**3GPP TSG-RAN WG4 Meeting #109 R4-231xxxx**

**Chicago, USA, 13th – 17th of November 2023**

**Agenda item:** 8.26.9

**Source:** THALES

**Title:** Topic summary for [109][308] NR\_NTN\_enh\_Part1

**Document for:** Information

# Introduction

This discussion summary document captures general issues related to NTN system parameters, regulatory information for Rel-18 NR\_NTN\_enh WI. It contains a summary of the contributions under sections and subsections of Agenda Items 8.26.1 (i.e. 8.26.1.1, 8.26.1.2, 8.26.1.3) at TSG-RAN WG4#109, together with identified topics/proposals/options for discussion during the meeting.

Please also note the draft TSG-RAN WG4#109 meeting agenda with respect to NTN topic. The Agenda Items (AIs) considered in this Topic summary for [109][308] NR\_NTN\_enh\_Part1 are:

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

8.26 NR NTN enhancement [NR\_NTN\_enh]

8.26.1 General aspects [NR\_NTN\_enh-Core]

8.26.1.1 System parameters [NR\_NTN\_enh-Core]

\* Include band definition

8.26.1.2 Regulatory information [NR\_NTN\_enh-Core]

8.26.1.3 Others [NR\_NTN\_enh-Core]

8.26.2 Co-existence study for above 10GHz bands [NR\_NTN\_enh-Core]

8.26.3 SAN RF requirements [NR\_NTN\_enh-Core]

8.26.4 SAN RF conformance testing requirements [NR\_NTN\_enh-Perf]

8.26.5 UE RF requirements [NR\_NTN\_enh-Core]

8.26.5.1 RF requirements [NR\_NTN\_enh-Core]

8.26.5.2 Release independent requirements [NR\_NTN\_enh-Core]

8.26.6 RRM core requirements [NR\_NTN\_enh-Core]

8.26.6.1 NR-NTN RRM requirements in above 10 GHz bands [NR\_NTN\_enh-Core]

\* submit some general discussions if needed under this agenda. Submit the proposals for Type 1 and Type 2 UEs in the same contribution.

8.26.6.2 Network verified UE location [NR\_NTN\_enh-Core]

8.26.6.3 NTN-TN and NTN-NTN mobility and service continuity enhancements [NR\_NTN\_enh-Core]

8.26.7 RRM performance requirements [NR\_NTN\_enh-Perf]

8.26.8 Demodulation performance requirements [NR\_NTN\_enh-Perf]

8.26.8.1 SAN demodulation performance requirements [NR\_NTN\_enh-Perf]

8.26.8.2 UE demodulation performance and CSI requirements [NR\_NTN\_enh-Perf]

8.26.9 Moderator summary and conclusions

With the following pre-meeting deadlines:

* Before November 5 (Monday): Session chairs will provide the list of topics with moderator assignments.
* November 8 (Wednesday), 17:00 UTC: Moderators provide the initial summary for a topic
* November 9 (Thursday), 17:00 UTC: Deadline for companies review of initial summary
* November 10 (Friday), 17:00 UTC: Moderators submit the formal tdoc of summary for a topic
* November 12 (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 [109][308] NR\_NTN\_enh\_Part1:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| ***TDoc Number*** | ***TDoc Type*** | ***Title*** | ***Company/Source*** | ***General Purpose*** | ***Agenda Item*** |
| [R4-2319569](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319569.zip) | other | NTN enhancement: system parameters update | Ericsson | Approval | 8.26.1.1 |
| [R4-2320152](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320152.zip) | draftCR | Draft CR on TS 38.108: Corrections on channel raster and synchronization raster | NEC | Endorsement | 8.26.1.1 |
| [R4-2319571](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319571.zip) | CR | NTN enhancement: CR to TR 38.863 NTN Ka-band Regulatory aspects | Ericsson | Agreement | 8.26.1.2 |
| [R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip) | other | Discussion on regulatory information on NTN UE | Samsung | Approval | 8.26.1.2 |
| [R4-2320952](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320952.zip) | pCR | Draft TP for TR 37.911 - Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology | THALES | Approval | 8.26.1.3 |
| [R4-2320949](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320949.zip) | CR | Draft CR proposal to add Doppler and Delay variation examples as a function of time for NGSO and GSO in a new Annex | THALES | Agreement | 8.26.1.3 |

