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## Deliverable D6.5

### Standardization Action Plan

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## Abstract

This deliverable was created as part of the project Work Package 6 “Promotion” activities, and reports plans for standardization mainly in 3GPP and ETSI. This plan will be revised on a yearly basis if needed.

## Keywords

*5G ; Standardization ; Multi-Access ; 3GPP ; ETSI ; ITU-R*

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## Executive Summary

5G Communication Networks are today at the stage of maturity of developing key enabling technologies for extended proof-of-concepts (PoC). Although standardization of 5G is yet to be finalized, 5G players already reached a general agreement on key enabling technologies, architecture and deployment scenarios of 5G networks. The 5G community is now looking for translating 5G use cases, vertical industries requirements and ambitions in adopting 5G, into viable business cases. However, the support of 5G new services and seamless connectivity across various vertical industries and very diverse use cases, still requires the integration of multiple access technologies. The 5G-ALLSTAR project builds on the outcomes and the co-operation experience of 5GCHAMPION to design, develop, evaluate and trial multi-connectivity based on multiple access, combining cellular and satellite access technologies to support seamless reliable and ubiquitous broadband services. The project will develop a set of technologies and validate system interoperability to provide global connectivity and support mission critical applications of interest in both European and Korean regions.

To this end, 5G-ALLSTAR will develop selected technologies targeting a set of PoCs to validate and demonstrate in heterogeneous real setup:

- 5G cellular mmWave access system for providing broadband and low-latency 5G services,
- new radio based feasibility of satellite access for providing broadband and reliable 5G services,
- multi-connectivity support based on cellular and satellite access,
- spectrum sharing between cellular and satellite access.

In addition, the project will actively contribute to global 5G standardization including 3GPP and ETSI focusing on multi-RAT interoperability and New Radio based satellite access.

These efforts will be coordinated across Korean and European partners in order to approach standardization in a cooperative way, e.g. by proposing new study/work items.

This document corresponds to 5G-ALLSTAR deliverable D6.5 titled “Standardisation action plan”, and defines the detailed standardisation action plan for the project to ensure that 5G standards allow the full potential of an integrated satellite contribution to 5G terrestrial systems.

The plan was developed analysing the SatCom and 5G standardisation context and taking into account the 5G-ALLSTAR objectives, derived from the use cases defined in WP2 and the work plan defined in the Grant Agreement.

For each standardisation group identified as relevant to support the integration of satellite communication systems, ideally as “plug and play” solutions, in 5G end-to-end systems, specific objectives were set and a responsible partner as well as some contributors were identified.

This plan may need to be revised during the course of the project to take into account the progress on the project, especially at architecture and research pillars (e.g. RRM) levels, as well as the evolving 5G standardization context.

## Contents

1	Introduction .....	1
1.1	Background .....	1
1.2	Scope of the document .....	2
1.3	Structure of the document .....	2
2	Satcom positioning within 5G communication systems.....	3
2.1	Satcom key features and roles in 5G systems.....	3
2.2	Satellite integration into 5G terrestrial networks.....	3
3	Cellular network standardization context .....	5
3.1	3 <sup>rd</sup> Generation Partnership Project (3GPP).....	5
3.2	International Telecommunication Union - Radiocommunications (ITU-R).....	5
4	Rationale for the 5G-ALLSTAR standardization approach.....	7
5	5G-ALLSTAR approach for the integration of Satellite in 5G standards.....	8
5.1	Activities at 3GPP level .....	8
5.2	Activities at ITU-R level .....	14
6	5G-ALLSTAR standardization actions list.....	17
7	Conclusion .....	18

## List of Figures

Figure 1 : 5G radio access overview .....	4
Figure 2 : 5G-ALLSTAR standardization activities and inter-relationships .....	8
Figure 3 : 5G-ALLSTAR and 3GPP schedules .....	9
Figure 4. 3GPP 5G NR timeline for Releases 16.....	10
Figure 5: 3GPP Study and work items in release 16.....	11
Figure 6: Current work plan in 3GPP on non-terrestrial networks .....	12
Figure 7: Proposed updated work plan in 3GPP on non-terrestrial networks .....	13
Figure 8 : Overview of timeline for IMT development and deployment.....	14
Figure 9: Information flow between ITU-R and 3GPP .....	15



## List of Tables

Table 1 : ITU-R deliverables for IMT-2020.....	15
Table 2 : Standardization actions list .....	17



# 1 Introduction

## 1.1 Background

The advent of 5<sup>th</sup> generation (5G) mobile communications will bring a wide range of potential opportunities and challenges. 5G will enable the introduction of new services and markets whereas imposing several unprecedented technical requirements. More specifically, support for the new services involves seamless connectivity across various vertical industries including multimedia, healthcare, internet-of-things (IoT), automotive, and manufacturing. Such verticals are into three main use cases, as follows:

- **Enhanced Mobile Broadband (eMBB)** originates from human-centric services requiring large amount of data rate such as internet browsing and multimedia streaming through smartphones, tablets, and so on. In addition to the high data rate, low latency and large coverage area are also considered.
- **Massive Machine Type Communications (mMTC)** targets to support communications between machines such as sensor monitoring and asset tracking, which are typically low-cost and battery-operated devices. It also requires wireless connectivity among the massive number of deployed devices.
- **Ultra-Reliable Low-Latency Communications (URLLC)** refers to application scenarios with very tight requirements for the reliability and latency. Examples of this use case include industrial manufacturing control, remote surgery, and self-driving cars.

These use cases can be supported in various 5G deployment scenarios such as indoor, urban, rural, high-speed trains, highways, etc. From scenario to scenario, deployment specific requirements are quite different. For example, the indoor hotspot scenario focuses on achieving high user throughput with no or little mobility. Rural scenarios focus more on providing larger and continuous coverage rather than high throughput. The high-speed train scenario targets to support very high mobility up to 500 km/h.

Efficient and reliable support for the above mentioned diverse use cases in various deployment scenarios can be further aided through the integration of multiple access technologies as specified in 3GPP TS 22.261 “Service requirements for next generation new services and markets”<sup>1</sup> (in clause 6.3). Providing tight interworking and integration between 5G and existing LTE networks or between 5G cellular and non-terrestrial (e.g., satellite) networks will be beneficial in terms of providing improved coverage and service continuity in a cost effective manner. Multiple access support is particularly useful for providing robust, seamless, and continuous wireless services for critical applications such as public safety and emergency case communications, i.e., when a cellular link fails due to an accident or a disaster, non-intermittent wireless services will be provided through a satellite access.

