

# 5G ALLSTAR



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## Deliverable D1.5

### Impact report and Collaboration plan

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## Abstract

This deliverable contains the impact report of 5G-ALLSTAR and the collaboration plan between the European and Korean partners and stakeholders.

It details the envisioned future collaborations between the European and Korean partners and stakeholders. Therefore, after recalling the major impacts of the project, it presents concrete leads for future collaborations:

- (i) the contribution of 5G-ALLSTAR partners to 3GPP and ITU-R standardization on V2X and on the integration of Non-Terrestrial Networks into future 5G Systems through active participation to the standardization meeting and through its technical results that will continue even after the end of the 5G-ALLSTAR project;
- (ii) European – Korean satellite manufacturers and operators demonstrations;
- (iii) Institutional relationships, through organization of events for dissemination of a common vision;
- (iv) project results that will impact 5G and beyond 5G stakeholders even after the end of the project.

## Keywords

International Cooperation, 5G, Beyond 5G, 6G, Trials, Stakeholders.

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## 1 Impact report

During the setup of the project, four main impacts were identified. The results of the project with respect to them is summarized below.

### 1.1 Global interoperability demonstrations for 5G networks, contribution to the integration framework towards access and core.

In WP2, an overall system architecture including the architecture of access network and core network as well as the interfaces required for both multi-connectivity of different access technologies and intercontinental interoperability has been defined, see D2.2 and D2.3. This provided a technical baseline for WP3, WP4, and WP5.

The performance of the identified key enablers and technologies have been evaluated for the use-cases and KPIs defined, see deliverables of WP3 and WP4.

In WP5, the feasibility of the multi-connectivity and the global interoperability have been demonstrated through a wide range of experimentations and PoC demonstrations with testbeds implementing several key enabling technologies developed in WP3 and WP4, see D5.1 to D5.6.

### 1.2 Joint contributions to global 5G standards specifications in relevant organisations

5G-ALLSTAR included standardization activities for incorporation of technologies developed during the project into the 5G system definition, mainly at 3GPP. One of the project's objectives was indeed to contribute to the definition of 5G system as part of the release 16 and beyond with the inclusion of 5G satellite access, mobile wireless backhaul and multiple access / connectivity.

The plan, as defined in D6.5 was to leverage on ongoing standardization on eMBB and 5G satellite access. Additional standardization activities in bodies such as ETSI, IEEE and ITU, have been considered in complement to 3GPP activities. Contributions have been provided to selected groups at 3GPP and ITU-R level, in order to support product adoption and interoperability developed in the context of the project, see D6.6, D6.7 and D6.8.

### 1.3 Successful showcasing trials or testbeds with joint demonstration across regions

Due to the Covid-19 crisis, the final demonstration of the project was not held during a public event. Nevertheless, Korean and European partners succeeded in demonstrating an intercontinental scenario where low latency and high throughput flows were exchanged and where terrestrial/satellite multi-connectivity was involved at both ends, see D5.6.

### 1.4 Social and economic impacts

Part of the effort of 5G-ALLSTAR was dedicated to 5G business assessment and exploitation towards vertical stakeholders.

We first provided an overall summary of the current state of 5G market in 2020. In a second step we discussed the emerging configurations based on a desk analysis of available literature and studies, and on direct interviews we conducted with key informants. This allowed us to understand 5G networks and to frame our discussion around key dimensions of the business models in terms of balancing risks with promises while managing tensions and synergies to provide a holistic overview of what we expect within the upcoming 5G business models in industry.

Based on the joint analysis literature, available cases, and interviews we finally discussed the opportunities for 5G-ALLSTAR technologies in the identified vertical markets describing effects of the different dimensions of business models (transport, public safety, rural area), helping the definition of viable strategies.

## 2 Future collaboration plan between the European and Korean partners

### 2.1 Future collaboration plan between the European and Korean stakeholders

#### 2.1.1 Standardization

The 5G-ALLSTAR consortium has continued the standardization work started within the 5GCHAMPION project that led to the inclusion in the 3GPP standard of a study item on 'new radio impacts to support Non-Terrestrial Networks'. 5G-ALLSTAR has actively continued participating to the standardization meeting (ETRI, TAS, FhG IIS, FhG HHI). Within the 5G-ALLSTAR project, industrial stakeholders from Europe (TAS) and Korea (KTSAT, SKT, SNET ICT) have cooperated to identify the key technical enablers required to achieve effective inclusion and support of Non-Terrestrial Networks in 5G and beyond networks.

#### 2.1.2 TAS – KTSat collaboration

The presence of KTSat among the Korean partners allowed TAS to initiate a preliminary discussion on a common demonstration of 5G via satellite during the meetings in Grenoble and Jeju. This allowed, also with the help of the respective Sales & Marketing departments of TAS and KTSat, to put in contact the technical teams of both companies which then continued their collaboration until the realization of a real demonstration on the Koreasat-5A satellite of KTSat, built by TAS.

