GSOA response to Public Consultation on

the Draft RSPG Report on 6G Strategic vision

20 December 2024

Introduction

6G, also called IMT-2030, is the next generation of wireless communications that is expected to offer transformative advancements beyond the capabilities of 5G. 6G is to rely on the orchestration of different Terrestrial Network (TN) and Non-Terrestrial Network (NTN) technologies together extending the possibilities and efficiencies of existing connectivity solutions. Satellite communications will play a key role in the contribution of NTN to 6G.

As such, the RSPG consultation on the 6G Strategic Vision for Europe is an important initiative aimed at shaping the future radio spectrum policy needs, as new specifications for the integration of NTN and TN start emerging. GSOA noticed that the RSPG consultation addresses key aspects of how radio spectrum, a vital resource for wireless communication, should be allocated, regulated, and utilized to support the development of 6G systems.

As explained below, we expect the contribution of NTN by satellite to the 6G ecosystem to be manifold, as NTN is an umbrella of different applications. GSOA's input to this consultation will help for the adoption of suitable policies and regulations to enable satellite technologies to support a successful transition to 6G in Europe.

GSOA supports the need to identify spectrum bands for the first launches of 6G, and we urge the RSPG to consider the bands already identified by previous WRCs as well as legacy bands (2G, 3G, 4G, 5G), while ensuring the protection and continued operation of existing services.

NTN, a Key Element of 6G

The new and enhanced capabilities which 6G is to provide compared to 5G are clear from the IMT-2030 palette diagram which RSPG references in Section 4, Figure 3. Amongst these capabilities, Interoperability and Sustainability are considered essential, and the seamless integration of Satellite and Terrestrial will be essential to reach these objectives.

More specifically, and as mentioned in Section 6, the satellite component of NTN is to play a vital role in increasing coverage, reliability and security/resilience of networks for highly ubiquitous M2M/IoT and broadband solutions to users at fixed locations or in mobility.

The NTN satellite component of 6G will also rely on a large variety of satellite solutions, operating not only in Low Earth Orbit (LEO) constellations, but also at Medium Earth Orbit (MEO) and Geostationary Earth Orbit (GEO), as stand-alone platforms or in concert. Multi-orbit combinations, inter-satellite links, the integration of AI and quantum technology and other advanced features will equip next generation satellite (ground and space) systems to further contribute to the massive and secure distribution of data globally, and also respond to time-sensitive 6G applications like autonomous vehicles, industrial automation, and other immersive services, as identified for IMT-2030.

Additional details can be found in the GSOA whitepaper on New Satellite Technologies for Transformative Connectivity[1].

Use Cases & Spectrum Needs

Therefore, a large variety of NTN satellite use cases are envisaged to respond to 6G ambitions, each one subject to specific spectrum needs, such as (but non-exhaustively):

- Direct-to-Device (D2D): RSPG has clearly identified this role and the spectrum-related options (MSS or Terrestrial bands), based on GSOA's paper on Various Approaches to D2D Services[2]. We note from the report that *"the European Commission has requested RSPG to form an opinion on the EU-level policy approach to the use of satellite Direct-to-Device connectivity and related Single Market issues. The opinion is requested to assess different policy approaches covering both MSS and ECS (mobile) bands. RSPG is requested to deliver the final opinion on this matter in June 2025."*
- Connected Vehicles: NTN enables vehicles to stay constantly connected, providing features like real-time traffic updates, navigation assistance, remote diagnostics and software/firmware updates. Typical spectrum usage is in Ku or Ka band frequencies.
- In-Flight and Maritime Connectivity: Airlines and maritime vessels can leverage NTN to offer reliable, high-speed internet access on flights and shipping routes, allowing passengers to stay connected while in the air or sea. Typical spectrum needs are in C/Ku /Ka band frequencies, sometimes relying on multi-orbit configurations.
- IoT Applications for Smart Homes: With NTN, consumers can connect smart home devices, such as security cameras, thermostats and other intelligent digital appliances, even in areas lacking robust terrestrial internet. L/S/Ku/Ka band spectrum allocated to MSS or FSS is usable to this end.
- Access to Broadband Everywhere: Provide high-speed internet access to fixed rural, remote and other isolated locations lacking sufficient terrestrial