Therefore, the 5G-ALLSTAR project aims at developing a set of technologies enabling tight interworking and integration between cellular and satellite links supporting a heterogeneous environment with multi-access technology. Several use cases and deployment scenarios will be considered such as multimedia service (eMBB-type) to passengers on board train, bus, or ship, mMTC-type service for asset tracking and logistics, and public safety and emergency case communications requiring highly reliable QoS even in a disaster situation. After developing test beds based on selected 5G technologies, a demonstration involving interoperation/integration between cellular and satellite access will be provided either in Europe and/or in Korea.

<sup>1</sup> <https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3107>

In particular, the 5G-ALLSTAR project focuses on the provision of novel technologies at device, infrastructure and core network levels to enable multiple access in the context of shared spectrum in order to support critical communication services in 5G systems.

Finally, 5G-ALLSTAR will leverage the SaT5G<sup>2</sup> project standardisation activities, defined in its deliverable D6.2 “Standardization Action Plan” to progress on specific topics (hybrid cellular/satellite access, hand-over, traffic steering).

## 1.2 Scope of the document

This deliverable proposes an action plan for standardization activities on the 5G-ALLSTAR project to support the inclusion of technologies developed by the project, in 5G systems definition. These activities will be mainly undergone at 3GPP.

The document:

- Presents the rationale for a new standardization approach for Satcom based on the analysis of the current standardization context in Satcom market and the on-going standardization context for 5G;
- Proposes an approach to integrate satellite in the 5G related standards including the identification/justification of the potential standardization requirements arising from 5G-ALLSTAR;
- Gives a standardization action plan including the timeline, the Standardization Organizations and groups where 5G-ALLSTAR plans to contribute and the 5G-ALLSTAR members involved;

This plan may need to be revised during the course of the project to take into account the progress on the project, especially at architecture and research pillars (e.g. RRM) levels, as well as the evolving 5G standardization context.

## 1.3 Structure of the document

In this document **Chapter 2** reviews the roles for Satcom in 5G within the context of the 5G-ALLSTAR project scope. **Chapter 3** then describes the main current 5G standardization bodies and **Chapter 4** reviews the rationale for the appropriate standardization approach for 5G-ALLSTAR. From this, a phased approach for the project is identified in **Chapter 5** and the resulting action plan is defined in **Chapter 6**.

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<sup>2</sup> SaT5G (Satellite and Terrestrial network for 5G), 2017-2019, H2020-EU.2.1.1. - INDUSTRIAL LEADERSHIP ICT-07-2017 - 5G PPP Research and Validation of critical technologies and systems, grant agreement 761413.

## 2 Satcom positioning within 5G communication systems

### 2.1 Satcom key features and roles in 5G systems

The EMEA Satellite Operators Association (ESOA) has recently published a 5G White Paper<sup>3</sup> on the SatCom services' role as an integral part of the 5G ecosystem as some of its specific features can appear to be real key feature in the following cases:

- **Large areas to cover:** Satellite provides high speed capacity across the globe using the following enablers: capacity fill-in inside geographic gaps, overspill to satellite when terrestrial links are over capacity, general global wide coverage, backup / resilience for network fall-back and especially communications during emergency.
- **Mobile users:** Satellite is the only readily available technology capable of providing connectivity anywhere on the ground, in sea or air for moving platforms, such as air-planes, ships and trains.
- **Ubiquity and broadcast needs:** Satellite can efficiently deliver rich multimedia and other content across multiple sites simultaneously using broadcast and multicast streams with information centric networking and content caching for local distribution.

The possible roles of satellite in the 5G systems are acknowledged by the 5G ecosystem in 3GPP technical reports already published (TR 22.822 and TR 38.811):

- **Foster the roll out of 5G service in un-served areas** that cannot be covered economically by terrestrial 5G network (isolated/remote areas, on board aircrafts or vessels) and underserved areas (e.g. sub-urban/rural areas) to upgrade the performance of limited terrestrial networks in cost effective manner;
- **Reinforce the 5G service availability** by providing service continuity for Machine-to-Machine (M2M)/IoT devices or for passengers on board moving platforms (e.g. passenger vehicles-aircraft, ships, high speed trains, bus and cars) or ensuring service anywhere especially for critical communications, future railway communications or maritime communications;
- **Enable 5G network scalability** by providing efficient multicast/broadcast resources for data delivery towards the network edges or even user terminal.

### 2.2 Satellite integration into 5G terrestrial networks

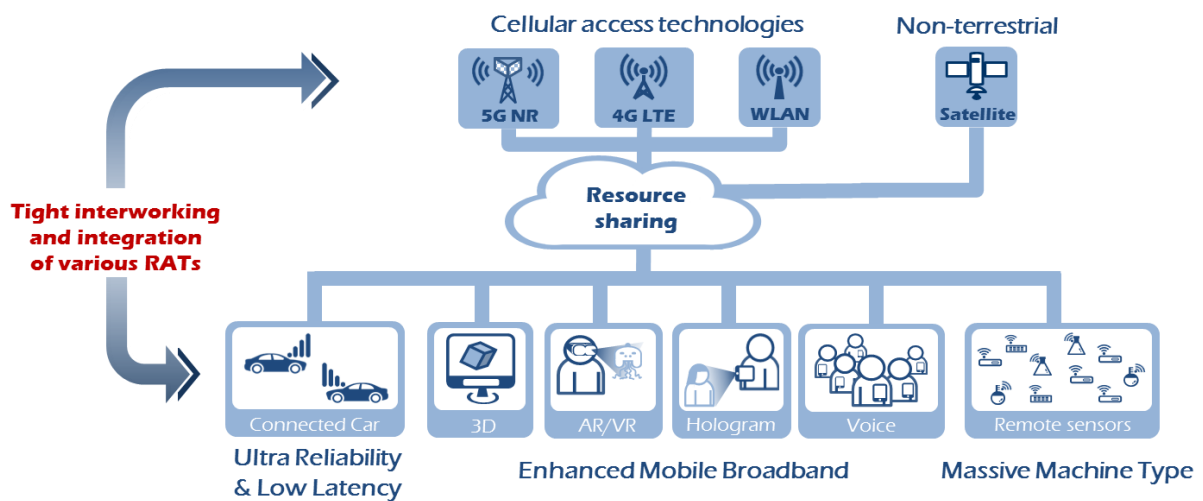
5G network are expected to be combinations of diverse services/applications and heterogeneous radio access technologies (RATs).

