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Telecom Regulatory Authority of India

Consultation on Terms and Conditions for the Assignment of Spectrum for Certain Satellite-Based Commercial Communication Services

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Introduction

Sateliot, founded in 2018, is the pioneering satellite operator to provide IoT (Internet of Things) connectivity via the 5G NB-IoT Non-Terrestrial Network (NTN) standard. As the first company to extend terrestrial mobile network operators' (MNOs) reach through satellite constellations, Sateliot acts as a critical enabler of seamless global IoT connectivity. Our business model focuses exclusively on the wholesale provision of satellite capacity to MNOs and IoT operators. Through GSMA-standard roaming agreements, we facilitate uninterrupted connectivity for commercial IoT devices, addressing the challenge of connectivity in rural, remote, and underserved areas.

We extend our sincere appreciation to the Telecom Regulatory Authority of India (TRAI) for the opportunity to provide feedback on this important consultation regarding the terms and conditions for the assignment of spectrum for satellite-based commercial communication services. The initiative is timely, particularly in light of India's growing digital economy, where seamless IoT connectivity will play a crucial role in supporting industries, improving rural connectivity, and promoting technological innovation.

Sateliot recognizes the importance of this consultation, not only to support a robust framework for satellite services but also to ensure that the allocation and management of valuable spectrum resources is done efficiently. Effective spectrum management is essential to avoiding resource underutilization, mandating satellite network operators (SNOs) to deliver or complement the connectivity needs of India, as well as promoting healthy competition in the telecommunications sector. Given the emerging demands for satellite-based connectivity, especially in rural regions, this consultation is vital for building a regulatory landscape that supports innovation while ensuring fair access to spectrum.

We look forward to continuing our collaborative efforts with TRAI and other stakeholders in fostering a regulatory environment that encourages growth, innovation, and sustainability in satellite-based communication services. Sateliot is committed to playing an active role in shaping this ecosystem by providing satellite IoT connectivity that complements India's digital and connectivity goals.

Sateliot's Answers

Q2. Types of Spectrum for MSS

2. Which frequency band(s)/ range(s) should be considered for the assignment to GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet service. Please provide a detailed response separately for the user link and feeder link.

When considering the frequency bands for assignment to Geostationary Satellite Orbit (GSO) and Non-Geostationary Satellite Orbit (NGSO) based Mobile Satellite Services (MSS) for providing voice, text, data, and Internet services, it is essential to recognize that the appropriate spectrum allocation depends on the specific use case and the type of service being delivered. The requirements for high-bandwidth applications such as broadband services differ from those for low-data-rate applications like IoT. As such, spectrum allocations must be carefully aligned with the specific communication needs of the service and the technical characteristics of the bands.

For more specialized applications like narrowband IoT (NB-IoT) services, particularly for satellite connectivity, it is crucial to consider spectrum that aligns with globally agreed standards. In the case of Sateliot, for instance, the S-band and L-band are particularly important for enabling IoT connectivity. The L Band (1-2 Ghz) and the S-band (2-4 GHz), designated by 3GPP for Non-Terrestrial Networks (NTN) as part of the 5G NB-IoT standard, provides the necessary spectrum for reliable and scalable IoT services via satellite. This ensures seamless integration with terrestrial networks and allows global IoT devices to operate without requiring modifications, which is crucial for large-scale IoT deployment.

Sateliot provides services exclusively through ITU-R-conforming MSS-designated bands, as defined by the 3GPP standards, and specifically operates in the NTN Satellite Band 256.

For clarity, the 3GPP 5G standard for NB-IoT in NTN specifies the following frequency bands, which are essential for the provision of 3GPP-based NB-IoT services in non-terrestrial networks (NTN)::

NTN Satellite Band	***Uplink***	***Downlink***	***Duplex mode***	***Space duplex***
255	1626.5 - 1660.5 MHz	1525 – 1559 MHz	FDD	101.5 MHz
256	1980 – 2010 MHz	2170 – 2200 MHz	FDD	190 MHz

These bands are crucial for enabling Sateliot's satellite-enabled IoT services, as they provide the necessary spectrum to ensure reliable communication and seamless integration with existing terrestrial infrastructure. The use of these bands allows for efficient spectrum sharing and coexistence, helping to maximize the utility of satellite services while minimizing potential interference with other users. As Sateliot continues to operate within these globally recognized bands, it helps maintain the smooth and cost-effective deployment of standardized 5G IoT solutions, which are particularly useful for industries that rely on low data rates and wide-area coverage.

The commercial opportunities presented by these spectrum allocations are vast. In agriculture, satellite IoT can help optimize water usage, monitor crop health, and improve resource management in underserved or remote regions, which is essential for improving the productivity and sustainability of India's agrarian sector. Similarly, in logistics, real-time asset tracking enhances supply chain efficiency and reliability, a critical factor in India's rapidly growing e-commerce and manufacturing sectors. Satellite

IoT solutions can also support public services, enabling efficient monitoring of environmental data, enhancing disaster management, and improving rural healthcare services through remote monitoring and telemedicine.

