



**5TH GENERATION END-TO-END NETWORK, EXPERIMENTATION,  
SYSTEM INTEGRATION, AND SHOWCASING**

[H2020 - Grant Agreement No. 815178]

Deliverable D7.7

# Standardization and Regulation Report (Release C)

**Editors** David Artuñedo (TID)

**Contributors** INT, ADS, NEM, UPV, UMA, ATH, AVA, FhG, IHP, IT, KAU,  
LMI, NCSR, REL, TID, UNIS, FOGUS, PLC, ECM ATOS

**Version** 1.0

**Date** December 30<sup>th</sup>, 2021

**Distribution** PUBLIC (PU)



## List of Authors

<b>TID</b>	<b>Telefonica I+D</b>
David Artuñedo Guillén	
<b>INT</b>	<b>Intel</b>
Valerio Frascolla, Thijs Metsch, Angela Zoeger	
<b>ADS</b>	<b>Airbus</b>
Arthur Lallet	
<b>NEM</b>	<b>Nemergent</b>
Eneko Atxutegi, Jose Oscar Fajardo	
<b>UPV</b>	<b>Universidad Politécnica de Valencia</b>
Carlos E. Palau, Alejandro Fornes	
<b>UMA</b>	<b>Universidad de Málaga</b>
Pedro Merino, Iván González, Bruno García	
<b>ATH</b>	<b>Athonet</b>
Daniele Munaretto, Marco Centenaro, Stefano Cocco	
<b>AVA</b>	<b>Avanti Hylas 2 Cyprus Ltd</b>
Simon Watts, Andreas Perentos	
<b>FhG</b>	<b>Fraunhofer FOKUS</b>
Marc Emmelmann	
<b>FOGUS</b>	<b>Fogus Innovations &amp; Services</b>
Nikos Passas, Dimitris Tsolkas	
<b>IHP</b>	<b>Innovations for High Performance Microelectronics</b>
Jesús Gutiérrez, Eckhard Grass	
<b>IT</b>	<b>Instituto de Telecomunicacoes</b>
Antonio J. Morgado, Shahid Mumtaz, Jonathan Rodriguez	
<b>KAU</b>	<b>Karlstads Universitet</b>
Anna Brunström	
<b>LMI</b>	<b>LM Ericsson Ireland</b>
Anne Marie Cristina Bosneag	
<b>LMI</b>	<b>LM Ericsson Ireland</b>
Anne Marie Cristina Bosneag	
<b>NCSR</b>	<b>National Center for Scientific Research "DEMOKRITOS"</b>
George Xilouris, Harilaos Koumaras, Maria Christopoulou	
<b>REL</b>	<b>RunEL</b>

Israel Koffman	
<b>UNIS</b>	<b>University of Surrey</b>
Seiamak Vahid	
<b>PLC</b>	<b>PrimeTel PLC</b>
Michael Georgiades	
<b>ECM</b>	<b>Eurecom</b>
Panagiotis Matzakos	
<b>ATOS</b>	<b>ATOS SPAIN</b>
Javier Melian, Elisa Jimeno	

## Disclaimer

---

The information, documentation and figures available in this deliverable are written by the 5GENESIS Consortium partners under EC co-financing (project H2020-ICT-815178) and do not necessarily reflect the view of the European Commission.

The information in this document is provided “as is”, and no guarantee or warranty is given that the information is fit for any particular purpose. The reader uses the information at his/her sole risk and liability.

---

## Copyright

---

Copyright © 2021 the 5GENESIS Consortium. All rights reserved.

The 5GENESIS Consortium consists of:

NATIONAL CENTER FOR SCIENTIFIC RESEARCH “DEMOKRITOS”	Greece
AIRBUS DS SLC	France
ATHONET SRL	Italy
ATOS SPAIN SA	Spain
AVANTI HYLAS 2 CYPRUS LIMITED	Cyprus
AYUNTAMIENTO DE MALAGA	Spain
COSMOTE KINITES TILEPIKOINONIES AE	Greece
EURECOM	France
FOGUS INNOVATIONS & SERVICES P.C.	Greece
FON TECHNOLOGY SL	Spain
FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.	Germany
IHP GMBH – INNOVATIONS FOR HIGH PERFORMANCE MICROELECTRONICS/LEIBNIZ-INSTITUT FUER INNOVATIVE MIKROELEKTRONIK	Germany
INFOLYSIS P.C.	Greece
INSTITUTO DE TELECOMUNICACOES	Portugal
INTEL DEUTSCHLAND GMBH	Germany
KARLSTADS UNIVERSITET	Sweden
L.M. ERICSSON LIMITED	Ireland
MARAN (UK) LIMITED	UK
MUNICIPALITY OF EGALEO	Greece
NEMERGENT SOLUTIONS S.L.	Spain
EKINOPS FRANCE/ONEACCESS	France
PRIMETEL PLC	Cyprus
RUNEL NGMT LTD	Israel
SIMULA RESEARCH LABORATORY AS	Norway
SPACE HELLAS (CYPRUS) LTD	Cyprus
TELEFONICA INVESTIGACION Y DESARROLLO SA	Spain
UNIVERSIDAD DE MALAGA	Spain
UNIVERSITAT POLITECNICA DE VALENCIA	Spain
UNIVERSITY OF SURREY	UK

This document may not be copied, reproduced or modified in whole or in part for any purpose without written permission from the 5GENESIS Consortium. In addition to such written permission to copy, reproduce or modify this document in whole or part, an acknowledgement of the authors of the document and all applicable portions of the copyright notice must be clearly referenced.

## Version History

---

<b>Rev. N</b>	<b>Description</b>	<b>Author</b>	<b>Date</b>
<b>1.0</b>	Release of D7.7	David Artuñedo Guillén, all partners	30/12/2021

## LIST OF ACRONYMS

Acronym	Meaning
AIOTI	The Alliance for Internet of Things Innovation
CA	Consortium Agreement
eBCS	Enhanced Broadcast Services
EPC	Evolved Packet Core
FDD	Frequency Division Duplexing
GA	Grant Agreement
KPI	Key Performance Indicator
LSA	Licensed Shared Access
MANO	Management and Orchestration
MCS	Mission Critical Services
MCPTT	Mission Critical Push To Talk
MEC	Multi-access Edge Computing
NFV	Network Function Virtualisation
NR	New Radio
NSA	Non-Standalone
OAI	OpenAirInterface
ONF	Open Networking Foundation
OSS	Operations Support Systems
OSM	Open Source MANO
RAN	Radio Access Network
SA	Standalone
SCF	Small Cell Forum
SDN	Software Defined Networks
SDO	Standards Developing Organization
TDD	Time Division Duplexing
UE	User Equipment
UTRAN	UMTS Terrestrial Radio Access Network
WG	Working Group

## Executive Summary

---

The scope of deliverable D7.7 is to update the analysis and the strategy at project level towards fulfilling needs and gaps found on standardization and regulatory bodies activities performed after the end of second one of the project.

Delvierable D7.7 presents the last reporting period of activities related to Standardization bodies tracking and impact, and the final status of the Spectrum allocation for each 5GENESIS platform.