New services/applications are the ones which are being defined in the framework of the verticals that the 5G architecture should support (i.e. energy, transport, health, content delivery, public safety/emergency, etc.). Possible application fields include virtual/augmented reality (VR/AR), massive wireless sensors, self-driving cars, industrial automation, etc. These new services/applications are characterized by very different end-to-end Service/Application Requirements. In addition, each single application instance, even depending on the present surrounding context and on the users' feedbacks, is characterized by Personalized QoE Requirements. For example, VR/AR applications are required to achieve high data rate with low latency. Supporting massive wireless sensors require ability to create and manage massive number of links. Self-driving car and industrial automation applications need to be supported via highly reliable and very low latency links. It should be clear that in all the above-mentioned

<sup>3</sup> ESOA 5G White Paper, "Satellite Communications Services: An integral part of the 5G Ecosystem," ESOA, 2017. [Online]. Available: <https://www.esoa.net/cms-data/positions/ESOA%205G%20Ecosystem%20white%20paper.pdf>.

examples, the satisfaction of end-to-end Service/Application Requirements, even dependent on the surrounding context and on the user expectations in terms of QoE, is essential.

These new services/applications will be supported on top of a set of tightly coupled existing and new radio access technologies. The RATs include cellular-based access such as 5G NR, 4G LTE, and WLAN, and non-terrestrial access such as satellite. Therefore, as shown in Figure 1, tight interworking and integration of various RATs coupled with the design of proper resource sharing algorithms can allow the satisfaction of the end-to-end Service/Application Requirements of each application instance while keeping efficient, secure and scalable the network integrating 5G and non-5G RATs, hereinafter also referred to as integrated multi-RAT network.



**Figure 1 : 5G radio access overview**

The RATs to be integrated/interworked are very heterogeneous including cellular systems such as 3GPP 5G NR, 4G LTE, WLAN, and non-terrestrial systems such as satellite access.

### 3 Cellular network standardization context

The following standardisation groups are directly or indirectly responsible for standardisation activities related to the definition of the 5G system and therefore they are relevant for the integration of satellite in 5G networks.

#### 3.1 3<sup>rd</sup> Generation Partnership Project (3GPP)

3rd Generation Partnership Project is the Global Standardisation body for the definition of 5G. It covers cellular telecommunications network technologies, including radio access, the core transport network, and service capabilities and thus provides complete system specifications. 3GPP counts more than 540 Members such as IC vendors, Terminal vendors, Infrastructure providers, Telecom operators, Governmental bodies and now vertical industries.

There are Three Technical Specification Groups (TSG):

- TSG Radio Access Network (RAN), with the following working (sub)groups:
  - RAN WG1 Radio Layer 1 spec;
  - RAN WG2 Radio Layer 2 spec, Radio Layer 3 RR spec;
  - RAN WG3 lub spec, lur spec, lu spec, UTRAN O&M requirements;
  - RAN WG4 Radio Performance Protocol aspects;
  - RAN WG5 Mobile Terminal Conformance Testing;
  - RAN WG6 Legacy RAN radio and protocol.
- TSG Service and System Aspects (SA) with the following groups:
  - SA WG1 Services;
  - SA WG2 Architecture;
  - SA WG3 Security;
  - SA WG4 Codec;
  - SA WG5 Telecom Management;
  - SA WG6 Mission-critical applications.
- TSG Core and Terminal (CT)

#### 3.2 International Telecommunication Union - Radiocommunications (ITU-R)

The ITU-R develops the technical bases for decisions taken at World Radiocommunication Conferences and develop global standards (Recommendations). It also reports and handbooks on radiocommunication matters. Topics addressed in its study groups includes efficient management and use of the spectrum/orbit resource, radio systems characteristics and performance, spectrum monitoring and emergency radiocommunications for public protection and disaster relief. There are 7 study groups in ITU-R:

- Study Group 1 (SG 1) : Spectrum management
- Study Group 3 (SG 3): Radiowave propagation
- Study Group 4 (SG 4): Satellite services
- Study Group 5 (SG 5): Terrestrial services
- Study Group 6 (SG 6): Broadcasting service
- Study Group 7 (SG 7): Science services

The most relevant study groups for standardization work on the 5G-ALLSTAR project are:

- Study Group 4 - Satellite Services: Systems and networks for the fixed-satellite service, mobile-satellite service, broadcasting-satellite service and radiodetermination-satellite service.
- Study Group 5 - Terrestrial Services: Systems and networks for fixed, mobile, radiodetermination, amateur and amateur-satellite services.



## 4 Rationale for the 5G-ALLSTAR standardization approach

The 5G ecosystem, system architecture and radio access technology that are currently being defined provide a broad range of design flexibilities and capabilities (e.g. deployment scenarios) that are of great potential benefit to Satcom market opportunities, provided effective and timely standardisation efforts are undertaken.

Integration of Satcom into the 5G heterogeneous network can take place at different levels, notably:

- Integration of the Satcom system into the 5G network management system supporting different access network technologies (e.g. 5G, 4G, Wifi...) which allows a Mobile Network Operator to configure and control the Satcom resources and to provide seamless service continuity. This also covers Virtualization of satellite communication elements as a non-conventional virtualized resources on 5G end to end services;
- Integration of the Satcom system into the 5G core network to provide 5G services to satellite terminals;
- Interoperability between Satcom terminals and Satcom hub from different Satcom vendors. This requires open standard and interoperability tests and enables keeping the same terminal when changing satellite operator and reducing cost of the terminal;

In the context of 5G-ALLSTAR the standardization activities are focusing on the integration of the Satcom system with the cellular network system. This requires the possible extension of 3GPP protocols to support the integration of Satcom with cellular network. This requires also the definition of interoperability tests with 5G terrestrial infrastructure.

