D7.3: Standardisation interim report

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Abstract	This document aims at reporting on the standardization activities conducted during the first 18 months.
Keywords	5G, NTN, standardisation, 3GPP

Document Revision History

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0.1	25/06/2024	Draft version	Flavien Ronteix (TAS-F)
0.2	01/07/2024	QA review from CTTC	Musbah Shaat, Marius Caus (CTTC
0.3	01/07/2024	Revised version according to the QA review comments	Flavien Ronteix (TAS-F)
1.0.F	04/07/2024	Final version for approval and EC submission	Tomaso de Cola (DLR)

DISCLAIMER

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* R: Document, report (excluding the periodic and final reports)

DEM: Demonstrator, pilot, prototype, plan designs

DEC: Websites, patents filing, press & media actions, videos, etc.

DATA: Data sets, microdata, etc.

DMP: Data management plan

ETHICS: Deliverables related to ethics issues.

SECURITY: Deliverables related to security issues

OTHER: Software, technical diagram, algorithms, models, etc.

EXECUTIVE SUMMARY

This deliverable aims at providing a summary of the activities conducted in 5G-Stardust project in the field of Standardisation. A standardisation action plan (D.7.3) has been elaborated during the first phases of the project. The present deliverable examines the progress made with respect to this Workplan and up to Q2 2024.

In the first part of the deliverable, the main standardization activities relevant to NTN, which are taking place at the 3GPP standardization development body are described. The 3GPP work on the support hybrid terrestrial-satellite systems enabling NR services through satellites work, started with study items on NTN in Releases-15 and 16. The necessary features for the support of this NTN component have been specified as part of the 3GPP Release-17. The Release-17 normative works on NTN in 3GPP TSG RAN and TSG SA have been completed in June 2022 and the ASN.1 freeze in September 2022.

To support new scenarios covering deployments in frequency bands above 10 GHz and to introduce several performance optimization enhancements for NR NTN, a normative work is being carried out as part of Release 18. Service continuity enhancements are also part of Release 18 for both NTN-TN and NTN-NTN mobility. The normative phase has been completed in June 2024 for both core and performance parts.

The Release 19 work item objectives have been approved in December 2023, which include the support of the regenerative payload. The normative work is expected to be completed in June 2025.

According to the given outlook, the second half of the project will be devoted to consolidate the technical work towards the reporting into the identified standardisation venues.

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ABBREVIATIONS

3GPP	3rd Generation Partnership Project
5G-Stardust	5G-Satellite and Terrestrial Access for Distributed, Ubiquitous, and Smart Telecommunications
AI/ML	Artificial Intelligence/Machine Learning
AMR	Adaptive MultiRate audio codec
ASN.1	Abstract Syntax Notation One
ATG	Air-to-Ground
DAPS	Dual Active Protocol Stack
DL	DownLink
DMRS	DeModulation Reference Signal
E2E	End to End
eMTC	Enhanced Machine-Type communication
ESIM	Earth Station in Motion
FDD	Frequency Division Duplex
FR	Frequency Range
FWA	Fixed Wireless Access
GEO	Geosynchronous Earth Orbit
gNB	next Generation Node B
GNSS	Global Navigation Satellite System
GSO	Geo Synchronous Orbit
HAPS	High Altitude Platform Station
HARQ	Hybrid Automatic Repeat reQuest
HARQ-ACK	HARQ ACKnowledgment
IMS	Ip Multimedia Subsystem
IoT	Internet of Things
IP	Internet Protocol
ISL	Inter Satellite Link
LEO	Low Earth Orbit
LOS	Line of Sight
MEO	Medium Earth Orbit
MIMO	Multiple Input Multiple Output
NGAP	Next Generation Application Protocol
NGSO	Non Geosynchronous Orbit
NR	New Radio
NTN	Non-Terrestrial Networks
OCC	Orthogonal Cover Codes
PLMN	Public Land Mobile Network
PUCCH	Physical Uplink Control CHannel
RACH	Random Access CHannel
RAN	Radio Access Network
RAT	Radio Access Technology
Rel.	Release
RF	Radio Frequency
RRC	Radio Resource Control
Rx	Reception

SA	System Aspects
SI	Study Item
SIB	System Information Block
SNS	Smart Networks and Services
TDD	Time Division Duplex
TN	Terrestrial Network
TR	Technical Report
TS	Technical Specification
TSG	Technical Specification Group
Tx	Transmission
UE	User Equipment
UL	UpLink
VoIP	Voice Over IP
VSAT	Very Small Aperture Terminal
WG	Working Group
WI	Work Item
WID	Work Item Description
WP	Work Package

1 INTRODUCTION

This deliverable aims at providing a summary of the activities conducted in 5G-STARDUST in the field of Standardisation in the first half of the project, (i.e. from Jan. 2023 until June 2024).

A standardisation and regulatory action plan (D7.3) was elaborated during the first phases of the project. The present deliverable examines the progress made with respect to this workplan in 2023 and mid-2024.

For reminder, the 5G-STARDUST project objectives are:

- Study, design, a 5G-based satellite network, implementing onboard processing and storage capabilities towards effective networking and mobile computing in the sky
- Define, design data-driven management system components, building on AI/ML based solutions for resource allocation and service provision in highly dynamic integrated hybrid networks
- To define, design, and analyse a unified radio interface towards a cost-effective TN-NTN network integration
- Design, implement, and demonstrate E2E services over a fully integrated TN-NTN advanced network architecture with regenerative space nodes
- Contribute to the development of a European Research and Technology roadmap to ensure strategic positioning and global competitiveness of Europe in integrated TN-NTN communications.

The objectives for the standardization part to support scenarios defined in D2.1 involve:

- Support regenerative payload architecture
- Enable dual connectivity between TN and NTN
- Enhance service continuity between TN and NTN
- Support Ka band
- Enhance NTN coverage

2 STANDARDIZATION REPORT

2.1 3GPP STANDARDIZATION WORK ON NTN

The standardization work on the integration of satellite access in 3GPP eco system started in Rel-15 with a SI on NR to support NTN in the RAN WGs and an SI on using satellite access in 5G conducted in SA1.

In Release-16 several study items have been conducted in different WGs:

- In SA1, a study on using satellite access in 5G to identify the use cases for the provision of services when considering the integration of 5G satellite-based access components in the 5GS,
- System & service and performance requirements for 5G satellite access have been established by SA1,
- In SA2, a study on architecture aspects for using satellite access in 5G,
- In SA5, a study on management and orchestration aspects of integrated satellite components in a 5G network,
- In RAN, based on the outcomes of the Release 15 study item, RAN WGs have conducted a study on solutions for NR to support NTN.

In Release-17, 3GPP conducted normative work on NR NTN and IoT NTN:

- In SA2, WI on the integration of satellite in 5G architecture
- In CT1, study and specification of the solutions related to the integration of satellite in 5G architecture and the support of PLMN selection for satellite access
- In RAN, 3GPP Release 17 WI on 5G NR to support NTN. Initial studies have been performed in Release-17 for IoT as well, followed by a normative work to specify both NB-IoT and eMTC support for satellite access.

The first set of 3GPP technical specifications incorporating the necessary features and adaptations for 5G to support NTN have been completed in June 2022 as part of the Release-17 with the ASN.1 freeze in September 2022.

NTN Release 18, which started in May 2022, includes WI on further enhancements for NR and NB-IoT/ eMTC over NTN, respectively (they will be detailed in the next section). The release was concluded in June 2024, including core and performance parts.

NTN Release 19 started in March 2024 in RAN WG 1 after WI approval in December 2023. It includes evolutions for NR and NB-IoT/eMTC over NTN including the support of the regenerative payload.

2.2 3GPP TIMELINE FOR REL-18 AND REL-19

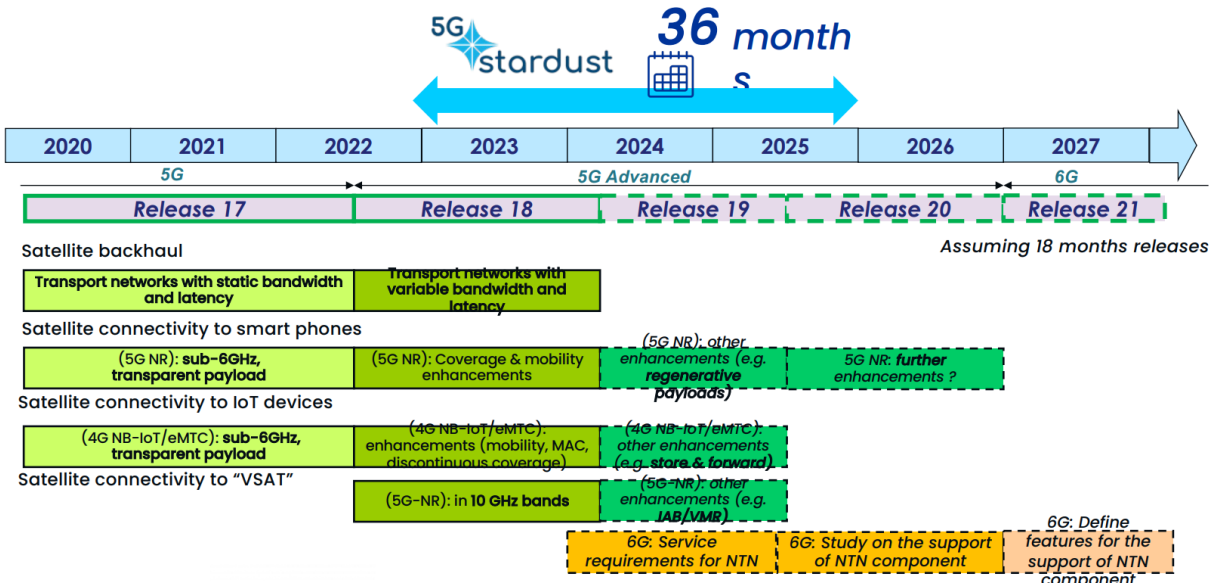

Figure 1 - 3GPP standardisation timeline

The 5G- STARDUST project covers Rel-18, Rel-19 and preparation of Rel-20 and further (i.e. 6G). The content of the WI for Release 18 was already approved at the beginning of the project. Rel-19 contents was discussed and approved during the project execution.

5G-STARDUST participation to the standardisation process within 3GPP has happened through the individual companies (e.g., Thales Alenia Space, Hispasat, and Orange) and with the discussion taking place through the ESA-supported SSIG[1] platform (Standardisation Special Interest Group), where a larger participation of organisations is involved (Thales Alenia Space, Hispasat, DLR, CNIT, CTTC for what concerns 5G-STARDUST consortium). This platform has been mostly used for preparing forthcoming 3GPP meetings or discussing the results of recently held ones, as well as introducing possible new SI/WI of interest for the overall NTN community (industry and academia/research institutes).

2.3 SATELLITE STANDARDISATION ACTIVITIES IN 3GPP REL-18

NOTE: The 5G-STARDUST project started after the definition of the Rel-18 objectives.

2.3.1 Release-18 WID Objectives

As part of Release 18, a new WI is proposed to further optimize satellite access performance, address new bands with their specific regulatory requirements, and support new capabilities and services as the evolution of 5G continues.

Specifically, Release 18 WI defines enhancements for NG-RAN based NTNs in order to:

- Support new scenarios to cover deployments in frequency bands above 10 GHz.

[1] https://connectivity.esa.int/sites/default/files/SSIG_ToR_revised_AJM.pdf

- Offer optimized performance, especially when addressing handset terminals (including smartphones) with more realistic assumptions on antenna gains, rather than the 0 dBi antenna gain. The specific realistic antenna gain assumption will be determined at the working group level w.r.t. coverage, considering the NTN characteristics such as large propagation delay and satellite movement.

- Provide mobility and service continuity enhancements considering the NTN characteristics such as large propagation delay and satellite movement.

- Address requirements, as determined by the FS_NR_NTN_netw_verif_UE_loc study outcome, which mandate the network operator to cross check the UE location reported by the UE. This verification is essential to comply with the regulatory requirements such as Lawful intercept, emergency call, Public Warning System. The network must verify the UE-reported location by estimating UE location at the network side and, if necessary, specify mechanisms to fulfil the regulatory requirements.

In the context of the 5G-Stardust project, the service continuity and the new scenarios to cover Ka-Band are considered. The detailed Release-18 work item objectives that are relevant to 5G-Stardust project are recalled hereafter:

The WI aims at specifying enhancements for NG-RAN based NTN according to the following assumptions with implicit compatibility to support HAPS and ATG scenarios:

- GSO and NGSO. NGSO includes LEO and MEO.

- Earth fixed tracking area. Earth fixed & Earth moving cells for NGSO

- FDD mode

- UEs with GNSS capabilities

- Both “VSAT” devices with directive antenna (including fixed and moving platform mounted devices) and commercial handset terminals (e.g. Power class 3) are supported in FR1

- Only “VSAT” devices with directive antenna (including fixed and moving platform mounted devices) are supported in above 10 GHz bands.

Note 1: In Rel-17 WID, “VSAT” device with external antenna on moving platform is equivalent to a device that operate on platforms in motion, and this is referred to as ESIM.

Note 2: The Rel-17 NTN architecture is assumed.

This WI is adding functionality in Rel-18 to enhance features that were introduced in Rel-15/16/17.

Coverage enhancement

The Rel-18 NTN objectives are focused on the applicability of the “solutions developed by general NR coverage enhancement” (NR_cov_enh) to NTN, and identifying potential issues and enhancements if necessary, considering the NTN characteristics including large propagation delay and satellite movement. Only NTN-specific characteristics are to be

included in this coverage enhancement work, otherwise it should be part of another WI (e.g., UL enhancement of coverage).

The following reference scenario is considered for the definition of uplink coverage enhancements for NTN: parameter set-1 for LEO-1200 satellite operating at LOS and commercial smartphones with -5.5 dBi antenna gain and 3 dB polarisation loss (per antenna port).

Note: It is understood that the enhancements defined for LEO can also apply to GEO and MEO scenarios as appropriate. No additional work is expected for MEO/GEO.

The targeted services are VoIP using AMR 4.75 kbps and data transmission services with Low data rate of 3 kbps.

The detailed objectives for NTN are:

- To specify PUCCH enhancements for Msg4 HARQ-ACK (e.g. repetition) [RAN1, RAN4]

- To specify if necessary, enhancements to the Rel-17 procedures for DMRS bundling for PUSCH taking into account NTN-specifics (e.g. time-frequency pre-compensation) [RAN1]

NR-NTN deployment in above 10 GHz bands

The following assumptions are taken as a baseline for this work:

- GSO and NGSO (e.g. LEO, MEO) based satellite access to be considered.
    - ESIM scenarios for NGSO in Ka band are not considered in this WI.
- Targeted UE types: fixed and mobile VSAT. VSAT UE characteristics from TR38.821 to be considered in priority but additional NTN UE classes may be considered if justified.
    - Regarding mobile VSAT, three types of terminals and scenario exist; airborne, maritime and land based ESIM. Which type(s) to be specified depending on the outcome of the regulation analysis and co-existence study.
- FDD mode is assumed for the service link (satellite – UE) of the satellite networks operating in above 10 GHz frequency bands, while TDD mode is assumed for “terrestrial” mobile network (gNB – UE) operating in bands in FR2
- The ITU-R harmonized Ka band will serve as reference
- Co-existence between overlapping NTN and TN band portions is out of scope of this WI. This aspect will be captured in the specification.

The objectives for NR-NTN deployment in above 10 GHz bands covers:

- Study and identify NTN example band: Analysis of regulations and adjacent channel co-existence scenarios. [RAN4]

- Consider the satellite harmonized Ka band as the example band [DL: 17.7 - 20.2 GHz; UL: 27.5 – 30.0 GHz], according to ITU allocation; taking into account deployment type (e.g. VSAT, ESIM), scenarios, and ITU-R/regional regulations, define a set of NTN bands (n510, n511, n512) covering the example band suitable for development of generic 3GPP minimum performance requirements [RAN4].

- Study implications of FDD operation in FR2 and derive requirements for the identified example band appropriately. Satellite bands introduced in 3GPP for NTN for FDD shall not impact the existing 3GPP TDD specifications for terrestrial bands adjacent to the NTN band (see note 3 of the approved way forward RP-211596 in RAN#92-e) [RAN4].

- Relevant coexistence scenarios and analysis to be considered in RAN4, if and where applicable, to ensure that satellite bands introduced in 3GPP for NTN shall not impact the existing specifications and shall not cause degradation (in the sense of RAN4 co-existence studies) to networks in 3GPP specified terrestrial bands adjacent to the NTN band. In that, it is assumed that the NTN-TN adjacent band coexistence will be performed at the harmonized Ka band edges. The outcome is expected to be applicable to all NTN-TN adjacent band scenarios (if any) in the whole Ka band range where applicable and regulations allow [RAN4].

- For all the above, RAN4 process as agreed for NTN in FR1 (see 3GPP TR 38.863) should be used for coexistence analysis in above 10 GHz bands [RAN4].

