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Dynamic spectrum sharing and bandwidth-efficient techniques for high-throughput MIMO Satellite systems

D6.5: Standardisation and Regulatory Report

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Abstract

This document aims at reporting on the standardisation and regulatory activities conducted during the first year of the project.

Keywords: standardization, regulation, 3GPP

Document Revision History

Version	Date	Description of change	List of contributor(s)
V1.0	03/12/2021		Thales Alenia Space University of Bologna Magister Solutions Fair Spectrum University of Parma
V1.01	09/01/2022	Final preparation and submission	University of Bologna

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OTHER: Software, technical diagram, etc

EXECUTIVE SUMMARY

This deliverable aims at providing a summary of the activities conducted in DYNASAT in the field of Standardisation and Regulations. A standardisation and regulatory action plan (D.6.2) has been elaborated during the first phases of the project. The present deliverable examines the progress made with respect to this Workplan in 2021.

In the first part of the deliverable are described the main standardization activities relevant to NTN, taking place at the 3GPP forum. Standardization of successive Releases are done in parallel, hence Rel-17 and -18 are reported separately.

In the regulatory domain, the report focuses on the promotion of the integration of satellite and terrestrial IMT, including with respect to Satellite Radio Interfaces. DYNASAT partners are active in promoting an integrated vision of satellite and terrestrial IMT systems. The current development by ITU of Vision and Requirements for satellite component of IMT-2020 provides an opportunity to support this vision, and to promote the international recognition of 5G NR as a satellite radio interface. It also provides information on activities conducted in ITU which may have interest in the DYNASAT context.

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ABBREVIATIONS

APS	**Altitude Platform Station**
ATG	**Air To Ground**
ACM	**Adaptive coding and modulation**
AWGN	**Additive White Gaussian Noise**
BER	**Bit error rate**
BLER	**Block error rate**
CDF	**Cumulative Distribution Function**
CPE	**Common phase error**
CRC	**Cyclic redundancy check**
CSI	**Channel State Information**
DC	**Dual Connectivity**
DCI	**Downlink control information**
DLSCH	**Downlink shared channel**
DMRS	**Demodulation reference signal**
FFR	**Full Frequency Reuse**
FR	**Frequency Reuse**
H-ARQ	**Hybrid automatic repeat request**
INR	**Interference-to-Noise Ratio**
IMT	**International Mobile Telecommunications**
ISL	**Inter Satellite Link**
ITU	**International Telecommunications Union**
LDPC	**Low density parity check**
LEO	**Low Earth Orbit**
LOS	**Line-of-Sight**
KPI	**Key Performance Indicator**
MB	**Multi-Beam**
MIMO	**Multiple Input Mulitple Output**
MU-MIMO	**Multi User MIMO**
MNO	**Mobile Network Operator**
MPC	**Maximum Power Constraint**
NCC	**Network Control Center**
NGSO	**Non-Geosynchronous Orbit**
NLOS	**Non-Line-Of-Sight**
NR	**New Radio**
NTN	**Non-Terrestrial Network**
OFDM	**Orthogonal frequency division multiplexing**

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PAC	**Per Antenna Constraint**
PDCCH	**Physical downlink control channel**
PDSCH	**Physical downlink shared channel**
PRACH	**Physical random access channel**
PTRS	**Phase tracking reference signal**
PUSCH	**Physical uplink shared channel**
QoS	**Quality of Service**
SINR	**Signal-to-Interference-plus-Noise Ratio**
SIR	**Signal-to-Interference Ratio**
SNR	**Signal-to-Noise Ratio**
sMPC	**satellite MPC**
SPC	**Sum Power Constraint**
SSB	**Signal synchronization block**
SS-MMSE	**Spatially Sampled MMSE**
SSP	**Sub Satellite Point**
SSPA	**Solid state power amplifier**
sSPC	**satellite SPC**
TR	**Technical Report**
TS	**Technical Specification**
TSG	**3GPP Technical Specification Groups**
UE	**User Equipment**
ULSCH	**Uplink shared channel**
VSAT	**Very Small Aperture Terminal**

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1 INTRODUCTION

This deliverable aims at providing a summary of the activities conducted in DYNASAT in the field of Standardisation and Regulations.

A standardisation and regulatory action plan (D.6.2) was elaborated during the first phases of the project. The present deliverable examines the progress made is respect of this workplan in 2021.

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2 STANDARDISATION REPORT

2.1 Satellite standardisation activities in 3GPP Release-17

3GPP studied the feasibility and the standard enhancements needed to enable NR communication (Direct Access) over satellite systems at 3GPP Release-16. The normative activities on Non-Terrestrial Networks (NTN) was started in Release-17 which generated growing interest in the subject: A wide range of user equipment's, chipset, and RAN infra-vendors as well as service providers from both the mobile and space industries and vertical user groups were supportive of Release-17 NTN work item.

Different 3GPP Technical Specification Groups (TSG) made good progress on Release-17 NTN specifications. Thereby, 3GPP has been progressing towards the goal of satellite inclusion in 3GPP technical specifications. This joint effort between mobile and satellite industries will enable the full integration of satellite in the 3GPP ecosystem and define a global standard for future satellite networks.

2.1.1 Release 17 WID Objectives

In 3GPP Release-17, a work item was carried out to define solutions enabling New Radio and NG-RAN to support Non-Terrestrial Networks (NTN): The focus is on transparent payload architecture with FDD systems where all UEs are assumed to have GNSS capabilities. The normative phase includes adaptation to the physical and access layer aspects, radio access network and system architecture, radio resource management, and RF requirements for targeted satellite networks operating at LEO, MEO or GEO orbits.

The objectives of Release-17 NTN work item are recalled hereafter:

The work item aims to specify the enhancements identified for NR NTN (non-terrestrial networks) especially LEO and GEO with implicit compatibility to support HAPS (high altitude platform station) and ATG (air to ground) scenarios according to the following principles:

FDD is assumed for core specification work for NR-NTN.

NOTE: This does not imply that TDD cannot be used for relevant scenarios e.g. HAPS, ATG

Earth fixed Tracking area is assumed with Earth fixed and moving cells

UEs with GNSS capabilities are assumed.

Transparent payload is assumed

Handheld devices in FR1 are supported (e.g. Power class 3)

"VSAT" devices with external antenna (including fixed and moving platform mounted devices) at least in FR2 are supported for the RAN1-3 specifications. "VSAT" characteristics in TR 38.821 can be assumed for the RAN1-3 specifications.

The detailed objectives are to specify enhancing features to Rel-15 & Rel-16's NR radio interface & NG-RAN as follows:

RAN1:

Enhancing features to address the identified issues due to long propagation delays, large Doppler effects, and moving cells in NTN, the following should be specified (see TR 38.821):

Timing relationship enhancements [RAN1, RAN2]

Enhancements on UL time and frequency synchronization [RAN1, RAN2]

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HARQ

Number of HARQ process [RAN1]

Enabling / disabling of HARQ feedback as described in the TR 38.821 [RAN1&2]

In addition, the following topics should be specified if beneficial and needed

Enhancement on the PRACH sequence and/or format and extension of the ra-ResponseWindow duration (in the case of UE with GNSS capability but without pre-compensation of timing and frequency offset capabilities) [RAN1/2].