5GENESIS partners have gone through moving all SDOs meetings to a remote or online format, while SDOs calendars have been adapted, introducing significant delays. Despite the changes introduced in the SDOs way of working, 5GENESIS partners have successfully managed to continue performing the tracking activities of reference SDOs such as 3GPP, ETSI, and IEEE, with many working groups being monitored during the last reporting period, as elaborated in Section 2. Additionally, components release as Open Source during the project have been updated with the latest changes during the last reporting period, bringing Open Source releases to the latest versions used in 5GENESIS.

In this complex situation, 5GENESIS partners have strongly pushed to complete some of the actions related to impacting SDOs such as the ETSI INT Technical report on Testing Methodologies of Vertical Appications over B5G 5G infrastructure, the IETF Transport services architecture and application programming interface (API) or the Advanced Dinamic Spectrum allocation activities in IETF and ETSI. This information is presented in detail in Section 3.

Finally, with the six months project extension, 5GENESIS platforms have successfully secured Spectrum allocation needed to complete the trials towards the end of 2021. Final spectrum allocation is summarized in Section 4.



# Table of Contents

- LIST OF ACRONYMS .....7**
- 1. INTRODUCTION.....11**
- 2. STANDARDIZATION TRACKING ACTIVITIES UPDATE .....12**
  - 2.1. SDOs tracking update ..... 13
    - 2.1.1. 3GPP ..... 13
    - 2.1.2. mmWave terrestrial Transport solution for 5G..... 14
    - 2.1.3. IEEE P802.11 – Task Group BF (WLAN Sensing) ..... 14
    - 2.1.4. IoT Interoperability and protocols ..... 14
    - 2.1.5. Multi-Access Edge Computing (MEC) ..... 15
    - 2.1.6. Spectrum management ..... 15
      - 2.1.6.1. 3GPP Rel-17 ..... 15
      - 2.1.6.2. 3GPP Rel-18 ..... 17
      - 2.1.6.3. ETSI RRS..... 17
      - 2.1.6.4. IEEE P1932.1 ..... 17
    - 2.1.7. Satellite Communication integration into 5G..... 17
    - 2.1.8. Mission Critical Services in 5G..... 18
    - 2.1.9. IEEE 802.11 TGbc Broadcast Services ..... 20
    - 2.1.10. IETF Transport Services ..... 20
- 3. CONTRIBUTION TO STANDARDS .....21**
  - 3.1. Introduction..... 21
  - 3.2. Málaga Platform originated contributions ..... 21
    - 3.2.1. ETSI INT Technical Report 00170 ..... 21
    - 3.2.2. Open-source contributions ..... 22
    - 3.2.3. Mission Critical Communications Standardization Impact ..... 22
    - 3.2.4. IETF Impact on 5G Transport Network Benchmarking ..... 23
  - 3.3. Athens Platform originated contributions ..... 23
    - 3.3.1. Transport Services Architecture and Implementation..... 23
    - 3.3.2. Policy Management in ONAP ..... 24
    - 3.3.3. Testing Automation in OpenTAP ..... 24
  - 3.4. Surrey Platform originated contributions ..... 25
    - 3.4.1. Advanced Dynamic Spectrum Allocation..... 25
      - 3.4.1.1. ETSI RRS..... 25

- 3.4.1.2. IEEE 1932.1 ..... 25
- 3.5. Limassol Platform originated contributions ..... 26
  - 3.5.1. Supporting 5G slicing over conventional satellite links ..... 26
- 3.6. Pre-Standardization activities through 5G-PPP and AIOTI Work Groups..... 26
- 4. REGULATION BODIES ENGAGEMENT AND SPECTRUM LICENSING STATUS UPDATE .....27**
  - 4.1. Introduction..... 27
  - 4.2. Meetings with Regulation bodies during last period ..... 27
    - 4.2.1. Telefónica de España (ES)..... 27
    - 4.2.2. Office of the Commissioner of Electronic Communications & Postal Regulations (CY) ..... 27
    - 4.2.3. Interactions with the Bundesnetzagentur (German federal network agency) ..... 27
  - 4.3. Spectrum Licensing status per Platform ..... 28
    - 4.3.1. Málaga Platform..... 28
    - 4.3.2. Limassol Platform..... 28
    - 4.3.3. Surrey Platform ..... 29
    - 4.3.4. Berlin Platform ..... 29
    - 4.3.5. Athens Platform ..... 29
- REFERENCES .....31**

# 1. INTRODUCTION

---

The scope of deliverable D7.7 is to report on tracking activities and impact on SDOs, as well as update on interaction with regulatory bodies for the final period of the project.

The document is kept short and comprehensive, and as such it is composed of the following three main sections, maintaining the same structure of Deliverables 7.5 and 7.6:

- Standardization tracking and SDOs Liaison activities
- Contribution to Standards
- Regulatory bodies and Spectrum Licensing

The *Standardization tracking and SDOs Liaison activities* section comprises all tracking activities and actions led by 5GENESIS project partners monitoring and attending selected SDOs and additional organizations related to SDOs and standardization activities, such as 5G-IA and AIOTI Work Groups (WG) related to standardization activities. Section 1 includes a list of conducted activities separated per technology, architecture and Platform needs.

The *Contribution to Standards* section aims at highlighting main contributions to SDOs by project partners developing solutions for 5GENESIS. The section comprises an updated list of SDOs impacted during the last reporting period of 5GENESIS.

The *Regulation bodies engagement and Spectrum Licensing* section provides information about the meetings held with Regulatory entities and Operators and presents the final picture of the use of Spectrum by 5GENESIS Platforms during the duration of the project.

## 2. STANDARDIZATION TRACKING ACTIVITIES UPDATE

During the whole duration of 5GENESIS, the partners set up the needed infrastructure to be represented in strategic SDOs for each partner. As it was described in previous editions of this document (D7.5, D7.6) the following clusters of SDOs were monitored by the mentioned partners, with minor adjustments to the initial plan of the project.

	SDO	Partner	Key Topics
Radio/Access	3GPP RAN WG1	RunEL, INT	5G RAN
	Small Cell Forum (SCF)	Eurecom	OpenAir Interface
	mmWave terrestrial Transport solution for 5G	IHP, FhG	IEEE 802.11ay (WiFi fronthaul for Small Cells)
	IEEE P802.11 – Task Group BF (WLAN Sensing)	IHP	Joint localization and sensing, WLAN sensing
	MultiFire Radio Access	Athonet	LTE on unlicensed spectrum
	ETSI SES SCN	AVA	Satellite communications
	AIOTI	UPV, INT	IoT interoperability
	IETF Core WG	KAU	CoAP protocol
Core / Edge	5G Core	Athonet, INT	5G Core Functions
	IETF Transport Services	KAU	TAPS
	3GPP SA2 WG: Network Sharing	UMA, INT	MOCN, GWCN
	ETSI ISG MEC	Athonet, INT, TID, NCSRDR	Multi-access Edge Computing
	TIP	Athonet, TID	MEC, ORAN
	Open Networking Foundation (ONF)	TID	SDN
Management and Orchestration	ETSI NFV	Atos, TID, NCSRDR	Open Source MANO (OSM)
	MEF	NCSRDR	Real time deployment of MEF Services
	3GPP	NCSRDR, Atos, INT	Slice Management
	3GPP, ETSI RRS, IEEE1932.1 WG	INT, IT	Dynamic Spectrum Management
	NFV ISG	Athonet, TID, Atos	NFV Plugfests
	3GPP, ITU-R and NGMN	TID, UMA, FOGUS	5G KPIs
Verticals	ETSI CTI and TC TCCE WG	Nemergent, Athonet	MCPTT/ MCS/ MCX
	3GPP MCS, 3GPP SA1	Airbus, INT	MCPTT, MCData and MCVideo
	3GPP TSG SA WG3	Airbus, INT	Security