- Definition of NTN band(s) above 10 GHz does not change the current frequency ranges definition, nor automatically apply to future terrestrial bands defined in this frequency region; (see proposal 2 of the approved way forward RP-211596 in RAN#92-e) [RAN4]

- Specify Rx/Tx requirements for satellite access node and different VSAT UE class (not only 60 cm aperture) as appropriate for the identified example band [RAN4]

- Identify values for physical layer parameters chosen from the existing FR1 and FR2 sets. The following set of parameters to specify, but not necessarily limited to, are listed as follows [RAN4]:

  - time relationship related enhancement (e.g. K_offset)

  - subcarrier spacing for different UL/DL signals/channels

  - PRACH configuration index for FDD above 10 GHz

- Specify necessary RRM requirements for electronically-steered beam UEs (Type 1) and mechanically-steered beam UEs (Type 2)

NTN-TN and NTN-NTN mobility and service continuity enhancements

This work considers existing methods from NR TN as well as outcome of Rel-17 NR NTN WI outcome as baseline for NTN-TN mobility.

- Specify NTN-TN and NTN-NTN measurement/mobility and service continuity enhancements [RAN2,RAN3,RAN4]
    - For NTN-NTN mobility, specify cell reselection enhancements for earth moving cell, the timing based and location-based cell reselection for quasi-earth fixed cell in Rel-17 can be considered as the starting point [RAN2, RAN3, RAN4].
    - Specify NTN-NTN handover enhancement for RRC_CONNECTED UEs in the quasi-earth-fixed cell and earth-moving cell to reduce the signalling overhead [RAN2, RAN3].
    - Specify cell reselection enhancements for RRC_IDLE/INACTIVE UEs to reduce UE power consumption (NTN-TN mobility is prioritized [RAN2, RAN3, RAN4].
- Study and, if needed, specify enhancement to Xn[/NG] signalling to support feeder link switch-over, CHO, e.g. exchange of necessary information between gNBs [RAN3].Identify and if needed, define RRM enhancement in idle/inactive mode for autonomous SMTC shifting to address the effect of opposite satellite motion across adjacent orbital planes (RAN4)

2.3.2 List of 3GPP meetings attended by 5G-STARDUST partners

Since January 2023, 5G-STARDUST partners have participated to the following 3GPP RAN meeting for 5G NR NTN WI:

Table 1 - Participation of 5G-Stardust to RAN plenary meetings for Rel-18

3GPP Meeting	Dates	Location
RAN#99	2023-03-20 / 2023-03-23	Rotterdam (NL)
RAN#100	2023-06-12 / 2023-06-14	Taiwan (TW)
RAN#101	2023-09-11 / 2023-09-15	Bangalore (IN)
RAN#102	2023-12-11 / 2023-12-15	Edinburgh (UK)
RAN#103	2024-03-18 / 2024-03-21	Maastricht (NL)
RAN#104	2024-06-17 / 2024-06-20	Shanghai (CN)

Since January 2023, 5G-STARDUST partners have participated to the following 3GPP RAN 1 meetings for 5G NR NTN WI:

Table 2 - Participation of 5G-STARDUST to RAN WG1 meetings for Rel-18

3GPP Meeting	Dates	Location
RAN1#112	2023-02-27 / 2023-03-03	Athens (GR)
RAN1#112-bis-e	2023-04-17 / 2023-04-26	Electronic
RAN1#113	2023-05-22 / 2023-05-26	Incheon (KR)
RAN1#114	2023-08-21 / 2023-08-25	Toulouse (FR)
RAN1#114-bis	2023-10-09 / 2023-10-13	Xiamen (CN)
RAN1#115	2024-11-13 / 2024-11-17	Chicago (US)

Since January 2023, 5G-STARDUST partners have participated to the following 3GPP RAN 2 meetings for 5G NR NTN WI:

Table 3 - Participation of 5G-STARDUST to RAN WG2 meetings for Rel-18

3GPP Meeting	Dates	Location
RAN2#121	2023-02-27 / 2023-03-03	Athens (GR)
RAN2#121-bis-e	2023-04-17 / 2023-04-26	Electronic
RAN2#122	2023-05-22 / 2023-05-26	Incheon (KR)
RAN2#123	2023-08-21 / 2023-08-25	Toulouse (FR)
RAN2#123-bis	2023-10-09 / 2023-10-13	Xiamen (CN)
RAN2#124	2024-11-13 / 2024-11-17	Chicago (US)
RAN2#125	2024-02-26 / 2024-03-01	Athens (GR)

Since January 2023, 5G- STARDUST partners have participated to the following 3GPP RAN 3 meetings for 5G NR NTN WI:

Table 4 - Participation of 5G- STARDUST to RAN WG3 meetings for Rel-18

3GPP Meeting	Dates	Location

RAN3#119	2023-02-27 / 2023-03-03	Athens (GR)
RAN3#119-bis-e	2023-04-17 / 2023-04-26	Electronic
RAN3#120	2023-05-22 / 2023-05-26	Incheon (KR)
RAN3#121	2023-08-21 / 2023-08-25	Toulouse (FR)
RAN3#121-bis	2023-10-09 / 2023-10-13	Xiamen (CN)
RAN3#122	2024-11-13 / 2024-11-17	Chicago (US)
RAN3#123	2024-02-26 / 2024-03-01	Athens (GR)

Since January 2023, 5G- STARDUST partners have participated to the following 3GPP RAN 4 meetings for 5G NR NTN WI:

Table 5 - Participation of 5G-Stardust to RAN WG4 meetings for Rel-18

3GPP Meeting	Dates	Location
RAN4#106	2023-02-27 / 2023-03-03	Athens (GR)
RAN4#106-bis-e	2023-04-17 / 2023-04-26	Electronic
RAN4#107	2023-05-22 / 2023-05-26	Incheon (KR)
RAN4#108	2023-08-21 / 2023-08-25	Toulouse (FR)
RAN4#108-bis	2023-10-09 / 2023-10-13	Xiamen (CN)
RAN4#109	2024-11-13 / 2024-11-17	Chicago (US)
RAN4#110	2024-02-26 / 2024-03-01	Athens (GR)
RAN4#110-bis	2024-04-15 / 2024-04-19	Changsha (CN)
RAN4#111	2024-05-20 / 2024-05-24	Fukuoka (JP)

2.3.3 Contributions

The following are the contributions of 5G- STARDUST partners to 3GPP RAN meetings for Rel-18 NR NTN WI:

Table 6 - Contributions of 5G- STARDUST partners to 3GPP RAN meetings for Rel-18 NR NTN WI

Meeting	Tdoc	Contributors	Title
RAN#99	RP-230610	Apple, **Thales**, Hughes/EchoStar, Lockheed Martin, OPPO, Ligado, …	On Rel-18 NR NTN Downlink Coverage Enhancement
	RP-230629	Ericsson, Qualcomm, **Thales**	3GPP submission towards IMT-2020 Satellite
	RP-230630	Ericsson, Qualcomm, **Thales**	New SID: Study on Self-Evaluation towards IMT-2020 Satellite Radio Interface Submission
	RP-230728	**Thales**	Summary of offline discussion about NR NTN (Non-Terrestrial Networks) enhancements
	RP-230731	Ericsson, Qualcomm, **Thales**, MediaTek Inc.	New SID: Study on Self-Evaluation towards IMT-2020 Satellite Radio Interface Submission
	RP-230736	Ericsson, Qualcomm, **Thales**, MediaTek Inc.	New SID: Study on Self-Evaluation towards IMT-2020 Satellite Radio Interface Submission
	RP-230738	**Thales**	Draft LS to ITU-R WP4B on 3GPP submission towards IMT-2020 Satellite (to: SA; cc: -; contact: **Thales**)
	RP-230809	**Thales**	Revised WID: NR NTN (Non-Terrestrial Networks) enhancements
RAN#100	RP-230877	**Thales**	Revised WID: NR NTN (Non-Terrestrial Networks) enhancements
	RP-230878	**Thales**	Motivation to revise the Rel-18 WID NR_NTN_enh
	RP-231038	**Thales**	New WI: Extension to 30 MHz Channel Bandwidth for NR NTN in FR1
	RP-231320	MediaTek Inc., Qualcomm Inc., Ericsson, **Thales**	IMT-2020 submission of 3GPP satellite RITs
	RP-231437	**Thales**	New WI: Extension to 30 MHz Channel Bandwidth for NR NTN in FR1
	RP-231451	**Thales**	Way forward on WI NR_NTN_enh
	RP-231457	MediaTek Inc., Qualcomm Inc., Ericsson, **Thales**	IMT-2020 submission of 3GPP satellite RITs
	RP-231458	**Thales**	New WI: Extension to 30 MHz Channel Bandwidth for NR NTN in FR1
	RP-231482	**Thales**	Way forward on WI NR_NTN_enh
	RP-231484	**Thales**	Revised WID: NR NTN (Non-Terrestrial Networks) enhancements
	RP-231497	**Thales**	New WI: Extension to 30 MHz Channel Bandwidth for NR NTN in FR1
	RP-231499	**Thales**	New WI: Extension to 30 MHz Channel Bandwidth for NR NTN in FR1
RAN#101	RP-231565	**Thales**	Proposed RAN1/2/3 led topics for Rel-19 NTN evolution
	RP-231566	**Thales**	Consideration on RAN4 led NTN topics for Release 19
	RP-231957	**Thales**, Huawei, Ericsson	On Network Verified UE Location for Rel-18 NR NTN
	RP-232591	**Thales**	Characteristics template for 3GPP 5G NR satellite access RIT (Release 17 and beyond)
	RP-232647	**Thales**	Revised WID: 30 MHz Channel Bandwidth for NR NTN in FR1
	RP-232654	**Thales**	Way forward regarding NOTE in the network verified UE location objective in the NR NTN enhancement WID
	RP-232669	**Thales**	Revised WID: NR NTN (Non-Terrestrial Networks) enhancements
	RP-232694	**Thales**	Way forward on potential RRM objectives for NR-NTN deployment in above 10 GHz (NR-NTN-enh WID)
RAN#102	RP-234011	**Thales**	Revised WID: NR NTN (Non-Terrestrial Networks) enhancements
	RP-233958	**Thales**	WI exception: NR NTN (Non-Terrestrial Networks) enhancements
RAN#103	RP-240142	**Thales**, NTT Docomo	Rel-18 WI exception for NR NTN (Non-Terrestrial Networks) enhancements

The following are the contributions of 5G- STARDUST partners to 3GPP RAN 1 meetings for Rel-18 NR NTN WI:

Table 7 - Contributions of 5G- STARDUST partners to 3GPP RAN 1 meetings for Rel-18 NR NTN WI

Meeting	Tdoc	Contributors	Title
RAN1#112	R1-2300319	**Thales**	Discussion on network verified UE location in NR NTN
	R1-2300320	**Thales**	FL Summary #1: Network verified UE location for NR NTN
	R1-2300321	**Thales**	FL Summary #2: Network verified UE location for NR NTN
	R1-2300322	**Thales**	FL Summary #3: Network verified UE location for NR NTN
	R1-2300323	**Thales**	FL Summary #4: Network verified UE location for NR NTN

	R1-2300324	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R1-2302182	Moderator (**Thales**)	Draft CR on the Type-1 HARQ-ACK codebook
	R1-2302223	**Thales**	FL Summary #5: Network verified UE location for NR NTN
	R1-2302229	Moderator (**Thales**), OPPO, NTT DOCOMO, Xiaomi, Samsung, Ericsson	CR on the Type-1 HARQ-ACK codebook
RAN1#112-bis-e	R1-2302401	**Thales**	Discussion on network verified UE location in NR NTN
	R1-2302402	**Thales**	FL Summary #1: Network verified UE location for NR NTN
	R1-2302403	**Thales**	FL Summary #2: Network verified UE location for NR NTN
	R1-2302404	**Thales**	FL Summary #3: Network verified UE location for NR NTN
	R1-2302405	**Thales**	FL Summary #4: Network verified UE location for NR NTN
	R1-2302406	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R1-2302744	**Thales**	Draft CR on editorial correction on Common TA parameters
	R1-2302753	**Thales**	Draft CR on editorial correction on epoch time
	R1-2302873	Ericsson, Qualcomm, **Thales**	Assumptions for the Self-Evaluation for the Satellite Component of IMT-2020
	R1-2304078	Moderator (**Thales**)	FL Summary #2: Rel-17 NR NTN maintenance
RAN1#113	R1-2304610	**Thales**	Discussion on network verified UE location in NR NTN
	R1-2304611	**Thales**	FL Summary #1: Network verified UE location for NR NTN
	R1-2304612	**Thales**	FL Summary #2: Network verified UE location for NR NTN
	R1-2304613	**Thales**	FL Summary #3: Network verified UE location for NR NTN
	R1-2304615	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R1-2304759	**Thales**	Consideration on IMT-2020 Satellite self-evaluation
	R1-2306004	Rapporteur (**Thales**)	Initial input on higher layer parameters for Rel-18 NR NTN
	R1-2306005	Rapporteur (**Thales**)	RAN1 agreements for Rel-18 WI on NR NTN enhancements
	R1-2306253	Moderator (**Thales**)	Summary of offline discussion on RRC parameters for Rel-18 NR NTN enhancements
	R1-2306264	WI rapporteur (**Thales**)	RAN1 agreements for Rel-18 WI on NR NTN enhancements up to RAN1#113
RAN1#114	R1-2306404	**Thales**	Discussion on network verified UE location in NR NTN
	R1-2306407	**Thales**	Simulation results for the study on self-evaluation towards the IMT-2020 of the 3GPP Satellite RIT
	R1-2306408	**Thales**	Discussion on RAN4 LS on the system parameters for NTN above 10 GHz
	R1-2306410	Moderator (**Thales**)	Feature Lead Summary #1 on Network verified UE location for NR NTN
	R1-2306412	Moderator (**Thales**)	Feature Lead Summary #3 on Network verified UE location for NR NTN
	R1-2306413	Moderator (**Thales**)	Feature Lead Summary #4 on Network verified UE location for NR NTN
	R1-2306416	Moderator (**Thales**)	Feature Lead Summary #3 on self-evaluation results for NR NTN
	R1-2307729	**Thales**	Consideration on IMT-2020 Satellite self-evaluation
	R1-2308480	Moderator (**Thales**)	Summary of offline discussion on RRC parameters for Rel-18 NR NTN enhancements
	R1-2308608	Moderator (**Thales**)	Feature Lead Summary #5 on Network verified UE location for NR NTN
	R1-2308678	WI rapporteur (**Thales**)	RAN1 agreements for Rel-18 WI on NR NTN enhancements up to RAN1#114
RAN1#114-bis	R1-2308862	**Thales**	Maintenance on network verified UE location in NR NTN
	R1-2308863	**Thales**	Considerations on the system parameters for FR2-NTN
	R1-2308864	**Thales**	Feature Lead Summary #1 on Network verified UE location for NR NTN
	R1-2308865	**Thales**	Feature Lead Summary #2 on Network verified UE location for NR NTN
	R1-2308866	**Thales**	Feature Lead Summary #3 on Network verified UE location for NR NTN
	R1-2308868	**Thales**	Self-evaluation results for NR NTN
	R1-2308869	**Thales**	Feature Lead Summary#1 on self-evaluation results for NR NTN
	R1-2308870	**Thales**	Feature Lead Summary#2 on self-evaluation results for NR NTN
	R1-2308871	**Thales**	Feature Lead Summary#3 on self-evaluation results for NR NTN
	R1-2310221	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R1-2310397	Moderator (**Thales**)	FL Summary #1: Rel-17 NR NTN maintenance
	R1-2310650	Moderator (**Thales**)	Rel-18 Higher Layer Parameters for NR NTN
	R1-2310687	WI rapporteur (**Thales**)	RAN1 agreements for Rel-18 WI on NR NTN enhancements up to RAN1#114-bis
RAN1#115	R1-2310935	**Thales**	Maintenance on network verified UE location in NR NTN
	R1-2310936	**Thales**	Considerations on the system parameters for FR2-NTN
	R1-2310937	Moderator (**Thales**)	Feature Lead Summary #1 on Network verified UE location for NR NTN
	R1-2310938	Moderator (**Thales**)	Feature Lead Summary #2 on Network verified UE location for NR NTN
	R1-2310939	Moderator (**Thales**)	Feature Lead Summary #3 on Network verified UE location for NR NTN
	R1-2310940	**Thales**	Self-evaluation results for NR NTN