Feeder link switch [RAN2, RAN1]

Beam management and Bandwidth Parts (BWP) operation for NTN with frequency reuse [RAN1/2]

Including signalling of polarization mode

RAN2:

NOTE: offset based solutions for timer adaptations are assumed.

The following user plane procedures enhancements should be specified (see TR 38.821)

MAC

Random access:

Definition of an offset for the start of the ra-ResponseWindow for NTN.

Introduction of an offset for the start of the ra-ContentionResolutionTimer to resolve Random access contention

Solutions for resolving preamble ambiguity and extension of RAR window.

Adaptation for Msg-3 scheduling

Only for the case with pre-compensation of timing and frequency offset at UE side)

Enhancement on UL scheduling to reduce scheduling latency.

DRX:

If HARQ feedback is enabled, introduction of offset for *drx-HARQ-RTT-TimerDL* and *drx-HARQ-RTT-TimerUL*.

If HARQ is turned off per HARQ process, adaptions in HARQ procedure

Scheduling Request: Extension of the value range of *sr-ProhibitTimer*

RLC

Status reporting: Extension of the value range of *t-Reassembly*

Sequence Numbers: extension of the SN space only for GEO scenarios

PDCP

SDU discard: Extension of the value range of *discardTimer*.

Sequence Numbers: extension of the SN space for GEO scenarios.

The following control plane procedures enhancements should be specified (see TR 38.821)

Idle mode:

Definition of additional assistance information for cell selection/reselection (e.g. using UE location information, satellite Ephemeris information)

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Definition of NTN (satellite/HAPS) cell specific information in SIB

Connected mode

Enhancement necessary to take into account location information (UE & Satellite/HAPS) and/or ephemeris in determining when to perform hand-over, in order to have a high degree of hand-over control for hand-over robustness and coverage management.

Enhancement to existing measurement configurations to address absolute propagation delay difference between satellites (e.g. SMTC measurement gap adaptation to the SSB/CSI-RS measurement window) [RAN2/4]

Service continuity for mobility from TN to NTN and from NTN to TN systems (to be addressed when connected mode mobility has sufficiently progressed)

Identify potential issues associated to the use of the existing Location Services (LCS) application protocols to locate UE in the context of NTN and specify adaptations if any [RAN2/3]

Furthermore, the following can be considered with 2nd priority

Verify the applicability of existing Rel-16 ANR techniques to solve PCI confusion in order to support co-channel operation between HAPS & terrestrial networks and develop enhancements if needed [RAN2/3]

RAN3:

The following NG-RAN architecture enhancements should be specified (see TR 38.821)to support feeder link switch over in Transparent payload architecture-based LEO scenarios

network identities handling

registration update and paging handling

cell relation handling and related features e.g. neighbours, ANR, RAN paging …

RAN4:

Study the framework how NTN core requirements are defined.

Specify the following requirements [RAN4] (Note 1)

UE RRM core requirements

Study and identify which bands may be potentially relevant to NTN including:

Analysis of regulations in the spectrum considered

Adjacent channel co-existence

Considering the potential bands to be used as example for the WID:

Specify needed generic RF core requirements for the network and the UE such that adjacent channel co-existence scenarios are met and performance of other RF parameters (RX performance, TX signal quality etc.) are subject to acceptable minimum requirements

Investigate and specify UE timing & frequency pre compensation accuracy requirements as needed [RAN4].

Note 1: It is assumed that this work item will be frequency agnostic and therefore we can consider that NTN can operate in FR1 or FR2 ranges. Defining NR bands for NTN should be included as part of dedicated Rel-17 RAN4 led work items including an analysis of regulations in spectrum considered, which bands 3GPP should specify, as well as potential co-existence between NR terrestrial and satellite

Note 2: The spectrum usage on the service link for HAPS might be a different spectrum allocation than for Satellite.

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2.1.2 3GPP Timeline for Release-17

Release-17 completion dates stay the same as planned, with the following major milestones:

- Dec'21 RAN1 completion,
- Mar'22 RAN2/3/4 completion,
- and June'22 ASN.1 freeze.

With this expected completion date of March 2022, the 3GPP Release-17 specifications will support 5G NR based satellite access deployed in Frequency Range 1 bands (FR1 corresponding frequency range is from 410 MHz to 7125 MHz) serving handheld devices for global service continuity.

Further, the 3GPP Release-17 specifications will also support NB-IoT and eMTC based satellite access to address massive Internet of Things (IoT) use cases in areas such as logistics, manufacturing, agriculture, energy networks, Public Safety and many more.

Upon completion of Release-17 the long-awaited standard for satellite networks serving handheld devices should be in place by 2022, with commercial product availability expected sometime in 2024. Including satellite as part of the 3GPP specifications will support the promise of worldwide access to 5G services and drive explosive growth in the satellite industry.

The 3GPP Timeline for Release-17 is shown in the figure below: The freeze date for the Release-17 set of features will remain the major focus in the technical specifications working groups until the end of the first quarter of 2022.

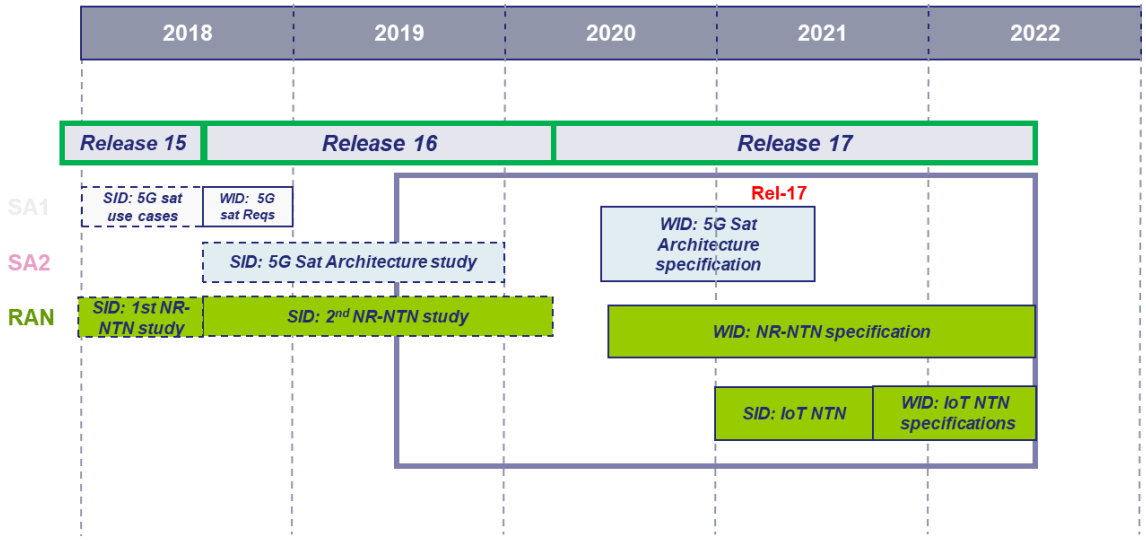


Figure 1 Satellite related activities in 3GPP Release-17 timeline

2.1.3 List of 3GPP meetings attended by DYNASAT partners

During the period, DYNASAT partners have participated to the following 3GPP RAN meetings:

3GPP Meeting	DATES	LOCATION
3GPPRAN#91-e	2021-03-16 12:00 - 2021-03-26 18:00	Online
3GPPRAN#92-e	2021-06-14 08:00 - 2021-06-18 18:00	Online
3GPPRAN-Rel-18 workshop	2021-06-28 09:00 - 2021-07-02 17:30	Online
3GPPRAN#93-e	2021-09-13 09:00 - 2021-09-17 17:30	Online
3GPPRAN#94-e	2021-12-06 09:00 - 2021-12-17 17:00	Online

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During the period, DYNASAT partners have participated to the following 3GPP RAN1 meetings:

3GPP Meeting	DATES	LOCATION
3GPPRAN1#104-e	2021-01-25 09:00 - 2021-02-05 17:00	Online
3GPPRAN1#104-bis-e	2021-04-12 11:00 - 2021-04-20 19:00	Online
3GPPRAN1#105-e	2021-05-10 14:00 - 2021-05-27 19:00	Online
3GPPRAN1#106-e	2021-08-16 09:00 - 2021-08-27 17:00	Online
3GPPRAN1#106-bis-e	2021-10-11 11:00 - 2021-10-20 01:00	Online
3GPPRAN1#107-e	2021-11-11 10:00 - 2021-11-19 18:00	Online

During the period, DYNASAT partners have participated to the following 3GPP RAN2 meetings:

3GPP Meeting	DATES	LOCATION
3GPPRAN2#113-e	2021-01-25 09:00 - 2021-02-05 17:30	Online
3GPPRAN2#113-bis-e	2021-04-12 09:00 - 2021-04-20 17:30	Online
3GPPRAN2#114-e	2021-05-19 09:00 - 2021-05-27 17:30	Online
3GPPRAN2#115-e	2021-08-09 09:00 - 2021-08-27 17:30	Online
3GPPRAN2#116-e	2021-11-01 09:00 - 2021-11-12 17:30	Online

During the period, DYNASAT partners have participated to the following 3GPP RAN3 meetings:

3GPP Meeting	DATES	LOCATION
3GPPRAN3#111-e	2021-01-25 09:00 - 2021-02-05 17:30	Online
3GPPRAN3#112-e	2021-05-17 09:00 - 2021-05-28 17:30	Online
3GPPRAN3#113-e	2021-08-16 09:00 - 2021-08-26 17:30	Online
3GPPRAN3#114-e	2021-11-01 09:00 - 2021-11-11 17:30	Online

During the period, DYNASAT partners have participated to the following 3GPP RAN4 meetings:

3GPP Meeting	DATES	LOCATION
3GPPRAN4#98-e	2021-01-25 09:00 - 2021-02-05 17:30	Online
3GPPRAN4#98-bis-e	2021-04-12 09:00 - 2021-04-20 17:30	Online
3GPPRAN4#99-e	2021-05-19 09:00 - 2021-05-27 17:30	Online
3GPPRAN4#100-e	2021-08-16 09:00 - 2021-08-27 17:30	Online
3GPPRAN4#101-e	2021-11-01 09:00 - 2021-11-12 17:30	Online

During the period, DYNASAT partners have participated to the following 3GPP SA meetings:

3GPP Meeting	DATES	LOCATION
3GPPSA#91-e-elections	2021-03-18 09:00 - 2021-03-22 17:30	Online
3GPPSA#91-e	2021-03-18 09:00 - 2021-03-29 17:30	Online
3GPPSA#92-e	2021-06-15 09:00 - 2021-06-21 17:30	Online
3GPPSA-Rel-18 Workshop	2021-09-09 09:00 - 2021-09-10 18:00	Online
3GPPSA#93-e	2021-09-14 09:00 - 2021-09-20 17:30	Online
3GPPSA-Rel-18 Prioritization Workshop	2021-12-09 09:00 - 2021-12-10 17:30	Online
3GPPSA-Rel-18 Prioritization Workshop	2021-12-09 11:00 - 2021-12-10 20:00	Online
3GPPSA#94-e	2021-12-14 09:00 - 2021-12-20 17:30	Online

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During the period, DYNASAT partners have participated to the following 3GPP SA1 meetings:

3GPP Meeting	DATES	LOCATION
3GPPSA1#93-e	2021-02-22 09:00 - 2021-03-04 17:30	Online
3GPPSA1#94-e-	2021-05-10 09:00 - 2021-05-20 17:30	Online
3GPPSA1#94-e	2021-05-10 09:00 - 2021-05-20 17:30	Online
3GPPSA1#94-bis-e	2021-07-04 23:00 - 2021-07-12 15:30	Online
3GPPSA1#95-e	2021-08-23 09:00 - 2021-09-02 17:30	Online
3GPPSA1#96-e	2021-11-08 09:00 - 2021-11-18 17:30	Online

During the period, DYNASAT partners have participated to the following 3GPP SA2 meetings:

3GPP Meeting	DATES	LOCATION
3GPPSA2#143-e	2021-02-24 00:00 - 2021-03-09 18:00	Online
3GPPSA2#144-e	2021-04-12 00:00 - 2021-04-16 18:00	Online
3GPPSA2#145-e	2021-05-17 00:00 - 2021-05-28 18:00	Online
3GPPSA2#146-e	2021-08-16 00:00 - 2021-08-27 17:00	Online
3GPPSA2#147-e	2021-10-18 00:00 - 2021-10-22 17:00	Online
3GPPSA2#148-e	2021-11-15 00:00 - 2021-11-22 17:00	Online

2.1.4 Preparing and participating to 3GPP meetings

The following are the contributions of DYNASAT partners to 3GPP RAN meetings:

List of contributions submitted to 3GPPRAN#91-e meeting:

TDoc	Title	Source
RP-210228	Draft Reply LS to ITU_R_WP4B_TEMP_10 = RP-210219 on the integration of satellite solutions into 5G networks (to: ITU-R WP4B; cc: -; contact: THALES)	THALES
RP-210234	Revised WID: Solutions for NR to support non-terrestrial networks (NTN)	THALES
RP-210493	IoT-NTN: proposed way forward	THALES
RP-210791	Moderator's summary for email discussion [91E][28][NTN_scope&bands]	THALES
RP-210793	Draft Reply LS to ITU_R_WP4B_TEMP_10 = RP-210219 on the integration of satellite solutions into 5G networks (to: ITU-R WP4B; cc: -; contact: THALES)	THALES
RP-210828	Draft Reply LS to ITU_R_WP4B_TEMP_10 = RP-210219 on the integration of satellite solutions into 5G networks (to: ITU-R WP4B; cc: -; contact: THALES)	THALES
RP-210887	Revised WID: Solutions for NR to support non-terrestrial networks (NTN)	THALES
RP-210908	Revised WID: Solutions for NR to support non-terrestrial networks (NTN)	THALES

List of contributions submitted to 3GPPRAN#92-e meeting:

TDoc	Title	Source
RP-210987	Rel-17 NR-NTN-solutions WID correction	THALES
RP-210988	Revised WID: NR-NTN-solutions	THALES
RP-211039	Proposed WF for NR-NTN in Rel-17	THALES

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RP-211040	proposed way forward for IOT-NTN in Rel-17	THALES
RP-211489	Proposed WF for NR-NTN in Rel-17	THALES
RP-211514	Revised WID: NR-NTN-solutions	THALES
RP-211557	Revised WID: NR-NTN-solutions	THALES

List of contributions submitted to 3GPPRAN#93-e meeting:

TDoc	Title	Source
RP-211746	Candidate enhancements for NTN in Rel-18	THALES
RP-211784	Revised WID: Solutions for NR to support non-terrestrial networks (NTN)	THALES
RP-212574	Moderator's summary for discussion [93e-34-NR-NTN-WID]	THALES
RP-212593	Moderator's summary for discussion [93e-34-NR-NTN-WID]	THALES
RP-212616	Moderator's summary for discussion [93e-34-NR-NTN-WID]	THALES

List of contributions submitted to 3GPPRAN#94-e meeting:

TDoc	Title	Source
RP-212803	Status report WI NR-NTN-solutions	THALES
RP-212820	New WI: NR NTN (Non-Terrestrial Networks) enhancements	THALES
RP-212821	Solutions for NR to support non-terrestrial networks (NTN)	THALES
RP-212939	NTN specific requirements in RAN4 NR related TS	THALES
RP-212940	New WI: IoT NTN (Non-Terrestrial Networks) enhancements	THALES
RP-213201	Verticals and proposed WI/SI for Rel-18	THALES

The following are the contributions of DYNASAT partners to 3GPP RAN1 meetings:

List of contributions submitted to 3GPPRAN1#104-e meeting:

TDoc	Title	Source
R1-2100520	Considerations on UL timing and frequency synchronization in NR NTN	THALES
R1-2100832	[Draft] Reply LS on SA WG2 assumptions AN-PDB and PER targets for satellite access	THALES
R1-2101288	Beam management and BWP operation in NTN	THALES
R1-2101289	Discussion on HARQ for NTN	THALES
R1-2101805	FL Summary#1 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2101871	FL Summary#2 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2101938	FL Summary#3 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2102028	FL Summary#4 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2102140	FL Summary#5 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)

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TDoc	Title	Source
R1-2102182	FL Summary#6 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2102215	FL Summary#7 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2102263	LS on NTN UL time and frequency synchronization requirements	RAN1, THALES
R1-2102264	Moderator summary for [104-e-Post-R17-NTN-01] Email discussion on LS to RAN4 on NTN UL time and frequency synchronization requirements	Moderator (THALES)

List of contributions submitted to 3GPPRAN1#104-bis-e meeting:

TDoc	Title	Source
R1-2102360	Considerations on UL timing and frequency synchronization in NTN	THALES
R1-2102836	NR_NTN_solutions work plan	THALES
R1-2103671	Discussion on timing relationship enhancement in NTN	THALES
R1-2103792	Feature lead summary #1 on enhancements on UL timing and frequency synchronization	Moderator (THALES)
R1-2103905	Feature lead summary #2 on enhancements on UL timing and frequency synchronization	Moderator (THALES)
R1-2103989	Feature lead summary #3 on enhancements on UL timing and frequency synchronization	Moderator (THALES)
R1-2103990	Feature lead summary #4 on enhancements on UL timing and frequency synchronization	Moderator (THALES)
R1-2104076	Feature lead summary #5 on enhancements on UL timing and frequency synchronization	Moderator (THALES)

List of contributions submitted to 3GPPRAN1#105-e meeting:

TDoc	Title	Source
R1-2104301	Considerations on UL timing and frequency synchronization in NTN	THALES
R1-2104302	Feature lead summary #1 on enhancements on UL timing and frequency synchronization for NR NTN	THALES
R1-2104303	Feature lead summary #2 on enhancements on UL timing and frequency synchronization for NR NTN	THALES
R1-2104304	Feature lead summary #3 on enhancements on UL timing and frequency synchronization for NR NTN	THALES
R1-2104305	Feature lead summary #4 on enhancements on UL timing and frequency synchronization for NR NTN	THALES
R1-2104307	Beam management and BWP operation in NTN	THALES
R1-2106112	Considerations on UL timing and frequency synchronization in NTN	THALES
R1-2106290	Feature lead summary #5 on enhancements on UL timing and frequency synchronization for NR NTN	THALES
R1-2106305	LS on broadcast of NTN GW or gNB position	RAN1, THALES

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TDoc	Title	Source
R1-2106332	LS on broadcast of NTN GW or gNB position	RAN1, THALES

List of contributions submitted to 3GPPRAN1#106-e meeting:

TDoc	Title	Source
R1-2106556	Considerations on UL timing and frequency synchronization in NTN	THALES
R1-2106781	Feature lead summary #1 on enhancements on UL timing and frequency synchronization	THALES
R1-2106782	Feature lead summary #2 on enhancements on UL timing and frequency synchronization	THALES
R1-2106784	Feature lead summary #4 on enhancements on UL timing and frequency synchronization	THALES
R1-2106785	Feature lead summary #5 on enhancements on UL timing and frequency synchronization	THALES
R1-2107076	Updated NR_NTN_solutions work plan	THALES
R1-2108586	FL Summary #6 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2108587	FL Summary #7 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2108675	RRC parameter changes required for NR-NTN, up to RAN1 #106-e	Moderator (THALES)

List of contributions submitted to 3GPPRAN1#106-bis-e meeting:

TDoc	Title	Source
R1-2108720	Considerations on UL timing and frequency synchronization in NTN	THALES
R1-2108721	FL Summary #1 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2108722	FL Summary #2 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2108779	FL Summary #3 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2108780	FL Summary #4 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2108781	FL Summary #5 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2110374	Updated NR_NTN_solutions work plan	THALES
R1-2110602	FL Summary #6 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2110603	Draft LS on Combination of open and closed loop TA control in NTN	Moderator (THALES)
R1-2110604	LS on Combination of open and closed loop TA control in NTN	RAN1, THALES
R1-2110624	Summary of [106bis-e-R17-RRC-NR-NTN] Email discussion on Rel-17 RRC parameters for NR to support NTN	Moderator (THALES)

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List of contributions submitted to 3GPPRAN1#107-e meeting:

TDoc	Title	Source
R1-2111122	Considerations on UL timing and frequency synchronization in NTN	THALES
R1-2111123	FL Summary #1 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2111124	FL Summary #2 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2111125	FL Summary #3 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2111126	FL Summary #4 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2111127	FL Summary #5 on enhancements on UL time and frequency synchronization for NR NTN	Moderator (THALES)
R1-2112849	Summary of [107-e-R17-RRC-NR-NTN] Email discussion on Rel-17 RRC parameters for NR to support NTN	Moderator (THALES)

The following are the contributions of DYNASAT partners to 3GPP RAN2 meetings:

List of contributions submitted to 3GPPRAN2#113-e meeting:

TDoc	Title	Source
R2-2100229	Stage 2 Running CR 38.300 NR-NTN	THALES
R2-2101056	Impact on Static Devices	THALES
R2-2101069	UE Positioning Methods in NR-NTN	THALES
R2-2101254	Enhancements on UL scheduling for NTN	THALES
R2-2101259	Remaining Aspects on Enhancements for NTN on RLC and PDCP Timers	THALES
R2-2101277	[DRAFT] Reply LS on SA WG2 assumptions AN-PDB and PER targets for satellite access	THALES
R2-2101297	Enhancements for NTN on MAC Layer	THALES
R2-2102036	[DRAFT] LS about location requirements for NTN	THALES
R2-2102049	Stage 2 Running CR 38.300 NR-NTN	THALES
R2-2102057	RAN3 feedback on worksplit between RAN2 Running CR and RAN3 BL CR	THALES
R2-2102252	Support Non-Terrestrial Networks	THALES (Moderator)

List of contributions submitted to 3GPPRAN2#113-bis-e meeting:

TDoc	Title	Source
R2-2103469	NR_NTN_solutions work plan	THALES

List of contributions submitted to 3GPPRAN2#114-e meeting:

TDoc	Title	Source
R2-2104790	NR-REDCAP identification and SI indication	THALES
R2-2104850	About HARQ for NTN	THALES

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R2-2104962	NTN Stage2 running CR 38.300	THALES
R2-2104963	NR-NTN-solutions work plan	THALES
R2-2105642	Simplified Static solution	THALES
R2-2106539	NTN Stage2 running CR 38.300	THALES

List of contributions submitted to 3GPPRAN2#115-e meeting:

TDoc	Title	Source
R2-2107117	NR-REDCAP access restriction/allowance indication to ease mobility	THALES
R2-2107118	NR-REDCAP stationarity relaxations based on measurements	THALES
R2-2107146	Updated NR-NTN-solutions work plan	THALES
R2-2108829	Stg 2 Running CR_38.300_NR-NTN	THALES

List of contributions submitted to 3GPPRAN2#116-e meeting:

TDoc	Title	Source
R2-2109575	NR-REDCAP stationarity relaxations in case of RRC_CONNECTED	THALES
R2-2109586	Support Non-Terrestrial Networks	THALES
R2-2111336	Support Non-Terrestrial Networks	THALES
R2-2111367	Summary of [Post116-e][101][NTN] Stage 2 running CR (THALES)	THALES
R2-2111544	Summary of [AT116-e][107][NTN] Stage 2 running CR (THALES)	THALES
R2-2111613	Support Non-Terrestrial Networks	THALES

The following are the contributions of DYNASAT partners to 3GPP RAN3 meetings:

List of contributions submitted to 3GPPRAN3#111-e meeting:

TDoc	Title	Source
R3-210151	NTN switch overs	THALES

List of contributions submitted to 3GPPRAN3#112-e meeting:

TDoc	Title	Source
R3-211787	NTN control data	THALES
R3-212696	CB: # 77_NTN_General - Summary of email discussion	THALESTHALES-moderator
R3-212699	CB: # 80_NTN_FeederSwitch - Summary of email discussion	THALESTHALES-moderator
R3-212794	CB: # 80_NTN_FeederSwitch - Summary of email discussion	THALESTHALES-moderator

List of contributions submitted to 3GPPRAN3#113-e meeting:

TDoc	Title	Source
R3-214204	CB: # 2001_NTN_General - Summary of email discussion	THALESTHALES-moderator

List of contributions submitted to 3GPPRAN3#114-e meeting:

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TDoc	Title	Source
R3-215462	Multi TAC handling and reporting	THALES
R3-215880	CB: # 2001_NTN_General - Summary of email discussion	THALESTHALES-moderator

The following are the contributions of DYNASAT partners to 3GPP RAN4 meetings:

List of contributions submitted to 3GPPRAN4#98-e meeting:

TDoc	Title	Source
R4-2100111	NTN architecture aspects	THALES
R4-2101858	Criteria for Choosing FR1 Exemplary Band	THALES
R4-2101859	NTN FR1 Coexistence Scenarios and Related Core Requirements	THALES
R4-2101880	Simulations for NTN FR1 Coexistence Cases	THALES
R4-2101882	NTN PVT Accuracy Aspects	THALES
R4-2103749	Email discussion summary for [98e][310] NTN_Solutions_Part1	Moderator (THALES)
R4-2103877	WF for NTN general part	THALES
R4-2103948	Email discussion summary for [98e][310] NTN_Solutions_Part1	Moderator (THALES)

List of contributions submitted to 3GPPRAN4#98-bis-e meeting:

TDoc	Title	Source
R4-2104879	NR_NTN_solutions work plan	THALES
R4-2105978	Email discussion summary for [98-bis-e][307] NTN_Solutions_Part1	Moderator (THALES)
R4-2106103	WF on [307] NTN_Solutions_Part1	THALES
R4-2106147	Email discussion summary for [98-bis-e][307] NTN_Solutions_Part1	Moderator (THALES)
R4-2107263	NTN Architecture Aspects	THALES
R4-2107270	On the S-band NTN coexistence scenarios and simulation parameters	THALES
R4-2107275	NTN UL frequency synchronization requirement	THALES
R4-2107277	NTN UL timing accuracy	THALES

List of contributions submitted to 3GPPRAN4#99-e meeting:

TDoc	Title	Source
R4-2108099	Way Forward on NTN_solutions_Part1	THALES
R4-2108437	Email discussion summary for [99-e][312] NTN_Solutions_Part1	Moderator (THALES)
R4-2108643	Way Forward on NTN_solutions_Part1	THALES
R4-2108699	Email discussion summary for [99-e][312] NTN_Solutions_Part1	Moderator (THALES)
R4-2111460	On the Rx Parameters and Rx Testing Setup for NTN gNB	THALES
R4-2111462	On the S-band NTN Scenarios and Parameters for Coexistence Study	THALES
R4-2111474	NTN UL Frequency Accuracy Pre-Compensation Budget	THALES
R4-2111477	NTN UL Timing Accuracy	THALES

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List of contributions submitted to 3GPPRAN4#100-e meeting:

TDoc	Title	Source
R4-2114420	NTN UL Timing Accuracy	THALES
R4-2114424	On the S-band NTN Scenarios and Parameters for Calibration and Coexistence Simulations	THALES
R4-2114425	On the NTN Propagation Model	THALES
R4-2114471	On the New NTN Specifications Titles and their Scope	THALES
R4-2114486	NTN co-existence calibration with THALESupdated values	THALES
R4-2115602	Email discussion summary for [100-e][312] NTN_Solutions_Part1	Moderator (THALES)
R4-2115640	Way Forward on NTN_solutions_Part1	THALES
R4-2115784	Email discussion summary for [100-e][312] NTN_Solutions_Part1	Moderator (THALES)

List of contributions submitted to 3GPPRAN4#101-e meeting:

TDoc	Title	Source
R4-2119505	On the NTN UL Timing Accuracy	THALES
R4-2119507	NTN NR UE RRM Specification Discussion	THALES
R4-2119546	Correction of some Simulation Parameters for NTN Coexistence Scenarios	THALES
R4-2119553	NTN NR UE Technical Specification Discussion	THALES
R4-2119554	On NTN-NTN Coexistence Analysis	THALES
R4-2119556	On the Variation of NTN ACLR and NTN ACS Parameters	THALES
R4-2119592	On the Definition of NTN gNB Classes	THALES
R4-2120240	On the NTN UL Timing Accuracy	THALES
R4-2120617	Email discussion summary for [101-e][309] NTN_Solutions_Part1	Moderator (THALES)
R4-2120669	Way Forward on NTN_solutions_Part1	THALES
R4-2120740	Email discussion summary for [101-e][309] NTN_Solutions_Part1	Moderator (THALES)
R4-2120771	Way Forward on NTN_solutions_Part1	THALES
R4-2120774	Way Forward on NTN_solutions_Part1	THALES

2.2 Satellite standardisation activities in 3GPP Release-18

Discussions on the 3GPP Release-18 (5G-advanced) have been started in 3GPP Rel-18 workshop held in June with agreement due on Approval of Rel-18 Package/content in December 2021 (During TSG#94-emeetings, scheduled from Dec. 6 to 17, 2021).