[1] https://gsoasatellite.com/reports_and_studies/new-satellite-technologies-for-transformative-connectivity/
[2] https://gsoasatellite.com/reports_and_studies/the-future-of-satellite-connectivity-various-approaches-to-direct-to-device-services/

infrastructure is an absolute necessity for 6G. Ensuring global and secure connectivity for online services, video streaming services and other data communications without interruption in all areas to remain attractive, for SMEs, aging populations, transient populations (migrants, holiday takers) will increasingly rely on NTN satellite solutions. Ku/Ka band FSS spectrum remains critical to this end.

- Supporting Smart Agriculture: Agricultural areas, particularly in rural regions, often face connectivity challenges that limit the adoption of smart farming technologies, which can improve efficiency and sustainability. NTN satellite technologies can provide farmers with reliable connectivity, enabling the use of precision farming tools that rely on IoT devices and sensors, while reducing the environmental impact of farming practices.
- Telecommunications Networks Backhaul: NTN by satellite increasingly serves as an effective backhaul solution for communications networks. To extend networks, improve capacity and ensure reliable connectivity even in remote or difficult-to-reach areas, it is sometimes the only viable option. FSS spectrum in C/Ku /Ka band frequencies have long proven to be suitable in this case.
- Disaster Relief & Emergency: Satellite systems most often provide the only means to restore communications in situations of natural disaster or for emergency plans (e.g. fiber outages, electricity blackouts), when terrestrial communications are seriously weakened or totally off. These NTN solutions will remain vital and rely on FSS access to C/Ku /Ka band frequencies.

GSOA members today are active in a number of standard bodies (3GPP, ATIS, ETSI, etc.) as well as in international bodies such as the ITU, CEPT to promote the role of satellite and NTN in 6G. A seamless integration between terrestrial and satellite networks is to play an essential role in enabling 6G global coverage and resilience.

We believe RSPG could more explicitly address the need for harmonized spectrum sharing between terrestrial and non-terrestrial systems to ensure interoperability and seamless handoff between the two types of networks.

Sustainability Challenges in 6G

RSPG rightly highlights in section 8.12 that discussions are focusing on energy efficiency, which is an indicator of sustainable ICT.

NTN can possibly contribute to the sustainability of 6G networks. In terms of energy efficiency and coverage: reducing the need for terrestrial infrastructure can be a key benefit of NTN, as they provide global coverage with (much) fewer installations on Earth. This may help reduce the overall energy consumption associated with extensive deployments of power-hungry terrestrial towers and cells.

While higher frequency bands in 6G are expected to increase power consumption, NTN can contribute to ensure that 6G remains energy-efficient and sustainable. By reducing

reliance on terrestrial infrastructure, and optimizing spectrum use, NTN satellite solutions can help mitigate some of the challenges posed by 6G's energy demands.

Additional spectrum related considerations

GSOA notes the discrepancy between mobile equipment manufacturer projections of "at least 500MHz per network" of new spectrum, and the MNOs' ask for 200 MHz. We also note that WRC-23 identified the 6425-7125 MHz band with associated conditions to protect existing services, for ITU Region 1.

GSOA would like to highlight its position on C- and X-band spectrum. Many countries rely heavily on C-band and X-band satellite services for critical applications, which in many cases cannot be provided reliably, or provided at all, by other means. Considering that studies conducted in the past have demonstrated that sharing between satellite services and IMT is not feasible without imposing the addition of heavy regulatory or technical constraints on satellite, GSOA supports a position of *No Change* in the C and X band spectrum considered under WRC-27 AI 1.7 (i.e. 4400-4800 MHz and 7125-8400 MHz).