The current list of topics/sub-topics/issues prior to the meeting is:

* **Topic #1:** System parameters & regulatory information

\* Include band definition

* + Sub-topic 1-1: System parameters
		- Issue 1-1-1: NR-ARFCN Extension for NTN in above 10 GHz
		- Issue 1-1-2: GSCN Extension for NTN in above 10 GHz
	+ Sub-topic 1-2: Regulatory information for NTN UE
		- Issue 1-2-1: Emission limitations
		- Issue 1-2-2: Power limits for earth stations
		- Issue 1-2-3: Minimum antenna elevation angle
		- Issue 1-2-4: Earth station antenna performance standards
		- Issue 1-2-5: Narrowband analog transmissions and digital transmissions in the GSO FSS
		- Issue 1-2-6: Off-axis EIRP density envelopes for FSS earth stations transmitting in certain frequency bands
		- Issue 1-2-7: Operating and coordination requirements for earth stations in motion (ESIMs)
	+ Sub-topic 1-3: Draft CRs & pCRs/TPs.
		- Issue 1-3-1: Update TR 38.863 - regulatory section with information for Ka-band ([R4-2319571](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319571.zip), Ericsson).
		- Issue 1-3-2: Update TS 38.108 - Define the NR-ARFCN and GSCN parameters for the frequency range between 24.25 GHz and 30 GHz for FR2-NTN ([R4-2320152](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320152.zip), NEC).
		- Issue 1-3-3: Update TR 37.911 - Draft TP for TR 37.911 - Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology ([R4-2320952](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320952.zip), THALES).
		- Issue 1-3-4: Update TR 38.863 - Plots for NGSO (LEO at 600 km, LEO at 1200 km) with orbit inclination of 88 degrees and GSO with orbit inclination of 7 degrees is given as part of a new Annex ([R4-2320949](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320949.zip), THALES).

# Topic #1: System parameters & regulatory information

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| [R4-2319569](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319569.zip) | Ericsson | **Proposal: Extend the NR-ARFCN parameters table with the following range:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Range of frequencies (MHz) | ΔFGlobal (kHz) | FREF-Offs (MHz) | NREF-Offs | Range of NREF |
| 24250 – 100000 | 60 | 24250.08 | 2016667 | 2016667 – 3279165 |

 |
| [R4-2320152](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320152.zip) | NEC | Frequency range of FR2-NTN is defined as between 17,300 MHz and 30,000 MHz. However, NR-ARFCN and GSCN parameters are defined only up to 24,250 MHz.The CR proposes to define the NR-ARFCN and GSCN parameters for the frequency range between 24.25 GHz and 30 GHz for FR2-NTN. |
| [R4-2319571](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319571.zip) | Ericsson | This CR proposes updates of TR 38.863 mentioning the regulatory information of NTN Ka-band. |
| [R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip) | Samsung | **Proposal 1: Adopt FCC 25.202(f) for band n511 and n510 for OOBE requirements for NTN UE in TS 38.101-5.****Proposal 2: Adopt FCC 25.202(f)(4) for band n511 and n510 for spurious emission requirements for NTN UE in TS 38.101-5.****Proposal 3: Adopt FCC 25.204(b), (c), (d), (e)(1), (e)(3) and (e)(4) for band n511 and n510 to the transmit power requirements for NTN UE in TS 38.101-5.****Proposal 4: Adopt FCC 25.205 for band n511 and n510 to the transmit power requirements for NTN UE in TS 38.101-5.****Proposal 5: Adopt FCC 25.209(a)(1), (a)(3), (a)(6), (b)(3), (e) and (f) for band n511 and n510 to the off-axis eirp limit requirements for NTN UE in TS 38.101-5.****Proposal 6: Adopt FCC 25.212(e) for band n511 and n510 to the transmit power requirements for NTN UE in TS 38.101-5.****Proposal 7: Adopt FCC 25.218(i) for band n511 and n510 to the off-axis eirp limit requirements for NTN UE in TS 38.101-5.****Proposal 8: We propose the meeting to consider whether the FCC operational requirements, related to n510 and n511, need to be considered in the TS. It relates to the mechanism to apply stop-transmission command to an earth station that creating unacceptable interferences and others.** |
| [R4-2320952](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320952.zip) | THALES | Draft TP for TR 37.911 - Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology. |
| [R4-2320949](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320949.zip) | THALES | Doppler shift and Delay variation versus time is not explicitly defined in TS 38.863.Plots for NGSO (LEO at 600 km, LEO at 1200 km) with orbit inclination of 88 degrees and GSO with orbit inclination of 7 degrees is given as part of a new Annex. |