All 3GPP Technical specification groups are continuing to work on further enhancements for both NR-NTN and IoT-NTN to be considered in 3GPP Release-18. Plans are underway to further optimize satellite access performance and to define the enablers for NR based satellite access in bands above 10 GHz to serve fixed and moving platforms (e.g., aircraft, vessels, UAVs) as well as building- mounted devices (e.g., businesses and premises).

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The TSG#93-e meetings have agreed that the start of full-on Release 18 work can only begin once Release 17 has reached its functional freeze date – the date from which only essential corrections to the specifications are permitted - in March 2022.

2.2.1 Release 18 WID Objectives

As part of Release 18, a new work item (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 eNR-NTN WI defines enhancements for NG-RAN based Non-Terrestrial Networks in order to:

- Support new scenarios to cover deployments in frequency bands above 10 GHz
- Offer optimized performance especially when addressing handset terminals (including smartphones with more realistic assumptions on antenna gains, e.g., -5dBi instead of 0 dBi antenna gain) w.r.t. coverage and mobility/service continuity considering the NTN characteristics such as large propagation delay and satellite movement.
- Address requirements, if needed based on the study outcome, associated with regulated services regarding a network verified UE location i.e. to be able to check the UE reported location information.

The Rel-18 eNR-NTN WI justification, objectives, potential scope as well as identified leading WG and secondary WGs for each objective will be discussed during 3GPPRAN#94-e meeting (2021-12-06 09:00 - 2021-12-17). A consolidated WID should be approved as outcome of 3GPPRAN#94-e plenary meeting.

2.2.2 3GPP RAN Timeline for Release-18

RAN held its first Rel-18 workshop June 28th – July 2nd. The endorsed summary of the workshop including NTN (Non-Terrestrial Networks) and IoT NTN evolution in Release 18 can be found in RWS-210659. The subsequent email discussions for RAN Release-18 occurred during August 30th – September 3rd, and in October 2021 deriving RAN1/2/3/4 WIs and SIs from consolidated proposals. In December 21, RAN#94-e to approve RAN1/2/3/4 work package for Rel-18.

The 3GPP Timeline for Release-18 is shown in the figure below. Release duration is decided to be 18 months. Release-18 starts in 2Q’22 for RAN1 and in 3Q’22 for RAN2/3/4.

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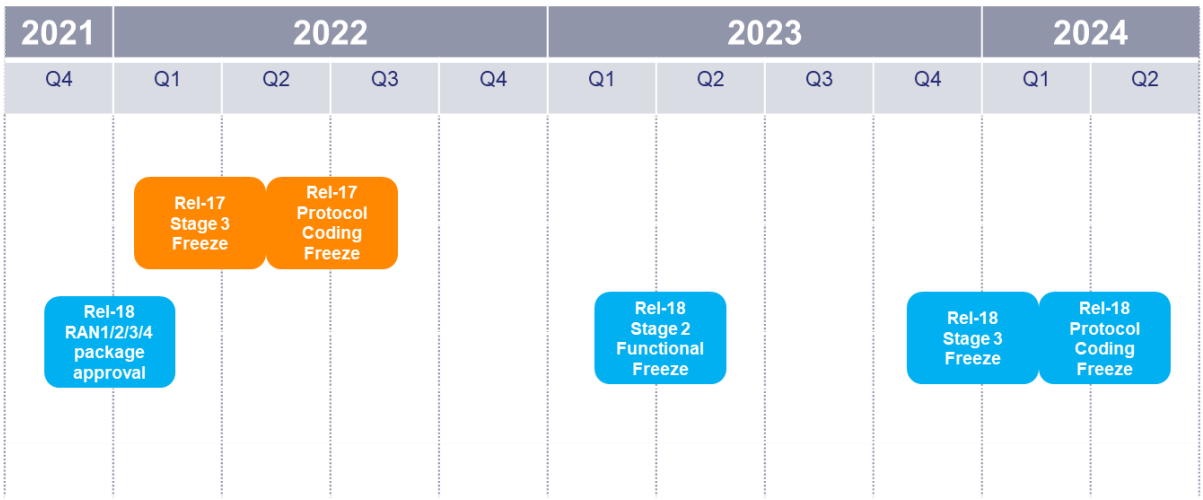


Figure 2 3GPP Release-18 (5G-advanced) timeline

2.2.3 List of 3GPP meetings attended by DYNASAT partners

During the period, DYNASAT partners have participated to the following 3GPP RAN meetings and workshops defining Release 18 package including evolution of NTN and IoT NTN:

3GPP Meeting	DATES	LOCATION
3GPPRAN-Rel-18 workshop	2021-06-28 09:00 - 2021-07-02 17:30	Online
3GPPRAN#93-e	2021-09-13 09:00 - 2021-09-17 17:30	Online
3GPPRAN#94-e	2021-12-06 09:00 - 2021-12-17 17:00	Online

During the period, DYNASAT partners have participated to the following 3GPP SA meetings and workshops defining Release 18 package including evolution of NTN and IoT NTN:

3GPPSA#89-e	2020-09-15 11:00 - 2020-09-21 18:00	Online
3GPPSA-Rel-18 Workshop	2021-09-09 09:00 - 2021-09-10 18:00	Online
3GPPSA-Rel-18 Prioritization Workshop	2021-12-09 09:00 - 2021-12-10 17:30	Online
3GPPSA-Rel-18 Prioritization Workshop	2021-12-09 11:00 - 2021-12-10 20:00	Online
3GPPSA#94-e	2021-12-14 09:00 - 2021-12-20 17:30	Online

2.2.4 Preparing and participating to 3GPP meetings

The following are the contributions of DYNASAT partners to RAN-Rel-18 workshop held in June:

TDoc	Title	Source
RWS-210074	NTN in Rel-18	THALES
RWS-210600	Email discussion summary for [RAN-R18-WS-non-eMBB-THALES]	THALES

The following are the contributions of DYNASAT partners submitted to 3GPPRAN#93-e meeting:

TDoc	Title	Source
RP-211746	Candidate enhancements for NTN in Rel-18	THALES

The following are the contributions of DYNASAT partners submitted to 3GPPRAN#94-e meeting:

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TDoc	Title	Source
RP-212820	New WI: NR NTN (Non-Terrestrial Networks) enhancements	THALES
RP-212940	New WI: IoT NTN (Non-Terrestrial Networks) enhancements	THALES
RP-213201	Verticals and proposed WI/SI for Rel-18	THALES

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3 REGULATION REPORT

Several areas of activity were identified in D6.2 as relevant to the DYNASAT objectives. These activities are given in the table below:

#	Description	Target group/entities	Target start date
1	Monitor developments related to Resolution 212 and HIBS (WRC-23 Agenda Item 1.4)	WP5D, WP4C, ECC/PT1	Q1-2021
2	Follow-up of 3GPP LS to ITU-R WP 5D/4C/4B providing status on NTN in Release 17	3GPP, WP5D/4C/4B as appropriate	Q1-2021
3	Contribute to the development of IMT-2020 satellite radio interfaces requirements in ITU-R	WP4B mainly, WP5D as necessary	Q2-2021
4	Raise awareness, and build technical/regulatory exchanges with external entities on cellular/satellite spectrum sharing.	Selected Radio agencies	Q1 2021

Table 1: Planned regulatory actions for DYNASAT year 1

The calendar of relevant ITU-R meetings for 2021, and foreseen for 2022 is provided below:

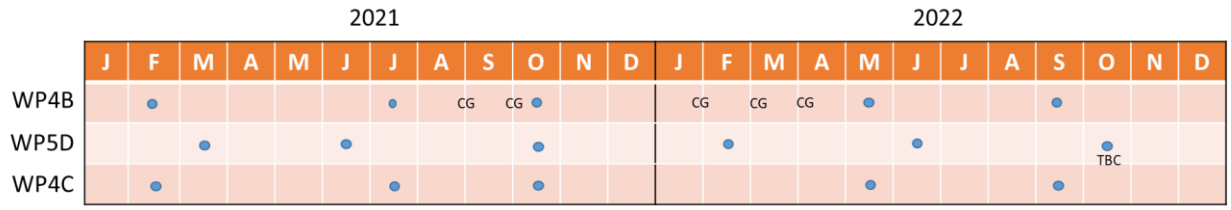


Figure 3 - ITU-R WP 4B 5D and 4C meeting schedule

CG: Correspondance Group on IMT-2020 satellite radio interfaces

In the following sections the prominent events and actions undertaken for each area are summarized.

3.1 Developments in relation to HIBS and Resolution 212

3.1.1 HIBS

A high-altitude platform station (HAPS) is defined in Radio Regulation as a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth.

Currently, whole or parts of the frequency bands 1885-1980 MHz, 2010-2025 MHz and 2110-2170 MHz may be used by High-Altitude Platform Stations as IMT base stations (HIBS) to provide

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IMT on a global or regional level[1].

World Radiocommunication Conference 23 (WRC-23) Agenda Item 1.4 aims at expanding the use of HIBS in certain frequency bands below 2.7 GHz, on a global or regional level: specifically, Resolution 247 (WRC-19) calls for possible HIBS use in the bands 694-960 MHz, 1710-1885 MHz and 2500-2690 MHz, but also for possible review of current technical and regulatory constraints applicable in the 2 GHz band, in order to facilitate the use of HIBS with the latest radio interface technologies of IMT.

This agenda item is of interest because the type of integration sought for HIBS is similar to the DYNASAT concept (Base station on a satellite) and, because Agenda Item 1.4 aims at considering the use of HIBS in certain frequency bands below 2.7 GHz, on a global or regional level. In addition, in 3GPP, the NTN concept encompasses both HAPS and Satellite.

Within WP 5D, HIBS discussions are very active and are held under a dedicated Sub Working Group under the chairmanship of Brazil. Two documents are currently under development in order to consolidate CPM text on WRC-23 Agenda Item 1.4:

- Working document towards a preliminary draft new Report ITU-R M.[HIBS-CHARACTERISTICS] / Working document related to WRC-23 Agenda Item 1.4 [2] ;
- Working document towards sharing and compatibility studies of HIBS under WRC-23 Agenda Item 1.4 [3].

3.1.1.1 Working document on HIBS characteristics

This document provides the spectrum needs, usage deployment scenarios and technical and operational characteristics for use of HIBS in sharing studies. Its content is now stable and provides a good guidance on how HIBS could operate in the frequency ranges under study.

Possible HIBS usages range from coverage enhancement for rural and remote areas to safety and security, internet of things, event services, or integrated communication and sensing. As such, HIBS are foreseen to be deployed potentially in unpopulated, rural, or even urban/suburban areas for offloading of ground-based IMT base stations. Operation will be done along Recommendation ITU-R M.1036 frequency arrangements, for FDD and TDD.

The HIBS deployment and system characteristics described in this working document are close to the ground-based IMT ones, especially as HIBS UEs and ground-based UEs are supposed to be the same. Three HIBS UEs will be operated per HIBS cell and HIBS UEs power control will be used as per Rec. ITU-R M.2101.

As per RR 4.23 definition, HIBS will be located between 20 km and 50 km. However, sensitivity of HIBS in altitudes lower than 20 km, and their possible regulatory consequences will also be considered. HIBS area is typically of about 90/100 km radius consisting of multiple cell layers (e.g., 7 cells deployment) with multi-beam configurations by the combination of several AAS antenna panels, as illustrated below :

[1] See Resolution 221 (Rev.WRC-07) and No5.388A

[2] See document 5D/TEMP/512 : Spectrum needs, usage and deployment scenarios, and technical and operational characteristics for the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT

[3] See document 5D/TEMP/519 : Sharing and compatibility studies of high-altitude platform stations as IMT base stations (HIBS) on WRC-23 agenda item 1.4

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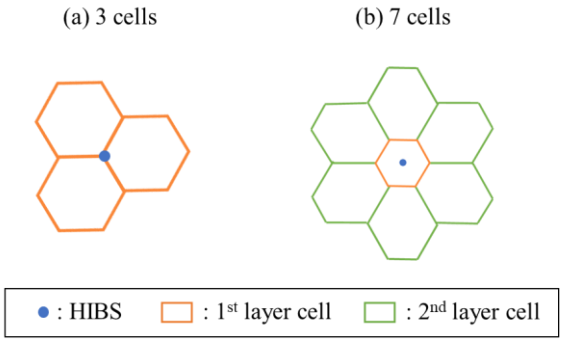


Figure 4 - Examples of HIBS multiple cells deployment

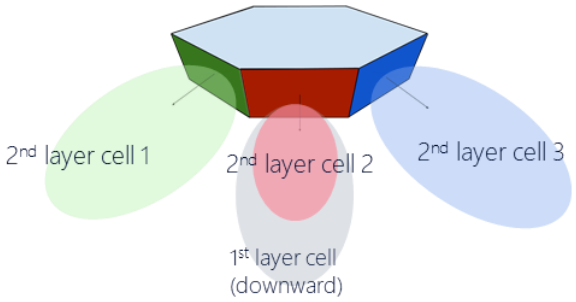


Figure 5 - Example of HIBS antenna design (for 7 cells deployment)

3.1.1.2 Working document on sharing and compatibility studies

Most sharing and compatibility studies have been initiated during last WP5D meeting in October 2021, and are still to be consolidated. These cover all frequency ranges of study, and some of them are concluding on the need to relax the technical and regulatory constraints applicable on the 2 GHz band.

