

ESOA



EMEA SATELLITE OPERATORS ASSOCIATION



ESOA Satellite Action Plan for 5G Standards

The Information, Communication and Technology industry is moving to a very exciting time with the development of 5G system which refers to the concept of a unified network infrastructure incorporating all access technologies (wireless, wireline and broadcast) to support the challenging service requirements of users and provide users with the best possible experience. This heterogeneous network will benefit from the integration of satellite communication solutions to provide service ubiquity, continuity, and scalability to 5G users.



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Satellites, in addition to terrestrial wireless and other communications technologies, will be an important part of the 5G network infrastructure.

Satellite communications will bring certain key features to 5G networks including:

Ubiquity	Satellites provide high speed capacity across the globe, no matter how remote.
Mobility / Resiliency	Satellites offer connectivity anywhere. Users on the ground and on moving platforms, such as airplanes, ships, trains and/or vehicles can therefore be reached either through terrestrial or satellite infrastructure or both simultaneously, based on Quality of Service criteria.
Broadcast / Multicast	Satellites 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.

Satellites can play many roles in the 5G system including:



Accordingly, including commercial satellite communications in the 5G network of networks infrastructure will provide users across the globe with many benefits, including added continuity, competition, ubiquity and resiliency of the communications network.

ESOA and its members are focused on ensuring that satellite communications be an important part of the 5G network of networks. The section below discusses how the 5G standards process can include satellite systems. As these standards are being developed and implemented, it is critical to identify the conditions to fulfill in order to ensure a smooth integration of satellite in 5G so that satellite solutions can become an increasingly important

part of the 5G ecosystem and deliver the expected value in terms of service ubiquity, continuity, scalability and resiliency.

Ensuring compatibility of satellite in the 5G value chain through the standards process

There is a long history of satellite communications and the use of standards. In the earlier days of operators deploying international telephony carriers over satellites, operators adhered to the Intelsat Earth Station Standards (IESS), ensuring compatibility among communications equipment and defined performance standards. Satellite communication then extended into private networks for intra-company, multi-facility corporations, plus direct-to-

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home TV broadcasting. Over the past two-to-three decades there has been a move away from international telephony carriers over satellite and a significant increase in private networks. During this time, each manufacturer designed their own system and networks for the individual enterprise. It was only with the success of direct to home satellite services, that the development of industry-wide standards for the satellite industry was seen as critical.

Following this, satellite communications system standards have been mainly developed in two standardization bodies – DVB and ETSI (European Telecommunication Standard Institute), as well as some other bodies such as the Telecommunications Industry Association (TIA) and to a limited extent the ITU. The satellite communications industry has been very successful at working in these bodies to obtain required standards. DVB, digital video broadcast, is an industry forum established initially to create a set of standards for the TV broadcasting industry via terrestrial, satellite or cable networks. The DVB technical specifications are published by ETSI. Within the ETSI, the Technical Committee Satellite Earth Stations and Systems is responsible for all aspects related to satellite earth stations and satellite communications systems, services and applications including fixed, mobile and broadcasting. This group has established liaisons with 3GPP. ETSI has defined several satellite radio interfaces including GMR-1, SL and GMR-2 families.

Over the past few decades, terrestrial mobile networks have significantly benefited commercially and globally from international standardization efforts, including in

3GPP, which has provided the capability to incorporate various protocols/features from other standards development organizations, including ETSI into the 3GPP standards. The benefits of this include significant economies of scale, leading to CAPEX and OPEX reduction for operators, devices cost reduction for subscribers, and greater availability of terrestrial equipment in the market. In contrast, satellite has relied on the DVB and other technical specifications that are insufficient to preclude some proprietary features at architecture, protocol stack and radio access levels, so that basic satellite access network interoperability between different solution vendors often remains difficult.

Hence, the recent approach followed by the commercial satellite communications industry has led to loose integration with the cellular system, a fragmented satellite communications market with no or little interoperability between vendors' equipment and in most satellite communications systems the terminals provided by a small number of companies. In a 5G network of network world, this is not sustainable if satellite operators want to be part of the ecosystem.

The 5G ecosystems, system architecture and radio access technology that are currently being defined provide a broad range of design flexibilities and capabilities to support a wide range of scenarios. It creates opportunities for many use cases where satellites solutions are needed (i.e., 3GPP TR 38.811 and 3GPP TR 22.822) and significant potential benefit to the satellite communications market, provided effective and timely standardization efforts are deployed by the satellite community.

The conditions for maximizing the successful integration of satellite into the 5G infrastructure are listed below:

- ▶ Interoperability of satellite network solutions with the 5G network management system allowing a third party (e.g., mobile network operator or service provider) to manage and configure the satellite network resources.
- ▶ Integration of the satellite communications system into the 5G core network to provide secure end-to-end 5G services to and through satellite terminals.
- ▶ Multi-vendor interoperability between elements (e.g., terminals, radio access networks – RAN -) of satellite network solutions for 5G.
- ▶ Technology commonality of satellite network solutions with cellular network solutions to benefit from an economy of scale allowing cost reduction and increased product diversity.

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For some commercial satellite communication operators, there is a focus on backhaul via satellite with the transport of 5G network interfaces (e.g., 5G CN-RAN). This will likely require the extension of 3GPP protocols primarily by adaptation of the satellite communication equipment to support the integration of satellite communications with the cellular network and requires the definition of interoperability tests with 5G terrestrial infrastructure.

With the development of 5G systems, satellite communications systems can leverage open standards to reduce the development, deployment and operational cost of terminals, as well as other satellite network infrastructure equipment such as gateways. This will make the inclusion of satellite network solutions into the 5G ecosystem much more economically attractive than if proprietary standards are followed. Further, this approach will facilitate a tighter operational integration (e.g., plug and play approach) into the 5G heterogeneous network to support vertical hand-over and/or multi-connectivity under common network management.

The on-going 5G standardization process provides a unique opportunity to insert satellite specific hooks as required. The commercial satellite industry has an opportunity to directly contribute to the development of 5G in order to integrate satellite communications.

This includes:

▶ Defining satellite communications protocols and functions extensions or amendments to enable satellite systems to support 5G at access or transport levels in single or multi connectivity set-up.

▶ Defining architecture and protocols for future satellite communications systems featuring high technology and interface protocols commonalities with the 5G system.

▶ Defining virtualized satellite network functions as well as software defined satellite networks featuring high scalability, reconfigurability and multi-tenancy/slicing.

▶ Test cases and procedures.

The 5G standardization process is on-going and will span over 3GPP Releases 15, 16 and beyond. The standardization process for satellite in 5G can take place in both 3GPP and ETSI in a phased approach, leveraging what is already defined for next generation cellular access and ensuring the inclusion of satellite-enabled features, bands, etc.

It is also anticipated that with the help of software techniques such as Network Function Virtualization, Software Defined Networking and network slicing, satellite network solutions will be able to support 5G features including multi-tenancy, reconfigurability, automation, scaling, etc. Therefore, it will be easier to integrate satellite communications into end to end 5G system for improved service delivery and/or network operations.

The commercial satellite communication industry is now fully engaged in the 3GPP process to define the necessary enablers for a full and seamless integration of satellite network solutions in the 5G system. Complementary activities will be carried out in other standardisation organisations such as ITU, ETSI and IEEE as needed. The intent is to define a set of specifications that will ensure that satellite solutions for 5G support multi-vendor interoperability, interoperate seamlessly within the 5G system and leverage 5G technologies and protocols as much as possible to benefit from the economy of scale of the 5G global market. These are the conditions to open new market opportunities for satellite network solutions and bring 5G users across the globe all the benefits of satellite communications.