	IEEE 802.11 WG	FhG, IHP	Enhanced Broadcast Services
--	----------------	----------	-----------------------------

Table 1 : SDOs Tracking activities per Partner

5GENESIS committed to survey and monitor the standardization landscape. A first plan of related actions was provided in **D7.1 “Dissemination, Standards and regulatory bodies plan”**, submitted in Month three (M3) of the project, and exhaustive description of activities during first and second year of the project was included in **D7.5 “Standardization and Regulation Report (Release A)”** and **D7.6 “Standardization and Regulation Report (Release B)”**.

In the sections below, partners have continued monitoring and analysing the relevant SDOs, or sub-working-groups of them, especially those focusing on architectural and protocol issues, during the last reporting period of the project.

## 2.1. SDOs tracking update

### 2.1.1. 3GPP

Telefónica, among other partners, have attended the following 3GPP meetings during the last reporting period of 5GENESIS:

- RAN WG: 3GPPRAN#93e, 3GPPRAN#91-e,
- SA WG: 3GPPSA#91-e, 3GPPSA#92-e, 3GPPSA-Rel-18 Workshop, 3GPPSA#93-e
- SA1 WG: 1 3GPPSA1#93-e, 3GPPSA1#94-e, 3GPPSA1#94-bis-e, 3GPPSA1#95-e
- SA2 WG: 3GPPSA2#143-e, 3GPPSA2#144-e, 3GPPSA2#145-e, 3GPPSA2#146-e
- SA3 WG: 3GPPSA3#103-e, 3GPPSA3#104-e
- SA5 WG: 3GPPSA5#135-e, 3GPPSA5#136-e, 3GPPSA5#137-e, 3GPPSA5#138-e
- PCT WG: 3GPPCT#93e, 3GPPCT#91-e, 3GPPCT#92-e

In this reporting period and due to the COVID situation, RunEL continued to monitor remotely the standardization process in the following 3GPP RAN Technical Specification Groups and their implications on the upcoming new 3GPP Releases (Rel-17 and Rel-18):

- RAN WG1 - Radio Layer 1 (Physical layer )
- RAN WG2 - Radio layer 2 and Radio layer 3 Radio Resource Control

UMA has joined 3GPP activities in 2021 and have followed these 3GPP working groups:

- 3GPP\_TSG\_CT
- 3GPP\_TSG\_RAN\_WG2
- 3GPP\_TSG\_SA\_WG1
- 3GPP\_TSG\_SA\_WG2

INT has attended all WG of 3GPP, providing a comprehensive coverage of the main activities related to project focus areas.

UMA and INT have contributed to the discussions, concluded in December 2021, towards the prioritization of the Rel-18 Study Items, with special support to items related to deterministic communications.

### 2.1.2. mmWave terrestrial Transport solution for 5G

IHP has focused its work on the development of the mmWave terrestrial backhaul solution (see deliverable D3.12) using an IEEE 802.11ad-like implementation. The final standard IEEE 802.11ay-2021 was approved in March 2021 and includes features that are not yet considered for implementation in the latest mmWave solution, since another platform needs to be considered to implement 802.11ay. However, effort is put in featuring the mmWave solution with sensing capabilities (see 2.1.3 for more details).

### 2.1.3. IEEE P802.11 – Task Group BF (WLAN Sensing)

Integrating sensing functionality together with communication is emerging as a key feature of the 6G Radio Access Network (RAN), allowing to exploit the dense cell infrastructure of 5G for constructing a perceptive network. The work on WLAN sensing carried out in IEEE 802.11bf is currently proving its capability to enable many applications, such as in home security, health care, enterprise, and building automation/management markets.

The BF Task Group proposes revising current communication infrastructures towards offering sensing capabilities. This can be done with rather slight modifications in hardware, signaling strategy, and communication standards.

IHP is currently carrying out work towards supporting sensing functionalities in its terrestrial mmWave backhaul solution, and the outcome of this work is a potential candidate for technical submissions proposals to This Task Group. IHP takes part in 802.11bf meetings (which started in September 2020) where the advances in sensing capabilities implemented on top of the mmWave solution are being discussed.

### 2.1.4. IoT Interoperability and protocols

UPV has been in charge of monitoring the SDOs related with IoT protocols and interoperability, aiming at understanding their interplay with 5G technology. In particular, UPV has tracked and participated in meetings and events of the following SDOs:

- **AIOTI**, (UPV together with **INT**) focusing on the Standardisation WG.
  - Related with 5G, AIOTI has focused its efforts on gathering 5G requirements imposed by IoT use cases and emerging topics in different domains and verticals, so SDOs like ISO, ITU, IEEE and 3GPP can make use of them [i].
- **ETSI**, tracking the **SmartM2M** group and standards from the MTS technical committee.
  - UPV is currently working with ETSI for delivering a paper related to SAREF ontology.
  - MTS has delivered in 2021 a set of new testing specifications for CoAP [ii], MQTT [iii] (focusing on conformance, performance, and most importantly, security and vulnerability issues and testing methods), and for its IoT security standard [iv].
  - UPV has participated in the **ETSI-IoT week**, held on April 2021, which focused on oneM2M, digitalization in Pandemic, Cybersecurity and AI in IoT.
- **IEEE SA** (Standard Association), current collaboration in a white paper for Next Generation IoT architectures, with 5G as key enabling technology.

Besides, UPV has participated in events of different IoT-related initiatives, in particular:

- The main European initiatives related to Next Generation Internet of Things, under the umbrella of the **NGIoT** initiative:
  - **EU-IoT**, focused on novel/advanced IoT solutions, ecosystems and architectures. UPV has participated in the organized workshops and webinars during 2021, where 5G is considered a key enabling technology for fulfilling requirements of novel and emerging IoT-related use cases, not just as access network but also as services management (NFV-based). UPV is currently drafting together with them a white paper related to novel IoT architectures, related to edge and 5G, which will be released soon.
  - **openDEI**, devoted to developing a unified architecture, standards and strategy for supporting EU Digital Transformation. UPV has participated in workshops during 2021. UPV used to be part of IoT European LSP (Large-Scale Pilots) Programme, being openDEI a natural evolution of this.
- **IoT Week**, (UPV together with INT) from the IoT forum, held on September 2021. 5G was discussed in different sessions, focusing on IPv6, interoperability at network level (with IoT protocols such as CoAP and MQTT on top), and automated mobility. More details on the Panel attended by Dr. Valerio Frascolla (INT) are provided in D7.4.
- Although UPV planned to keep participating on ITU Smart Sustainable Cities group, participation has shifted towards the European Technology Platform **ALICE**, which is an initiative devoted to transfer knowledge and research from H2020 and Horizon Europe programs in logistics and supply chain management (because of the larger expertise in this area).