	R1-2310941	Moderator (**Thales**)	Feature Lead Summary#1 on self-evaluation results for NR NTN
	R1-2310942	Moderator (**Thales**)	Feature Lead Summary#2 on self-evaluation results for NR NTN
	R1-2312001	MediaTek, **Thales**, Qualcomm	Text Proposal to TR 37.911 for Connection Density evaluation for IoT NTN and NR NTN
	R1-2312246	**Thales**	TP for TS 38.300
	R1-2312424	Moderator (**Thales**)	Rel-18 Higher Layer Parameters for NR NTN
	R1-2312444	MediaTek, **Thales**, Qualcomm	Text Proposal to TR 37.911 for Connection Density evaluation for IoT NTN and NR NTN
	R1-2312461	OPPO, **Thales**, ZTE	CR on transmission timing adjustments for Rel-17 NR-NTN
	R1-2312462	OPPO, **Thales**, ZTE	CR on transmission timing adjustments for Rel-17 NR-NTN
	R1-2312495	Moderator (**Thales**)	TP for TS 38.300
	R1-2312496	RAN1, **Thales**	LS on NR-NTN TP for TS 38.300
	R1-2312518	Moderator (**Thales**)	FLS#1 on NR-NTN TP for TS 38.300
	R1-2312625	Moderator (**Thales**)	FLS#2 on NR-NTN TP for TS 38.300
	R1-2312669	Moderator (**Thales**)	TP for TS 38.300
	R1-2312670	RAN1, **Thales**	LS on NR-NTN TP for TS 38.300
	R1-2312681	RAN1, **Thales**	LS on NR-NTN TP for TS 38.300
RAN1#116	R1-2400816	**Thales**	Considerations on the system parameters for FR2-NTN
	R1-2401537	Moderator (**Thales**)	FL Summary #1: Maintenance on Network verified UE location for NR NTN
	R1-2401538	Moderator (**Thales**)	FL Summary #2: Maintenance on Network verified UE location for NR NTN
	R1-2401539	Moderator (**Thales**)	FL Summary #3: Maintenance on Network verified UE location for NR NTN

The following are the contributions of 5G- STARDUST partners to 3GPP RAN 2 meetings for Rel-18 NR NTN WI:

Table 8 - Contributions of 5G- STARDUST partners to 3GPP RAN 2 meetings for Rel-18 NR NTN WI

Meeting	Tdoc	Contributors	Title
RAN2#121	R2-2301977	discontinuous coverage Deutsche Telekom, Nokia, Nokia Shanghai Bell, Ericsson, Huawei, HiSilicon, **Thales**, Vodafone, Telit, BT, Telstra, Telecom Italia, Turkcell	Correction related to AS deactivation due to discontinuous coverage
	R2-2301445	**Thales**	Corrections to 38.300 related to Section Scheduling and Timing
	R2-2301436	**Thales**	Correction related to a missing description of a parameter of the number of HARQ processes
	R2-2301344	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
RAN2#121-bis-e	R2-2303162	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R2-2304268	OPPO, Ericsson, **Thales**, Samsung	NTN stage-2 correction
	R2-2304260	Ericsson, OPPO, **Thales**	Correction for R17 IoT NTN
	R2-2303261	**Thales**	Discussion on network verified UE location in NR NTN
	R2-2302765	**Thales**	Corrections to 38.300 related to Section Scheduling and Timing
	R2-2302755	**Thales**	Correction to 38.331 for kmac definition
RAN2#122	R2-2304761	OPPO, Ericsson, **Thales**, Samsung	NTN stage-2 correction
	R2-2304892	CATT, Qualcomm Incorporated, **Thales**, Quectel, Turkcell, IPLOOK	Clarification on the SFTD applicability for NTN cell
	R2-2305376	OPPO, LG Electronics, Qualcomm, CATT, Huawei, Lenovo, **Thales**	NTN stage-2 correction
	R2-2305391	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R2-2305407	**Thales**	Stage 2 running CR for TS 38.300 for Rel-18 NTN
	R2-2305408	**Thales**	Discussion on network verified UE location in NR NTN
	R2-2305410	**Thales**	Discussion on IMT-2020 Satellite self-evaluation for Latency and Mobility
	R2-2305497	Intel Corporation, Qualcomm Inc.,	Different UE capability support between TN and NTN

		Nokia, MediaTek, OPPO, vivo, Xiaomi, Apple, **Thales**, Lenovo, Samsung	
	R2-2306261	Ericsson, OPPO, **Thales**	Correction for R17 IoT NTN
	R2-2306655	OPPO, Ericsson, **Thales**, Samsung	NTN stage-2 correction
	R2-2306658	OPPO, LG Electronics, Qualcomm, CATT, Huawei, Lenovo, **Thales**	NTN stage-2 correction
	R2-2306661	Intel Corporation, Qualcomm Inc., Nokia, MediaTek, OPPO, vivo, Xiaomi, Apple, **Thales**, Lenovo, Samsung, Ericsson	Different UE capability support between TN and NTN
	R2-2306667	OPPO, Ericsson, **Thales**, Samsung, LG Electronics, Qualcomm, CATT, Huawei, Lenovo	NTN stage-2 correction
	R2-2306960	**Thales** (Rapporteur)	Stage 2 running CR for TS 38.300 for Rel-18 NTN enhancements
RAN2#123	R2-2307318	**Thales** (Rapporteur)	Stage 2 running CR for TS 38.300 for Rel-18 NTN enhancements
	R2-2307319	**Thales**, Telit	Discontinuous coverage handling enhancement for IoT NTN
	R2-2307320	**Thales**	Discussion on network verified UE location in NR NTN
	R2-2307321	**Thales**	Discussion on mobility enhancements for VSAT
	R2-2307322	**Thales**	Discussion on IMT-2020 Satellite self-evaluation for Latency and Mobility
	R2-2307323	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R2-2309329	**Thales** (Rapporteur)	Stage-2 running CR for TS 38.300 for Rel-18 NTN enhancements
RAN2#123-bis	R2-2310037	**Thales**	Discussion on network verified UE location in NR NTN
	R2-2310046	**Thales**	Discussion on mobility enhancements for VSAT
	R2-2310084	**Thales**	Remaining Issues on NR Non-Terrestrial Networks (NTN)
	R2-2310085	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R2-2310086	**Thales**	Discussion on IMT-2020 Satellite self-evaluation for Latency
	R2-2310192	Inmarsat, Viasat, Sateliot, Novamint, ESA, **Thales**	NB-IoT NTN Coarse UE location reporting
	R2-2311229	Ericsson, **Thales**	NTN neighbour cell information in TN cells
	R2-2311255	**Thales** (Rapporteur)	Stage-2 running CR for TS 38.300 for Rel-18 NTN enhancements
RAN2#124	R2-2312857	**Thales**	Remaining Issues on NR Non-Terrestrial Networks (NTN)
	R2-2312858	**Thales**	Introduction of NTN enhancements
	R2-2312865	**Thales**	Discussion on IMT-2020 Satellite self-evaluation for Latency
	R2-2313506	**Thales**	Discussion on mobility enhancements for VSAT
	R2-2313530	Ericsson, **Thales**, Apple, Samsung, Deutsche Telekom, Qualcomm	NTN neighbour cell information in TN cells
	R2-2313552	LG Electronics France, Google Inc., **Thales**	Remaining issues on NTN-TN cell reselection enhancement
	R2-2313771	**Thales** (Rapporteur)	Introduction of NTN enhancements
	R2-2313878	**Thales**, Ericsson	TP for IMT-2020 Satellite self-evaluation for Latency
	R2-2314001	R3 (Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated, NEC)	Stage 2 CR for NR NTN
RAN2#125	R2-2401084	CATT, **Thales**, vivo, Samsung, Ericsson, Nokia, Nokia Shanghai Bell, Huawei, HiSilicon, ITL, OPPO	[C606] Further discussion on CHO in EMC
	R2-2402051	**Thales** (Rapporteur), Ericsson, Huawei,	38.300 NR NTN Corrections

		HiSilicon, Intel, Mediatek, Nokia, Nokia Shanghai Bell, Samsung	
RAN2#125-bis	R2-2403773	**Thales**	Stage-2 corrections on NR NTN
RAN2#126	R2-2406115	**Thales**	Stage-2 corrections on NR NTN

The following are the contributions of 5G- STARDUST partners to 3GPP RAN 3 meetings for Rel-18 NR NTN WI:

Table 9 - Contributions of 5G- STARDUST partners to 3GPP RAN 3 meetings for Rel-18 NR NTN WI

Meeting	Tdoc	Contributors	Title
RAN3#119	R3-230056	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell	UE Location Verification by the Network
	R3-230059	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	XnAP BLCR on NTN Functionality
	R3-230068	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	Support for IoT NTN enhancements
	R3-230135	**Thales**	Corrections to abbreviations, figures and table header
	R3-230435	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R3-230436	Ericsson, **Thales**, Intelsat, Lockheed Martin, Hughes Network Systems, CATT, ESA	NGAP Support for Time-Based HO in NTN
	R3-230438	Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, CATT, ESA	Time-Based HO for NTN - NGAP Impacts
	R3-230441	Ericsson, **Thales**	Time Margin for CHO in NR NTN
	R3-231060	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm	Stage 2 BL CR for NR NTN
RAN3#119-bis-e	R3-231139	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	XnAP BLCR on NTN Functionality
	R3-231140	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm	(BLCR) Stage 2 BL CR for NR NTN
	R3-231142	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BLCR) Support for IoT NTN enhancements
	R3-231364	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R3-231417	Ericsson, **Thales**, Intelsat, Lockheed Martin, Hughes Network Systems, CATT, ESA	NGAP Support for Time-Based HO in NTN
	R3-231418	Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, CATT, ESA	Time-Based HO for NTN - NGAP Impacts
	R3-231419	Ericsson, **Thales**	Time Margin for CHO in NR NTN
	R3-232093	Ericsson, **Thales**, Intelsat, Lockheed Martin, Hughes Network Systems, CATT, ESA	NGAP Support for Time-Based HO in NTN
	R3-232159	Ericsson, **Thales**, Intelsat, Lockheed Martin, Hughes Network Systems, CATT, ESA	NGAP Support for Time-Based HO in NTN
RAN3#120	R3-232518	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BLCR) Support for IoT NTN enhancements
	R3-232541	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	XnAP BLCR on NTN Functionality
	R3-232826	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated	(BLCR to 38.300) Stage 2 BL CR for NR NTN
	R3-232947	Ericsson, **Thales**, Intelsat, Lockheed Martin, Hughes Network Systems, CATT, ESA, Nokia, Nokia Shanghai Bell	NGAP Support for Time-Based HO in NTN
	R3-232948	Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA	Time-Based HO for NTN - NGAP Impacts
	R3-232967	Ericsson, **Thales**	Time Margin for CHO in NR NTN
	R3-233021	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3

	R3-233304	Ericsson, **Thales**, ESA	Time Margin for CHO in NR NTN
	R3-233309	Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA	Time-Based HO for NTN - NGAP Impacts
	R3-233482	Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Nokia, Nokia Shanghai Bell	Time-Based HO for NTN - NGAP Impacts
	R3-233494	Ericsson, **Thales**, Intelsat, Lockheed Martin, Hughes Network Systems, CATT, ESA, Nokia, Nokia Shanghai Bell, Huawei, ZTE, Qualcomm Incorporated	NGAP Support for Time-Based HO in NTN
	R3-233526	Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Nokia, Nokia Shanghai Bell, Qualcomm, Samsung	Time-Based HO for NTN - NGAP Impacts
	R3-233559	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated	(BLCR to 38.300) Stage 2 BL CR for NR NTN
	R3-233560	Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Nokia, Nokia Shanghai Bell, Samsung, Qualcomm Incorporated	NGAP BLCR on NTN Functionality
RAN3#121	R3-233751	Nokia, Nokia Shanghai Bell, Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated	NGAP BLCR on NTN Functionality
	R3-233773	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BLCR) Support for IoT NTN enhancements
	R3-233784	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated	(BLCR to 38.300) Stage 2 BL CR for NR NTN
	R3-233799	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	XnAP BLCR on NTN Functionality
	R3-233842	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R3-234158	Ericsson, **Thales**, ESA	Time Margin for CHO in NR NTN
	R3-234159	Ericsson, ESA, **Thales**	Time Margin for CHO in NR NTN - XnAP Impact
	R3-234222	Huawei, **Thales**, Ericsson	Altitude correction for the NTN TRP
	R3-234223	Huawei, **Thales**, Ericsson	NTN Access Point Position
	R3-234224	Huawei, **Thales**, Ericsson	NTN Access Point Position
	R3-234225	Huawei, **Thales**, Ericsson	LS on Altitude for the Access Point
	R3-234508	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated	(BLCR to 38.300) Stage 2 BL CR for NR NTN
	R3-234659	Nokia, Nokia Shanghai Bell, Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated	(BLCR to 38.413) BL CR for NR NTN
	R3-234660	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	(BLCR to 38.423) BL CR for NR NTN
	R3-234677	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BLCR to 36.413) IoT NTN enhancements
	R3-234780	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BL CR to 36.413) IoT NTN enhancements
	R3-234782	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	(BL CR to 38.423) for NR NTN
RAN3#121-bis	R3-235057	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated	(BL CR to 38.300) Stage 2 BL CR for NR NTN
	R3-235063	Nokia, Nokia Shanghai Bell, Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated	(BL CR to 38.413) BL CR for NR NTN

	R3-235070	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BL CR to 36.413) IoT NTN enhancements
	R3-235072	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	(BL CR to 38.423) BL CR for NR NTN
	R3-235146	**Thales**, Huawei, Ericsson	Discussion on E-CID method for NTN
	R3-235221	**Thales**	R18 WI NR-NTN-enh work plan at RAN1, 2 and 3
	R3-235327	ZTE, Ericsson, ESA, **Thales**	(TP for IoT NTN BL CR 36.423) Location-Triggered CHO for IoT NTN
	R3-235493	Ericsson, Huawei, **Thales**	Mapped Cell ID Introduction for E-CID and IoT NTN
	R3-235494	Ericsson, Huawei, **Thales**	(TP to BL CR for TS 36.455) NTN Access Point Position
	R3-235497	Ericsson, **Thales**, ESA	Time Margin for CHO in NR NTN
	R3-235498	Ericsson, ESA, **Thales**	(TP to BL CR for TS 38.423) Time Margin for CHO in NR NTN - XnAP Impact
	R3-235499	Ericsson, ESA, ZTE, **Thales**, Inmarsat	(TP to BL CR for TS 38.423) Location-Triggered CHO for NR NTN
	R3-235505	Huawei, **Thales**, Ericsson	Discussion on Altitude for the NTN TRP
	R3-235506	Huawei, **Thales**, Ericsson	(TP BL 38.455) NTN Access Point Position
	R3-235507	Huawei, **Thales**, Ericsson	Draft LS on Altitude for the Access Point (to: SA2; cc: CT1, CT4, SA5, RAN2, RAN1; contact: Huawei)
	R3-235508	Huawei, **Thales**, Ericsson	Mapped Cell Id Introduction for E-CID and NR NTN
	R3-235509	Huawei, **Thales**, Ericsson	E-CID for Network UE location Verification
	R3-235696	Ericsson, ESA, ZTE, **Thales**, Inmarsat, Hughes	(TP to BL CR for TS 38.423) Location-Triggered CHO for NR NTN
	R3-235839	Nokia, Nokia Shanghai Bell, Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated	(BL CR to 38.413) BL CR for NR NTN
	R3-235840	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	(BLCR to 38.423) BL CR for NR NTN
	R3-235853	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BL CR to 36.413) IoT NTN enhancements
	R3-235949	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BLCR to 36.413) IoT NTN enhancements
	R3-235981	Nokia, Nokia Shanghai Bell, Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated	(BLCR to 38.413) BL CR for NR NTN
	R3-235982	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	(BLCR to 38.423) BL CR for NR NTN
RAN3#122	R3-237058	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated	(BLCR to 38.300) Stage 2 BL CR for NR NTN
	R3-237059	Nokia, Nokia Shanghai Bell, Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated	(BLCR to 38.413) BL CR for NR NTN
	R3-237060	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC	(BLCR to 38.423) BL CR for NR NTN
	R3-237062	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BLCR to 36.413) IoT NTN enhancements
	R3-237369	Huawei, **Thales**, Ericsson	(TP to 38.305) Mapped cell Id usage for UE disambiguation in multi-RTT
	R3-237370	Huawei, **Thales**, Ericsson	Mapped Cell Id Introduction for E-CID and NR NTN
	R3-237371	Huawei, **Thales**, Ericsson	Discussion on Altitude for the NTN TRP
	R3-237372	Huawei, **Thales**, Ericsson	(TP BL 38.455) NTN Access Point Position
	R3-237373	Huawei, **Thales**, Ericsson	LS on Altitude for the Access Point
	R3-237375	Huawei, Ericsson, **Thales**	Discussion on NW verified UE location failure during cell change and reply LS

