UE and assumed TA at the gNB based on available TA report:
	+ Case 1: Dynamically scheduled DL reception collides with semi-statically configured UL transmission
	+ Case 2: Semi-statically configured DL reception collides with dynamically scheduled UL transmission
	+ Case 3: Semi-statically configured DL reception collides with semi-statically configured UL transmission
	+ Case 4: Dynamically scheduled DL reception collides with dynamic scheduled UL transmission
	+ Case 5: Configured SSB collides with dynamically scheduled or configured UL transmission
	+ Case 6: Dynamic or semi-static DL collides with valid RO
	+ Case 7: Collision due to direction switching

* At least the following potential issues can be further considered for (e)RedCap HD-FDD UEs
	+ Error cases in case 3 and case 4
	+ SIB19 reception collides with UL transmission
	+ Slot counting for UL repetition transmission colliding with SSB reception
	+ Invalid symbol determination for PUSCH repetition type B
	+ Actual TDW determination due to the collision between DL reception and UL transmission with DMRS bundling
	+ CPU occupation due to omitted DL reception or UL transmission

Note: Both GSO and Non-GSO should be considered.

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

Agreement

Adopt the table below for assumptions for Evaluation parameters for link level evaluation in NR NTN UL capacity and throughput enhancements

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Channel model | * NTN-TDL-C Rural, 30° elevation angle
 |
| Carrier frequency | * 2 GHz
 |
| Subcarrier spacing | * 15 kHz
 |
| UE speed | * 3 km/h
 |
| Frequency hopping  | * No frequency hopping
 |
| PUSCH mapping type A with | * 14 OS- for OCC across slots including DMRS
 |
| HARQ configuration  | * No HARQ
 |
| Channel coding | * LDPC
 |
| TBS | Reported by companies, e.g.* ≈184 bits payload @AMR 4.75kbps96 bits @Low data rate
 |
| DMRS configuration / port / bundling | 1 port per UEReported by companies* DMRS positions for single-symbol DMRS and optional double-symbol DMRS for PUSCH mapping type A defined in Table 6.4.1.1.3-3 and Table 6.4.1.1.3-4 respectively with *ld*=14, *l0*=2 and *pos1* in [38.211].
* up to 8 DMRS Ports

Optional DMRS Bundling |
| PRBs/MCS | Reported by companies, e.g. * 1 PRB, 2 PRBs
* MCS in Table 6.1.4.1-2 in [TS 38.214]
 |
| Max repetition number | * Reported by companies – up to 20 for VoIP, up to 32 for low data rates
 |
| OCC length  | Reported by companies, e.g.* Up to 8
 |
| OCC sequence | Reported by companies, e.g.* Walsh sequences in Table 6.3.2.6.3-1 in TS38.211
* DFT sequence in Table 6.3.2.6.3-2 in TS38.211
 |
| Antenna configuration at Satellite | * 1Rx
 |
| Antenna configuration at UE | * 1Tx
 |

Agreement

Adopt the table below for assumptions for modelling impairments for link level evaluation in NR NTN UL capacity and throughput enhancements

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| TO | Reported by companies* With TO: Uniform selection from [-0.94us, 0.94us], where 0.94us=29Ts
* Optional without TO
 |
| FO | Reported by companies* Uniform selection from [-0.1 ppm, +0.1 ppm], Variation of frequency error is negligible.
* Optional: with lower maximum residual FO, to be reported by companies
 |
| Timing drift  | Optional |
| Receiver algorithm | To be reported by companies, e.g.* MMSE
 |
| Channel estimation | * Real channel estimation
 |

Agreement

Adopt the table below for assumptions for KPIs for link level evaluation in NR NTN UL capacity and throughput enhancements

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Number of code-division multiplexed users | Reported by companies (up to 8) |
| KPI – SNR for a target BLER per UE | As in Rel-18 (otherwise reported by companies)* VoIP: SNR @2% BLER
* For other cases: SNR @10% BLER
 |
| KPI - Aggregated throughput | Reported by companiesTotal throughput according to number of code-division multiplexed users (up to 8)Note: companies should also report the throughput for the case without OCC |
|  |  |