### 2.1.5. Multi-Access Edge Computing (MEC)

As ISG Member, Athonet has been participating in ETSI MEC Tech Calls and Plenary meetings, to track activities ongoing in relevant Work Items. Athonet has contributed to MEC GS033 (IoT API).

INT has been driving in these last few quarters the activity of ETSI MEC, as Dario Sabella has been the work group chair. Discussion held in the group have been constantly reported to the 5GENESIS work, so to check that the implementation of MEC in affected Platforms did not deviate from the ongoing talks in the ETSI MEC WG. Insight on the evolution of the edge technologies and specific for the IoT domain, have been also monitored and reported to the 5GENESIS GA, when of general interest for the consortium work.

### 2.1.6. Spectrum management

In this reporting period (July 2020 – December 2021), IT and INT worked tightly together to track activities relevant for 5GENESIS and which were related with spectrum management in several standardization bodies, like 3GPP, ETSI RRS and IEEE P1932.1.

Regarding 3GPP, the following information were collected about Rel-17 and Rel-18 activities.

#### 2.1.6.1. 3GPP Rel-17

Rel-17 brings several **enhancements to**:

## 1. 5G New Radio (NR)

- extend 5G operation to 71GHz;
- add new 5G licensed and unlicensed bands;
- determine sharing parameters for the coexistence of incumbent services and 5G in bands 6425-7025 MHz, 7025-7125 MHz and 10000-10500 MHz;
- add RAN slicing;
- add LTE/NR spectrum sharing in bands n34, n38, n39 and n40;
- add cross-carrier scheduling for Dynamic Spectrum Sharing;
- add several new carrier aggregation band combinations;
- add new NR/LTE dual connectivity band combinations;
- add more flexible measurement gaps;
- allow switching across carriers during UL transmission;
- add the possibility to use non-standardized channel bandwidths (e.g. 7MHz, 11MHz);
- add new bands for D2D communication;
- identify bands for satellite operation taking into account existing regulations;
- specify parameters for adjacent channel coexistence between NR terrestrial and satellite signals.

## 2. RAN architecture

- enhance integrated access-and backhaul (IAB) for improved spectral efficiency and robustness;
- integrate satellite systems in 5G architecture;
- improve support to non-public networks.

## 3. Core Network features

- add 5G multicast and broadcast;
- improve access traffic steering, switching and splitting (ATSSS);
- improve network slicing interfaces, APIs and Network functions (NF);
- improve network slicing by adopting the GSMA slice template;
- increase automation through NWDAF.

## 4. Additionally, 3GPP Rel-17 also includes **network management topics** related to

- 5G network sharing;
- management of satellite networks in 5G Systems (5GS);
- management of non-public networks;
- management of 5G Service-Level-Agreement (SLA);
- end-to-end network slice management;
- exposure of network slice management capabilities;
- authentication of management services;
- cross-operator network slice management;
- update of network resource model (NRM) to accommodate Rel-17 new features;
- 5G user-equipment (UE) full-stack testing for Network Slicing;
- 5G self-organizing networks (improved data collection for SON, Plug and Connect for management of 5G network functions, use cases and management services for SON in 5G);



- 5G Autonomous networks (minimization of drive tests, autonomous network levels, intent driven management, and policy management for 5G).

#### 2.1.6.2. 3GPP Rel-18

IT and INT spent effort in surveying and analysing the new use cases being defined by the SA1 group which may introduce new requirements, or new tools (AI/ML; 5G personal, residential and local networks; use of satellite for 5G access and/or backhaul; use of multicast/broadcast in 5G; use of unlicensed band in 5G) with impact on spectrum management. It worth mentioning that a set of features that will be part of Rel-18 have been finally defined during the December 2021 plenary meeting, and normative work will start in RAN, SA and CT WGs not before Q1 2022.

#### 2.1.6.3. ETSI RRS

Regarding ETSI RRS, IT and INT continued tracking the WG1, which is responsible for the evolved Licensed Shared Access (eLSA) standard. In this period, the last document (TS 103 652-3) of the eLSA standard was published, defining the Information elements and protocols for the interface between the eLSA Controller (eLC) and the eLSA Repository (eLR).

#### 2.1.6.4. IEEE P1932.1

Since October 2020, IT and INT have attended P1932.1 meetings held every two months, in order to provide their contributions to the elaboration of the “Standard for Licensed/Unlicensed Spectrum Interoperability in Wireless Mobile Network”. This standard defines a new controller placed in the edge cloud of the 5G Core Network (5GC), which is in charge of steering the traffic towards the licensed or unlicensed network interfaces. The final draft of the standard has already been approved for ballot, as defined by IEEE working principles, and will be published most probably in Q1 2022.

#### 2.1.7. Satellite Communication integration into 5G

Avanti has attended various 3GPP calls and participated in supporting satcom sector direction to the 5G NTN (non-terrestrial networks) standards work. This included active participation via regular ESA hosted Standards Special Interest Group calls chaired by Thales France with generally at least one call per month. A number of Work Items (WIs) were concluded in release 17 and more agreed for release 18 and beyond. Satcom work included in release includes:

Solutions for NR to support non-terrestrial networks (NTN)	n/a*
Integration of satellite systems in the 5G architecture	n/a*
Study on PLMN selection for satellite access	TR24.821
Study on Narrow-Band Internet of Things (NB-IoT) / enhanced Machine Type Communication (eMTC) support for non-terrestrial networks (NTN)	TR36.763

\* The outcome is not a technical report; instead, relevant features are expected to be added to 3GPP specifications.

Two work items have been agreed for Rel-18, Avanti in general supported the first and had no objections to the second:

- **NR NTN (Non-Terrestrial Networks) enhancements (NR\_NTN\_enh):** The work item aims at specifying enhancements for NG-RAN based NTN (non-terrestrial networks) according to the following assumptions [with implicit compatibility to support HAPS (high altitude platform station) and ATG (air to ground) scenarios]:
  - GEO and NGSO (LEO and MEO) with transparent payload.
  - 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
- **IoT NTN enhancements (IoT\_NTN\_enh):** The work item aims to specify further enhancements for E-UTRA (LTE-RAN) based NTN (non-terrestrial networks) according to the following assumptions:
  - GEO and NGSO (LEO and MEO).
  - Earth fixed Tracking area. Earth fixed & Earth moving cells for NGSO
  - FDD mode
  - UEs with GNSS capabilities

Simon Watts of Avanti chairs the Standards Working Group of ESOA (European Middle-East and Africa Satellite Operators Association) and regular, generally, monthly meetings have been held. Work is underway to identify where else other than 3GPP the sector needs standards developments to support the deployment of 5G connectivity over satellite. The chair of the group also presented their activities to the 3GPP OP/PCG (effectively the 3GPP coordination board) where ESOA are the manufacturers’ representative partner. As a direct result of this there are follow up conversations with another sector representative organisation called 5G-MAG. They represent the broadcasts sector and there are follow up activities to identify where the two sectors needs can align.