Of particular interest is a compatibility study between HIBS network and ground-based IMT network, which conclude that due to the characteristics of the ground-based IMT network (interference limited), the increase in interference due to co-channel HIBS transmissions leads to limited or negligible performance degradation for a ground-based IMT network even at around the edge of the HIBS coverage area. No interference issue is expected for adjacent channel operation.

Note that extensive discussions took place in WP5D on the need to consider the scenario of HIBS UEs as interferers: as the UEs for HIBS and ground-based IMT are the same, views were expressed that no additional studies are required.

3.1.2 Resolution 212

Resolution 212 modified by WRC-19 addresses the implementation of IMT around 2 GHz. WRC-19 amended this Resolution in its Annex 1 to provide guidance on the implementation of technical and operational measures to facilitate coexistence between terrestrial and satellite components of IMT in the MSS S-band (i.e., 1980-2010 MHz and 2170-2200 MHz). Resolution 212 also invites to further studies on possible technical and operational measures to improve such coexistence situation when these frequency bands are shared in different countries by independent satellite and terrestrial components of IMT.

The WP4C meeting held 21-27 October 2020 discussed the issue based on a contribution and produced the document 4C/109 Annex08, titled “Elements for a working document towards a preliminary draft new Report - Technical and operational measures to improve co-existence and compatibility between the terrestrial and satellite components of IMT in the frequency bands 1 980-2 010 MHz and 2 170-2 200 MHz”.

This document is very preliminary. No contributions were received at the WP4C meetings held 15-19 February 2021 and 5-13 July 2021, hence no progress was made on the working document.

At the WP4C meeting held 20-26 October 2021, initial discussion took place on this issue and a new working document was initiated (4C/283 Annex 1). This document is merely a place holder for future discussions.

This subject has been controversial prior and during WRC-19. Given the nature of the debate

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since WRC-19, progress may be difficult to achieve.

3.2 3GPP – ITU-R relationship on NTN

The goal of this activity is to increase ITU-R and 3GPP mutual understanding on activities on NTN and the desired integration of satellite and terrestrial IMT access systems.

Liaison activity has been entertained between ITU-R WP4B and 5D on one hand and 3GPP RAN on the other hand. The following actions were undertaken:

Date	Topic	Group/Entity	Description
18-24/02/2020	3GPP – ITU-R relationship	ITU-R WP4B	Proposition and approval of a LS to WP5D to promote satellite/terrestrial integration. See 5D/537
18-24/02/2020	3GPP – ITU-R relationship	ITU-R WP4B	Liaison to 3GPP RAN asking further details on integration of satellite solutions into 5G networks. See 4B/50 Annex 03
01-12/03/2020	3GPP – ITU-R relationship	ITU-R WP5D	Discussion on 5D/537 (LS from WP4B) No consensus was reached on the treatment of the document. Document was noted without further action at the moment, based on the fact 5D focus is on terrestrial IMT.

3.3 IMT-2020 satellite radio interfaces

Date	Topic	Group/Entity	Description
18-24/02/2020	Satellite radio interfaces	ITU-R WP4B	Reaction to proposals to develop IMT-2020 SRIs. Proposal for a shortened timeline.
May 2021	Satellite radio interfaces	France/Other administrations	Informal Coordination with involved administration on inputs to WP4B on workplan towards SRI development, resulting on acceptable timeline being proposed.
12-16/07/2021	Satellite radio interfaces	ITU-R WP4B	First draft of ITU-R Report on Vision and Requirements for the satellite component of IMT-2020. Creation of a Correspondance Group
9 Sept 2021	Satellite radio interfaces	ITU-R WP4B – CG IMT2020sat	Coordinated industry position resulting on first version of the Vision and Requirements for the satellite component of IMT-2020. Progress made essentially on the Vision part of the Report French input on timeline for SRI development has been proposed.
30 Sept 2021	Satellite radio interfaces	ITU-R WP4B – CG IMT2020sat	Coordinated industry proposals on the Vision and Requirements for the satellite component of IMT-2020. Progress made

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			essentially on the Vision part of the Report After the meeting the Vision part of the Report is getting more stable. French input on satellite/terrestrial integration.
25-29 October 2021	Satellite radio interfaces	ITU-R WP4B	Off-line work up to next 4B with several administrations/operators ahead of the meeting. Report on Vision and Requirements has been progressed during the meeting, with the Vision part close to finalisation. The timeline for the overall process of SRI approval could not be agreed. Consequently, the release of circular letter from ITU to external bodies (e.g. 3GPP) could not be agreed.

As of end 2021, the Report on Vision and Requirements for satellite IMT-2020 is under work, see last version.

An aggressive timeline has been promoted by France, supported by other administrations and satellite industry players at the 4B Correspondence Group in September 2021, and further discussed at 4B meeting end October 2021. This timeline implied that:

- the ITU-R Radiocommunication Bureau Director issues in November 2021 a Circular Letter to external bodies informing about the satellite radio interface development roadmap
- the Vision and Requirement Report is completed at the initiation of Step 3 in May 2022. The goal is that the ITU-R requirements for radio interfaces are available at about the same time as the 3GPP Release 17 approval, so that NTN specifications could be sent to ITU-R without delay.

This timeline could not be agreed at the October 2021 meeting of WP4B, hence the Circular Letter details could not be finalized. A correspondence group has been set up with the task 1) to progress the report on Vision and Requirements, with focus on requirements and 2) finalise the timeline for the SRI, with meetings scheduled in January, March and April 2022.

3.4 Exchanges with external entities on satellite/terrestrial spectrum sharing

Two meetings have been held with the French administration in January and February 2021 respectively.

These meeting have been addressing mainly two aspects:

- Approach to promote the acceptance of terrestrial/satellite integration in IMT radio interfaces
- Methodology and criteria to assess the terrestrial/satellite coexistence to support the activities of Task 2.3.

Informal exchanges have also been held on the following topics: Active antennas, ITU filings.

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4 CONCLUSIONS

In the regulatory domain, the work done has allowed to bring forward the idea of satellite-terrestrial in IMT systems, in particular taking advantage of the development of Satellite Radio Interfaces by the ITU. The effort has been focused to ensure consistency both in terms of contents and schedule with the on-going activities in 3GPP. At this stage, the ITU is defining its Vision and Requirements for satellite IMT-2020. Contribution to this work is expected to continue in 2022.

An increased attention will be put in 2022 on the IMT-2030 Vision developments by WP5D.

Regarding satellite standardisation activities in 3GPP, the joint effort between mobile and satellite industries and the leading role of DYNASAT partners on 5G satellite in 3GPP will enable the full integration of satellite in the 3GPP ecosystem and define a global standard for future satellite networks.

Upon completion of 3GPP Release-17 the long-awaited standard for satellite networks serving handheld devices should be in place by 2022. Further, as part of 3GPP Release 18, a new work item (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.

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