## Open issues summary

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

### Sub-topic 1-1

*Sub-topic description* NTN regulatory information

*Open issues and candidate options before meeting:*

**Issue 1-1-1:** NR-ARFCN Extension for NTN in above 10 GHz

* Proposals
	+ Option 1: **Extend the NR-ARFCN parameters table with the following range (P1/**[R4-2319569](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319569.zip))**:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Range of frequencies (MHz) | ΔFGlobal (kHz) | FREF-Offs (MHz) | NREF-Offs | Range of NREF |
| 24250 – 100000 | 60 | 24250.08 | 2016667 | 2016667 – 3279165 |

* + Option 2: ([R4-2320152](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320152.zip))

Table 5.4.2.1-1: NR-ARFCN parameters for the global frequency raster

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Range of frequencies (MHz) | ΔFGlobal (kHz) | FREF-Offs (MHz) | NREF-Offs | Range of NREF |
|  0 – 3000 | 5 | 0 | 0 |  0 – 599999 |
| 3000 – 24250 | 15 | 3000 | 600000 | 600000 – 2016666 |
| 24250 – 30000 | 60 | 24250.08 | 2016667 | 2016667 – 2112499 |

* Recommended WF
	+ Option 2 if agreeable, since corresponds better to FR2-NTN range.

**Issue 1-1-2:** GSCN Extension for NTN in above 10 GHz

* Proposals
	+ Option 1: ([R4-2320152](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320152.zip))

Table 5.4.3.1-1: GSCN parameters for the global frequency raster

|  |  |  |  |
| --- | --- | --- | --- |
| Range of frequencies (MHz) | SS block frequency position SSREF | GSCN | Range of GSCN |
|  0 – 3000 | N \* 1200 kHz + M \* 50 kHz,N = 1:2499, M ϵ {1,3,5} (Note) | 3N + (M-3)/2 |  2 – 7498 |
| 3000 – 24250 | 3000 MHz + N \* 1.44 MHz, N = 0:14756 | 7499 + N | 7499 – 22255 |
| 24250 – 30000 | 24250.08 MHz + N \* 17.28 MHz, N = 0:332 | 22256 + N | 22256 – 22588 |
| NOTE: The default value for *operating bands* which only support SCS spaced channel raster(s) is M=3. |

* Recommended WF
	+ Option 1 if agreeable. However, the proposal seems strange since the NTN DL Ka-band is between 17.2 and 20.3 GHz.

### Sub-topic 1-2

*Sub-topic description* Regulatory information for NTN UE

*Open issues and candidate options before meeting:*

**Issue 1-2-1:** Emission limitations

* Proposals
	+ Option 1: **(P1 & P2/**[R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip))
		- **OOBE: Adopt FCC 25.202(f)(1)~(3) for band n511 and n510 for OOBE requirements for NTN UE in TS 38.101-5.**
		- **Spurious: Adopt FCC 25.202(f)(4) for band n511 and n510 for spurious emission requirements for NTN UE in TS 38.101-5.**
* Recommended WF
	+ Option 1 if agreeable.