This kind of cooperation with a Satcom Operator, among the best Asian customers of TAS, is always valuable for the French company.

The press release<sup>1</sup> is translated below:

**February 4, 2021** - *Thales Alenia Space, a joint venture between Thales (67%) and Leonardo (33%), is partnering with South Korean operator KT SAT, a subsidiary of Korea Telecom, the world's first company to commercialize 5G, to implement a demonstration to bring 5G network to remote areas using the Koreasat-5A geostationary communications satellite.*

*KT SAT sees this demonstration as the first phase of satellite integration into the 5G world. This first-of-its-kind experiment will connect a core network (5GCN) to a base station (gNB) via KT SAT's geostationary Koreasat-5A satellite. In this case, the satellite will complement the terrestrial 5G network; it will also become an integral part of it by receiving data from the terrestrial 5G network and retransmitting it to white zones, areas where conventional link technologies (cable, fiber, microwave) are not appropriate for technical and/or economic reasons. This demonstration was conducted from the KT SAT teleport in Kumsan.*



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*The Koreasat-5A satellite, successfully launched by SpaceX in 2017, is based on the Spacebus 4000B2 platform from Thales Alenia Space. Its payload carries Ku-band transponders. The satellite's coverage area includes the Indochinese peninsula, Japan, Korea, the Philippines and*

<sup>1</sup> <https://www.thalesgroup.com/fr/monde/espace/press-release/thales-alenia-space-sassocie-kt-sat-une-demonstration-liaison-5g>

Central Asia. As prime contractor, Thales Alenia Space designed, manufactured and tested the satellite.

This is not the first time Thales Alenia Space has participated in a demonstration around 5G: on February 20, 2018, as part of the **5G CHAMPION** project of the Horizon 2020 research program funded by the European Commission, Thales Alenia Space, with CEA-Leti (Electronics and Information Technology Laboratory) and Nokia as partners, carried out a 5G communication demonstration at the Winter Olympics in Pyeongchang, South Korea. As a member of the 3GPP2 consortium, Thales Alenia Space continues to adopt the new NTN (Non Terrestrial Network) 5G standards, to keep pace with the strong momentum of traditional cellular operators.

In November 2019, KT SAT had unveiled the first hybrid satellite-terrestrial 5G transmission router online. Developed with the KT Institute of Convergence Technology, this hybrid router will expand the role of satellites in 5G services.

## 2.2 Future collaboration plan between the European and Korean Institutions



The 5G-ALLSTAR project has consolidated the cooperation synergies established during the 5GCHAMPION project. Dedicated discussions between Korean and European partners have led to the identification of strategic key performance indicators, enabling technologies and use cases that will be key requirement for the inclusion of NTN in beyond 5G networks. As a concrete outcome, the paper “6G in the sky: On - demand intelligence at the edge of 3D networks” provides the common vision of Korean and European partners on 6G.

Thanks to the close collaboration between Korean and EU partners, ETRI and CEA were invited to present their vision on 6G at the 2019 Korea-EU Joint R&D Conference.

In 2020, CEA represented the vision of 5G-ALLSTAR to the 1st 6G Global 2020 in Seoul, hosted by the Ministry of Science and ICT. It was the first event in Korea to bring the policy leaders, industry leaders, and researchers together to share various issues on how to move forward to the 6G, including global 6G strategy, industrial 6G vision, and 6G core technologies prospects.

Mobile KOREA 2020

## 6G GLOBAL

Paving the ways toward 2030

2020년 11월 19일(목) **ON AIR**

**5G를 뛰어넘는 6G 이동통신, 각 국가와 전 세계 주요기업, 학계 및 연구소의 6G비전 및 핵심기술을 공유합니다.**

'6G Global 2020' 행사가 온라인 생중계로 개최 되오니 많은 관심과 참여 부탁드립니다.

\* 온라인 링크는 개최 하루 전날 사전등록하신 분들에게 한 해 별도 안내 드릴 예정입니다

**참여기업 및 단체**

**EVENT 1 사전등록 이벤트**

- 사전등록하기
- 선착순 300분에게 기프티콘 발송

경품 커피 기프티콘 (선착순 300명)

**EVENT 2 분방시수 이벤트**

- 분방시수한다
- 분방 중 나오는 QR을 찍고 이벤트에 참여한다
- 당일 추첨을 통한 경품 증정

경품 1등 5G 스마트폰 (1명)  
2등 5만원 상당의 상품 (5명)  
3등 1만원 상당의 기프티콘 (20명)

**무료 등록**

\* 온오프믹스 사이트에 들어가면 등록하실 수 있습니다. (www.onoffmix.com/event/227897)

주최: 과학기술정보통신부  
주관: 5GForum, ETRI, IITP

### 붙임 고위급 참석자 현황(8명)

국가	사진	소속	직급	이름	직책
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Due to the Covid situation, the 2021 edition has not been scheduled.