#### 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

Not started

#### 2.2.2 Remaining Open issues

## 2.3 RAN3

#### 2.3.1 Agreements

Not started

#### 2.3.2 Remaining Open issues

## 2.4 RAN4

#### 2.4.1 Agreements

Not started

#### 2.4.2 Remaining Open issues

## 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

**RAN1#116 meeting, Athens, Greece, February 26th – March 1st, 2024:**

* R1-2401730 Work Plan Work plan for NR\_NTN\_Ph3 THALES, CATT
* R1-2400843 Work Plan Work plan for NR\_NTN\_Ph3 THALES
* R1-2400871 discussion NR-NTN Downlink Coverage Enhancement PANASONIC
* R1-2400875 discussion Discussion on downlink coverage enhancement for NR NTN Lenovo
* R1-2400837 discussion Discussion on downlink coverage enhancements for NR NTN CCU, NTPU
* R1-2400897 discussion An operator view on Downlink Coverage Enhancements for FR2-NTN Eutelsat Group
* R1-2400787 discussion Discussion on NR-NTN downlink coverage enhancement LG Electronics
* R1-2400749 discussion Discussion on downlink coverage enhancement for NR-NTN Samsung
* R1-2401299 discussion Discussion on NR-NTN downlink coverage enhancement MediaTek Inc.
* R1-2401342 discussion On NR-NTN downlink coverage enhancement Ericsson
* R1-2401237 discussion Discussion on NR-NTN downlink coverage enhancement ETRI
* R1-2401282 discussion Link Level Enhancements for DL Coverage of NR NTN CEWiT
* R1-2401059 discussion Beam groups/patterns for NR-NTN downlink coverage enhancement Sharp
* R1-2401079 discussion Discussion on DL coverage enhancements for NR-NTN NICT
* R1-2401083 discussion Discussion on downlink coverage enhancement for NR NTN Baicells, CMCC
* R1-2401029 discussion Study on NR-NTN Downlink Coverage Enhancement Apple
* R1-2400971 discussion Downlink coverage enhancements for NR over NTN Nokia, Nokia Shanghai Bell
* R1-2400132 discussion Discussion on downlink coverage enhancements for NR NTN Huawei, HiSilicon
* R1-2400071 discussion Discussion on NR-NTN downlink coverage enhancement Spreadtrum Communications
* R1-2400259 discussion Discussion on NR-NTN downlink coverage enhancement vivo
* R1-2400344 discussion Discussion on NR-NTN DL coverage enhancement CMCC
* R1-2400355 discussion Discussion on DL coverage enhancement for NR NTN ZTE
* R1-2400303 discussion Discussion on NR NTN Downlink coverage enhancements THALES
* R1-2400402 discussion Downlink Coverage Enhancement for NR NTN Google
* R1-2400424 discussion Discussion on downlink coverage enhancement for NR NTN CATT
* R1-2400499 discussion NR-NTN downlink coverage enhancement Fraunhofer IIS, Fraunhofer HHI
* R1-2400478 discussion NR-NTN downlink coverage enhancement NEC
* R1-2400516 discussion Seamless NTN downlink coverage for high-availability services Dell Technologies
* R1-2400528 discussion Discussion on NR-NTN downlink coverage enhancement Honor
* R1-2400549 discussion Discussion on NR-NTN downlink coverage enhancement xiaomi
* R1-2400576 discussion NR-NTN downlink coverage enhancement InterDigital, Inc.
* R1-2400602 discussion Discussion on NR-NTN downlink coverage enhancement OPPO
* R1-2401470 discussion An operator view on Downlink Coverage Enhancements for FR2-NTN Eutelsat Group
* R1-2401843 discussion FL Summary #1: NR-NTN downlink coverage enhancements Moderator (THALES)
* R1-2401845 discussion FL Summary #3: NR-NTN downlink coverage enhancements Moderator (THALES)
* R1-2401592 discussion Discussion on downlink coverage enhancement for NR NTN Baicells
* R1-2401844 discussion FL Summary #2: NR-NTN downlink coverage enhancements Moderator (THALES)
* R1-2401458 discussion Downlink coverage enhancement for NR NTN Qualcomm Incorporated
* R1-2401130 discussion Discussion on DL coverage enhancement for NR-NTN NTT DOCOMO, INC.
* R1-2401131 discussion Discussion on support of RedCap and eRedCap UEs in FR1-NTN NTT DOCOMO, INC.
* R1-2401459 discussion Support of Redcap and eRedcap UEs in NR NTN Qualcomm Incorporated
* R1-2401194 discussion On HD-FDD Redcap UEs for NTN Ericsson
* R1-2401847 discussion Summary for Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Moderator (CATT)
* R1-2401861 discussion Final summary for Support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Moderator (CATT)
* R1-2400603 discussion Discussion on supporting of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands OPPO