**Issue 1-2-2:** Power limits for earth stations

* Proposals
	+ Option 1: **(P3/**[R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip))
		- **Adopt FCC 25.204(b), (c), (d), (e)(1), (e)(3) and (e)(4) for band n511 and n510 to the transmit power requirements for NTN UE in TS 38.101-5.**
* Recommended WF
	+ Option 1 if agreeable.

**Issue 1-2-3:** Minimum antenna elevation angle

* Proposals
	+ Option 1: **(P4/**[R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip))
		- **Adopt FCC 25.205 for band n511 and n510 to the transmit power requirements for NTN UE in TS 38.101-5.**
* Recommended WF
	+ Option 1 if agreeable.

**Issue 1-2-4:** Earth station antenna performance standards

* Proposals
	+ Option 1: **(P5/**[R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip))
		- **Adopt FCC 25.209(a)(1), (a)(3), (a)(6), (b)(3), (e) and (f) for band n511 and n510 to the off-axis eirp limit requirements for NTN UE in TS 38.101-5.**
* Recommended WF
	+ Option 1 if agreeable.

**Issue 1-2-5:** Narrowband analog transmissions and digital transmissions in the GSO FSS

* Proposals
	+ Option 1: **(P6/**[R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip))
		- **Adopt FCC 25.212(e) for band n511 and n510 to the transmit power requirements for NTN UE in TS 38.101-5.**
* Recommended WF
	+ Option 1 if agreeable.

**Issue 1-2-6:** Off-axis EIRP density envelopes for FSS earth stations transmitting in certain frequency bands

* Proposals
	+ Option 1: **(P7/**[R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip))
		- **Adopt FCC 25.218(i) for band n511 and n510 to the off-axis eirp limit requirements for NTN UE in TS 38.101-5.**
* Recommended WF
	+ Option 1 if agreeable.

**Issue 1-2-7:** Operating and coordination requirements for earth stations in motion (ESIMs)

* Proposals
	+ Option 1: **(P8/**[R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip))
		- **Propose the meeting to consider whether the FCC operational requirements, related to n510 and n511, need to be considered in the TS. It relates to the mechanism to apply stop-transmission command to an earth station that creating unacceptable interferences and others.**
* Recommended WF
	+ Option 1 if agreeable.

### Sub-topic 1-3

*Sub-topic description* Draft CRs & pCRs/TPs.

*Open issues and candidate options before meeting:*

**Issue 1-3-1:** Update TR 38.863 - regulatory section with information for Ka-band (R4-2319571, Ericsson).

* Proposals
	+ Option 1: This draft CR proposes updates of TR 38.863 mentioning the regulatory information of NTN Ka-band.
* Recommended WF
	+ To be Agreed if no other objections ([R4-2319571](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319571.zip) submitted from previous endorsed [R4-2315767](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_108bis/Docs/R4-2315767.zip), re-submitted from [R4-2313242](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_108/Docs/R4-2313242.zip))

**Issue 1-3-2:** Update TS 38.108 - Define the NR-ARFCN and GSCN parameters for the frequency range between 24.25 GHz and 30 GHz for FR2-NTN (R4-2320152, NEC).

* Proposals
	+ Option 1: Define the NR-ARFCN and GSCN parameters for the frequency range between 24.25 GHz and 30 GHz for FR2-NTN.
* Recommended WF
	+ To be Endorsed at least for NR-ARFCN if no other objections (in order to be included in the Running CR [R4-2319580](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319580.zip) “NTN enhancement: Running CR to TS 38.108 NTN Ka-band” from Ericsson, Huawei, THALES on TS 38.108 for RAN4#109)
	+ However, with respect to GSCN it seems strange since the NTN DL Ka-band is between 17.2 and 20.3 GHz.