Furthermore, Sateliot strongly advocates for ongoing regulatory support for standardized solutions, particularly the 3GPP NB-IoT standard for NTN, which plays a pivotal role in expanding IoT connectivity via satellite. This standard allows a wide range of devices to connect seamlessly to both terrestrial and satellite networks without costly infrastructure modifications. Ensuring continued access to these bands will be essential for scaling satellite-enabled IoT solutions and fostering economic growth and innovation across industries that are key to India's development, such as agriculture, logistics, smart cities, and healthcare.

To promote competition and prevent the monopolization of spectrum resources, it is important that spectrum allocation policies cater to both narrowband and broadband operators. Sateliot's services, based on narrowband technology, require only minimal spectrum for full-service delivery and national coverage. For instance, just 1 MHz of spectrum would be sufficient for Sateliot to operate at full capacity, providing local mobile network operators with a competitive edge. Given that we operate within the S-band, specifically between 1980-2010 MHz for uplink and 2170-2200 MHz for downlink, there is a risk that regulators may allocate the entirety of these bands to broadband operators. Such an allocation could restrict market entry for new operators and reduce competition, limiting the options and benefits available to end-users.

To address this, Sateliot suggests that regulators allocate a small portion of this spectrum specifically for NB-IoT operators. In particular, we recommend reserving a 5 MHz block within the S-band for NB-IoT operators. This allocation would allow up to five different narrowband operators to enter the market, with each needing only 1 MHz to provide nationwide services. Countries such as Australia and Saudi Arabia have already implemented this approach, reserving 5 MHz within the S-band for IoT services exclusively, enabling up to five satellite operators to provide NTN NB-IoT services. Such a policy would encourage competition, drive down costs for end-users, and enable the deployment of innovative IoT solutions across sectors critical to India, such as agriculture, logistics, smart cities, and healthcare.

In light of the growing demand for IoT connectivity in these sectors, we recommend that regulatory policies in India prioritize the assignment of S-band spectrum to NB-IoT services, in line with globally recognized standards. This approach will support the future growth of satellite-based IoT applications and enable the flexible licensing models essential for fostering collaboration between terrestrial and non-terrestrial networks, furthering India's leadership in satellite connectivity and IoT innovation.

Q3. Maximum Period of Assignment

3. *What should be the maximum period of assignment of spectrum for - (a) NGSO based Fixed Satellite Services for providing data communication and Internet services, and (b) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? Please provide a detailed response along with international practice in this regard.*

For spectrum assignments related to MSS, particularly for NGSO systems such as Sateliot's Low Earth Orbit (LEO) constellation, the maximum assignment period should balance long-term operational stability with the flexibility to adapt to technological advancements. A period of 10 years is widely regarded as optimal for NGSO-based MSS. This is in line with international practices in regions like the United States and the European Union, where spectrum licenses for satellite services typically range from 10 to 20 years. For instance, the U.S. Federal Communications Commission (FCC) often grants satellite licenses for 15 years, providing operators with the stability needed to secure investments and maintain operations.

The 10-year period allows operators to deploy and maintain satellite networks with confidence, ensuring continuity of service while safeguarding their long-term investments. This period is sufficient for operators like Sateliot, which rely on complex satellite infrastructure, to offer reliable IoT services over their LEO constellation. Moreover, it gives regulators the flexibility to reassess spectrum use based on market changes and technological advancements.

In line with international norms, we recommend incorporating a renewal mechanism, allowing operators to apply for extension before license expiration. In addition, implementing a “use-it-or-lose-it” policy would also prevent spectrum hoarding, ensuring that spectrum is efficiently utilized. This policy is crucial to guarantee that operators make use of the spectrum allocated to them within a reasonable time frame, such as two years, to prevent spectrum hoarding. If an operator does not begin providing services within this period, the spectrum could be reallocated to other operators who are ready to deploy services. This approach aligns with Sateliot’s commitment to efficient spectrum use, ensuring that these valuable resources are actively contributing to the market, fostering competition, and ultimately benefiting consumers.

In conclusion, Sateliot supports a 10-year maximum period for spectrum assignments for GSO/NGSO-based MSS, which aligns with global standards. This period will provide the operational certainty needed for developing and maintaining satellite services while promoting competition and innovation in satellite communications.

Q4. Treating Every ITU Filing as a Separate Satellite System

4. *For assigning spectrum for NGSO-based communication services, whether every ITU filing should be treated as a separate satellite system? Please provide a detailed response along with international practice in this regard.*

As an NGSO MSS operator, Sateliot has diligently followed the ITU filing process, treating each filing as a separate satellite system and assuming priority dates as assigned. This is particularly important for NGSO operators like Sateliot because of the dynamic and complex nature of satellite orbital demand in an era of satellite systems proliferation. By adhering to the ITU's regulatory framework, Sateliot – like many other MSS and FSS system operators – ensures that differentiated filed systems are treated independently, which is crucial for managing spectrum usage, access to orbital resources, avoiding interference, and that securing global operational rights are respected.