	R3-237426	Ericsson, Huawei, **Thales**	Mapped Cell ID Introduction for E-CID and IoT NTN
	R3-237427	Ericsson, Huawei, **Thales**	(TP to BL CR for TS 36.455) NTN Access Point Position
	R3-237443	Ericsson, **Thales**, Huawei	Remaining Issues on UE Location Verification
	R3-237454	**Thales**, Huawei, Ericsson	Discussion on E-CID method for NTN
	R3-237697	Nokia, Nokia Shanghai Bell, Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated	(BLCR to 38.413) BL CR for NR NTN
	R3-237702	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE	(BLCR to 36.413) IoT NTN enhancements
	R3-238157	Ericsson, CATT, **Thales**, Huawei, Samsung, ZTE, Nokia, Nokia Shanghai Bell, Qualcomm Incorporated, NEC	Stage 2 CR for NR NTN
	R3-238158	Huawei, Ericsson, **Thales**, ZTE, Omnispace, TTP, Nokia, Nokia Shanghai Bell, CATT, Hughes, EchoStar, CMCC, Qualcomm Incorporated, NEC	CR for NR NTN
	R3-238159	Nokia, Nokia Shanghai Bell, Ericsson, **Thales**, ZTE, Omnispace, TTP, CATT, Hughes Network Systems, Huawei, Lockheed Martin, Intelsat, ESA, Samsung, Qualcomm Incorporated, NEC	CR for NR NTN
	R3-238162	Nokia, Nokia Shanghai Bell, CATT, **Thales**, Ericsson, Huawei, ZTE, Qualcomm Incorporated	IoT NTN enhancements
RAN3#123	R3-240152	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions and NTN
	R3-240153	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with NTN - NR Stage 2 Impacts
	R3-240154	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with E-UTRA NTN - NGAP Impacts
	R3-240155	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restriction with E-UTRA NTN - XnAP Impacts
	R3-240156	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with NTN - LTE Stage 2 Impacts
	R3-240157	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with NR NTN - S1AP Impacts
	R3-240158	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with NR NTN - X2AP Impacts
	R3-240159	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with NTN - NR Stage 2 Impacts
	R3-240160	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with E-UTRA NTN - NGAP Impacts
	R3-240161	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restriction with E-UTRA NTN - XnAP Impacts
	R3-240162	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with NTN - LTE Stage 2 Impacts
	R3-240163	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with NR NTN - S1AP Impacts
	R3-240164	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell	Mobility Restrictions with NR NTN - X2AP Impacts
	R3-240859	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - S1AP Impacts

	R3-240860	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - X2AP Impacts
	R3-240861	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - S1AP Impacts
	R3-240862	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - X2AP Impacts
	R3-240863	ZTE, Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, CATT	Correction on handover restriction from NR TN to LTE NTN
	R3-240864	ZTE, Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, CATT	Correction on handover restriction from NR TN to LTE NTN
	R3-240865	ZTE, Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, CATT	Correction on handover restriction from NR TN to LTE NTN
	R3-240866	ZTE, Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, CATT	Correction on handover restriction from NR TN to LTE NTN
	R3-241054	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - S1AP Impacts
	R3-241055	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - X2AP Impacts
	R3-241056	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - S1AP Impacts
	R3-241057	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - X2AP Impacts
	R3-241058	ZTE, Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, CATT	Mobility Restrictions with NR NTN - NGAP Impacts
	R3-241059	ZTE, Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, CATT	Mobility Restrictions with NR NTN - NGAP Impacts
	R3-241060	ZTE, Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, CATT	Mobility Restrictions with NR NTN - XnAP Impacts
	R3-241061	ZTE, Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, CATT	Mobility Restrictions with NR NTN - XnAP Impacts
	R3-241185	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - S1AP Impacts
	R3-241186	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - X2AP Impacts
	R3-241187	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - S1AP Impacts
	R3-241188	Ericsson, Vodafone, **Thales** Alenia Space, Qualcomm Incorporated, Nokia, Nokia Shanghai Bell, ZTE, CATT	Mobility Restrictions with NR NTN - X2AP Impacts
RAN3#123-bis	R3-241907	Huawei, Ericsson, Apple, **Thales**	Discussion on UE Location Information for NB-IoT NTN
	R3-242032	Ericsson, Huawei, Apple, **Thales**	[DRAFT] Reply LS on UE Location Information for NB-IoT NTN
	R3-242033	Ericsson, **Thales**, Huawei	E-SMLC OAM Configuration for IoT NTN

The following are the contributions of 5G-Stardust partners to 3GPP RAN 4 meetings for Rel-18 NR NTN WI:

Table 10 - Contributions of 5G- STARDUST partners to 3GPP RAN 4 meetings for Rel-18 NR NTN WI

Meeting	Tdoc	Contributors	Title
RAN4#106	R4-2301482	Ericsson, **Thales**	CR to TS 38.108: OBUE and open issues clarifications
	R4-2302490	**Thales**	RAN4 ToR adding SAN
	R4-2302493	**Thales**	TP for TS 38.181 - Clause 4.1 Measurement uncertainties and test requirements
	R4-2302497	**Thales**	On the acquisition method of GNSS position for UE transmit timing test cases
	R4-2302517	**Thales**	RRM test cases methodology and configuration for SAN NTN assistance information parameters
	R4-2302527	**Thales**, Inmarsat, **Hispasat**	NTN UE Terminal Types for above 10 GHz
	R4-2302535	**Thales**	NTN Simulation Parameters for above 10 GHz Coexistence Studies
	R4-2302643	Inmarsat, **Hispasat**, **Thales**	NTN Ka-band, clarifications on regulatory background
	R4-2302714	**HISPASAT**, Hughes Network Systems, **Thales**, ESA, Eutelsat, Lockheed Martin, Intelsat, Inmarsat, Airbus	Satellite broadband user equipment
	R4-2302864	Ericsson, **Thales**	CR to TS 38.108: OBUE and open issues clarifications
	R4-2302867	**Thales**	TP for TS 38.181 - Clause 4.1 Measurement uncertainties and test requirements
	R4-2302877	**Thales**, ZTE, Huawei	WF for SAN RF requirements on above 10GHz
	R4-2302998	**Thales**	WF for system parameters of above 10GHz NTN band
	R4-2303757	Moderator - **Thales**	Topic summary for [106][312] NR_NTN_enh_Part1
RAN4#106-bis-e	R4-2305831	**Thales**	Discussion on system parameters for above 10 GHz
	R4-2305832	**Thales**	Discussion on RAN LS to RAN1 for NTN above 10 GHz
	R4-2305834	**Thales**, Magister Solutions Ltd	NTN Simulation Parameters for above 10 GHz Coexistence Studies
	R4-2305844	**Thales**, Hughes/EchoStar	NTN UE terminal reference architecture for above 10 GHz
	R4-2305845	**Thales**	Discussion on RAN LS to RAN1 for NTN above 10 GHz
	R4-2305847	**Thales**, Magister Solutions Ltd	Updated NTN Simulation Parameters for above 10 GHz Coexistence Studies and Initial Simulation Results
	R4-2305856	Moderator (**Thales**)	Topic Summary [106bis-e][309] NR_NTN_enh_Part1
	R4-2305925	**Thales**	WF on NTN enhancement - [106bis-e][309] NR_NTN_enh_Part1
	R4-2305979	Moderator (**Thales**)	Topic Summary [106bis-e][309] NR_NTN_enh_Part1
RAN4#107	R4-2309700	**Thales**, Magister Solutions Ltd	Initial NTN calibration results for above 10 GHz Coexistence Studies
	R4-2309717	**Thales**	Updates for NTN UE terminal requirements discussion in above 10 GHz
	R4-2309722	**Thales**	Proposal for Extension to 30 MHz Channel Bandwidth for NR NTN FR1
	R4-2309725	**Thales**	New WID on the extension to 30 MHz Channel Bandwidth for NR NTN in FR1
	R4-2309729	**Thales**	Corrections to SAN TS 38.108
	R4-2309731	**Thales**	Corrections to SAN TS 38.181
	R4-2309766	**Thales**	WF for system parameters on Ka band
	R4-2309854	**Thales**	Corrections to SAN TS 38.181
	R4-2309870	**Thales**	Corrections to SAN TS 38.108
	R4-2310448	Moderator, **Thales**	Summary for [107][309] NR_NTN_enh_Part1
	R4-2310483	**Thales**	WF on UE RF requirements for NR NTN enhancement
RAN4#108	R4-2311598	CATT, **Thales**	CR for TS 38.108, Correction on out-of-band emissions
	R4-2311677	MediaTek inc., Airbus, Eutelsat, SES, **Thales**	Discussion on RRM requirements for NTN above 10 GHz bands
	R4-2312120	**Thales**	Updates for NTN UE terminal requirements and NF in above 10 GHz
	R4-2312219	**Thales**	Specific NTN in above 10 GHz working hypothesis for RRM requirements
	R4-2312369	**Thales**	Discussion on RAN5 LS to RAN4 - R5-233672 LS on clarifications for Non-Terrestrial Networks
	R4-2312443	**Thales**, Magister Solutions Ltd	Updates on NTN calibration and coexistence simulation results for above 10 GHz
	R4-2312758	**Thales**	SAN requirements and NF in above 10 GHz
	R4-2313500	**Thales**	CR for TS 38.133 - Correction of satellite access Clause for Timing Advance adjustment

	R4-2313561	**Thales**, ZTE, CATT	CR for TS 38.108 – Adding 30 MHz CBW for SAN
	R4-2313574	**Thales**, ZTE, CATT	CR for TS 38.101-5 – Adding 30 MHz CBW for NTN UE
	R4-2313635	Keysight Technologies UK Ltd, **Thales**	Clarifications for Non-Terrestrial Networks LS response to RAN5
	R4-2313636	Keysight Technologies UK Ltd, **Thales**	Clarifications to 38.101-5 (Rel-17)
	R4-2313637	Keysight Technologies UK Ltd, **Thales**	Clarifications to 38.101-5 (Rel-18)
	R4-2313638	Keysight Technologies UK Ltd, **Thales**	Clarifications to 36.102
	R4-2313639	Keysight Technologies UK Ltd, **Thales**	New Annex B.8 definition for High level test procedure for SAN RRM tests
	R4-2313640	Keysight Technologies UK Ltd, **Thales**	Reply LS on clarifications for Non-Terrestrial Networks
	R4-2313862	Keysight Technologies UK Ltd, **Thales**	Reply LS on clarifications for Non-Terrestrial Networks
	R4-2313864	**Thales**	WF for NTN general part
	R4-2313865	**Thales**	WF for NTN co-existence study
	R4-2313987	**Thales**	WF for LS to RAN5 on NTN testing
	R4-2314001	Keysight Technologies UK Ltd, **Thales**	Reply LS on clarifications for Non-Terrestrial Networks
	R4-2314003	Keysight Technologies UK Ltd, **Thales**	Clarifications to 38.101-5 (Rel-18)
	R4-2314202	Moderator (**Thales**)	Topic summary for [108][120] NR_NTN_channel_30MHz
	R4-2314245	Moderator (**Thales**)	Topic summary for [108][309] NR_NTN_enh_Part1
	R4-2314268	Moderator (**Thales**)	Topic summary for [108][332] LS_NTN_R5-233672
	R4-2314366	**Thales**, Qualcomm	LS on RAN4 RRM work scope for NR NTN Ka band
	R4-2314471	**Thales**	CR for TS 38.133 - Correction of satellite access Clause for Timing Advance adjustment
	R4-2314484	**Thales**, Qualcomm	LS on RAN4 RRM work scope for NR NTN Ka band
	R4-2314654	**Thales**, ZTE, CATT, Ericsson, CAICT	CR for TS 38.101-5 – Adding 30 MHz CBW for NTN UE
	R4-2314655	**Thales**, ZTE, CATT, Ericsson, CAICT	CR for TS 38.108 – Adding 30 MHz CBW for SAN
	R4-2314929	Keysight Technologies UK Ltd, **Thales**	Clarifications to 38.101-5 (Rel-17)
	R4-2314930	Keysight Technologies UK Ltd, **Thales**	Clarifications to 36.102
RAN4#108-bis	R4-2316854	Keysight Technologies UK Ltd, **Thales**	Clarifications for Non-Terrestrial Networks LS response to RAN5
	R4-2316868	**Thales**, Magister Solutions Ltd	Initial coexistence simulation results for above 10 GHz and related requirements
	R4-2316870	**Thales**, Magister Solutions Ltd	Calibration updates for above 10 GHz and related information
	R4-2316871	**Thales**	Mapping NTN UE terminal requirements on NTN types
	R4-2316872	**Thales**	Clarification on the NTN RRM testing procedure configuration
	R4-2316875	**Thales**	RRM Requirements for Type 2 UE Terminal in above 10 GHz
	R4-2316885	**Thales**	On NTN testing work for NGSO deployments and related configuration
	R4-2316888	**Thales**	Draft CR on TS 38.108 for Clause 5 - Operating bands and channel arrangement
	R4-2316889	**Thales**	Draft CR on TS 38.108 for Clause 9.2 - Radiated transmit power and Clause 9.3 - OTA Satellite Access Node output power
	R4-2316891	**Thales**	Draft CR on TS 38.108 for Clause 9.6 - OTA transmitted signal quality
	R4-2317649	**Thales**	WF on DMRS bundling for NTN
	R4-2317767	**Thales**	WF on DMRS bundling for NTN
	R4-2317939	Moderator(**Thales**)	Topic summary for [108bis][307] NR_NTN_enh_Part1
RAN4#109	R4-2318200	Moderator (**Thales**)	Topic summary for [109][308] NR_NTN_enh_Part1
	R4-2318294	CATT, **Thales**, China Telecom, NEC, Ericsson	CR for TS 38.108, Correction on out-of-band emissions
	R4-2318412	Apple, Ligado Networks, Inmarsat, Viasat, Globalstar, **Thales**, Hughes/Echostar	Enhanced channel raster for NTN bands

	R4-2319580	Ericsson, Huawei, **Thales**	NTN enhancement: Running CR to TS 38.108 NTN Ka-band
	R4-2319620	Inmarsat, Viasat, Globalstar, Ligado Networks, **Thales**, Sateliot, Hughes/Echostar	Flexible TX-RX Separation for NR NTN FR1 bands
	R4-2319634	Inmarsat, Viasat, Globalstar, Ligado Networks, **Thales**, Sateliot, Hughes/Echostar	Flexible TX-RX Separation for IoT NTN in FR1 bands
	R4-2320333	ZTE Corporation , **Thales**, Samsung, Ericsson, Huawei	Joint contribution for NTN VSAT RF requirements in Ka-band
	R4-2320896	**Thales**, Inmarsat, Ligado Networks, Hughes/Echostar, Globalstar, Apple, IITH	Clarification for the Pi/2 BPSK modulation
	R4-2320899	**Thales**, Inmarsat, Ligado Networks, Hughes/Echostar, Globalstar, Apple, IITH	Clarification for the Pi/2 BPSK modulation
	R4-2320900	**Thales**	Details on NTN UE terminal requirements based on different NTN UE types
	R4-2320903	**Thales**	Draft CR to TS 38.101-5: NTN UE in Ka-band
	R4-2320917	**Thales**	Draft CR on TS 38.108 for Clause 9.7 - OTA unwanted emissions
	R4-2320949	**Thales**	Draft CR proposal to add Doppler and Delay variation examples as a function of time for NGSO and GSO in a new Annex
	R4-2320952	**Thales**	Draft TP for TR 37.911 - Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology
	R4-2320970	**Thales**, Magister Solutions Ltd	NTN-TN co-existence simulation results in above 10 GHz bands
	R4-2320971	**Thales**	On the NTN UL Timing Accuracy for above 10 GHz
	R4-2320972	**Thales**	Remaining issues for SAN RF requirements in above 10 GHz
	R4-2320973	**Thales**	VSAT and Satellite parameters for Ku-band Scenario
	R4-2320975	**Thales**	Summary of SIB19/SIB31 parameters for NGSO and GSO NTN UE/NTN IoT testing
	R4-2321029	**Thales**	Draft TP for TR 37.911 - Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology
	R4-2321031	Ericsson, Huawei, **Thales**	NTN enhancement: Running CR to TS 38.108 NTN Ka-band
	R4-2321058	**Thales**	Draft CR proposal to add Doppler and Delay variation examples as a function of time for NGSO and GSO in a new Annex
	R4-2321151	**Thales**	Draft CR on TS 38.108 for Clause 9.7 - OTA unwanted emissions
	R4-2321973	**Thales**	Draft CR to TS 38.101-5: NTN UE in Ka-band
RAN4#110	R4-2400152	Apple, Ligado Networks, Inmarsat, Viasat, Globalstar, **Thales**, Hughes/Echostar	Enhanced channel raster for NTN FR1 bands
	R4-2400153	Apple, Ligado Networks, Inmarsat, Viasat, Globalstar, **Thales**, Hughes/Echostar	Mandating enhanced channel raster for the NTN FR1 bands
	R4-2400235	Apple, Ligado Networks, Inmarsat, Hughes/Echostar, Globalstar Inc., Skyworks Solutions Inc., Viasat, **Thales**	Motivation for New WID on High-power classes for NTN NR FR1 bands
	R4-2400927	**Thales**	Candidate non spectrum related NTN topics for Rel-19 work plan
	R4-2401118	Samsung Electronics, **Thales**	CR on TR38.863 Addition of simulation assumptions in above 10GHz
	R4-2402332	Ericsson, **Thales**	NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - Tx spurious

	R4-2402523	ZTE Corporation , **Thales**	Joint contribution for NTN VSAT RF requirements in Ka-band
	R4-2402645	Moderator (**Thales**)	Topic summary for [110][305] NR_NTN_enh_Part1
	R4-2402762	Ericsson, **Thales**	NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - Tx spurious
	R4-2402816	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	Correction on TX-RX separation for IoT NTN bands
	R4-2402821	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	Correction on DSS support for the NTN bands from Rel-18
	R4-2402822	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**	Clarification on in-band and guard-band NB-IoT and eMTC NTN with NR NTN
	R4-2402924	**Thales**	Draft CR for 38101-5
	R4-2402927	**Thales**	CR proposal to add Doppler and Delay variation examples as a function of time for NGSO and GSO in a new Annex
	R4-2402928	**Thales**	Reply LS on the system parameters for NTN above 10 GHz
	R4-2402929	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**	Flexible TX-RX Separation for NR NTN FR1 bands
	R4-2402930	**Thales**	Remaining issues on NTN UL Timing Accuracy for above 10 GHz
	R4-2402931	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**	Motivation for In-band and guard-band NB-IoT NTN with NR
	R4-2402933	**Thales**, Magister Solutions Ltd	Remaining issues on VSAT UE requirements for above 10 GHz
	R4-2402947	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**	Flexible TX-RX Separation for NR NTN Bands from Rel-17
	R4-2402948	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	Correction on DSS support for the NTN bands from Rel-17
	R4-2403644	**Thales**	Draft CR for 38101-5
	R4-2403874	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	Correction on TX-RX separation for IoT NTN bands
	R4-2403875	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	Correction on DSS support for the NTN bands from Rel-17
	R4-2403876	Inmarsat, Viasat, Omnispace, Terrestar	Correction on DSS support for the NTN bands from Rel-18

		Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	
	R4-2403882	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	Correction on DSS support for the NTN bands
	R4-2403883	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	Correction on DSS support for the NTN bands from Rel-18
	R4-2403887	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	Correction on DSS support for the NTN bands from Rel-18
	R4-2403888	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, Hughes/Echostar, **Thales**, Apple	Correction on DSS support for the NTN bands from Rel-18
RAN4#110-bis	R4-2404163	Apple, Ligado Networks, Inmarsat, Viasat, Globalstar, **Thales**, Hughes/Echostar, Omnispace, Terrestar	Clarification for the mandatory support of enhanced channel raster for the NTN bands
	R4-2404941	Ericsson, **Thales**	NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - additional Tx updates to the running CR
	R4-2404942	Ericsson, **Thales**	NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - additional Rx updates to the running CR
	R4-2405555	Ericsson, **Thales**	Draft CR for TS 38.181: FR2 intro in clause 4.1 MUs
	R4-2405556	Ericsson, **Thales**	Draft CR for TS 38.181: FR2 intro in clause 4.7 test config
	R4-2405557	Ericsson, **Thales**	Draft CR for TS 38.181: FR2 intro in clause 9.4 output power dynamics
	R4-2405558	Ericsson, **Thales**	Draft CR for TS 38.181: FR2 intro in clause 9.7.5 spurious emissions
	R4-2405825	Moderator (**Thales**)	Topic summary for [110bis][305] NR_NTN_enh_Part1
	R4-2405835	Moderator (**Thales**)	Topic summary for [110bis][315] NR_NTN_Ph3
	R4-2405972	**Thales**, Magister Solutions Ltd, Eutelsat Group, ESA, Inmarsat, Viasat, Novamint, EchoStar, Amazon	On the ACS requirement issue for VSAT UE in above 10 GHz
	R4-2405976	**Thales**	CR for TR 38.863 regulatory update after WRC-23
	R4-2405977	**Thales**	CR for correction of SAN ACS value in TS 38.108
	R4-2405994	**Thales**	CR for TR 38.863 regulatory update after WRC-23
	R4-2405995	Huawei, **Thales**	Way Forward for [110bis][305] NR_NTN_enh_Part1 Doppler precompensation into the guard band
	R4-2405999	Ericsson, **Thales**	Draft CR for TS 38.181: FR2 intro in clause 4.1 MUs
	R4-2406000	Ericsson, **Thales**	Draft CR for TS 38.181: FR2 intro in clause 4.7 test config
	R4-2406001	Ericsson, **Thales**	Draft CR for TS 38.181: FR2 intro in clause 9.4 output power dynamics
	R4-2406109	**Thales**	Way Forward for [110bis][315] NR_NTN_Ph3
	R4-2406113	**Thales**	CR for correction of SAN ACS value in TS 38.108
	R4-2406602	Ericsson, **Thales**	NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - additional Tx updates to the running CR
	R4-2406606	Huawei, HiSilicon, Ericsson, **Thales**	Draft CR for 38.101-5 to introduce clause 10.1~10.3
RAN4#111	R4-2407043	Apple, Globalstar, **Thales**, Inmarsat, Viasat, Terrestar	Clarification for applicability of DSS for NTN FR1 bands

	R4-2407045	Apple, Globalstar, **Thales**, Inmarsat, Viasat, Terrestar	Clarification for applicability of DSS for NTN FR1 bands
	R4-2407049	Apple, Ligado Networks, Inmarsat, Viasat, Globalstar, **Thales**, Hughes/Echostar, Omnispace, Terrestar	Clarification for the mandatory support of enhanced channel raster for the NTN bands
	R4-2408696	Ericsson, CATT, **Thales**	NTN enhancement - Running CR to TS 38.181
	R4-2408697	Ericsson, **Thales**, CATT, Huawei, ZTE, NEC	NTN enhancement - Running CR to TS 38.108
	R4-2408700	Ericsson, **Thales**	NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - additional Tx updates to the running CR - subclause 9.6
	R4-2408708	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, EchoStar, **Thales**, Skyworks, Apple	(TEI18) CR to 36.102 In-band NB-IoT NTN deployment with NR from Rel-18 [TEI_NTN]
	R4-2408710	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, EchoStar, **Thales**, Skyworks, Apple	(TEI18) CR to 36.108 In-band NB-IoT NTN deployment with NR from Rel-18 [TEI_NTN]
	R4-2409117	Ericsson, **Thales**	Draft CR for TS 38.181: FR2 intro in clause 9.7.5 spurious emissions
	R4-2409657	Inmarsat, Viasat, Omnispace, Terrestar Solutions, Thuraya, Ligado Networks, EchoStar, **Thales**, Skyworks	(TEI) CR to 38.101-5 Flexible TX-RX Separation for NR NTN Bands from Rel-18 [TEI_NTN]
	R4-2409668	**Thales**, Ericsson	DraftCR for TS 38.181: FR2-NTN introduction in Clause 9.2 Radiated transmit power
	R4-2409670	**Thales**, Ericsson	DraftCR for TS 38.181: FR2-NTN introduction in Clause 9.3 OTA SAN output power
	R4-2409674	**Thales**	DraftCR for TS 38.181: FR2-NTN introduction in Clause 9.6 OTA transmitted signal quality
	R4-2409735	**Thales**	DraftCR for TS 38.181: FR2-NTN introduction in Clause 9.7.4 OTA out-of-band emissions
	R4-2409737	**Thales**	DraftCR for TS 38.181: FR2-NTN introduction in Clauses 9.7.1 General 9.7.2 OTA occupied bandwidth 9.7.3 ACLR
	R4-2409758	**Thales**, Ericsson	Tx Corrections to TS 38.101-5
	R4-2409777	**Thales**	Corrections to EIRPmax in TS 38.101-5
	R4-2409817	Ericsson, **Thales**, CATT, Huawei, ZTE, NEC	NTN enhancement - Running CR to TS 38.108
	R4-2409820	Ericsson, CATT, **Thales**	NTN enhancement - Running CR to TS 38.181
	R4-2410580	Ericsson, **Thales**	NTN enhancement: draft CR to TS 38.101-5 NTN Ka-band - additional Tx updates to the running CR - subclause 9.6
	R4-2410581	**Thales**, Ericsson	Tx Corrections to TS 38.101-5
	R4-2410612	Samsung, **Thales**	Big CR to TS 38.101-5
	R4-2410673	Apple, Globalstar, **Thales**, Inmarsat, Viasat, Terrestar	Clarification for applicability of DSS for NTN FR1 bands

The following are the contributions of 5G-Stardust partners to 3GPP SA2 meetings for Rel-18 NR NTN WI:

Table 11 - Contributions of 5G- STARDUST partners to 3GPP SA2 meetings for Rel-18 NR NTN WI

Meeting	Tdoc	Contributors	Title
SA2#154-AH-e	S2-2300273	**Thales**, Xiaomi, Novamint, TNO	Revised WID: 5GC/EPC enhancement for satellite access Phase 2 (5GSAT_Ph2).

	S2-2300278	**Thales**	DP on articulation between network centric(s) and UE centric procedures for mobility management and/or power saving for Satellite Discontinuous Coverage.
	S2-2300279	**Thales**	[DRAFT] Reply LS on Reply LS on Satellite coverage data transfer to a UE using UP versus CP
	S2-2300982	Huawei, HiSilicon, **Thales**, Intel, Xiaomi	Support of discontinuous coverage
	S2-2300983	Huawei, HiSilicon, **Thales**, Intel, Xiaomi	Procedures for support of discontinuous coverage
	S2-2301108	Huawei, HiSilicon, **Thales**	Support of mobility management and power saving with discontinuous coverage
	S2-2301328	**Thales**	WI and SID Status Report on 5GC enhancement for satellite access Phase 2
	S2-2301769	Huawei, HiSilicon, **Thales**, Intel, Xiaomi, Google Inc., Samsung, vivo, Nokia, Nokia Shanghai Bell, CATT, LG Electronics	Support of discontinuous coverage
SA2#155	S2-2302295	Intel, **Thales**	Provision of Satellite Coverage Availability (SCA) information and interfaces.
	S2-2302296	Intel, **Thales**	Satellite Coverage Availability Function (SCAF) services
	S2-2302297	Intel, **Thales**	Satellite Coverage Availability Function (SCAF) services
	S2-2302435	[Huawei, HiSilicon, **Thales**, Intel, Xiaomi, Google Inc., Samsung, vivo, Nokia, Nokia Shanghai Bell, CATT, LG Electronics], Ericsson	Support of discontinuous coverage
	S2-2302615	[Huawei, HiSilicon, **Thales**, Intel, Xiaomi, Google Inc., Samsung, vivo, Nokia, Nokia Shanghai Bell, CATT], LG Electronics	Support of discontinuous coverage
	S2-2302875	Intel, **Thales**	Introduction of Satellite Coverage Availability Function (SCAF)
	S2-2302877	Intel, **Thales**	Introduction of Satellite Coverage Availability Function (SCAF)
	S2-2302879	Huawei, HiSilicon [**Thales**], [Intel], [Xiaomi], [Google Inc.], [Samsung], [vivo], [Nokia], [Nokia Shanghai Bell], [CATT], [LG Electronics]	Support of discontinuous coverage
	S2-2302880	Huawei, HiSilicon [**Thales**], [Intel], [Xiaomi]	Procedures for support of discontinuous coverage
	S2-2302881	Huawei, HiSilicon, [**Thales**]	Support of mobility management and power saving with discontinuous coverage
	S2-2302904	[Huawei, HiSilicon, **Thales**, Intel,] Xiaomi, [Google Inc., Samsung, vivo, Nokia, Nokia Shanghai Bell, CATT, LG Electronics]	Support of discontinuous coverage
	S2-2302906	[Huawei, HiSilicon, **Thales**, Intel,] Xiaomi, [Google Inc., Samsung, vivo, Nokia, Nokia Shanghai Bell, CATT, LG Electronics]	Support of discontinuous coverage
	S2-2302949	[Intel, Xiaomi, Google Inc., Samsung, vivo, CATT, LG Electronics,] Huawei, HiSilicon,	Support of discontinuous coverage

		Thales, Nokia, Nokia Shanghai Bell	
	S2-2303113	[Huawei], [HiSilicon], [**Thales**], [Intel], [Xiaomi], [Google Inc]., Samsung, [vivo], [Nokia], [Nokia Shanghai Bell], [CATT], [LG Electronics]	Support of discontinuous coverage
	S2-2303417	[Huawei, HiSilicon, **Thales**, Intel, Xiaomi, Google Inc., Samsung, vivo, Nokia, Nokia Shanghai Bell, CATT, LG Electronics], Ericsson	Support of discontinuous coverage
	S2-2303418	Huawei, HiSilicon, **Thales**, Novamint	Support of mobility management and power saving with discontinuous coverage
	S2-2303424	Huawei, HiSilicon, **Thales**, Intel, Xiaomi, [Google Inc.], Samsung, [Vivo, Nokia, Nokia Shanghai Bell, CATT], LG Electronics, Ericsson, Mediatek	Support of discontinuous coverage
	S2-2303427	Huawei, HiSilicon, **Thales**, Intel, Xiaomi, Google Inc., Samsung, Vivo, Nokia, Nokia Shanghai Bell, CATT, LG Electronics, Ericsson, Mediatek	Support of discontinuous coverage
	S2-2303439	**Thales**	WI and SID Status Report on 5GC enhancement for satellite access Phase 2
	S2-2303668	**Thales**, Xiaomi, Novamint, TNO	Revised WID: 5GC/EPC enhancement for satellite access Phase 2 (5GSAT_Ph2).
	S2-2303910	**Thales**, Xiaomi, Novamint, TNO	Revised WID: 5GC/EPC enhancement for satellite access Phase 2 (5GSAT_Ph2).
SA2#156-e	S2-2303993	Intel, **Thales**	Standardization of Satellite Coverage Availability (SCA) information
	S2-2303994	Intel, **Thales**	Satellite Coverage Availability Function (SCAF) services
	S2-2303995	Intel, **Thales**	Satellite Coverage Availability Function (SCAF) services
	S2-2303996	Intel, **Thales**	Introduction of Satellite Coverage Availability Function (SCAF)
	S2-2303997	Intel, **Thales**	Introduction of Satellite Coverage Availability Function (SCAF)
	S2-2304433	Huawei, HiSilicon, [**Thales**], [Intel], [Xiaomi]	Procedures for support of discontinuous coverage
	S2-2304434	Huawei, HiSilicon, [**Thales**], [Novamint]	Support of mobility management and power saving with discontinuous coverage
SA2#157	S2-2306563	[Huawei], [HiSilicon], [**Thales**], [Novamint], Xiaomi	Support of mobility management and power saving with discontinuous coverage
	S2-2306921	**Thales**	Discussion Paper on LMF improvements for network verified UE location in NR NTN.
	S2-2307147	Huawei, HiSilicon, [**Thales**], [Intel], [Xiaomi]	Procedures for support of discontinuous coverage
	S2-2307148	Huawei, HiSilicon, [**Thales**], [Novamint]	Support of mobility management and power saving with discontinuous coverage
	S2-2307596	Huawei, HiSilicon, Samsung, **Thales**	Completion of Support discontinuous coverage
	S2-2307600	Huawei, HiSilicon, **Thales**, [Novamint]	Support of mobility management and power saving with discontinuous coverage
	S2-2307601	Huawei, HiSilicon, **Thales**, Intel, Xiaomi, Samsung	Procedures for support of discontinuous coverage

	S2-2307610	Huawei, HiSilicon, Samsung, **Thales**, Ericsson	Completion of Support discontinuous coverage
	S2-2307614	Huawei, HiSilicon, **Thales**, Novamint, Xiaomi, Samsung	Support of mobility management and power saving with discontinuous coverage
	S2-2307623	Huawei, HiSilicon, **Thales**, Novamint, Xiaomi, Samsung, Ericsson	Support of mobility management and power saving with discontinuous coverage
	S2-2307624	Huawei, HiSilicon, **Thales**, Intel, Xiaomi, Samsung, Novamint	Procedures for support of discontinuous coverage
	S2-2307625	Qualcomm Incorporated, Samsung, CMCC, **Thales**	Closing ENs for the procedures for discontinuous coverage reporting
SA2#160-Ad Hoc-e	S2-2400404	MediaTek Inc., Airbus, CEWiT, Deutsche Telekom, Echostar, ESA, Gatehouse, Inmarsat/Viasat, JSAT, Ligado, Lockheed Martin, Novamint, OQ Technology, Reliance Jio, Sateliot, Skylo, **Thales**, TNO, vivo	NB-IoT NTN: UE Coarse Location Information Reporting
SA2#161	S2-2403493	Ericsson, MediaTek Inc., Airbus, CEWiT, Echostar, ESA, Gatehouse, Inmarsat/Viasat, JSAT, Ligado, Lockheed Martin, Novamint, OQ Technology, Sateliot, Skylo, **Thales**, TNO	Mechanisms for UE location reporting for NB-IoT satellite access

2.3.4 Service continuity between TN and NTN

Rel-18 introduced mechanisms to facilitate the mobility from TN to NTN and from NTN to TN.

For the NTN to TN mobility, the NTN may broadcast TN cells coverage areas information via a new *SystemInformationBlock*, the SIB25. The SIB25 includes the coverage information consists in a list of geographical TN areas (*AreaID*, *ReferenceLocation*, *DistanceRadius*), with associated frequency information (SIB4, SIB5) of terrestrial cells. This information help the UE to decide on which network to camp into.

For the TN to NTN mobility, the TN can broadcast the SIB19 which contains NTN neighbour cell information. Thanks to that, the NTN-capable UE can know the existence of the NTN and perform measurements to switch between the two access technologies.

However, no procedure was introduced to have a seamless mobility between TN and NTN such as RACH-less HO or Conditional Handover. The usage of DAPS for seamless NT/NTN mobility was not in the WI scope.

The 5G-Stardust partners where particularly active to propose solutions on RAN2 to support the TN information broadcast in NTN and was active to propose a solution for TN to NTN mobility.