With the development of 5G systems, Satcom systems can leverage open standards to reduce the deployment and operation cost of terminals (VSAT, ESIM) as well as other satellite network infrastructure equipment (gateway), and, very importantly, to facilitate a tighter operational integration (plug and play approach) into a heterogeneous “network of networks” under common network management.

The on-going standardisation efforts around 5G thus provide a unique opportunity to insert the satellite-specific “hooks” as may be required.

Considering the opportunities to leverage economies of scale and to foster acceptance of future Satcom solutions by all 5G ecosystem stakeholders, the project will spend efforts to standardise the full integration of satellite in 5G and enable multi-vendor deployment. The goal is to open more business opportunities for Satcom solutions as well as for terrestrial ones.

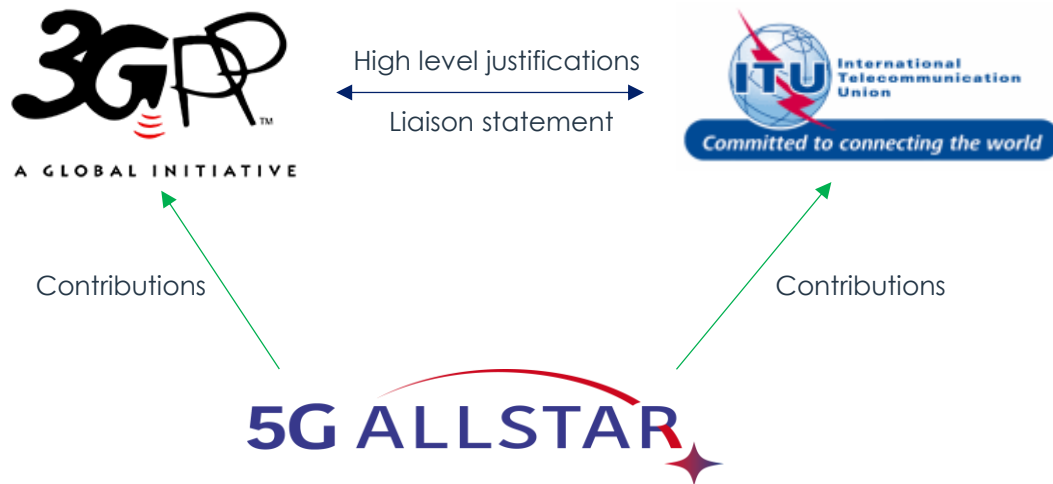
Hence it is opportune to contribute to standardisation organisations involved in the definition of the 5G system directly or indirectly aiming to define:

- Protocols and functions extensions or amendments to enable 5G to support satellite systems at access or transport levels in single or multi connectivity context in a plug and play manner;
- The architecture and protocols of future satellite communication systems featuring high technology commonalities with the 5G system;
- Tests and procedures.

The standardization effort on 5G will span over 3GPP release 15, 16, 17 and possibly beyond as well as in other standardisation bodies in parallel. Hence, the standardization on the integration of satellite in 5G can take place in a phased approach taking into account the SDOs schedule constraints.

## 5 5G-ALLSTAR approach for the integration of Satellite in 5G standards

In order to achieve the project standardization objectives, 5G-ALLSTAR will develop a number of targeted, interrelated and closely coordinated standardisation activities in different standardisation bodies. These activities are derived from the Architecture aspects as well as the Research Pillars. The figure below illustrates the relationships between the main activities undertaken in this context.



**Figure 2 : 5G-ALLSTAR standardization activities and inter-relationships**

### 5.1 Activities at 3GPP level

The plan is to use the project results and contribute as part of the release 16 and 17 to planned 3GPP study/work items, especially in the area of eMBB extension (satellite access, self-backhaul) and uRLLC as well as other items requiring multiple access. In a second phase, the project plans to contribute to the definition of multiple access as part of the release 17 as depicted here-after.