* R1-2400550 discussion Discussion on the support of Redcap UE for NTN operating on FR1 bands xiaomi
* R1-2400627 discussion Discussion on half-duplex RedCap issues for NTN FR1 operation InterDigital, Inc.
* R1-2400425 discussion Discussion on the operation of RedCap and eRedCap UEs In NTN CATT
* R1-2400356 discussion Discussion on support of RedCap/eRedCap UEs for NR NTN ZTE
* R1-2400345 discussion Discussion on the collision issues of HD-FDD Redcap UE in FR1-NTN CMCC
* R1-2400260 discussion Discussion on support of RedCap and eRedCap UEs with NR-NTN vivo
* R1-2400072 discussion Discussion on support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Spreadtrum Communications
* R1-2400133 discussion Discussion on HD-FDD RedCap UEs and eRedCap UEs for FR1-NTN Huawei, HiSilicon
* R1-2400972 discussion RedCap support for NR over NTN while operating in FR1-NTN bands Nokia, Nokia Shanghai Bell
* R1-2401030 discussion Discussion on support of RedCap UEs with NR NTN operation Apple
* R1-2401238 discussion Discussion on HD UEs with NR NTN ETRI
* R1-2401300 discussion Discussion on support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands MediaTek Inc.
* R1-2400750 discussion Discussion on support of RedCap and eRedCap UEs with NR NTN operating in FR1-NTN bands Samsung
* R1-2400788 discussion Discussion on support of (e)RedCap UEs with NR-NTN operating in FR1-NTN bands LG Electronics
* R1-2400789 discussion Discussion on NR-NTN uplink capacity/throughput enhancement LG Electronics
* R1-2400751 discussion Discussion on uplink capacity/throughput enhancement for NR-NTN Samsung
* R1-2400674 discussion Discussion on NR-NTN uplink enhancement China Telecom
* R1-2400819 discussion Discussion on NR-NTN Uplink Capacity/Throughput Enhancement Lenovo
* R1-2400824 discussion Uplink capacity/throughput enhancement for NR-NTN Panasonic
* R1-2401301 discussion Discussion on NR-NTN uplink capacity and throughput MediaTek Inc.
* R1-2401239 discussion Discussion on NR-NTN uplink capacity/throughput enhancement ETRI
* R1-2401031 discussion Study on NR-NTN Uplink Capacity Enhancement Apple
* R1-2400973 discussion On NR-NTN uplink capacity/throughput enhancements Nokia, Nokia Shanghai Bell
* R1-2400977 discussion On uplink capacity/throughput enhancement for NR NTN Ericsson
* R1-2401080 discussion NR-NTN uplink capacity/throughput enhancement NICT
* R1-2400134 discussion Discussion on uplink capacity/throughput enhancement for FR1-NTN Huawei, HiSilicon
* R1-2400073 discussion Discussion on NR-NTN uplink capacity/throughput enhancement Spreadtrum Communications
* R1-2400261 discussion Discussion on NR-NTN uplink capacity enhancement vivo
* R1-2400346 discussion Discussion on the NR-NTN uplink capacity/throughput enhancements CMCC
* R1-2400357 discussion Discussion on UL capacity enhancement for NR NTN ZTE
* R1-2400403 discussion Uplink Capacity Enhancement for NR NTN Google
* R1-2400426 discussion Discussion on UL capacity enhancement for NR NTN CATT
* R1-2400628 discussion NR-NTN uplink capacity/throughput enhancement InterDigital, Inc.
* R1-2400551 discussion Discussion on NR-NTN PUSCH capacity enhancement xiaomi
* R1-2400604 discussion Discussion on NR-NTN uplink capacity/throughput enhancement OPPO
* R1-2400517 discussion Disaggregated NTN uplink and downlink sessions Dell Technologies
* R1-2400479 discussion NR-NTN uplink capacity/throughput enhancement NEC
* R1-2401484 discussion Discussion on NR-NTN uplink capacity/throughput enhancement LG Electronics
* R1-2401791 discussion Feature lead summary #2 of AI 9.11.3 on NR-NTN uplink capacity and throughput Moderator (MediaTek)
* R1-2401543 discussion Feature lead summary #1 of AI 9.11.3 on NR-NTN uplink capacity and throughput Moderator (MediaTek)
* R1-2401460 discussion NR-NTN uplink capacity / throughput enhancement Qualcomm Incorporated
* R1-2401132 discussion Discussion on NR-NTN uplink capacity/throughput enhancement NTT DOCOMO, INC.
* R1-2401133 discussion NR-NTN uplink capacity/throughput enhancement Sharp

## 4.2 RAN2

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## 4.3 RAN3

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## 4.4 RAN4

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***END***