Avanti has also attended the ETSI/SES/SCN working group calls that have recently restarted. This WG focusses on standards activities directly relevant to satcoms. There is a study item (SI) underway that is comparing and contrasting through analysis the use of the conventional and highly optimised satellite waveforms such as DVB S2X with the use of the 5G NR waveforms over today’s satellites and over possible future designs. The correct title for this SI is ‘WI DTR/SES-00456 “DVB-S2x/RCS2 versus 3GPP New Radio protocol technical comparison for broadband satellite systems”’.

### 2.1.8. Mission Critical Services in 5G

Nemergent is responsible for monitoring the MCPTT status in ETSI. The role in the SDO is regular attendant to the ETSI MCPTT/MCX Plugtests and offline monitoring of documents inherited from 3GPP standardization. Both actions are performed so that the MCS solutions

fully follows the standard and the solution is interoperable. Summing up, the participated Plugtest events during 5GENESIS were:

- 5th MCX remote Plugtests during 21 September - 2 October 2020 FRMCS Remote Plugtests during 14 -18 June 2021
- 6th MCX Hybrid PLUGTESTS held in Malaga during 8-19 November 2021

Athonet participated to the ETSI FRMCS plugtests for mission-critical services for rail/train applications in June 2021.

Airbus DS has contributed as planned to the 3GPP MCS standard definition, composed of MCPTT (Mission Critical Push To Talk), MCDData (Mission Critical Data) and MCVideo (Mission Critical Video).

Airbus DS role in the SDO was, as a regular contributor, the active attendance and contribution to the MCS in Working Groups SA1 (services requirements), SA6 (System Architecture for Mission Critical Services), SA3 (Security) and CT1 (protocols) at 3GPP.

Airbus is also vice-charmain of the SA6 (System Architecture for Mission Critical Services). Airbus has attended all the 3GPP meetings for the working Groups SA1 (services requirements), SA6 (System Architecture for Mission Critical Services), SA3 (Security) and CT1 (protocols) as listed below:

- 3GPP CT1 meetings:
  - CT1 #125e, CT1 #126e, CT1 #127e, CT1 #127e, CT1 #128e, CT1 #129e and CT1 #131e taking place from August 2020 to August 2021.
- 3GPP SA1 meetings:
  - SA1#91e from the 24<sup>th</sup> of August to the 2<sup>nd</sup> of September 2020
  - 3GPP SA1#92-e from the 10<sup>th</sup> to the 19<sup>th</sup> of November 2020 where the guidelines for Extra-territorial 5G Systems and the Study on 5G Timing Resiliency System were part of the discussions
- 3GPP SA3 meetings:
  - 3GPP TSG SA WG3 (Security) Meeting #101, Meeting #102e, Meeting #103e, Meeting #104e taking place from November 2020 to August 2021.
- 3GPP SA6 meetings:
  - The 3GPP SA6 #38-e #39-e, #40-e, #41-e, #42-e, and #42-ebis meetings, where release 17 Mission Critical topics (enh3MCPTT, Mcover5GS, eMCDData3 and MCVideo) were discussed
  - The 3GPP SA6#43 meeting, from the 24<sup>th</sup> of May to the 2<sup>nd</sup> of June 2021, where release 17 MCPTT & MCDData, Mission Critical (MC) over 5GS, and release 18 FS\_Mcover5GS (Study on Mission Critical Services support over 5G System) topics were presented
  - The 3GPP SA6#44 meeting, from the 12<sup>th</sup> to the 20<sup>th</sup> of July 2021, where release 17 MCPTT & MCDData, and Mission Critical (MC) over 5GS topics were discussed
  - The 3GPP SA6#45 meeting, from the 25<sup>th</sup> of August to the 3<sup>rd</sup> of September 2021, where the 3GPP SA Release 18 workshop preparation were made
  - The 3GPP SA6#45bis meeting, from the 11<sup>th</sup> to 19<sup>th</sup> of October 2021, where new and ongoing Rel-18 work was discussed such as MCPTT Phase 4, Mission Critical (MC) over Prose, and MC over 5MBS

### 2.1.9. IEEE 802.11 TGbc Broadcast Services

The IEEE 802.11 task group providing broadcast service enhancements was monitored by Fraunhofer FOKUS. The goal was to follow up on the upcoming enhancements in that sector for WiFi to be integrated in the Berlin Platform as a non-3GPP access technology.

Over the course of the reporting period, 802.11 TGbc made significant progress towards producing two iterations of the draft standard, reaching a rather stable state of the document with P802.11bc-D2.0. The main enhancements provided by the standard will provide means to enable secured relaying of application layer information both in the up- and down-link, involving both associated and unassociated stations. Though still in its draft state, the enhancements will open means to include WiFi as a non-3GPP access technology in particular in large-scale events as well as in industrial environments; thus complementing 5G SA-based access with technologies operating in unlicensed spectrum. The need for having both, simultaneously useable access technologies was indicated by industrial partners as part of exploiting the Berlin Platform for application use cases beyond the lifetime of 5GENESIS. Based on this feedback, Fraunhofer FOKUS will continue to monitor the particular standardization activity beyond the 5GENESIS project in order to enhance the Berlin Platform in the future with such non-3GPP-based access schemes.

### 2.1.10. IETF Transport Services

KaU is contributing to standardisation within the IETF and is among other things actively contributing to the work within the transport services (TAPS) working group, see also Section 3.3.1. Within this context, KaU has attended the following working group meetings during 2020 and 2021.

- TAPS WG Virtual Interim, Friday July 17, 2020.
- TAPS WG Virtual Interim, Friday August 14, 2020.
- TAPS WG Virtual Interim, Friday September 11, 2020.
- TAPS WG Virtual Interim, Friday October 2, 2020.
- TAPS WG Virtual Interim, Friday October 23, 2020.
- TAPS WG Virtual Interim, Friday December 11, 2020.
- TAPS WG Virtual Interim, Friday January 29, 2021.
- TAPS WG Virtual Interim, Friday February 26, 2021.
- TAPS WG Virtual Interim, Friday April 9, 2021.
- TAPS WG Virtual Interim, Friday May 7, 2021.
- TAPS WG Virtual Interim, Friday June 11, 2021.
- TAPS WG Meeting at IETF 111 (virtual IETF meeting), Tuesday July 27, 2021.
- TAPS WG Virtual Interim, Friday August 20, 2021.
- TAPS WG Virtual Interim, Wednesday October 20, 2021.

## 3. CONTRIBUTION TO STANDARDS

---

### 3.1. Introduction

In the previous section, a description of standardization efforts in various SDOs is included, summarising information on stable and developing standards which have been monitored and identifying areas where 5GENESIS partners have been active in monitoring/contributing.