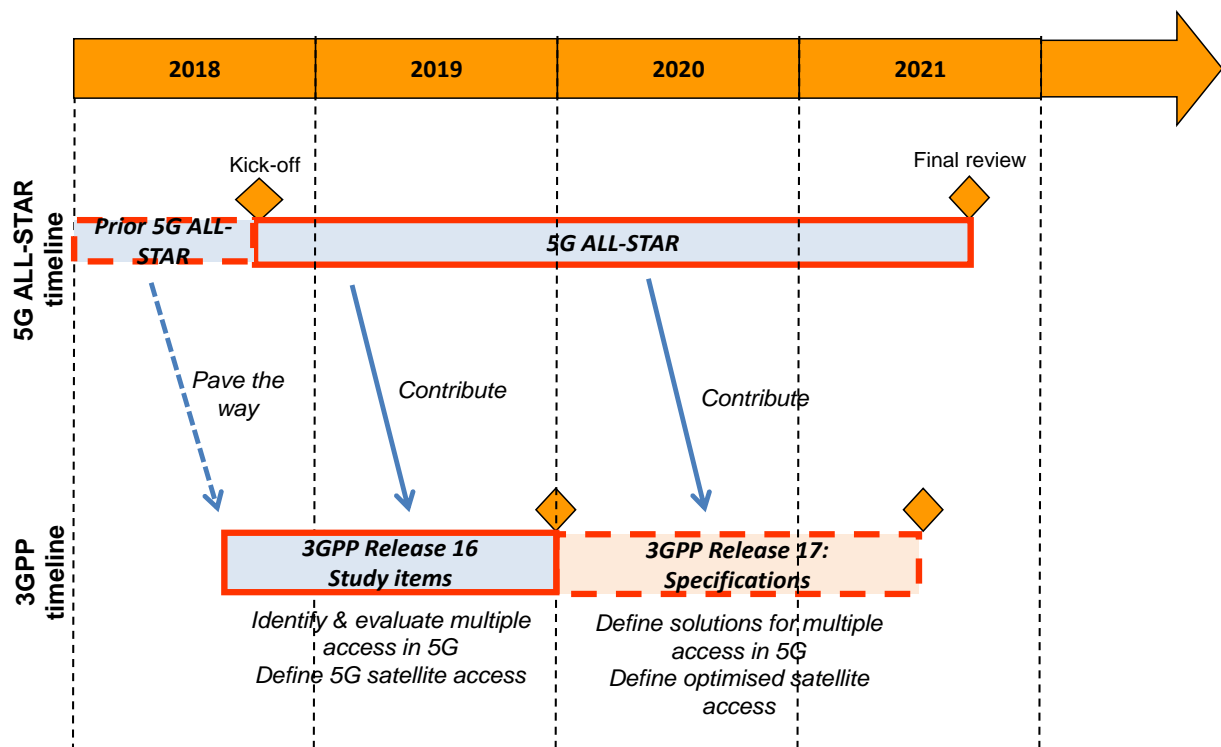


Figure 3 : 5G-ALLSTAR and 3GPP schedules

Prior to the project, 3GPP members in the consortium (Thales Alenia Space, Fraunhofer IIS, Fraunhofer HHI, CEA, CRAT via CNIT, ETRI) have combined their efforts to promote the need to initiate studies on multiple access enablers and 5G satellite access as part of release 16. Most of these organizations are already working together successfully in an ongoing study of 5G satellite access through the development of 3GPP TR38.811 “Study on NR to support non-terrestrial networks” and 3GPP TR 22.822 “Study on using Satellite Access in 5G” that were completed in 2018. Key persons of the 5G-ALLSTAR project have all been active contributors to 3GPP, mainly in RAN WGs over the past two years. It can be seen at [http://www.3gpp.org/news-events/3gpp-news/1933-sat\\_ntn](http://www.3gpp.org/news-events/3gpp-news/1933-sat_ntn), evidence of the active participation in 3GPP of some of these persons.

Based on the recently developed 5G New Radio (NR) Release 15 specification, the 3rd Generation Partnership Project (3GPP) plans to improve several features in the following releases, as seen in Figure 4. The 5G-ALLSTAR consortium partners are mainly involved in NR vehicle-to-everything (V2X) and NR non-terrestrial network (NTN) issues in 3GPP Radio Access Network (RAN) and System Architecture (SA) working groups.

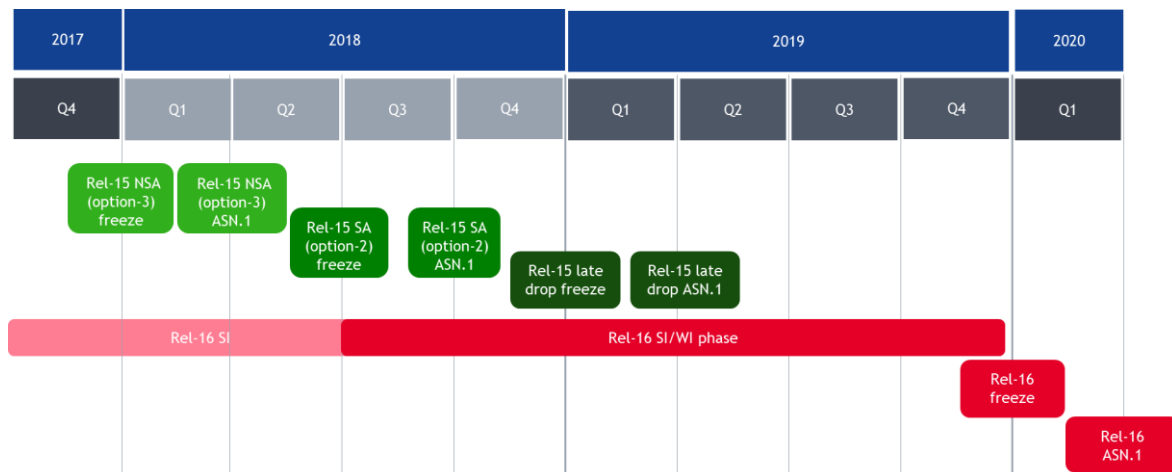


Figure 4. 3GPP 5G NR timeline for Releases 16

In the 3GPP RAN#80 plenary meeting, several new study and work items were approved, as seen in Figure 5.

Some of them are closely related to the research in 5G-ALLSTAR, but the two main activities the project will focus on are the following :

- **NR V2X SI:** This study item targets standardization of 5G NR in the area of vehicle applications. Identified use cases are vehicles platooning, extended sensors, advanced driving, and remote driving, and so on. Corresponding SI objectives includes sidelink design, Uu enhancements for advanced V2X use cases, Uu-based sidelink resource allocation/configuration, RAT/Interface selection for operation, QoS management, and Coexistence. This study item will be led by RAN1, RAN2, and RAN3. The 5G-ALLSTAR project also targets to support vehicle communications via cellular and satellite 5G NR links. Hence, the project results will be helpful in the NR V2X study and specification development.
- **NR Non-Terrestrial SI:** The scope of this study item is to identify solutions for physical layer control, random access, retransmission schemes from RAN1 perspective, and to study MAC, RLC, RRC, handover impacts from RAN2 and RAN3 perspective. Since satellite support is the main research topic of 5G-ALLSTAR project, many contributions are expected to this study item. In addition, the study item results will be used for the design of PoC development of the project.