2.3.5 Ka-band scenarios support

The Release-18 is the first to introduce bands above 10 GHz for NTN with the Ka Band. The bands 510, 511, 512 have been introduced as below:

Table 12 - NTN satellite operating band

NTN satellite operating band	UpLink (UL) operating band SAN receive / UE transmit $F_{UL,low}$ – $F_{UL,high}$	DownLink (DL) operating band SAN transmit / UE receive $F_{DL,low}$ – $F_{DL,high}$	Duplex mode
n512[1]	27.5 - 30.0 GHz	17.3 - 20.2 GHz	FDD
n511[2]	28.35 - 30.0 GHz	17.3 - 20.2 GHz	FDD
n510[3]	27.5 - 28.35 GHz	17.3 - 20.2 GHz	FDD
NOTE 1: This band is applicable in the countries subject to CEPT ECC Decision(05)01 and ECC Decision (13)01. **NOTE 2: This band is applicable in the USA subject to FCC 47 CFR part 25.** **NOTE 3: This band is applicable for Earth Station operations in the USA subject to FCC 47 CFR part 25. FCC rules currently do not include ESIM operations in this band (47 CFR 25.202).**			

Associated to spectrum-related Ka-band support, the NTN UE in FR2-NTN has been defined, especially in TS 38.101-5. The following NTN UE VSAT classes are defined associated to power requirements:

Table 13 - NTN VSAT class

NTN VSAT class	NTN VSAT type	Type description
Fixed VSAT	1	Fixed VSAT communicating with GSO and LEO with mechanical steering antenna.
	2[2]	Fixed VSAT communicating with GSO and LEO with electronic steering antenna.
	3	Fixed VSAT communicating with LEO only with electronic steering antenna.

Mobile VSAT	4	Mobile VSAT communicating with GSO with mechanical steering antenna.
	5[2]	Mobile VSAT communicating with GSO with electronic steering antenna.
Note 1: The NTN VSAT types are assuming NTN VSAT has only one antenna beam towards one satellite at a given time in this release. **Note 2: UE may need power reduction for meeting OFF-axis EIRP requirement defined in clause 9.2.2. Value is implementation dependent.**		

2.4 SATELLITE STANDARDISATION ACTIVITES IN 3GPP REL-19

During the preparation of the Rel-19 definition, 5G-Stardust partners were actively participating at the discussion to introduce for support of regenerative payloads for NR, support of dedication notification/alert channel and NTN/TN mobility enhancement in connected mode (e.g. DAPS).

2.4.1 Release-19 WID Objectives

As part of Release 19, a new WI is proposed to further optimize satellite access performance, address new bands with their specific regulatory requirements, and support new capabilities and services as the evolution of 5G continues.

Specifically, Release 19 WI defines enhancements for NG-RAN based NTNs in order to:

- Offer optimized performance for both system and link level, especially when addressing handset terminals (including smartphones with -5.5 dBi antenna gain) w.r.t. downlink coverage considering the NTN deployment constraints such as payload power limitation, large satellite footprint and limited feeder link bandwidth.

- Offer optimized capacity performance on uplink through multiplexing techniques.

- Address RedCap UE within FR1 NTN.

- MBS feature provides an important add-value for NR NTN system, leveraging the large coverage of the NTN compared to TN. Terrestrial MBS features are equally available for NR NTN in the 5G specifications, but for some cases the intended service area is expected to be smaller than the coverage of a Uu cell, some enhancements need to be done to notify the service area of a Broadcast service.

- Support NTN architecture with 5G system functions on board the NTN vehicle (i.e. regenerative payloads).

The detailed Release-19 WI objectives that are relevant to 5G-Stardust project are recalled hereafter:

Uplink Capacity/Throughput Enhancement for FR1-NTN [RAN1, RAN2, RAN4]
- Study then specify, if beneficial, DFT-s-OFDM PUSCH enhancements via OCC

  - Determine the achievable capacity improvement to be targeted considering realistic impairments (e.g. Doppler, time variation, phase distortion, etc)
  - Specify necessary signalling, if needed
  - Update RF requirements, accordingly, if needed
  - Note: The study can consider orthogonal cover codes across OFDM symbols, across slots, and/or within an OFDM symbol.
  - Note: the study phase is targeted to be completed by RAN#104
- Notes for this objective:
  - The enhancement is not targeting improvements/impacts of MU-MIMO capability
  - The enhancement is not targeted to PUSCH DMRS
  - No enhancement for initial access
  - Enhancements to PRACH are not in scope.
  - This feature may be applicable for UEs operating in terrestrial networks based on a common design

Support of regenerative payload [RAN3, RAN2, RAN4]
- Specify the support of gNB on board in TS 38.300
- Specify, if needed, any necessary enhancements related to the intra and inter-gNB mobility, especially for Xn interface over feeder link or over ISL. [RAN3]
- Note: if any additional necessary stage-3 specifications impact for e.g. NGAP is identified, RAN3 will handle it.

2.4.2 List of 3GPP meeting attended by 5G-STARDUST partners

Since January 2023, 5G- STARDUST partners have participated to the following 3GPP RAN1 meeting for 5G NR NTN WI:

Table 14 - Participation of 5G- STARDUST to RAN plenary meetings for Rel-19

3GPP Meeting	Dates	Location
RAN-Release 19 Workshop	2023-06-15 / 2023-06-16	Taiwan (TW)
RAN#102	2023-12-11 / 2023-12-15	Edinburgh (UK)
RAN#103	2024-03-18 / 2024-03-21	Maastricht (NL)
RAN#104	2024-06-17 / 2024-06-20	Shanghai (CN)

Since January 2023, 5G-Stardust partners have participated to the following 3GPP RAN 1 meetings for 5G NR NTN WI:

Table 15 - Participation of 5G- STARDUST to RAN WG1 meetings for Rel-19

3GPP Meeting	Dates	Location

RAN1#116	2024-02-26 / 2024-03-01	Athens (GR)
RAN1#116-bis	2024-04-15 / 2024-04-19	Changsha (CN)
RAN1#117	2024-05-20 / 2024-05-24	Fukuoka (JP)

Since January 2023, 5G-Stardust partners have participated to the following 3GPP RAN 2 meetings for 5G NR NTN WI:

Table 16 - Participation of 5G- STARDUST to RAN WG2 meetings for Rel-19

3GPP Meeting	Dates	Location
RAN2#125-bis	2024-04-15 / 2024-04-19	Changsha (CN)
RAN2#126	2024-05-20 / 2024-05-24	Fukuoka (JP)

Since January 2023, 5G-Stardust partners have participated to the following 3GPP RAN 3 meetings for 5G NR NTN WI:

Table 17 - Participation of 5G- STARDUST to RAN WG3 meetings for Rel-19

3GPP Meeting	Dates	Location
RAN3#123-bis	2024-04-15 / 2024-04-19	Changsha (CN)
RAN4#124	2024-05-20 / 2024-05-24	Fukuoka (JP)

Since January 2023, 5G-Stardust partners have participated to the following 3GPP RAN 4 meetings for 5G NR NTN WI:

Table 18 - Participation of 5G- STARDUST to RAN WG4 meetings for Rel-19

3GPP Meeting	Dates	Location
RAN4#111	2024-05-20 / 2024-05-24	Fukuoka (JP)

Since January 2023, 5G-Stardust partners have participated to the following 3GPP SA1 meetings for 5G NR NTN WI:

Table 19 - Participation of 5G- STARDUST to SA WG1 meetings for Rel-19

3GPP Meeting	Dates	Location

SA1#100 Adhoc	2023-01-16 / 2023-01-20	Electronic
SA1#101	2023-02-20 / 2023-02-24	Athens (GR)
SA1#102	2023-05-22 / 2023-05-26	Berlin (DE)
SA1#103	2023-08-21 / 2023-08-25	Goteborg (SW)
SA1#104	2024-11-13 / 2024-11-17	Chicago (US)
SA1#105	2024-02-26 / 2024-03-01	Athens (GR)
SA1#106	2024-05-27 / 2024-05-31	Jeju (KR)

Since January 2023, 5G-Stardust partners have participated to the following 3GPP SA2 meetings for 5G NR NTN WI:

Table 20 - Participation of 5G- STARDUST to SA WG2 meetings for Rel-19

3GPP Meeting	Dates	Location
SA2#154 Adhoc-e	2023-01-16 / 2023-01-20	Electronic
SA2#155	2023-02-20 / 2023-02-24	Athens (GR)
SA2#156-e	2023-04-17 / 2023-04-21	Electronic
SA2#157	2023-05-22 / 2023-05-26	Berlin (DE)
SA2#158	2023-08-21 / 2023-08-25	Goteborg (SW)
SA2#159	2023-10-09 / 2023-10-13	Xiamen (CN)
SA2#160	2024-11-13 / 2024-11-17	Chicago (US)
SA2#160-Ad hoc-e	2024-01-22 / 2024-01-29	Electronic
SA2#161	2024-02-26 / 2024-03-01	Athens (GR)
SA2#162	2024-05-27 / 2024-05-31	Jeju (KR)

2.4.3 Contributions

The following are the contributions of 5G- STARDUST partners to 3GPP RAN meetings for Rel-19 NR NTN WI:

Table 21 - Contributions of 5G- STARDUST partners to 3GPP RAN meetings for Rel-19 NR NTN WI

Meeting	Tdoc	Contributors	Title
Rel-19 Workshop	RWS-230048	**Thales**, Hughes, SES, Inmarsat, Ligado, Eutelsat, TTP, Lockheed, Novamint, Airbus, Lockheed Martin, ST Engineering, Sateliot, CeWIT, TNO, JSAT, Gatehouse, Omnispace, ESA, Intelsat, OneWeb, Fraunhofer IIS, Fraunhofer HHI, TNO, IRT Saint Exupery, **Hispasat**, G	Consideration on RAN1/2/3 led NTN topics for Release 19
	RWS-230049	**Thales**, Hughes, Fraunhofer IIS, Inmarsat, Sateliot, Ligado, Omnispace, Lockheed Martin, Novamint, Eutelsat, TTP, Terrestar, ESA, Intelsat, OneWeb, Airbus, JSAT, TNO, IRT Saint Exupery, **Hispasat**, Gilat, Gatehouse, Magister solutions, OQ Technology	Consideration on RAN4 led NTN topics for Release 19
RAN#102	RP-232859	**Thales**	WI exception: NR NTN (Non-Terrestrial Networks) enhancements
	RP-232860	**Thales**	Candidate topics for a Rel-19 NR-NTN-evolution Work Item
	RP-232861	**Thales**	Candidate topics for a Rel-19 IoT-NTN-evolution WI
	RP-233230	**Thales**	Candidate topics for RAN4 led Rel-19 NR-NTN-evolution WI(s)
	RP-233237	**Thales**	Candidate topics for RAN4 led Rel-19 IoT-NTN-evolution WI(s)
	RP-233944	MediaTek Inc., Ericsson, Qualcomm Incorporated, **Thales**	TP for TR 37.911 - IMT-2020 satellite RIT evaluation
	RP-233948	Hughes, **Thales**, Terrestar, OQ Technology, TTP, Gatehouse, Lockheed Martin, Airbus, Inmarsat, Viasat, OmniSpace, SES	Response to questions of RP-233795 on "What is Notification/Alert in NTN?"
	RP-233949	Ericsson, MediaTek, Qualcomm, **Thales**	pCR to TR 37.911 collecting inputs from RAN WGs for the Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology
	RP-233952	MediaTek Inc., Ericsson, Qualcomm Incorporated, **Thales**	TP for TR 37.911 (section 7 & 8) - IMT-2020 satellite RIT evaluation
	RP-233967	Ericsson, MediaTek, Qualcomm, **Thales**	pCR to TR 37.911 collecting inputs from RAN WGs for the Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology
	RP-233979	Ericsson, MediaTek, Qualcomm, **Thales**	pCR to TR 37.911 collecting inputs from RAN WGs for the Study on self-evaluation towards the IMT-2020 submission of the 3GPP Satellite Radio Interface Technology
RAN#103	RP-240060	**Thales**	WI summary for NR NTN (Non-Terrestrial Networks) enhancements
	RP-240061	**Thales**, CATT	New WID: Inter RAT mobility enhancements from E-UTRAN to NR-NTN
	RP-240062	**Thales**	Candidate non spectrum related NTN topics for Rel-19 work plan
	RP-240079	Eutelsat Group, Fraunhofer IIS, Fraunhofer HHI, Airbus, ESA, Novamint, MediaTek, Sharp, **Thales**, SyncTechno Inc., Continental Automotive, TTP, Lockheed Martin, Robert Bosch GmbH	Motivation to support mobile VSAT in NGSO deployment scenarios
	RP-240089	**Thales**	Candidate RAN4 led spectrum related NTN topics for Release 19
	RP-240091	**Thales**, CATT	Status report for New WID: Non-Terrestrial Networks (NTN) for NR Phase 3

	RP-240098	**Thales**, CATT	Revised WID: Rel-19 WI Non-Terrestrial Networks (NTN) for NR Phase 3
	RP-240143	**Thales**	Revised WID: NR NTN (Non-Terrestrial Networks) enhancements
	RP-240509	Apple, Ligado Networks, Inmarsat, Hughes/Echostar, Globalstar Inc., Skyworks Solutions Inc., Viasat, **Thales**	High-power classes UE for NTN NR FR1 bands
	RP-240775	**Thales**, CATT	Revised WID: Rel-19 WI Non-Terrestrial Networks (NTN) for NR Phase 3
	RP-240777	**Thales**	WI summary for NR NTN (Non-Terrestrial Networks) enhancements
	RP-240779	**Thales**	Revised WID: NR NTN (Non-Terrestrial Networks) enhancements
	RP-240814	**Thales**, CATT	New WID: Inter RAT mobility enhancements from E-UTRAN to NR-NTN
	RP-240843	**Thales**, CATT	New WID: Inter RAT mobility enhancements from E-UTRAN to NR-NTN
	RP-240844	EchoStar, **Thales**	Award for 3GPP NTN as Technology of the Year
	RP-240846	**Thales**, CATT	New WID: Inter RAT mobility enhancements from E-UTRAN TN to NR NTN
RAN#104	RP-240921	**Thales**	NR-NTN-enh for RAN104
	RP-240922	**Thales**	NR-NTN-enh
	RP-240923	**Thales**	NR-NTN-ph3
	RP-240924	**Thales**	Inter RAT mobility support from E-UTRAN TN to NR-NTN
	RP-240925	**Thales**	Inter RAT mobility support from E-UTRAN TN to NR-NTN
	RP-241036	**Thales**	Non-Terrestrial Networks (NTN) for NR Phase 3
	RP-241037	**Thales**	Non-Terrestrial Networks (NTN) for NR Phase 3 revisions - rational
	RP-241690	Intelsat, Eutelsat Group, **Thales**, CHTTL, **Hispasat**	New WID on Introduction of Ku Band for NR NTN

The following are the contributions of 5G- STARDUST partners to 3GPP RAN 1 meetings for Rel-19 NR NTN WI:

Table 22 - Contributions of 5G- STARDUST partners to 3GPP RAN 1 meetings for Rel-19 NR NTN WI

Meeting	Tdoc	Contributors	Title
RAN1#116	R1-2400843	**Thales**	Work plan for NR_NTN_Ph3
	R1-2401730	**Thales**, CATT	Work plan for NR_NTN_Ph3
	R1-2400303	**Thales**	Discussion on NR NTN Downlink coverage enhancements
	R1-2401843	Moderator (**Thales**)	FL Summary #1: NR-NTN downlink coverage enhancements
	R1-2401844	Moderator (**Thales**)	FL Summary #2: NR-NTN downlink coverage enhancements
	R1-2401845	Moderator (**Thales**)	FL Summary #3: NR-NTN downlink coverage enhancements
RAN1#116-bis	R1-2401988	**Thales**	Discussion on NR NTN Downlink coverage enhancements
	R1-2401989	**Thales**	Considerations on the system parameters for FR2-NTN
	R1-2401990	**Thales**	Work plan for Rel-19 NR_NTN_Ph3
	R1-2401991	**Thales**	FL Summary #1: NR-NTN downlink coverage enhancements
	R1-2401992	**Thales**	FL Summary #2: NR-NTN downlink coverage enhancements
	R1-2401993	**Thales**	FL Summary #3: NR-NTN downlink coverage enhancements
	R1-2403406	Ericsson, **Thales**	Draft CR for 38.211 on Introduction of FR2-NTN
	R1-2403463	Moderator (**Thales**)	FL Summary #1: Maintenance on Rel-18 NR NTN
	R1-2403464	Moderator (**Thales**)	FL Summary #2: Maintenance on Rel-18 NR NTN
	R1-2403591	Moderator (**Thales**)	Correction on CORESET monitoring regarding RACH less HO
	R1-2403592	Moderator (**Thales**)	Application time of Cell DRX in NTN
	R1-2403686	Moderator (**Thales**)	FL Summary #3: Maintenance on Rel-18 NR NTN
	R1-2403687	Moderator (**Thales**)	Draft CR on correction on timing of first Msg3 repetition
	R1-2403688	Moderator (**Thales**)	Draft CR on application time of Cell DRX in NTN
	R1-2403725	Moderator (**Thales**)	Draft CR on correction on timing of first Msg3 repetition
	R1-2403739	Ericsson, **Thales**, CATT, ESA, Eutelsat Group, Lockheed	Draft CR for 38.211 on Introduction of FR2-NTN