In this section, 5GENESIS reports its final findings on the activities that have led to contributions to standards. Contributions are grouped around Platforms, where main contributions have been originated. However, this does not mean that such contributions come exclusively from a specific Platform, as Platforms share a common architecture and many components.

Those results were obtained fulfilling some of the gaps detected in existing standards, in order to fully accomplish the vision of 5GENESIS, and around the Open Source communities, supporting these standards delivering reference implementations of them, where 5GENESIS has produced significant contributions.

Additionally, we include additional activities related to SDOs' impact, carried out in collaboration of the 5G PPP Pre standardization WG, and AIOTI Standardization WG, thanks to the strong involvement of project partners in the WG activities since the beginning of the project.

The impact in standards from 5GENESIS has been focusing mainly on defining methodologies for testing and measuring that have influenced standard bodies such as ETSI, releasing Open Source implementation of tools based in these methodologies, clarifying and trialling the use of MEC and MCC services along the project has produced impact in ETSI MEC and 3GPP MCC standards, and finally dynamic spectrum allocation activities managed to impact IEEE and ETSI SDOs.

### 3.2. Málaga Platform originated contributions

#### 3.2.1. ETSI INT Technical Report 00170

Telefónica I+D has led the publication of the ETSI INT Technical Report 00170 with title:

*“Core Network and Interoperability Testing (INT) Methodologies for E2E Testing & Validation of Vertical Applications over 5G & Beyond networks”*

The purpose of this report is to provide recommendations on methodologies for end-to-end testing and validation of vertical applications over 5G and beyond networks. The document includes recommendations covering the most aspects of a B5G-app validation framework by providing recommendation on B5G capabilities and enablers, on the testing and validation environment, on involved processes, on the relevant KPI mechanisms and, finally, on the design

of vertical applications under test. Such recommendations can be equally applicable to a wide range of industry verticals, application cases and beyond 5G scenarios.

The technical report provides a survey and review of the existing methodologies for testing and validating vertical applications, leveraging on the experiences gain through several innovation projects, where 5GENESIS has taken a prominent role. Several partners from 5GENESIS have collaborated in contributing to this Technical Report besides Telefónica I+D, such as UMA, Fogus and NCSR.

The document as of December 2021 has been approved by ETSI TB on 25-10-2021 “TB Approval” status. **It was original planned to be published on December 2021, though there will be some delay on the final date for publication.**

The document can be accessed from this ULR:

[https://portal.etsi.org/webapp/workProgram/Report\\_WorkItem.asp?wki\\_id=59575](https://portal.etsi.org/webapp/workProgram/Report_WorkItem.asp?wki_id=59575).

### 3.2.2. Open-source contributions

The University of Málaga has released the source code of several components developed within the context of 5GENESIS, either as part of the Open5Genesis Suite (along with components developed by other partners) or as extensions for the [OpenTAP](#) automation framework:

- The **Experiment Lifecycle Manager (ELCM)**, which is the main orchestration component of the 5Genesis orchestration layer is available in this repository: <https://github.com/5genesis/ELCM>
- The source code of the **5Genesis Portal**, which is a web-based interface for experimenters is available at <https://github.com/5genesis/Portal>
- A set of helpers for common functionality, required for the execution of experiments in the 5Genesis platforms has been distributed as the **5Genesis TAP plugin**, with source code and pre-compiled binaries available at <https://github.com/5genesis/TAP-plugins>
- Two probes, for the execution of latency (**Remote Ping Agent**) and throughput (**Remote iPerf Agent**) tests have been released and available in the following repositories: [https://github.com/5genesis/Remote\\_Ping\\_Agent](https://github.com/5genesis/Remote_Ping_Agent) and [https://github.com/5genesis/Remote\\_iPerf\\_agent](https://github.com/5genesis/Remote_iPerf_agent)
- An OpenTAP extension (TapPlugin) for the management of Android devices (**UMA Android**) has been included in the official repositories of the OpenTAP project, and is available at <https://gitlab.com/OpenTAP/Plugins/university-of-malaga/uma-android>
- A TapPlugin that contains functionality for managing several probes for Android devices (**UMA Adb Agents**), has been made available at the following repository: <https://gitlab.com/OpenTAP/Plugins/university-of-malaga/uma-adb-agents>

The source code of all these components has been released under the terms of the [Apache 2.0](#) license.

### 3.2.3. Mission Critical Communications Standardization Impact

Nemergent in the framework of mission critical communications and services has followed the progress of conformance tests of mission critical communications. Nemergent has monitored the dedicated Mission-Critical Agreement Group (MCAG) by the GCF-TCCA joint task-force in June-July 2020.

In the clear objective of monitoring standards and being compliant with them Nemergent has contributed to RAN5's work in several ways: by developing several external functions, by raising CRs to RAN5 test case prose (some of their own, some in coordination with MCC TF160, in charge of translating the prose to code), and also by proposing and defending the implementation of the IPCAN model, which shall allow full verification (which until now was impossible using the IP model).

Thanks to these contributions being fully approved by 3GPP, Nemergent together with other partners has been the first ever to verify an MCX test case, and since then, two more test cases have been verified and some more twenty test cases have been submitted and are waiting for the verification status. To this day, the preparation of tests for verification is still ongoing and so is the integration of new ones.

Airbus has taken part in the 3GPP "Study on Mission Critical services support over 5G System" which is aiming at defining the impacts and the necessary changes in the Stage 2 Mission Critical specifications, which were originally based on LTE. This work is to ensure that all the mission critical services are supported over the 5G system.

While participating in the 3GPP SA6 #45 bis meeting, Airbus has also discussed with the participants about two new 3GPP work items which are related to the topics of 5GENESIS and Mission Critical Services: "Mission Critical Services over 5MBS" and "Mission Critical Services over 5GProSe"

### 3.2.4. IETF Impact on 5G Transport Network Benchmarking

Telefónica representatives in 5GENESIS (David Artuñedo Guillén and Alberto Flórez Pages), have collaborated with 5GEVE Telefónica representative (Luis Miguel Contreras), in the IETF Internet Draft 5G transport network benchmarking. More information can be found here:

<https://datatracker.ietf.org/doc/html/draft-contreras-bmwg-5g-02>.

An updated version of the draft was released in November 2, 2020.

The purpose of that document is to overview the implications of 5G services in transport networks and to provide guidance on benchmarking of the infrastructures supporting those services. For this purpose, previous work from 5GENESIS in 5G PPP TMV, collected in the whitepaper "Validating 5G Technology Performance", 5G PPP TMV WG, June 2019, has been used as a reference model for 5G KPI definitions.

## 3.3. Athens Platform originated contributions

### 3.3.1. Transport Services Architecture and Implementation

The transport services architecture and application programming interface (API) that is under standardization within the IETF TAPS working group decouples applications from the underlying transport protocols and network properties to facilitate the optimization of the

network stack on the basis of application requirements and network conditions at run-time. KaU representative in 5GENESIS Anna Brunstrom is one of the contributors to the ongoing standardisation within TAPS, serving as one of the authors of the draft describing the architecture for transport services and as one of the editors for the implementation draft that serves as a guide to implementation on how to build a system that provides a Transport Services API.