GSOA further notes a reference to the 12.7-13.25 GHz band in section 9.1 of the RSPG report, as being considered in the US. GSOA strongly opposes this band being considered as a potential terrestrial 6G band in Europe as this band is a core satellite (FSS) band.

GSOA agrees with the general promotion of spectrum sharing as a core element of 6G. One example, as noted in RSPG's report, is the development at CEPT level of a harmonized technical framework for the use of low and medium power local area networks in 3800-4200 MHz, while ensuring the protection of incumbent services such as FSS, FS and other services in the adjacent bands such as radio altimeter. Although we generally agree with the objective of efficient spectrum usage, it is important to have clear guidelines and harmonized frameworks to enable a viable coexistence amongst all users. The limitation to low/medium power levels for local area mobile networks in the 3800-4200 MHz band, as well as the reliance on an individual licensing regime subject to coordination demonstrates that spectrum sharing can be complex and require careful planning by administrations. It also demonstrates that not all technology is suitable for spectrum sharing.

Although the RSPG report rightfully highlights that intra-spectrum sharing between mobile network operators (MNOs) is possible, this has historically not been feasible between MNOs and other services such as satellite. The introduction of high-power, high-density mobile services such as 4G/5G in occupied frequency bands was most often associated with a migration of other services out of the band, resulting in an actual failure to share spectrum. With increasingly limited spectrum resources, we therefore fully support putting the emphasis on spectrum sharing for 6G, as stated by RSPG.

More specifically, RSPG mentions the following innovation regarding intra-MNO sharing:

- « *Spectrum sharing between different services and technologies allows MNOs to dynamically allocate and share the same frequency spectrum between 4G and 5G. This*

has enabled MNOs to facilitate a faster roll-out of new technologies without the need for complex refarming of frequencies, allowing for an optimised utilisation of spectrum resources during the migration phase »

- « *Due to the ability to share spectrum resources on demand in real-time, complex refarming of frequencies is no longer necessary. While allowing a faster roll out of new technologies for customers with user equipment (UE) supporting the latest generation of mobile technologies, customers with legacy UE can still be served. This optimised utilisation of spectrum resources leads to a better overall user experience.* »

GSOA strongly recommends to further develop those innovations (e.g., Dynamic Spectrum Sharing or DSS) among different mobile generations to accommodate 6G in the lower mobile frequencies, considering that ECC has already harmonized more than 1 200 MHz of spectrum for mobile broadband in the frequency range from 694 MHz to 3.8 GHz[3], either for legacy mobile technologies (2G, 3G, 4G), for 5G or for 6G.

GSOA supports the EU needs to indicate in which spectrum bands the first launches of 6G are planned, and urges the RSPG to consider these frequencies, the best in terms of indoor penetration, nationwide-area coverage and Capex optimization for MNOs.

Conclusion

In summary, while the RSPG draft report on the 6G Strategic Vision provides a welcome NTN/TN holistic picture of tomorrow's communications ecosystem, the full potential and corresponding spectrum needs of NTN by satellite deserve more attention. These elements are critical for ensuring that 6G networks are truly global, seamless, and capable of delivering transformative capabilities.

GSOA is looking forward to further contribute to the RSPG's 6G vision and will wait for the 6G spectrum roadmap, due as a follow-up to this report.

GSOA is the global non-profit association of the entire satellite ecosystem that brings members together and serves as the premier platform for worldwide collaboration. As the world's only CEO-driven satellite association, GSOA takes the lead in addressing global challenges, seizing opportunities, and providing a unified voice for the satellite industry. GSOA is widely recognized as the representative body for satellite operators by international, regional, and national entities, including regulators, policymakers, standard-setting organizations like 3GPP, and international organizations such as the International Telecommunications Union (ITU) and the World Economic Forum (WEF).

[3] See https://cept.org/ecc/topics/spectrum-for-wireless-broadband-5g