**3GPP TSG-RAN WG4 Meeting #112 R4-2413410**

Maastricht, NL, 19th – 23rd of August, 2024

**Agenda item: 8.25.5**

**Source:** Moderator (THALES)

**Title:** Topic summary for [112][310] NR\_NTN\_Ph3\_General\_SAN\_RF

**Document for:** Information

# Introduction

This document is a summary of the proposals made in the contributions submitted under AI 8.25.1 and AI 8.25.3 for the RAN4#112 meeting.

Please also note the draft TSG-RAN WG4#112 meeting agenda with respect to NTN topic. The Agenda Items (AIs) considered in this Topic summary for [112][310] NR\_NTN\_Ph3\_General\_SAN\_RF are:

-------------------------------------- Items led by other WGs --------------------------------------------------------------

**8.25 Non-Terrestrial Networks (NTN) for NR Phase 3 [NR\_NTN\_Ph3]**

8.25.1 General aspects [NR\_NTN\_Ph3-Core]

8.25.2 UE RF requirements [NR\_NTN\_Ph3-Core]

8.25.2.1 RedCap UE RF requirements [NR\_NTN\_Ph3-Core]

8.25.2.2 Other requirements [NR\_NTN\_Ph3-Core]

8.25.3 SAN RF requirements [NR\_NTN\_Ph3-Core]

8.25.4 RRM core requirements [NR\_NTN\_Ph3-Core]

8.25.5 Moderator summary and conclusions [NR\_NTN\_Ph3]

With the following pre-meeting deadlines:

* Before August 12 (Monday): Session chairs will provide the list of topics with moderator assignments.
* August 14 (Wednesday), 17:00 UTC: Moderators provide the initial summary for a topic.
* August 15 (Thursday), 17:00 UTC: Deadline for companies review of initial summary.
* August 16 (Friday), 17:00 UTC: Moderators submit the formal tdoc of summary for a topic.
* August 18 (Sunday): Session chairs share the initial meeting notes taking moderators summary in consideration.

And the following pre-meeting and meeting schedule:



The following documents are considered for discussion in [112][310] NR\_NTN\_Ph3\_General\_SAN\_RF:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***TDoc Number*** | ***TDoc Type*** | ***Title*** | ***Company/Source*** | ***General Purpose*** | ***Agenda Item*** |
| [R4-2411355](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411355.zip) | Work Plan | Updated work plan for NR\_NTN\_Ph3 | CATT, Thales | Approval | 8.25.1 |
| [R4-2412980](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412980.zip) | other | General issue for NTN RedCap | Ericsson | Approval | 8.25.1 |
| [R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip) | discussion | General aspects for NTN NR Phase 3 | THALES | Discussion | 8.25.1 |
| R4-2413230  (reserved, not available) | discussion | Beam switching delay aspects for DL Coverage Enhancements | Inmarsat, Viasat | Endorsement | 8.25.3 |
| [R4-2413244](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413244.zip) | draftCR | Draft CR: Introduction of regenerative payload | Huawei, HiSilicon | Endorsement | 8.25.3 |
| [R4-2412982](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412982.zip) | other | SAN RF impact overview | Ericsson | Approval | 8.25.3 |
| [R4-2412717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412717.zip) | discussion | Discussion on RF requirements for NTN SAN in Rel-19 | ZTE Corporation, Sanechips | Discussion | 8.25.3 |
| [R4-2411068](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411068.zip) | discussion | Discussion on transient time for SAN | CATT | Discussion | 8.25.3 |
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The current list of topics/sub-topics/issues prior to the meeting is:

* **Topic #1:** Topics to address for NR\_NTN\_Ph3-Core

\* Include band definition

* + Sub-topic 1-1: DL coverage enhancements for FR1-NTN or FR2-NTN
    - Issue 1-1-1: “Transient time” and CP size
    - Issue 1-1-2: Beam switching delay value
    - Issue 1-1-3: Working hypothesis for DL coverage enhancements/beam hopping
    - Issue 1-1-4: RF requirements enhancements for spatial domain techniques
    - Issue 1-1-5: Network synchronisation
    - Issue 1-1-6: Network energy saving (NES) & Cell Tx
  + Sub-topic 1-2: RedCap
    - Issue 1-2-1: General discussion on RedCap
  + Sub-topic 1-3: Broadcast Service
    - Issue 1-3-1: RAN4 SAN RF impact for Broadcast Service
  + Sub-topic 1-4: Updated work plan for NR\_NTN\_Ph3
    - Issue 1-4-1: Work plan for NR\_NTN\_Ph3 (R4-2411355, CATT, THALES)
* **Topic #2:** Draft CRs & CRs.
  + Sub-topic 2-1: Draft CRs
    - Issue 2-1-1: **Draft CRs to TS 38.108 Rel-19**