<https://datatracker.ietf.org/doc/draft-ietf-taps-arch/>  
<https://datatracker.ietf.org/doc/draft-ietf-taps-impl/>

The standardization of TAPS is based on a few independent implementations of the transport services concept. One of these implementations is NEAT, which is used within 5GENESIS to explore the integration of transport services within the 5G architecture. The experiences from 5GENESIS serve as input for the ongoing refinement of the transport services architecture and implementation guidelines.

### 3.3.2. Policy Management in ONAP

The APEX (Adaptive Policy Execution) Engine represents a strong tool for automated decision making, being able to handle adaptive policies, i.e. policies that can modify their behaviour based on system and network conditions, including decision making at runtime rather than at policy definition time and the ability to use context information that was not provided in the incoming event or request. This policy engine was initially developed in LMI and then released as open source in ONAP, where it has been optimized and adapted to work with ONAP. Joseph McNamara from LMI has been involved with APEX since its early days and has worked closely with the Athens and Surrey platforms supporting the integration of ONAP into these platforms.

In the Athens platform, APEX was integrated as part of the 5GENESIS Slice Manager, and specific policies have been written for both of these platforms. These experiences formed the basis for our feedback towards ONAP, as part of the User Experiences group:

<https://wiki.onap.org/display/DW/Adaptive+Policy+EXecution+-+5GENESIS+Experience>

Our feedback includes integration and deployment aspects, experiences with more complex aspects of configuration and policy writing, as well as reporting on the challenges we had in realising policies that require additional information outside of context, as well as handling output events.

The experiences with integrating ONAP into real 5G platforms and working with different types of deployments and policies help advance all actors' understanding of APEX (platforms, users, etc.) and also provide feedback towards the ONAP open source community.

### 3.3.3. Testing Automation in OpenTAP

NCSR D is contributing on the creation of the TMV basic testing bundle which includes tools coming from different 5GPPP projects. This bundle includes TAP agents developed for measuring purposes, including those that are part of the OPEN 5GENESIS Suite: <https://gitlab.com/OpenTAP/Plugins/5g-ppp-test-measurement-and-kpis-validation-wg/5gppp-tmv-basic-testing-bundle>



## 3.4. Surrey Platform originated contributions

### 3.4.1. Advanced Dynamic Spectrum Allocation

#### 3.4.1.1. ETSI RRS

The aim of both IT and INT since the beginning of the project has always been to contribute to ETSI RRS on a new, more general, flexible and fine-grained spectrum allocation scheme in both time and space domains than the eLSA standard, that was finalized within the activities of the ETSI RRS SDO. After the first presentations from INT, it was not possible to reach the broad consensus that would have allowed the new proposal to be effectively taken onboard by the workgroup, as more than few aspects and concerns (including the overall doubt that it was considered not the right time – i.e. too early in time – for such discussions, indicating a more suitable 2022-2023 time window) were raised by several members of the group regarding the real need for such standard, even though the policy makers, e.g. RSPG/CEPT in Europe and FCC in USA, continue pushing for this type of features, by increasing the number of bands where unlicensed and shared operation is envisioned. Given that inertia, we did not think as viable way forward to insist on that topic and opted to drop the intention to contribute further to ETSI RRS. To get more information, one can refer to the 5GENESIS deliverable D3.12 to understand the technical basis of the proposed solution, and to the deliverable D.4.9 to read the application of this proposal in the Limassol testbed use case, where we proposed to share a band between the access and backhaul domains of a 5G network.

#### 3.4.1.2. IEEE 1932.1

The significant increase in the number of connected users and downloaded data (applications, video) has motivated the evolution of a new paradigm of wireless mobile networks that employ additional air interfaces operating in the unlicensed spectrum. Those air interfaces will become supplementary downlinks (SDL) to increase throughput at the end user side. However, those interfaces are not necessarily tidily integrated within the licensed base station, and they are distributed across various domains. Wi-Fi is one of the main technologies used for boosting capacity through the user plane interface. Since the availability of unlicensed channels may change in time in an unpredicted way, that traffic will be buffered in Wi-Fi until new radio slots become free and transmissions can therefore be resumed. Tailoring to the 5G strict round-trip time requirements, the IEEE 1932.1 standard defines a new virtual controller that resides at the mobile edge-cloud to coordinate the multi-connectivity model and traffic sharing between the licensed and unlicensed interfaces, considering the real-time status of unlicensed channel availability for a certain user equipment.

IT and INT presented two schemes for managing multi-connectivity modes: Distributed and Centralized. In distributed scheme, the new controller manages the traffic forwarding and steering between distributed radio interfaces across the domain sites. In the centralized scheme, the various radio interfaces are co-located in the same base station and the controller will manage traffic steering through new unified 5G MAC design. The controller will manage the traffic sharing between various interfaces given that operators will provide access to operator deployed Wi-Fi or any other customer Wi-Fi using separated SLA agreements. Multi-connectivity modes imply efficient new services that may require measuring airtime for each interface and changes to billing models.

## 3.5. Limassol Platform originated contributions

### 3.5.1. Supporting 5G slicing over conventional satellite links

A review of standards was followed up by some high-level designs for supporting 5G slices and related quality indicators (5G QI) using conventional satellite class of service and VLAN separation. Avanti intend to pursue this concept further in future projects from which some inputs may arise; for example in to ETSI/SES/SCN – the ETSI Working Group on Satellite Communications and Navigation (SCN) that reports in to the Technical Committee (TC) Satellite Earth Stations and Systems (SES) within ETSI.

## 3.6. Pre-Standardization activities through 5G-PPP and AIOTI Work Groups

5GENESIS project joined the 5G PPP Pre-standardization WG in 2019. 5GENESIS representatives in the WG continue to be:

- David Artuñedo Guillén (Telefónica I+D) as Standardization Manager in 5GENESIS and Task 7.4 Leader,
- Arthur Lallet (Airbus) as TASK 7.3 Leader.
- Valerio Frascolla (INT) as WP7 Leader.

All 5GENESIS attendees have provided several inputs to the ongoing work of the WG, for instance in defining the next steps for the most promising new technologies that could impact future SDOs work (especiall 3GPP bodies), based on the experienced gained by the deployment activities conducted along the 5GENESIS project in the five project Platforms.

In addition, also the pre-standardization work of the AIOTI WG on Standardization was monitored and impact with similar inputs than the 5G-PPP WG above, by Dr. Valerio Frascolla.

## 4. REGULATION BODIES ENGAGEMENT AND SPECTRUM LICENSING STATUS UPDATE

---

### 4.1. Introduction

Following the first two reports on meeting Regulatory bodies and Spectrum allocation per Platform, we now describe the further meetings being held with Regulatory bodies during the last reporting period of the project, and we provide the final Spectrum allocation per Platform.

### 4.2. Meetings with Regulation bodies during last period

#### 4.2.1. Telefónica de España (ES)

In Spain, UMA have had contacts with the regulator to explore the future options for 26GHz and 28GHz bands, and have obtained authorization to install two 5G NSA cells using such bands.