		Martin, Inmarsat, Sharp	
	R1-2403754	Moderator (**Thales**), vivo, Ericsson, Samsung	CR on correction on timing of first Msg3 repetition
	R1-2403791	Moderator (Nokia), Ericsson, **Thales**, CATT, ESA, Eutelsat Group, Lockheed Martin, Inmarsat, Sharp	Draft CR for 38.211 on Introduction of FR2-NTN
RAN1#117	R1-2404201	**Thales**	Discussion on NR NTN Downlink coverage enhancements
	R1-2404202	**Thales**	FL Summary #1: NR-NTN downlink coverage enhancements
	R1-2404203	**Thales**	FL Summary #2: NR-NTN downlink coverage enhancements
	R1-2404204	**Thales**	FL Summary #3: NR-NTN downlink coverage enhancements
	R1-2404205	**Thales**	Work plan for Rel-19 NR_NTN_Ph3
	R1-2404206	**Thales**	On RAN4 LS on the system parameters for FR2-NTN
	R1-2404218	**Thales**	Draft CR for 38.211 on Introduction of FR2-NTN
	R1-2405342	**Thales**, Magister	Discussion on NR NTN Downlink coverage enhancements
	R1-2405395	Moderator (**Thales**)	FL Summary #1: Maintenance on Rel-18 NR NTN
	R1-2405396	Moderator (**Thales**)	FL Summary #2: Maintenance on Rel-18 NR NTN
	R1-2405397	Moderator (**Thales**)	FL Summary #3: Maintenance on Rel-18 NR NTN
	R1-2405581	Moderator (**Thales**)	Correction on the application time of cell DRX for NR NTN
	R1-2405587	**Thales**	Draft CR for 38.211 on Introduction of FR2-NTN
	R1-2405706	Moderator (**Thales**), Huawei, HiSilicon, Samsung, CATT, Ericsson	Correction on PUSCH retransmission for CG RACH-less handover
	R1-2405730	Moderator (**Thales**)	FL Summary #4: NR-NTN downlink coverage enhancements

The following are the contributions of 5G- STARDUST partners to 3GPP RAN 2 meetings for Rel-19 NR NTN WI:

Table 23 - Contributions of 5G- STARDUST partners to 3GPP RAN 2 meetings for Rel-19 NR NTN WI

Meeting	Tdoc	Contributors	Title
RAN2#125-bis	R2-2402357	CATT, **Thales**	Work plan for Rel-19 NR_NTN_Ph3
	R2-2403066	Telit Communications S.p.A. ; **Thales**	Support for LTE to NR-NTN idle mode mobility
	R2-2403274	**Thales**	Discussion on Store and Forward support for IoT NTN Phase 3
	R2-2403275	**Thales**	Discussion on MBS broadcast additional features for NR NTN Evolution
	R2-2403276	**Thales**	Discussion on RAN2 Aspects for Downlink Coverage Enhancements in NR NTN evolution
	R2-2403606	**Thales**, CATT, Huawei, ZTE, Inmarsat, Viasat	Regenerative NTN payload support in NR NTN Evolution
RAN2#126	R2-2404198	Telit Communications S.p.A. ; **Thales**	Support for LTE to NR-NTN idle mode mobility
	R2-2404207	CATT, **Thales**	Updated work plan for NR NTN Ph3
	R2-2405239	**Thales**	Discussion on MBS broadcast additional features for NR NTN Evolution
	R2-2405240	**Thales**	Discussion on RAN2 Aspects for Downlink Coverage Enhancements in NR NTN evolution
	R2-2405241	**Thales**	Regenerative NTN payload support in NR NTN Evolution

The following are the contributions of 5G- STARDUST partners to 3GPP RAN 3 meetings for Rel-19 NR NTN WI:

Table 24 - Contributions of 5G- STARDUST partners to 3GPP RAN 3 meetings for Rel-19 NR NTN WI

Meeting	Tdoc	Contributors	Title
RAN3#123-bis	R3-241930	CATT, **Thales**	Work plan for Rel-19 NR_NTN_Ph3
	R3-242043	Ericsson, **Thales**	Service Area for a Broadcast Service in NR NTN

	R3-242044	Ericsson, **Thales**, Deutsche Telekom, Nokia	Support for Regenerative Payload in NR NTN
RAN3#124	R3-243412	Ericsson, Eutelsat Group, SES, **Thales**	MBS Service Area in NR NTN
	R3-243413	Ericsson, **Thales**, Deutsche Telekom, Nokia, ESA, CATT, ZTE, Sateliot, Huawei	Support for Regenerative Payload in NR NTN
	R3-243553	**Thales**	Discussion on MBS broadcast additional features for NR NTN Evolution
	R3-243671	CATT, **Thales**	Updated work plan for NR_NTN_Ph3
	R3-243866	Ericsson, **Thales**, Deutsche Telekom, Nokia, ESA, CATT, ZTE, Sateliot, Huawei	Support for Regenerative Payload in NR NTN
	R3-243949	Ericsson, **Thales**, Deutsche Telekom, Nokia, ESA, CATT, ZTE, Sateliot, Huawei, Dish Networks, Echostar, Eutelsat Group, Xiaomi, Samsung, CMCC, LG Electronics	Support for Regenerative Payload in NR NTN

The following are the contributions of 5G- STARDUST partners to 3GPP RAN 4 meetings for Rel-19 NR NTN WI:

Table 25 - Contributions of 5G- STARDUST partners to 3GPP RAN 4 meetings for Rel-19 NR NTN WI

Meeting	Tdoc	Contributors	Title
RAN4#111	R4-2409787	**Thales**	General aspects for NTN NR Phase 3

The following are the contributions of 5G- STARDUST partners to 3GPP SA 1 meetings for Rel-19 NR NTN WI:

Table 26 - Contributions of 5G- STARDUST partners to 3GPP SA 1 meetings for Rel-19 NR NTN WI

Meeting	Tdoc	Contributors	Title
SA1#101	S1-230156	Qualcomm, **Thales**, Futurewei, SyncTechno	Initial consolidation proposal
	S1-230450	ETRI, Novamint, **Thales**, Eutelsat, Lockheed Martin, KT Corporation,	Use case on service continuity for UE-to-UE communication across
	S1-230457	ETRI, Novamint, **Thales**, Eutelsat, Lockheed Martin, KT Corporation,	Use case on service continuity for UE-to-UE communication across
	S1-230645	ETRI, Novamint, **Thales**, Eutelsat, Lockheed Martin, KT Corporation,	Use case on service continuity for UE-to-UE communication across
	S1-230669	ETRI, Novamint, **Thales**, Eutelsat, Lockheed Martin, KT Corporation,	Use case on service continuity for UE-to-UE communication across
SA1#102	S1-231017	**Thales**, Lockheed Martin, SES, Avanti, Intelsat, CeWIT, Airbus, **Hispasat**, Inmarsat, Gilat, TNO,	Use Case on supplementary downlink data via a second 3GPP network

		ESA, Qualcomm, Novamint	
	S1-231089	Novamint, China Telecom, **Thales**, Airbus, Avanti, CEWiT, ESA, ETRI, Eutelsat, GateHouse, Gilat, Hughes Network systems, IIIT Hyderabad, Inmarsat, Intelsat, IRT Saint Exup ry, Ligado, Lockheed Martin, Nokia, Omnispace, OneWeb, Sateliot, SES, ST Engineering iDirect Ireland, TNO, TTP	New WID: Satellite access - Phase 3
	S1-231201	Qualcomm, Nokia, Nokia Shanghai Bell, FirstNet, Verizon UK Ltd, **Thales**	New WID on Human readable name for network service
	S1-231202	Qualcomm, Nokia, Nokia Shanghai Bell, FirstNet, Verizon UK Ltd, **Thales**	Human readable name for netwok service
	S1-231361	Qualcomm, Nokia, Nokia Shanghai Bell, FirstNet, Verizon UK Ltd, **Thales**, Xiaomi, KDDI	New WID on Human readable name for network service
	S1-231571	Novamint, China Telecom, **Thales**, Airbus, Avanti, CEWiT, ESA, ETRI, Eutelsat, GateHouse, Gilat, Hughes Network systems, IIIT Hyderabad, Inmarsat, Intelsat, IRT Saint Exup ry, Ligado, Lockheed Martin, Nokia, Omnispace, OneWeb, Sateliot, SES, ST Engineering iDirect Ireland, TNO, TTP	New WID: Satellite access - Phase 3
	S1-231602	**Thales**, Lockheed Martin, SES, Avanti, Intelsat, CeWIT, Airbus, **Hispasat**, Inmarsat, Gilat, TNO, ESA, Qualcomm, Novamint, Lenovo, Ericsson, IRT Saint Exupery, JSAT, Ligado, Sateliot, Omnispace, Gatehouse, EchoStar, Viasat, Cobham Satcom, SA catapult, Eutelsat, Leonardo, OneWeb, Forsway	Use Case on supplementary downlink data via a second 3GPP network
	S1-231621	Qualcomm, Lenovo, CableLabs, Xiaomi, Comcast Corporation, Verizon UK Ltd, Tencent, **Thales**, Charter Communications,	pCR for FS_DualSteer Consolidated requirements

		SyncTechno Inc., InterDigital, KDDI, Nokia, Nokia-Shanghai Bell, Vivo, Lockheed Martin, Sennheiser, Viasat, KPN, LG Electronics, Apple, Novamint, Futurewei, NEC, ETRI, IRT Saint Exupery, CATT, DSIT, Ericsson	
	S1-231706	**Thales**, Lockheed Martin, SES, Avanti, Intelsat, CeWIT, Airbus, **Hispasat**, Inmarsat, Gilat, TNO, ESA, Qualcomm, Novamint, Lenovo, Ericsson, IRT Saint Exupery, JSAT, Ligado, Sateliot, Omnispace, Gatehouse, EchoStar, Viasat, Cobham Satcom, SA catapult, Eutelsat, Leonardo, OneWeb, Forsway, China Telecom, ETRI, ST Engineering iDirect,	Use Case on supplementary downlink data via a second 3GPP network
	S1-231707	Qualcomm, Lenovo, CableLabs, Xiaomi, Comcast Corporation, Verizon UK Ltd, Tencent, **Thales**, Charter Communications, SyncTechno Inc., InterDigital, KDDI, Nokia, Nokia-Shanghai Bell, Vivo, Lockheed Martin, Sennheiser, Viasat, KPN, LG Electronics, Apple, Novamint, Futurewei, NEC, ETRI, IRT Saint Exupery, CATT, DSIT, Ericsson	pCR for FS_DualSteer Consolidated requirements
	S1-231738	Novamint, China Telecom, **Thales**, Airbus, Avanti, CEWiT, ESA, ETRI, Eutelsat, GateHouse, Gilat, Hughes Network systems, IIIT Hyderabad, Inmarsat, Intelsat, IRT Saint Exup ry, Ligado, Lockheed Martin, Nokia, Omnispace, OneWeb, Sateliot, SES, ST Engineering iDirect Ireland, TNO, TTP	New WID: Satellite access - Phase 3
	S1-231800	**Thales**, Lockheed Martin, SES, Avanti, Intelsat, CeWIT, Airbus, **Hispasat**, Inmarsat, Gilat, TNO, ESA, Qualcomm, Novamint, Lenovo,	Use Case on supplementary downlink data via a second 3GPP network

		Ericsson, IRT Saint Exupery, JSAT, Ligado, Sateliot, Omnispace, Gatehouse, EchoStar, Viasat, Cobham Satcom, SA catapult, Eutelsat, Leonardo, OneWeb, Forsway, China Telecom, ETRI, ST Engineering iDirect,	
SA1#103	S1-232035	**Thales**, Lockheed Martin, SES, Avanti, Intelsat, CeWIT, Airbus, **Hispasat**,	Use Case on supplementary downlink data via a second 3GPP network
	S1-232239	Qualcomm, Lenovo, CableLabs, Xiaomi, Comcast Corporation, Verizon UK Ltd, Tencent, **Thales**, Charter Communications, SyncTechno Inc., InterDigital, KDDI, Nokia, Nokia-Shanghai Bell, Vivo, Lockheed Martin, Sennheiser, Viasat, KPN, LG Electronics, Apple, Novamint, Futurewei, NEC, ETRI, IRT Saint Exupery, CATT, DSIT, Ericsson	DualSteer_Normative requirements
	S1-232257		DualSteer Normative requirements
	S1-232288		DualSteer Normative requirements
	S1-232337	**Thales**, Lockheed Martin, SES, Avanti, Intelsat, CeWIT, Airbus, **Hispasat**,	Use Case on supplementary downlink data via a second 3GPP network
	S1-232371		DualSteer Normative requirements
SA1#104	S1-233033	**Thales**, Novamint, Eutelsat	Clarifications to the Use Case on NTN-based dual 3GPP access
	S1-233106	Qualcomm, ETRI, Verizon UK Ltd, US Cellular, Apple, NEC, **Thales**,	New WID on Upper layer traffic steering and switching over dual 3GPP
	S1-233107	Qualcomm, ETRI, Verizon UK Ltd, US Cellular, Apple, NEC, **Thales**, Novamint, Viasat, CeWIT, JSAT, Ligado, Omnispace, SA Catapult, Avanti, Hughes, Gilat, Terrestar Solutions, Inmarsat, Sateliot, TTP, ESA, Intelsat, Gatehouse, University of Surrey, SES, **Hispasat**, Airbus, Eutelsat, MITRE, Nokia, Nokia Shanghai Bell, SyncTechno, InterDigital, Lockeed Martin, IRT Saint Exupery, Tencent	DualSteer Normative requirements

	S1-233201	NOVAMINT, **Thales**, Airbus, Eutelsat, Fraunhofer, TNO,	Satellite Access: Next Steps - Motivation for study in Rel-20 and beyond
	S1-233301	**Thales**, Novamint, Eutelsat, TNO, Lockheed Martin	Clarifications to the Use Case on NTN-based dual 3GPP access
	S1-233336	Qualcomm, ETRI, Verizon UK Ltd, US Cellular, Apple, NEC, **Thales**,	New WID on Upper layer traffic steering and switching over dual 3GPP
	S1-233337	Qualcomm, ETRI, Verizon UK Ltd, US Cellular, Apple, NEC, **Thales**, Novamint, Viasat, CeWIT, JSAT, Ligado, Omnispace, SA Catapult, Avanti, Hughes, Gilat, Terrestar Solutions, Inmarsat, Sateliot, TTP, ESA, Intelsat, Gatehouse, University of Surrey, SES, **Hispasat**, Airbus, Eutelsat, MITRE, Nokia, Nokia Shanghai Bell, SyncTechno, InterDigital, Lockeed Martin, IRT Saint Exupery, Tencent	DualSteer Normative requirements
	S1-233345	Qualcomm, ETRI, Verizon UK Ltd, US Cellular, Apple, NEC, **Thales**,	New WID on Upper layer traffic steering and switching over dual 3GPP
	S1-233347	Qualcomm, ETRI, Verizon UK Ltd, US Cellular, Apple, NEC, **Thales**, Novamint, Viasat, CeWIT, JSAT, Ligado, Omnispace, SA Catapult, Avanti, Hughes, Gilat, Terrestar Solutions, Inmarsat, Sateliot, TTP, ESA, Intelsat, Gatehouse, University of Surrey, SES, **Hispasat**, Airbus, Eutelsat, MITRE, Nokia, Nokia Shanghai Bell, SyncTechno, InterDigital, Lockeed Martin, IRT Saint Exupery, Tencent, vivo, Lenovo	DualSteer Normative requirements
	S1-233348	**Thales**, Novamint, Eutelsat, TNO, Lockheed Martin	Clarifications to the Use Case on NTN-based dual 3GPP access
	S1-233371	Qualcomm, ETRI, Verizon UK Ltd, US Cellular, Apple, NEC, **Thales**, Novamint, Viasat, CeWIT, JSAT, Ligado, Omnispace, SA Catapult, Avanti, Hughes, Gilat, Terrestar Solutions,	DualSteer Normative requirements

		Inmarsat, Sateliot, TTP, ESA, Intelsat, Gatehouse, University of Surrey, SES, **Hispasat**, Airbus, Eutelsat, MITRE, Nokia, Nokia Shanghai Bell, SyncTechno, InterDigital, Lockeed Martin, IRT Saint Exupery, Tencent, vivo, Lenovo	
	S1-233372	Qualcomm, ETRI, Verizon UK Ltd, US Cellular, Apple, NEC, **Thales**,	New WID on Upper layer traffic steering and switching over dual 3GPP
SA1#105	S1-240052	Novamint, **Thales**, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI,	New SID: Study on satellite access - Phase 4
	S1-240053	NOVAMINT, **Thales**, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI, vivo, SKY Perfect JSAT, Sateliot, Lockheed Martin, Hughes Network systems, CATT, Nokia, Nokia Shanghai Bell, OQ Technology, China Telecom	Motivation for a Study on satellite access - Phase 4
	S1-240064	SES, **Thales**, Ligado, Novamint, Inmarsat, Viasat, Avanti, Airbus, ESA, **Hispasat**,	Use Cases motivations for 5G MBS over NTN study
	S1-240070	Hughes Network Systems, Dish Network, Novamint, **Hispasat**, **Thales**,	Mini WID on Robust Notification Alert for 5G system with satellite access
	S1-240071	Hughes Network Systems, DISH Network, Novamint, **Hispasat**, OQ Technology, OmniSpace, SES, TTP Plc, **Thales**	Robust Notification Alert for 5G satellite acsess to notify UE of missed paging call(s) when normal paging fails
	S1-240130	Nokia, Nokia Shanghai Bell, KDDI, SK Telecom, Rakuten Mobile, Spark NZ, Reliance Jio, KT Corp., LG Uplus, ETRI, **Thales**, Novamint, Sateliot	Structure considerations for SA1 Rel-20 Part B study
	S1-240189	HUGHES Network Systems, Dish Network, Novamint, **Hispasat**, **Thales**, OmniSpace, OQ Technology, SES	mini-WID on Robust Notification Alert for NR-NTN
	S1-240210	Novamint, **Thales**, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI,	New SID: Study on satellite access - Phase 4