# Topic #1: Topics to address for NR\_NTN\_Ph3-Core

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2411355](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411355.zip) | CATT, Thales | **Updated work plan for NR\_NTN\_Ph3 submitted for RAN4 approval.** |
| [R4-2412980](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412980.zip) | Ericsson | 1. RAN4 discuss if the 38.307 should be updated for RedCap NTN as release independent feature (operating band).   9.2 Additional operating bands for Redcap for NR frequency range 1  Requirements for a Redcap UE for additional operating bands within FR1 of TS 38.101-5 in Rel-P [2] are introduced via this clause.  Table 9.2 -1: NR NTN RedCap operating band   |  |  |  |  | | --- | --- | --- | --- | | Feature | Duplex-mode | Release  independent from | Requirements to be fulfilled  (see TS 38.307 of the release in which the band was introduced) | | Redcap operating band | FDD | Rel-17 |  | |
| [R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip) | THALES | **Observation 1:** The worst-case beam switching time is hence based on the analogue implementation and is estimated as < 100ns.  **Proposal 1.** If the duration of the transient time is below CP size, the definition of a RAN4 requirement for beam switching/beam hopping is not needed.  **Proposal 2.** Whether the baseband can properly time the command to the phase shifter in advance is an implementation issue. The Feederlink used for NTN communication is not currently specified by 3GPP and therefore the requirement to properly time the phase shifter in advance is not necessary.  **Proposal 3.** Synchronisation aspects between ground gNB and satellite payload for transparent architecture should not be considered as part of RAN4 work in Rel-19.  **Proposal 4.** The current working hypothesis should be maintained: PA always on, phase shift (pre-)reconfiguration to perform beam-hopping. Moreover, based on TR 38.817-02, the worst-case beam switching time is estimated as < 100ns.  **Proposal 5.** No RAN4 SAN RF requirements impact foreseen for Rel-19 NTN Phase-3 WI Objectives 3 broadcast service. |
| [R4-2412982](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412982.zip) | Ericsson | **Observation 1** The beam switching delay incurs the system overhead for a full load system.  **Observation 2** No data transmission during the beam switching time incurs the system overhead for full load system.  **Observation 3** For transparent payload, the network synchronization error will advance or delay the beam switching, adding additional time uncertainty for beam switching.  **Proposal-1:** No RF impact due to the Cell TX (e.g The NES Cell DTX RF conclusion due to Cell DTX can be reused) assuming the transient time occurs during the beam OFF status.  **Proposal-2:** RAN4 can send LS to RAN1 to notify if beam switching delay has other value than 0.  **Proposal-3:** The network synchronization aspect should be considered for transparent payload together with beam switching delay.  **Proposal-4:** No need to consider the spatial and power domain in Rel-18 NES impact on NTN RF for now. |
| [R4-2412717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412717.zip) | ZTE Corporation, Sanechips | **Proposal 1**: regarding beam switching delay for beam hopping for beam sweeping, the beam switching delay would be around 100ns. |
| [R4-2411068](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411068.zip) | CATT | **Observation 1: The terminology “transient time” may cause some confusion.**  **Observation 2: The delay caused by phase array antenna may need to be tested in OTA manner.**  **Proposal 1: There is no RF requirements impact by the beam switching delay of phase array antenna.** |
|  |  |  |

### Sub-topic 1-1

*Sub-topic description:* DL coverage enhancements for FR1-NTN or FR2-NTN

**Issue 1-1-1: “Transient time” and CP size**

* Proposals:
  + **Proposal 1.** If the duration of the transient time is below CP size, the definition of a RAN4 requirement for beam switching/beam hopping is not needed. (P1/[R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip))
* Recommended WF
  + Agree if no controversial discussion

**Issue 1-1-2: Beam switching delay value**

* Proposals:
  + **Proposal 1:** RAN4 can send LS to RAN1 to notify if beam switching delay has other value than 0. (P2/[R4-2412982](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412982.zip))
    - No data transmission during the beam switching time incurs the system overhead for full load system. (O2/[R4-2412982](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412982.zip))
  + **Proposal 2:** Regarding beam switching delay for beam hopping for beam sweeping, the beam switching delay would be around 100ns.(P1/[R4-2412717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412717.zip), O1/[R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip))
    - **NOTE:** The worst-case beam switching time is hence based on the analogue implementation and is estimated as < 100ns (TR 38.817-02). (O1/[R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip))
* Recommended WF
  + Agree on Proposal 2 if no controversial discussion.