#### 4.2.2. Office of the Commissioner of Electronic Communications & Postal Regulations (CY)

Primetel PLC was the main contact point on behalf of the Limassol Platform in Cyprus. Since the writing of D7.6, Primetel continued close communication and regular correspondence with the Department of Electronic Communications of the Ministry of Research, Innovation, and Digital Policy and the Office of the Commissioner of Electronic Communications & Postal Regulations. In December 2020 Primetel PLC was among the 4 companies on the island which was awarded a commercial 5G Licence. More specifically Primetel PLC acquired at a price of € 8,500,000 the usage rights for the Radio Spectrum: 2×5 MHz at 700 MHz and 50 MHz at 3.6 GHz. For 5GENESIS Limassol Platform and mainly since the writing of D7.6 this meant that the 5GENESIS experimental licence was dropped (used only for 2019 and 2020) since from 2021 onwards experiments were now formally and legally covered by the commercial licence. The Office of the Commissioner of Electronic Communications & Postal Regulations (CY) was also regularly updated with the progress of the 5GENESIS progress.

#### 4.2.3. Interactions with the Bundesnetzagentur (German federal network agency)

Fraunhofer FOKUS and IHP have interacted with the Bundesnetzagentur towards being granted a permanent spectrum license for 5G Campus networks in order to operate the Berlin facility beyond the lifetime of 5GENESIS. Anticipated lease time for the spectrum is target to be around 10 years. Interactions with the Bundesnetzagentur are ongoing and will likely result in the transitions from operating the Berlin Platform under an experimental spectrum license towards being granted a permanent licence within the next 6 months.

### 4.3. Spectrum Licensing status per Platform

Building on top of the previous report (D7.6), we now provide an update to the final report of Spectrum allocation per Platform.

This section outlines the final status of the Spectrum usage agreed per Platform with National Regulatory entities and/or Operators collaborating in 5GENESIS project.

#### 4.3.1. Málaga Platform

Málaga Platform Spectrum agreements are summarized in the following table:

Platform	Spectrum	Legal Agreement	Timeline	Geography/Area
Málaga	50 MHz in B43 (3.6-3.8 Mhz) B7 (2.6 Mhz)	Public contract SU. 28/2019 PA signed on 07/11/2019 between UMA and Telefonica de España.	Valid until 2022	UMA Campus (500m)
		Public contract 78/2019 signed on 7/2/2020 between Ayuntamiento de Málaga and Telefonica de España.	Valid until 2022	City Center

#### 4.3.2. Limassol Platform

As mentioned in part 4.2.2 Primetel PLC (ISP and member of the Limassol Platform) was one of the companies who bid for a 5G Commercial License, the other being CYTA/Cytamobile-Vodafone (Cyprus Telecommunications Authority, the local incumbent operator), EPIC and Cablenet. On December 17, 2020, the Department of Electronic Communications of the Ministry of Research, Innovation, and Digital Policy in Cyprus announced the 4 winners which were granted rights to use the Radio Frequency Spectrum (700 MHz, 3.6 GHz) for the Establishment and Operation of 5th Generation Networks. Primetel PLC acquired the usage rights for the Radio Spectrum: 2x5 MHz at 700 MHz and 50 MHz at 3.6 GHz at a price of € 8,500,000 and was given formal permit to begin deployment from January onwards. According to DEC (Department of Electronic Communications) the general target for Cyprus deployment of 5G networks is covering 70% of the population alongside all major highways by 31 December 2025. For the 5GENESIS Limassol Platform this also meant experimentation could continue smoothly with the Satellite/Mobile integrated setup without depending on the 5G Experimental License.

Platform	Spectrum	Legal Agreement	Timeline	Geography/Area
Limassol	100MHz (3400-3500MHz) at 3.6GHz	Experimental Licence: Ref No: IIEP-2019-03	2019-2020	Cyprus

	2x5 MHz at 700 MHz and 100 MHz at 3.6 GHz	Commercial Licence: Ref No: 50 Εξουσιοδότηση-04	5 February 2021- 5 February 2041	Cyprus
--	---	---	--	--------

#### 4.3.3. Surrey Platform

Surrey Platform Spectrum agreements are summarized in the following table:

Platform	Spectrum	Legal Agreement	Timeline	Geography/Area
Surrey	20 MHz in 700 MHz band	Agreement between UNIS and Ofcom	08/08/2021 (yearly renewal)	UNIS campus (4km <sup>2</sup> )
	30 MHz in 2.3 GHz band		11/05/2021 (yearly renewal)	
	20 MHz in 2.6 GHz band		29/02/2021 (yearly renewal)	
	20 MHz in 800 MHz band		29/02/2020 (yearly renewal)	
	100 MHz in 3.5 GHz band		12/06/2021 (yearly renewal)	

#### 4.3.4. Berlin Platform

Berlin Platform Spectrum agreements are summarized in the following table:

Platform	Spectrum	Legal Agreement	Timeline	Geography/Area
Berlin	100MHz in band n78 (3700 – 3800 MHz grant)	Ref. No 01 55 0348	Valid until 31/12/2021	Berlin
	100MHz in band n78 (3700 – 3800 MHz grant)	Ref. No 95 55 0001	Valid until 31/10/2022	Frankfurt (Oder)

The Berlin Platform currently operates under experimental licences, which are renewable on a yearly basis. Contact with the Bundesnetzagentur has been established to transition from an experimental license towards a permanent license lease (likely to be granted for 10 years).

#### 4.3.5. Athens Platform

Athens Platform Spectrum agreements follow a different framework for COSMOTE and NCSR Demokritos.

Platform	Spectrum		Legal Agreement	Geography/Area
<b>Athens</b>	3400-3410 MHz	10MHz	NCSRД, published law 4727 /2020 (ΦΕΚ Α 184 - 23.09.2020) clause 92	NCSRД
	3450-3600MHz	150MHz	COSMOTE, Commercially available	OTE Academy, Egaleo stadium

NCSRД, as a public research institution, falls within the recently published law 4727/2020 (ΦΕΚ Α 184 - 23.09.2020) of the Ministry of Digital Governance, where in clause 92 (5G Frequencies for pilot applications) is foreseen that the public sector reserves the bandwidth of 3400-3410 MHz for ten years with scope the exclusive use of it for research and development purposes. The use of that bandwidth is provided to universities and research centres of Greece in order to support their 5G pilots, without any cost.

COSMOTE as a mobile operator, uses the purchased range of 3450-3600MHz, with bandwidth of 150MHz (TDD) for the experimental needs of the 5GENESIS.

## REFERENCES

---

<sup>i</sup> AIOTI WG Standardisation, “IoT and Edge Computing impact on Beyond 5G: enabling technologies and challenges”, AIOTI, 2021

<sup>ii</sup> ETSI MTS, “TS 103 596: Test Specification for CoAP”, Parts 1-3, ETSI, 2021

<sup>iii</sup> ETSI MTS, “TS 103 597: Test Specification for MQTT”, Parts 1-3, ETSI, 2021

<sup>iv</sup> ETSI MTS: “TS 103 646, Test specification for foundational Security IoT-Profile”, ETSI, 2021