	S1-240211	NOVAMINT, **Thales**, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI, vivo, SKY Perfect JSAT, Sateliot, Lockheed Martin, Hughes Network systems, CATT, Nokia, Nokia Shanghai Bell, OQ Technology, China Telecom	Motivation for a Study on satellite access - Phase 4
	S1-240235	Novamint, **Thales**, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI,	New SID: Study on satellite access - Phase 4
	S1-240258	Novamint, **Thales**, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI,	New SID: Study on satellite access - Phase 4
	S1-240290	Novamint, **Thales**, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI,	New SID: Study on satellite access - Phase 4
	S1-240298	Novamint, **Thales**, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI,	New SID: Study on satellite access - Phase 4
	S1-240312	Novamint, **Thales**, Airbus, Eutelsat Group, Fraunhofer IIS, TNO, ESA, SES, ETRI,	New SID: Study on satellite access - Phase 4
SA1#106	S1-241017	NOVAMINT, SES, **Thales**, ESA	Motivation for revising FS_5GSAT_Ph4 SID to add Reliable Multicast Use Cases for NTN
	S1-241041	**Thales**	Views on 6G SA1 study item(s)
	S1-241183	NOVAMINT, SES, **Thales**, ESA, Inmarsat, Viasat	Revised SID: Study on satellite access - Phase 4
	S1-241235	**Thales**, TNO, Airbus, Novamint, CEWiT	Views on 6G SA1 study item(s)
	S1-241251	Novamint, SES, **Thales**, ESA, Inmarsat, Viasat, EchoStar, JSAT, TNO, Gilat,	Revised SID: Study on satellite access - Phase 4
	S1-241275	EchoStar, Dish Network, Novamint, SES, **Thales**, Vivo	5G system with satellite access to support Robust Notification Alert
	S1-241285	EchoStar, Dish Network, Novamint, SES, **Thales**, Vivo, Sateliot	5G system with satellite access to support Robust Notification Alert
	S1-241290	EchoStar, Dish Network, Novamint, SES, **Thales**, Vivo, Sateliot,	5G system with satellite access to Resilient/Robust support Robust
	S1-241352	Novamint, SES, **Thales**, ESA, Inmarsat, Viasat, EchoStar, JSAT, TNO, Gilat,	Revised SID: Study on satellite access - Phase 4
	S1-241369	EchoStar, Dish Network, Novamint,	5G system with satellite access to support Robust Resilient Notification

		SES, **Thales**, Vivo, Sateliot,	
	S1-241393	Novamint, SES, **Thales**, ESA, Inmarsat, Viasat, EchoStar, JSAT, TNO, Gilat,	Revised SID: Study on satellite access - Phase 4
	S1-241411	EchoStar, Dish Network, Novamint, SES, **Thales**, Vivo, Sateliot,	5G system with satellite access to support Resilient Notification

The following are the contributions of 5G- STARDUST partners to 3GPP SA 2 meetings for Rel-19 NR NTN WI:

Table 27 - Contributions of 5G- STARDUST partners to 3GPP SA 2 meetings for Rel-19 NR NTN WI

Meeting	Tdoc	Contributors	Title
SA2#157	S2-2306693	Qualcomm Incorporated, CableLabs, Lockheed Martin, Futurewei, **Thales**, Novamint	Supporting material for DualSteer study item proposal
	S2-2306896	**Thales**, Novamint, CATT	New SID on Study on Integration of satellite components in the 5G architecture Phase III.
SA2#158	S2-2308445	**Thales** (moderator, Q3 NWM process)	New SID on Study on Integration of satellite components in the 5G architecture Phase III
	S2-2308448	**Thales**	SA WG2 Rel. 19 SID, Satellite architecture enhancement Q3 NWM discussion moderator report
	S2-2309631	**Thales**	New SID on Study on Integration of satellite components in the 5G architecture Phase III.
	S2-2310027	**Thales** (moderator, Q3 NWM process)	New SID on Study on Integration of satellite components in the 5G architecture Phase III
SA2#159	S2-2310143	**Orange**, Telecom Italia, BT plc, **Thales**, Ministère Economie et Finances	New WID on Emergency Short Message Service over IMS
	S2-2310455	CATT, **Thales**	FS_5GSAT_ARCH_Ph3 TR Skeleton.
	S2-2310457	CATT, **Thales**	FS_5GSAT_ARCH_Ph3 TR Scope.
	S2-2310458	CATT, **Thales**	FS_5GSAT_ARCH_Ph3 TR architectural assumptions.
	S2-2310459	CATT, **Thales**	FS_5GSAT_Ph3_ARCH_Key issue for WT#1.
	S2-2310460	CATT, **Thales**	FS_5GSAT_ARCH_Ph3_Key issue for WT#2.
	S2-2310461	CATT, **Thales**	FS_5GSAT_ARCH_Ph3_Key issue for WT#3.
	S2-2311167	**Orange**, Telecom Italia, BT plc, **Thales**, Minist re Economie et Finances, Google	New WID on Emergency Short Message Service over IMS.
	S2-2311379	CATT, **Thales**	FS_5GSAT_ARCH_Ph3 TR Skeleton.
	S2-2311382	CATT, **Thales**	FS_5GSAT_ARCH_Ph3 TR Scope.
	S2-2311553	CATT, **Thales**	FS_5GSAT_ARCH_Ph3 TR Scope.
	S2-2311603	CATT, **Thales**	FS_5GSAT_ARCH_Ph3 TR Scope.
	S2-2311913	CATT, **Thales**	FS_5GSAT_ARCH_Ph3 TR Skeleton.
SA2#160	S2-2312007	**Orange**, Telecom Italia, BT plc, **Thales**, Minist re Economie et Finances, Google	New WID on Emergency Short Message Service over IMS.
	S2-2312146	**Thales**	Example network and satellite configurations for WT3 in FS_5GSAT_ARCH_Ph3.
	S2-2312461	CATT, **Thales**, Novamint, Samsung, Airbus, Eutelsat, TNO, IRT Saint-Exupery, Apple	FS_5GSAT_ARCH_Ph3_Key issue for WT#3.
	S2-2312988	CATT, **Thales**, Novamint, China Telecom, Spreadtrum, vivo	FS_5GSAT_Ph3_ARCH_Key issues for WT#1.
	S2-2313027	Novamint, CATT, **Thales**, Sateliot, Gatehouse	FS_5GSAT_ARCH_Ph3_Key issue for WT#2.

	S2-2313364	CATT, **Thales**, Novamint, China Telecom, Spreadtrum, vivo, TNO, Eutelsat, Nokia, Nokia Shanghai Bell, NEC	FS_5GSAT_Ph3_ARCH_Key issues for WT#1.
	S2-2313365	Novamint, CATT, **Thales**, Sateliot, Gatehouse, TNO	FS_5GSAT_ARCH_Ph3_Key issue for WT#2.
	S2-2313367	CATT, **Thales**, Novamint, Samsung, Airbus, Eutelsat, TNO, IRT Saint-Exupery, Apple, Nokia,Nokia Shanga Bell	FS_5GSAT_ARCH_Ph3_Key issue for WT#3.
	S2-2313368	**Thales**	Example network and satellite configurations for WT3 in FS_5GSAT_ARCH_Ph3.
	S2-2313623	CATT, **Thales**, Novamint, China Telecom, Spreadtrum, vivo, TNO, Eutelsat, Nokia, Nokia Shanghai Bell, NEC, Xiaomi, SAMSUNG, OPPO, Deutsche Telekom, Airbus	FS_5GSAT_Ph3_ARCH_Key issues for WT#1.
	S2-2313624	Novamint, CATT, **Thales**, Sateliot, Gatehouse, TNO, Airbus, Deutsche Telekom, Oppo, Vivo, Xiaomi, CEWiT, Hughes Network Systems, Skylo, Samsung, NEC	FS_5GSAT_ARCH_Ph3_Key issue for WT#2.
	S2-2313625	Vivo, Samsung, Huawei, HiSilicon, **Thales**, Deutsche Telekom	FS_5GSAT_ARCH_Ph3 Architecture assumption updates UE-satellite-UE communications.
	S2-2313626	CATT, **Thales**, Novamint, Samsung, Airbus, Eutelsat, TNO, IRT Saint-Exupery, Apple, Nokia, Nokia Shanga Bell, Xiaomi, OPPO, Vivo, Motorola Solutions	FS_5GSAT_ARCH_Ph3_Key issue for WT#3.
	S2-2313627	**Thales**	Example network and satellite configurations for WT3 in FS_5GSAT_ARCH_Ph3.
	S2-2313702	Novamint, CATT, **Thales**, Sateliot, Gatehouse, TNO, Airbus, Deutsche Telekom, Oppo, Vivo, Xiaomi, CEWiT, Hughes Network Systems, Skylo, Samsung, NEC, LGE, Nokia, Nokia Shanghai Bell, Huawei	FS_5GSAT_ARCH_Ph3_Key issue for WT#2.
	S2-2313703	Vivo, Samsung, Huawei, HiSilicon, **Thales**, Deutsche Telekom	FS_5GSAT_ARCH_Ph3 Architecture assumption updates UE-satellite-UE communications.
	S2-2313704	CATT, **Thales**, Novamint, Samsung, Airbus, Eutelsat, TNO, IRT Saint-Exupery, Apple, Nokia, Nokia Shanga Bell, Xiaomi, OPPO, Vivo, Motorola Solutions, NEC	FS_5GSAT_ARCH_Ph3_Key issue for WT#3.
	S2-2313861	**Thales**	Example network and satellite configurations for WT3 in FS_5GSAT_ARCH_Ph3.
SA2#160-Ad Hoc-e	S2-2400347	**Orange**, Telecom Italia, BT plc, **Thales**, Minist re Economie et Finances, Google, Ericsson	New WID on Emergency Short Message Service over IMS.
	S2-2401077	**Thales**	New Solution for KI#3: Solution to determine UE-SATs-UE eligibility and enable communication setup.

	S2-2401627	**Orange**, Telecom Italia, BT plc, **Thales**, Minist re Economie et Finances, Google, Ericsson	New WID on Emergency Short Message Service over IMS.
	S2-2401663	FS_5GSAT_Ph3_ARCH Rapporteur (**Thales**)	WI Status Report for Study on Integration of satellite components in the 5G architecture Phase 3 (FS_5GSAT_Ph3_ARCH)
	S2-2401807	**Thales**	New Solution for KI#3: Solution to determine UE-SATs-UE eligibility and enable communication setup.
SA2#161	S2-2402093	**Thales**	New SID on Study on Integration of satellite components in the 5G architecture Phase 3.
	S2-2402362	**Orange**, Telecom Italia, BT plc, **Thales**, Minist re Economie et Finances, Google, Ericsson, Nokia, Nokia Shanghai Bell, Apple, DISH Network, Samsung	New WID on Emergency Short Message Service over IMS.
	S2-2402669	**Thales**	New Solution for KI#2: Inverse AKA, solution to optimize authentication flow in case of intermittent/temporary connectivity. .
	S2-2402675	**Thales**	New Solution for KI#2: IOPS security concept for Store and Forward. .
SA2#162	S2-2405072	NOVAMINT, Sateliot, **Thales**	KI#2 - Initial principles for S&F Satellite operation for solution evaluation.
	S2-2405601	NOVAMINT, Sateliot, **Thales**	KI#2 - Initial principles for S&F Satellite operation for solution evaluation.
	S2-2405621	NOVAMINT, Sateliot, **Thales**, Deutsche Telekom	KI#2 - Initial principles for S&F Satellite operation for solution evaluation.
	S2-2405630	Rapporteur (**Thales**)	WI Status report for Study on Integration of satellite components in the 5G architecture Phase 3
SA2#163	S2-2406505	**Thales**	New WID on Integration of satellite components in the 5G architecture Phase III.
	S2-2406526	**Thales**(rapporteur)	Introduction for conclusions on the architecture principles following the NWM discussions, for KI1.
	S2-2406529	**Thales**(rapporteur)	Introduction for conclusions on the architecture principles following the NWM discussions, for KI2.
	S2-2406530	**Thales**(rapporteur)	Introduction for conclusions on the architecture principles following the NWM discussions, for KI3.
	S2-2406905	Huawei, HiSilicon, Intel, NTT DOCOMO, **Thales**	KI#1 Conclusion: For regenerative-based satellite access.
	S2-2407160	Huawei, HiSilicon, Intel, NTT DOCOMO, **Thales**, Samsung, China Telecom, vivo, OPPO, Ericsson	KI#1 Conclusion: For regenerative-based satellite access.
	S2-2407293	Rapporteur (**Thales**)	WI Status report for Study on Integration of satellite components in the 5G architecture Phase 3
	S2-2407368	**Thales**	New WID on Integration of satellite components in the 5G architecture Phase III.

2.4.4 Regenerative payloads

In preparation of the Release 19, the regenerative payload architecture options were extensively discussed. The baseline adopted in SA2, RAN2 and RAN3 embarks the full gNB on-board and put the 5GC on the ground. The TR 23.700-29 led by SA2 provides system solutions to support the mobility of the NG-RAN interfaces over the feeder link for NGSO.

The other options are not prohibited by implementation, such as the different split options between RU, DU and CU.

The 5G-Stardust partners actively participated to the discussions in preparation to the Rel-19 to include regenerative payload support and to include different architecture options.

2.4.5 Ku-band support

The Ku-band is part of the Rel-19 after the RAN#104 meeting approval of the WI. In complement of FR2-NTN 510, 511, 512 for Ka-band, the objective of the WI is to introduce 4 new Ku-band between 10.70 and 14.5 GHz.

With the definition of Ku band in 3GPP Specifications, future satellite networks will be able to inter-operate with the terrestrial mobile system under the 5G technology framework and provide coverage extension for broadband Machine-Type Communications devices.

2.4.6 Dual steer

SA1 captured in TR 22.841 for Release 19 the use cases and potential service requirements related to 5G system support of traffic steering, splitting, and switching of UE's user data across two 3GPP access networks. Dual steering technics allow to ensure service continuity for a UE by using for instance TN and NTN (or different orbit of NTN, e.g. LEO and GEO). Dual Steer study can be used as a baseline for further study in Rel-20 by SA2 for new NTN/TN dual connectivity solutions.

The 5G- STARDUST was leader on the definition of the dual steer use cases and requirements in SA1.

3 CONCLUSIONS

Regarding satellite standardisation activities in 3GPP, the newly 3GPP specified standard for NTN is the result of a joint effort between stakeholders of both mobile and satellite industry and the leading role of 5G-STARDUST partners on 3GPP specifications in different working groups. In this respect, 5G-STARDUST participated to the most relevant 3GPP initiatives inherent to NTN standardisation through the involved individual organisations (i.e. Thales Alenia Space, Hispasat, and Orange) and the participation to the ESA-based SSIG platform.

Integration of satellite with mobile systems is now possible with 3GPP Release 17 NTN standard. This NTN standard has been designed to support the wide range of satellite network deployment scenarios covering any orbit, any frequency band, any device, any beam size and type. It is expected that this NTN standard will be welcomed by Telecommunication User groups (Public safety, transport, automotive, media and entertainment, defence, agriculture,…) calling for seamless combination of satellite and mobile systems, native support of 5G added value features across the access technologies (e.g. Slicing, energy saving, mobility, 3rd party network management, application & service platforms) and multi-vendor interoperability preventing vendor lock associated to legacy proprietary satellite access technologies.

5G- STARDUST partners actively contributing to Rel-18 to enhance service continuity between TN and NTN and to support Ka-band scenarios. As part of the Rel-19, the partners contributed to define the Rel-19 work items objectives, especially to support regenerative payload architecture.

By the end of 2025, the Rel-19 should be completed, including support of regenerative payload and Ku-band. The 5G- STARDUST partners will be involved in the newly formed NTN-Forum [2](Kick-off on July 5th 2024) led by ESA to coordinate the standardization effort for NTN, especially in preparation of Rel-20 and Rel-21 i.e. 6G study and normative phase. 5G-Stardust outcomes on TN-NTN service continuity will be highly valuable for the 6G objective of unification of TN and NTN.

[2] The NTN Forum will formally replace the SSIG platform, as of July 2024. More details available here: https://connectivity.esa.int/nonterrestrial-networks-ntn-forum

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[4] 3GPP, “SP-211651 WI Study on 5GC enhancement for satellite access Phase 2”, December 2022.
[5] 3GPP, “SP-220679 WI Study on satellite access - Phase 3”, December 2023.