**Issue 1-1-3: Working hypothesis for DL coverage enhancements/beam hopping**

* Proposals:
  + **Proposal 1:** The current working hypothesis should be maintained: PA always on, phase shift (pre-)reconfiguration to perform beam-hopping. Moreover, based on TR 38.817-02, the worst-case beam switching time is estimated as < 100ns. (P4/[R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip))
* Recommended WF
  + Agree on Proposal 1.

**Issue 1-1-4: RF requirements enhancements for spatial domain techniques**

* Proposals:
  + **Proposal 1:** There is no RF requirements impact by the beam switching delay of phase array antenna. (P1/[R4-2411068](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411068.zip))
* Recommended WF
  + Agree not to define any RF requirements related to beam switching delay of phase array antenna.

**Issue 1-1-5: Network synchronisation**

* Proposals:
  + **Proposal 1:** The network synchronization aspect should be considered for transparent payload together with beam switching delay. (P3/[R4-2412982](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412982.zip))
    - **NOTE:** For transparent payload, the network synchronization error will advance or delay the beam switching, adding additional time uncertainty for beam switching. (O3/[R4-2412982](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412982.zip))
  + **Proposal 2:** Synchronisation aspects between ground gNB and satellite payload for transparent architecture should not be considered as part of RAN4 work in Rel-19. (P3/[R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip))
    - **NOTE:** Whether the baseband can properly time the command to the phase shifter in advance is an implementation issue. The Feederlink used for NTN communication is not currently specified by 3GPP and therefore the requirement to properly time the phase shifter in advance is not necessary. (P2/[R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip))
* Recommended WF
  + TBD. Decide on Proposal 1 or Proposal 2 after further discussion.

**Issue 1-1-6: Network energy saving (NES) & Cell Tx**

* Proposals:
  + **Proposal 1:** No need to consider the spatial and power domain in Rel-18 NES impact on NTN RF for now. (P4/[R4-2412982](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412982.zip))
  + **Proposal 2:** No RF impact due to the Cell TX (e.g The NES Cell DTX RF conclusion due to Cell DTX can be reused) assuming the transient time occurs during the beam OFF status. (P1/[R4-2412982](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412982.zip))
* Recommended WF
  + Further discuss the relationship between NES Rel-18, NES Cell DTX RF, and Rel-19 NTN coverage enhancements.

### Sub-topic 1-2

*Sub-topic description:* RedCap

**Issue 1-2-1: General discussion on RedCap**

* Proposals:
  + RAN4 discuss if the 38.307 should be updated for RedCap NTN as release independent feature (operating band). (P1/[R4-2412980](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412980.zip))
* Recommended WF
  + Agree if no controversial discussion
  + If this is agreeable, the following proposal (adding a new Clause 9.2 in TS 38.307) should be further discussed:

## 9.1 Additional NR operating bands for NR NTN in frequency range 1

## 9.2 Additional operating bands for Redcap for NR frequency range 1

Requirements for a Redcap UE for additional operating bands within FR1 of TS 38.101-5 in Rel-P [2] are introduced via this clause.

**Table 9.2 -1: NR NTN RedCap operating band**

|  |  |  |  |
| --- | --- | --- | --- |
| Feature | Duplex-mode | Release  independent from | Requirements to be fulfilled  (see TS 38.307 of the release in which the band was introduced) |
| Redcap operating band | FDD | Rel-17 |  |

### Sub-topic 1-3

*Sub-topic description:* Broadcast Service

**Issue 1-3-1:** **RAN4 SAN RF impact for Broadcast Service**

* Proposals:
  + No RAN4 SAN RF requirements impact foreseen for Rel-19 NTN Phase-3 WI Objectives 3 broadcast service. (P5/[R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip))
* Recommended WF
  + Agree if no controversial discussion.

### Sub-topic 1-4

*Sub-topic description:* Updated work plan for NR\_NTN\_Ph3

**Issue 1-4-1:** **Work plan** for NR\_NTN\_Ph3 ([R4-2411355](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411355.zip), CATT, THALES)

* Proposals:
  + Agree with updated work plan for NR\_NTN\_Ph3 ([R4-2411355](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411355.zip), CATT, THALES) submitted for RAN4 approval.
* Recommended WF
  + Take into account any received comments and agree if no controversial discussion.