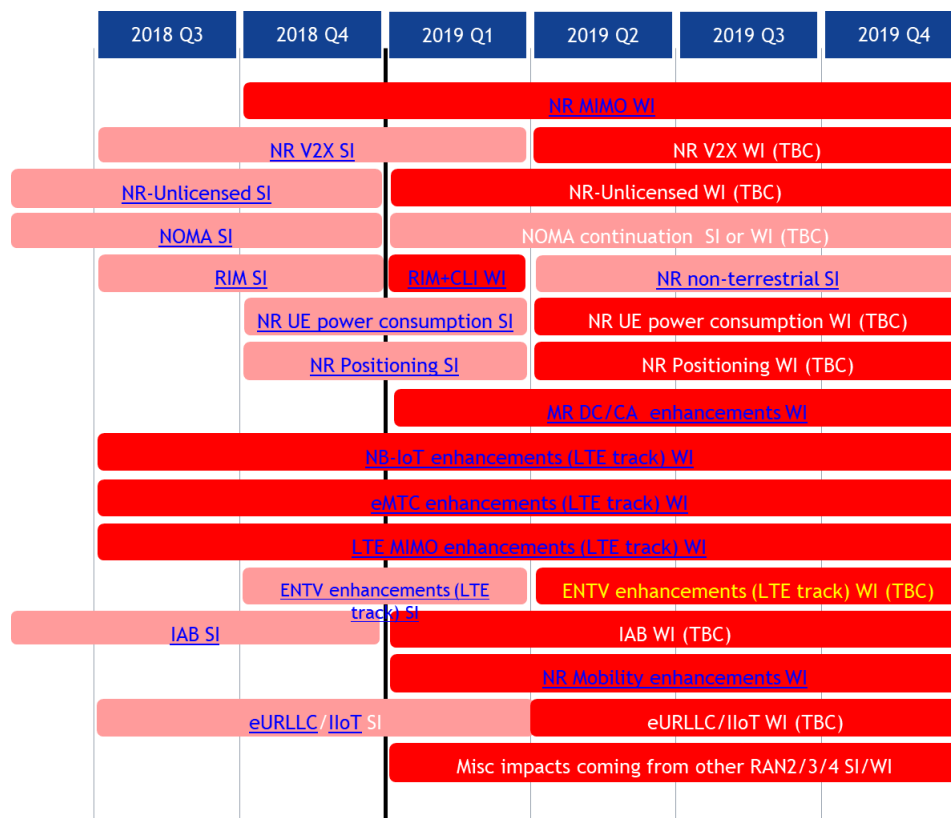
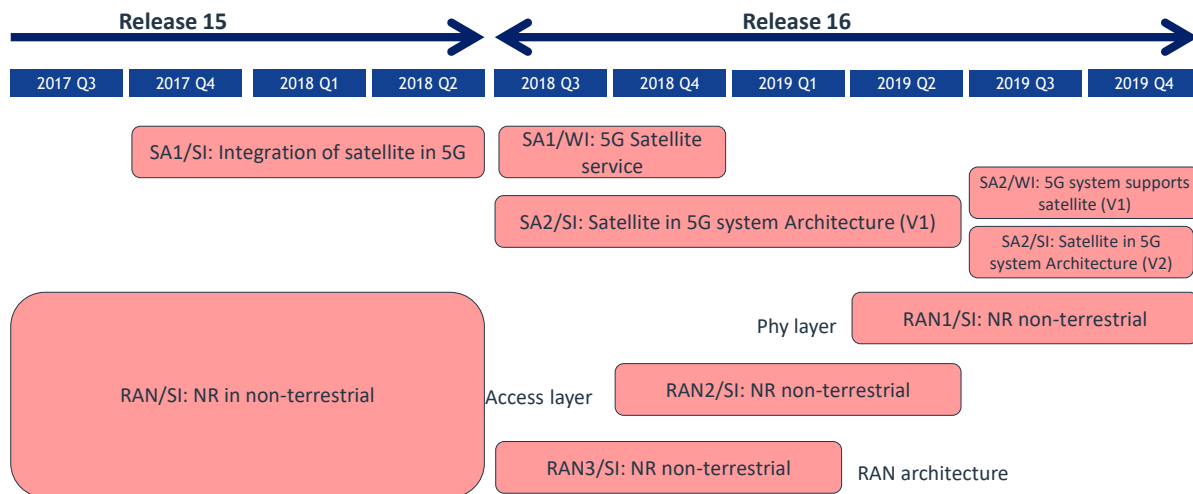


Figure 5: 3GPP Study and work items in release 16

It is specified in SID of NR V2X (RP-181480) that the closing of the SI and the opening of the WI should not be dependent on the completion level of FR2 while it is targeted to complete SI aspects for both FR1 and FR2, which implies that FR1 has a higher priority than FR2. In fact, it was confirmed that the discussions until the 3GPP RAN1#95 meeting were mainly focused on the FR1-band NR V2X technology. On the other hand, as part of the 5G-ALLSTAR project, we aim to identify possible use cases of mmWave-based vehicular communications and to validate their feasibility. Therefore, we will make a special effort to highlight the feasibility and potential of FR2-band NR V2X communications. More specifically, we'll contribute to the SI and the upcoming WI by making the technical proposals from the following aspects:

- Support of multi-beam operation for NR V2X sidelink both in FR1 and FR2 and the key technologies
  - Design of physical layer structure and procedure for NR V2X sidelink supporting the multi-beam operation
    - Design of physical channel and physical signal
    - Resource allocation mechanism
- Multiple access of NR V2X sidelink and LTE V2X sidelink
- Satellite link-assisted V2X communications
  - Synchronization
  - Multi-connectivity between satellite link and V2X link



**Figure 6: Current work plan in 3GPP on non-terrestrial networks**

As described in RP-182444 presented in RAN#82/Sorrento mid December 2018, the current objective of the study item on NTN are based on the outcomes of the TR 38.811, to study a set of necessary features/adaptations enabling the operation of NR protocol in non-terrestrial networks for 3GPP Release 16 with a priority on satellite access. UAS (including HAPS) based access could be considered as a special case of non-terrestrial access with lower delay/Doppler value and variation rate.

Targeted usage-scenarios with satellite access are pedestrian, stationary in building, on board vehicle, high speed train or airplanes. Stationary in building, on board vehicle, high speed train or airplanes usage-scenarios may require a relay UE. The focus of the Rel-16 study will be on pedestrian and on board vehicle usage-scenarios.

The possible reference scenarios and architecture options for non-terrestrial networks will be identified and described. However, the scope of the release 16 study item will be limited to key issues and solutions associated with transparent GEO satellite and LEO based non-terrestrial access network (moving beam on earth). The CU-DU and IAB features as well as the combined operation of GEO / LEO networks for idle mode will not be considered in this study during release 16.

### **Physical layer**

Consolidation of potential impacts as initially identified in TR 38.811 and identification of related solutions if needed [RAN1]:

- Physical layer control procedures (e.g. CSI feedback, power control)
- Uplink Timing advance/RACH procedure including PRACH sequence/format/message
- Making retransmission mechanisms at the physical layer more delay-tolerant as appropriate. This may also include capability to deactivate the HARQ mechanisms.