ETRI and CEA will continue to share their joint vision on 6G:

- At IEEE ICC 2022, they will organize an industrial panel on beyond 5G/6G Non-Terrestrial Networks (accepted in the final program of the conference). Panel description:

In recent years, due to the development of innovative satellite launch vehicle technologies, the cost of launching and producing satellites has rapidly decreased. Consequently, a large number of operators have emerged to provide global communication services through low-orbit satellite clusters such as OneWeb, SpaceX, Project Kuiper, and Telesat. Also, the global market of unmanned aerial vehicles such as smart airlines, flying taxis (air taxis), and drones is expected to increase rapidly. The area of communication that provides Gbps grade internet service will be expanded to non-terrestrial networks (NTN) to support not only service enhancement and coverage extension on the ground, but also in a three-dimensional (3D) space and at sea. Therefore, terminals will be able to receive Gbps grade internet service anytime, anywhere. In order to provide such a service, B5G/6G NTN



technologies for providing communication coverage in the 3D space are required beyond the limit of a ground-oriented mobile communication service. It is expected that it will be possible to provide reliable internet services to various moving vehicles in the air and on the ground through integrated satellite and terrestrial network technologies. The integrated satellite-terrestrial networks leverage on various technologies to make the architecture of heterogeneous networks operationally effective as seamless service coverage, robust service supporting ability, and high-efficiency performance. New handover schemes to tackle frequent handover due to satellite movement will be developed. The improvement of beam management will be required for mobility of satellites and aerial vehicles, long round-trip time (RTT), wide beam coverage, and various beam types. Antenna technologies for LEO satellite payload will be crucial. Also, the support of mobile edge cloud and edge intelligence through NTN connectivity will be important.

- At EUCNC & 6G Summit 2022, hosted by CEA in Grenoble. ETRI is a member of the Technical Program Committee; Mr. Taesang Choi and Mr. Ilgyu Kim will respectively co-chair the Wireless, Optical and Satellite Networks and the Operational & Experimental Insights sessions.

Finally, dissemination of the results of the project will continue after the end, in particular with the writing, by all partners, and the submission of a paper describing the results of the final demonstration.

### **3 Plan to address stakeholders**

#### **3.1 Workshops**

GEM worked toward the diffusion and involvement of industry stakeholders and public raising their awareness of the opportunity of 5G satellite multi-connectivity. The activities mainly involved a specific action toward media, with our appearance on national media (both radio and television), a new set of new interviews with key informants, and the organization of two workshops targeting vertical stakeholders. In particular, GEM involved communities in the Alpine area for which the 5G opportunity represent an important opportunity for improving the base service offering. The first workshop was held online in May 2021 gathering more than 80 participants. The workshop gathered both researchers contributing to the development of 5G technologies, and business actors focused in understanding the economic and industrial benefits of 5G networks in vertical markets. The second workshop is planned for the end of 2021 and mainly targets an international and broader audience. GEM plans to invite multiple stakeholders, beyond those currently directly involved with the 5G-ALLSTAR project.

#### **3.2 Open-source tools**

The tools developed during the project will perpetuate its impact on the scientific community. The QUADRIGA channel simulator, based on MATLAB, has been enriched with the satellite component and made available as an open-source tool. This will accelerate and make more relevant the research trying to demonstrate the usefulness of satellite integration in the 5G standard.

A simulator allowing the evaluation of multi-RAT connectivity algorithms has also been created and made available in open-source. This will give the scientific community the opportunity to optimize the use of the satellite, making its use profitable for verticals.

### **4 Conclusion**

During more than three years of activity, 5G-ALLSTAR has been successful in achieving its goals, influencing both the 5G ecosystem and the beyond-5G (6G) ecosystem by identifying

key 5G enablers, defining a framework for the integration of terrestrial and satellite networks, and contributing to standardization activities and proposals.

In addition, a major position paper on the 5G-ALLSTAR vision of how non-terrestrial networks will integrate and support the evolution to 6G was jointly produced by Korean and European partners.

The 5G-ALLSTAR consortium effectively and proactively transferred knowledge about 5G technologies and beyond to the general public and press, verticals, telecom operators, academia, etc., and demonstrated 5G-ALLSTAR solutions and prototypes through several representative trials in a final intercontinental demonstration.

Thanks to active daily coordination work by ETRI and CEA, both sides of the consortium (from Korea and Europe) have learned to work together, cooperate, and have now established cooperation in scientific research, industrial activities, and standardization studies that will also continue after the end of the project, as evidenced by the joint organization of the EUCNC and the 6G Summit in Grenoble in 2022.