**Issue 1-3-3:** Update TR 37.911 - Draft TP for TR 37.911 - Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology (R4-2320952, THALES).

* Proposals
	+ Option 1: TP for introduction of Clauses 7.2 Bandwidth and 7.3 Spectrum.
* Recommended WF
	+ To be Approved if no other objections.

**Issue 1-3-4:** Update TR 38.863 - Plots for NGSO (LEO at 600 km, LEO at 1200 km) with orbit inclination of 88 degrees and GSO with orbit inclination of 7 degrees is given as part of a new Annex (R4-2320949, THALES).

* Proposals
	+ Option 1: Add plots Doppler, Delay=Function(time) as examples for NGSO (LEO at 600 km, LEO at 1200 km) with orbit inclination of 88 degrees and GSO with orbit inclination of 7 degrees is given as part of a new Annex of TR 38.863.
* Recommended WF
	+ To be Approved if no other objections.

# ANNEX with all Tdocs and proposals initially submitted to [109][308] NR\_NTN\_enh\_Part1

|  |  |  |
| --- | --- | --- |
| ***TDoc Number*** | ***Company/Source*** | ***Proposals*** |
| [R4-2319569](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319569.zip) | Ericsson | **Proposal: Extend the NR-ARFCN parameters table with the following range:**

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| 24250 – 100000 | 60 | 24250.08 | 2016667 | 2016667 – 3279165 |

 |
| [R4-2320152](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320152.zip) | NEC | Frequency range of FR2-NTN is defined as between 17,300 MHz and 30,000 MHz. However, NR-ARFCN and GSCN parameters are defined only up to 24,250 MHz.The CR proposes to define the NR-ARFCN and GSCN parameters for the frequency range between 24.25 GHz and 30 GHz for FR2-NTN. |
| [R4-2319571](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319571.zip) | Ericsson | This CR proposes updates of TR 38.863 mentioning the regulatory information of NTN Ka-band. |
| [R4-2319182](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2319182.zip) | Samsung | **Proposal 1: Adopt FCC 25.202(f) for band n511 and n510 for OOBE requirements for NTN UE in TS 38.101-5.****Proposal 2: Adopt FCC 25.202(f)(4) for band n511 and n510 for spurious emission requirements for NTN UE in TS 38.101-5.****Proposal 3: Adopt FCC 25.204(b), (c), (d), (e)(1), (e)(3) and (e)(4) for band n511 and n510 to the transmit power requirements for NTN UE in TS 38.101-5.****Proposal 4: Adopt FCC 25.205 for band n511 and n510 to the transmit power requirements for NTN UE in TS 38.101-5.****Proposal 5: Adopt FCC 25.209(a)(1), (a)(3), (a)(6), (b)(3), (e) and (f) for band n511 and n510 to the off-axis eirp limit requirements for NTN UE in TS 38.101-5.****Proposal 6: Adopt FCC 25.212(e) for band n511 and n510 to the transmit power requirements for NTN UE in TS 38.101-5.****Proposal 7: Adopt FCC 25.218(i) for band n511 and n510 to the off-axis eirp limit requirements for NTN UE in TS 38.101-5.****Proposal 8: We propose the meeting to consider whether the FCC operational requirements, related to n510 and n511, need to be considered in the TS. It relates to the mechanism to apply stop-transmission command to an earth station that creating unacceptable interferences and others.** |
| [R4-2320952](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320952.zip) | THALES | **Draft TP for TR 37.911 - Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology** |
| [R4-2320949](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_109/Docs/R4-2320949.zip) | THALES | Doppler shift and Delay variation versus time is not explicitly defined in TS 38.863.Plots for NGSO (LEO at 600 km, LEO at 1200 km) with orbit inclination of 88 degrees and GSO with orbit inclination of 7 degrees is given as part of a new Annex. |