Given that NGSO and GSO systems involve multiple system coordination process, the risk of interference with other networks is significant when attempting to work out the coexistence with multiple filings being part of a unique system. Each filing provides specific technical details, including orbital parameters and frequency use, which are critical in coordinating with other operators and avoiding conflicts in spectrum allocation.

The filing process also allows SNOs to manage their operational rights, value in market, as well as their obligations under international regulations, namely the ITU Radio Regulations. As a satellite operator, Sateliot understands that each system must comply with both ITU rules and national regulations across different regions, thus treating separate ITU filings as a unique system at the national level India, may contradict the ITU guidance.

Q12.Timelines for Processing the Applications for the Assignment of Spectrum

12. *Whether there is a need to prescribe timelines for processing the applications for the assignment of frequency spectrum for - (a) NGSO based Fixed Satellite Services for providing data communication and Internet services; (b) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? Please provide a detailed response with justifications.*

There is a clear need to prescribe specific timelines for processing applications for the assignment of spectrum for both NGSO-based FSS and GSO/NGSO-based MSS. This is particularly crucial for NGSO-based services, such as Sateliot's LEO constellation, where the lifespan of satellites typically ranges from 5 to 10 years. Any delays in the assignment of spectrum can result in the underutilization of valuable satellite resources, ultimately affecting service rollout and overall investment efficiency.

In the case of LEO constellations like Sateliot's, where the primary goal is to rapidly deploy satellite IoT services and extend connectivity to underserved regions, timely spectrum assignment is critical. Given the relatively short lifespan of LEO satellites compared to Geostationary satellites, a delay of several months in processing spectrum applications can significantly reduce the operational life of the satellite network. This not only leads to inefficiencies but also compromises the commercial viability and speed at which operators can provide innovative satellite-based services such as IoT connectivity for agriculture, logistics, and smart cities.

International practices often emphasize the importance of expedited spectrum assignment processes for NGSO systems. For example, regulators in countries such as the United States and European Union have defined timelines to ensure that spectrum is assigned within reasonable periods, reducing administrative delays and allowing operators to bring their services to market quickly. These practices reflect the need to balance regulatory oversight with market demand for faster service deployment.

Therefore, we recommend that specific timelines be established for the processing of spectrum applications, particularly for NGSO-based services. A processing window of 3 months from the date of application would be appropriate. This would ensure that LEO satellite operators like Sateliot can roll out their services within optimal timeframes, maximizing the operational efficiency of their satellite constellations and delivering on their promise to bridge connectivity gaps in remote and underserved areas.

Q18. Should spectrum charges for GSO and NGSO-based MSS that provide voice, text, data, and Internet services be levied: i. On a per MHz basis, ii. On a percentage of AGR basis, or iii. Through some other methodology? Please provide a detailed justification for your answer.

For spectrum charges related to GSO and NGSO-based Mobile Satellite Services (MSS) providing voice, text, data, and Internet services, both the per MHz model and the revenue-based model can be valid options, depending on the context and specific characteristics of each operator.

The per MHz charge model is appropriate as long as the prices are reasonable, as it aligns with global practices and ensures that fees are directly tied to actual spectrum usage, promoting efficient use. For operators like Sateliot, which use narrow frequency bands for NB-IoT services, this approach would ensure fair pricing and prevent disproportionately high fees that could hinder service deployment, particularly in underserved regions.

On the other hand, the revenue-based (AGR) model may be applicable in cases where satellite operators work in a business model partnership with Mobile Network Operators (MNOs). In this case, the satellite operator's revenue after the "revenue share" with the MNO could be a suitable basis for calculating charges, ensuring that costs are aligned with revenue generation without discouraging investment in lower-revenue areas.

Both approaches can be adapted according to market needs, always with the goal of promoting the rapid and efficient expansion of satellite services, in alignment with the country's connectivity objectives, without imposing an excessive burden on operators.

Closing Remarks

In summary, Sateliot is largely supportive of the steps TRAI is taking to enhance India's spectrum assignment processes for satellite-based services. These efforts reflect a forward-thinking approach to ensuring India remains competitive and adaptive in the rapidly evolving satellite and telecommunications sectors.

Sateliot remains committed to contributing to India's ongoing efforts to create a regulatory environment that promotes innovation, competition, and inclusivity in the satellite communications market. We are fully available to support TRAI in refining this framework and welcome continued engagement to ensure that satellite IoT services can thrive and enhance connectivity across India's diverse regions, especially in underserved and remote areas.

We look forward to further collaboration with TRAI and other stakeholders to unlock the full potential of satellite IoT services in India and ensure the country remains at the forefront of satellite communications innovation globally.

Sincerely,

Elisabet Fonalleras
Head of Regulatory Affairs
Satelio IoT Services, S.L.