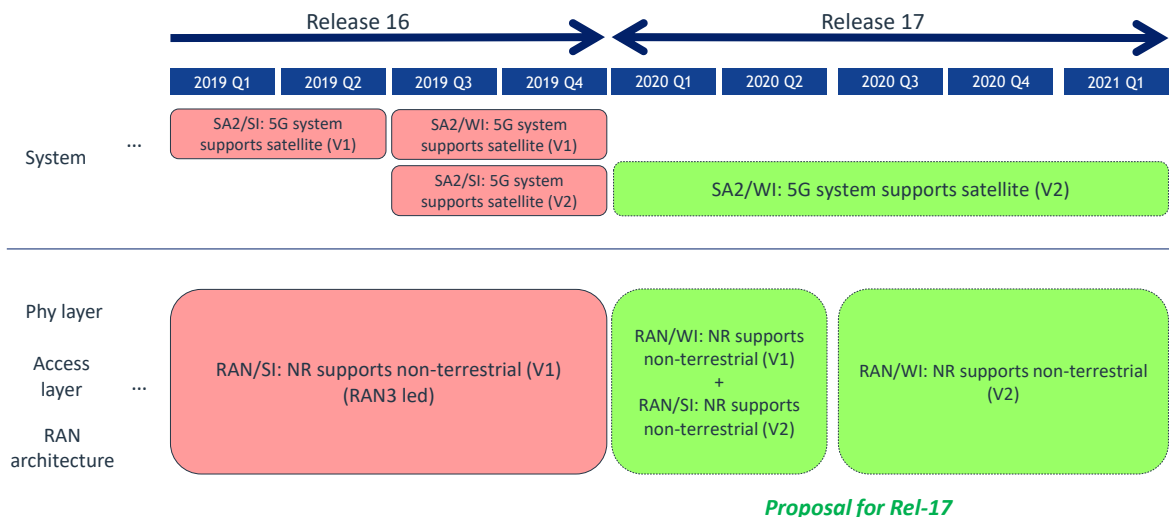
Performance assessment of NR in selected deployment scenarios (LEO based satellite access, GEO based satellite access) through link level (Radio link) and system level (cell) simulations [RAN1]

### **Layer 2 and above, and RAN architecture**

- Study the following aspects and identify related solutions if needed: Propagation delay: Identify timing requirements and solutions on layer 2 aspects, MAC, RLC, RRC, to

support non-terrestrial network propagation delays considering FDD and TDD duplexing mode. This includes radio link management. [RAN2]

- Handover: Study and identify mobility requirements and necessary measurements that may be needed for handovers between some non-terrestrial space-borne vehicles (such as Non Geo stationary satellites) that move at much higher speed but over predictable paths [RAN2, RAN1]
- **Multi connectivity involving NTN-based NG-RAN (Transparent GEO or LEO satellites) and terrestrial based NG-RAN access or two NTN-based NG-RAN access (between Regenerative LEO satellites)**
- Architecture: Identify needs for the 5G's Radio Access Network architecture to support non-terrestrial networks (e.g. handling of network identities) [RAN3]
- Paging: procedure adaptations in case of moving satellite foot prints or cells



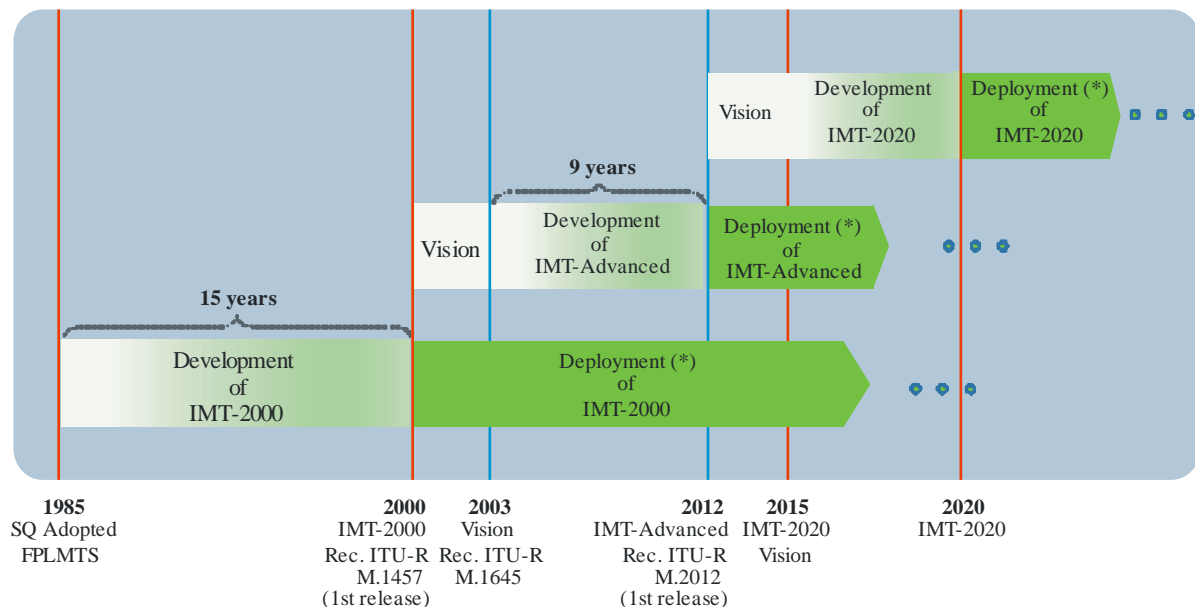
**Figure 7: Proposed updated work plan in 3GPP on non-terrestrial networks**

In release 17, the following items are envisaged:

- Work item « Enable NR to support non-terrestrial networks » (V1): Using outcomes of Rel-16 Study item FS\_NR NTN\_solutions: on going
- Work item « Optimize NR to support non-terrestrial networks » (V2):
  - Using outcomes of Rel-17 Study item to be carried out and addressing postponed topics such as:
  - LEO scenario with steerable beams
  - on board/on ground mapping of CU/DU
  - IAB node on board
  - Enhanced HARQ
  - Low PAPR waveform
  - ...

## 5.2 Activities at ITU-R level

The 5G-ALLSTAR project fits well with the development plan of IMT-2020 systems (5G) as defined by ITU-R in its Recommendation ITU-R M.2083-0 (09/2015), “IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond”.



(\*) Deployment timing may vary across countries.