# Topic #2: Draft CRs & CRs

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2413244](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413244.zip) | Huawei, HiSilicon | **Draft CR: Introduction of regenerative payload – for Rel-19 TS 38.108 endorsement.** |
|  |  |  |

## Open issues summary

### Sub-topic 2-1

*Sub-topic description:* Draft CRs

**Issue 2-1-1: Draft CRs to TS 38.108 Rel-19**

* Proposals: Check if the following draft CRs could be endorsed:

|  |  |  |  |
| --- | --- | --- | --- |
| **T-doc number** | **Company** | **Title** | **To be Endorsed or Revised?** |
| [R4-2413244](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413244.zip) | Huawei, HiSilicon | **Draft CR: Introduction of regenerative payload – for Rel-19 TS 38.108 endorsement.** |  |

# Recommendations for Tdocs

**Existing tdocs**

|  |  |  |  |
| --- | --- | --- | --- |
| **Tdoc number** | **Source** | **Recommendation** | **Comments** |
| [R4-2413244](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413244.zip) | Huawei, HiSilicon | Discuss/Endorse | Status to be checked in 1st round |

# Annex – submitted documents under [112][310] NR\_NTN\_Ph3-Core

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2411355](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411355.zip) | CATT, Thales | **Updated work plan for NR\_NTN\_Ph3 submitted for RAN4 approval.** |
| [R4-2412980](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412980.zip) | Ericsson | Proposal-1: RAN4 discuss if the 38.307 should be updated for RedCap NTN as release independent feature (operating band).  9.2 Additional operating bands for Redcap for NR frequency range 1  Requirements for a Redcap UE for additional operating bands within FR1 of TS 38.101-5 in Rel-P [2] are introduced via this clause.  **Table 9.2 -1: NR NTN RedCap operating band**   |  |  |  |  | | --- | --- | --- | --- | | Feature | Duplex-mode | Release  independent from | Requirements to be fulfilled  (see TS 38.307 of the release in which the band was introduced) | | Redcap operating band | FDD | Rel-17 |  | |
| [R4-2413353](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413353.zip) | THALES | **Observation 1:** The worst-case beam switching time is hence based on the analogue implementation and is estimated as < 100ns.  **Proposal 1.** If the duration of the transient time is below CP size, the definition of a RAN4 requirement for beam switching/beam hopping is not needed.  **Proposal 2.** Whether the baseband can properly time the command to the phase shifter in advance is an implementation issue. The Feederlink used for NTN communication is not currently specified by 3GPP and therefore the requirement to properly time the phase shifter in advance is not necessary.  **Proposal 3.** Synchronisation aspects between ground gNB and satellite payload for transparent architecture should not be considered as part of RAN4 work in Rel-19.  **Proposal 4.** The current working hypothesis should be maintained: PA always on, phase shift (pre-)reconfiguration to perform beam-hopping. Moreover, based on TR 38.817-02, the worst-case beam switching time is estimated as < 100ns.  **Proposal 5.** No RAN4 SAN RF requirements impact foreseen for Rel-19 NTN Phase-3 WI Objectives 3 broadcast service. |
| R4-2413230  (reserved, not available) | Inmarsat, Viasat | **N/A** |
| [R4-2413244](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2413244.zip) | Huawei, HiSilicon | **Draft CR: Introduction of regenerative payload – for Rel-19 TS 38.108 endorsement.** |
| [R4-2412982](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412982.zip) | Ericsson | **Observation 1** The beam switching delay incurs the system overhead for a full load system.  **Observation 2** No data transmission during the beam switching time incurs the system overhead for full load system.  **Observation 3** For transparent payload, the network synchronization error will advance or delay the beam switching, adding additional time uncertainty for beam switching.  **Proposal-1:** No RF impact due to the Cell TX (e.g The NES Cell DTX RF conclusion due to Cell DTX can be reused) assuming the transient time occurs during the beam OFF status.  **Proposal-2:** RAN4 can send LS to RAN1 to notify if beam switching delay has other value than 0.  **Proposal-3:** The network synchronization aspect should be considered for transparent payload together with beam switching delay.  **Proposal-4:** No need to consider the spatial and power domain in Rel-18 NES impact on NTN RF for now. |
| [R4-2412717](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2412717.zip) | ZTE Corporation, Sanechips | **Proposal 1**: regarding beam switching delay for beam hopping for beam sweeping, the beam switching delay would be around 100ns. |
| [R4-2411068](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_112/Docs/R4-2411068.zip) | CATT | **Observation 1: The terminology “transient time” may cause some confusion.**  **Observation 2: The delay caused by phase array antenna may need to be tested in OTA manner.**  **Proposal 1: There is no RF requirements impact by the beam switching delay of phase array antenna.** |
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