M.2083-01

**Figure 8 : Overview of timeline for IMT development and deployment**

By researching multiple access solutions providing service ubiquity, the project will contribute to enable the role of **Bridging the Digital Divide** expected from IMT2020 as indicated in §3.2 of the M.2083-0 recommendation. It will also contribute to the objective set by ITU-R in clause §6.1.2 “Relationship between IMT-2020 and other access systems” and the following recommendation: “Users should be able to access services anywhere, anytime. To achieve this goal, interworking will be necessary among various access technologies, which might include a **combination of different fixed, terrestrial and satellite networks. Each component should fulfill its own role, but also should be integrated or interoperable with other components to provide ubiquitous seamless coverage.**”



The following table shows the deliverables produced by ITU-R in the development of IMT-2020 interfaces:

Scope	Reference
Vision	Rec M.2083 2015
Requirements	Report M.2410 2017
Submission	Report M.2411 2017
Evaluation	Rep M.2412 2017
Outcome	Rep M.[IMT-2020.OUTCOME] Expected 2020
Specifications	Rep M.[IMT-2020.SPECS] Expected 2020

Table 1 : ITU-R deliverables for IMT-2020

Bodies such as 3GPP producing technical specifications are in the process of submitting those in accordance with defined submission templates (see ITU-R Report M.2411) and that will be evaluated as per ITU-R Report M.2412.

The outcome of the evaluation and the selected interface specifications will be included in dedicated Reports to be released in 2020. NTN characteristics have to be embodied in those deliverables, and/or within specifically developed ITU-R Reports or Recommendations.

The detailed schedule of meetings and information flow between ITU-R and 3GPP is described below (source [www.etsi.org](http://www.etsi.org)) :

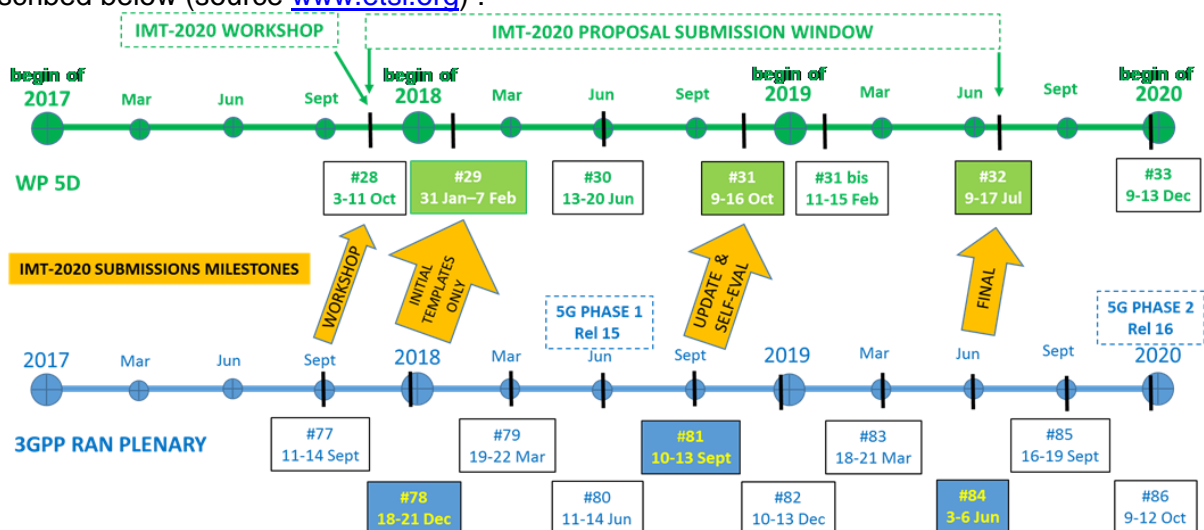


Figure 9: Information flow between ITU-R and 3GPP

In complement of the above, ITU-R Working Party (WP) 4B is elaborating a report (report ITU-R M.[NGAT\_SAT]) on key elements for integration of satellite systems into Next Generation Access Technologies. This Report focuses on how satellites are capable of supporting the various usage scenarios and provides envisaged use cases and key elements requiring careful considerations needed to enable integration of satellite solutions into Next Generation Access Technologies.

## 6 5G-ALLSTAR standardization actions list

The table below gives the list of all the standardization actions intended to be taken over the 5G-ALLSTAR project duration.

Standardisation body/group	Action description	Deadline
3GPP RAN1	Contribute to the study of physical layer issues of NR V2X-based vehicle communication	Early 2019
ITU-R SG4 & SG5	Inform relevant ITU-R Working Parties on activities in 3GPP	Mid 2019
3GPP RAN3	Study procedures for hand-over/multi connectivity between 2 satellite accesses or between satellite and cellular access and identify/describe solutions	Mid 2019
3GPP RAN2 & 3	Study enablers for coordinated radio resource management between satellite/cellular access	Mid 2019
3GPP RAN1	Contribute to the study of issues associated to NR physical layer support non-terrestrial network	End 2019
3GPP RAN1	Contribute to the specification of NR V2X physical layer design regarding vehicle communication	End 2019
3GPP RAN2	Study access layer protocol impacts associated to hand-over/multi connectivity between 2 satellite accesses or between satellite and cellular access and identify/describe solutions	End 2019
3GPP RAN3	Specify procedures for hand-over/multi connectivity between 2 satellite accesses or between satellite and cellular access	Mid 2020
3GPP RAN2	Specify NR access layer protocol modifications enabling support of hand-over/multi connectivity between 2 satellite accesses or between satellite and cellular access	Mid 2020
3GPP RAN1	Specify NR physical layer protocol modifications enabling support of non-terrestrial network	Mid 2020
3GPP RAN2 & 3	Specify enablers for coordinated radio resource management between satellite/cellular access	Mid 2020
ITU-R SG4 & SG5	Contribute to ITU-R Recommendation(s) on NTN integration in IMT-2020 networks	Mid 2020

**Table 2 : Standardization actions list**

## 7 Conclusion

This deliverable proposes an initial action plan for standardization activities on the 5G-ALLSTAR project to support the inclusion of technologies developed by the project, in 5G systems definition. These activities will be undergone at 3GPP and ITU-R. This plan may need to be revised during the course of the project to take into account the progress on the project, especially at architecture and research pillars (e.g. RRM) levels, as well as the evolving 5G standardization context. Therefore, some further releases of this document may be issued along the project lifetime.

**END OF DOCUMENT**