Skylo Technologies, Inc / Skylotech India Pvt. Ltd
Response to TRAI Public Consultation on
Terms and Conditions for the Assignment of Spectrum for
Certain Satellite-Based Commercial Communication Services
October 18, 2024

Public Consultation	Terms and Conditions for the Assignment of Spectrum for Certain Satellite-Based Commercial Communication Services
Organization	Skylo Technologies, Inc. / Skylotech India Pvt. Ltd.
Email address	regulatory@skylo.tech
Phone Number	+1 650 459 0164
Representatives	Mindel De La Torre Natcha Techachainiran

Questions and Responses:

<table>
<tr><th>No.</th><th>Question</th><th>Response</th></tr>
<tr><td>Q1</td><td>Which frequency band(s)/ range(s) should be considered for the assignment to NGSO based Fixed Satellite Services for providing data communication and Internet service? Please provide a detailed response separately for the user link and feeder link.</td><td>-</td></tr>
<tr><td>Q2</td><td>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.</td><td>For user links:
Frequencies that should be considered for the assignment to GSO/ NGSO based mobile-satellite service (MSS) are:
<table>
<tr><th>UE Rx</th><th>UE Tx</th></tr>
<tr><td>1525-1559 MHz</td><td>1626.5-1660.5 MHz</td></tr>
<tr><td>2170-2200 MHz</td><td>1980-2010 MHz</td></tr>
<tr><td>2180-2200 MHz</td><td>2000-2020 MHz</td></tr>
</table>
Additional frequencies, which may be eligible for allocation now or in the near future:
<table>
<tr><th>UE Rx</th><th>UE Tx</th></tr>
<tr><td>2120-2160 MHz</td><td rowspan="2">2010-2025 MHz</td></tr>
<tr><td>2160-2170 MHz</td></tr>
<tr><td>1427-1432 MHz</td><td>1920-1960 MHz</td></tr>
<tr><td>1518-1525 MHz</td><td>1668-1675 MHz</td></tr>
</table>
Skylo encourages TRAI to include these bands for the assignment to GSO/ NGSO based MSS as soon</td></tr>
</table>

No.	Question	Response
		as practicable to increase the amount of spectrum available for Non-Terrestrial Network (NTN) 'direct-to-device' (D2D) services. Additionally, Skylo recommends ensuring that when allocating spectrum to MSS applicants, that there is room for an adequate number of MSS operators.
Q3	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.	(b) For GSO/ NGSO based MSS for providing voice, text, data and internet services, the maximum period of assignment of spectrum should be 20 years. If the assignment is for a new MSS system, then international best practice usually mirrors the assignment to the life of the MSS system with a presumption of re-assignment if the MSS provider is offering a significant and commercially available service to consumers.
Q4	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.	-
Q5	Whether the provisions of ITU-RR are sufficient to resolve interference related challenges and coordination issues? If not, what additional conditions should be prescribed while assigning frequency 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.	The provisions of ITU-RR have long been sufficient to resolve interference issues, however, as more systems rely on ITU-RR Article 4.4 and must operate on a non-interference basis, the risk of interference with existing systems operating consistently with the ITU-RR is increased despite the requirement to operate on a non-interference basis. Because the proliferation of NGSO D2D systems operating on a non-interference basis is very recent, there is very little international best practice so far. However, administrations that are allowing Article 4.4 MSS systems have all required that they operate internationally on a non-interference basis.
Q6	For satellite earth station gateways of different satellite systems operating in the same frequency range, whether there is a need to prescribe a protection distance or any other measures to avoid interference from each other– (a) Between the gateways of GSO and NGSO systems; and (b) Between the gateways of NGSO systems? If yes, please provide a detailed response along with international practice in this regard.	-
Q7	In case the spectrum assigned for satellite gateway links is also assigned to terrestrial networks such as Fixed Service, IMT etc., what protection distance or criterion should be included in the terms and conditions of the assignment of spectrum for satellite gateway links to avoid any interference to/ from terrestrial networks? Please provide a detailed response along with international practice in this regard.	-

No.	Question	Response
Q8	In case the spectrum assigned to the satellite user link is also assigned to terrestrial networks such as Fixed Service, what criterion should be included in the terms and conditions of the assignment of spectrum for satellite user links to avoid any interference to/ from terrestrial networks? Please provide a detailed response along with international practice in this regard.	Some criteria can be included in the terms and conditions of spectrum assignment for satellite user links, e.g.: 1. Power Limits and Emission Control: Define maximum permissible power levels and out-of-band emission limits for satellite user links and terrestrial services to ensure compatibility between both services. 2. Guard Bands: Assign guard bands or specific frequency separations to reduce adjacent band interference between satellite and terrestrial systems. These criteria can ensure that satellite user links and terrestrial networks can coexist without causing harmful interference.
Q9	Whether there is a need to prescribe any conditions to mitigate the risk of scarcity of satellite gateway sites? If yes, please provide a detailed response along with international practice in this regard.	-
Q10	In addition to the roll-out conditions recommended by TRAI for satellite-based Telecommunication Service Authorisation through its recommendations on the Framework for Service Authorisations to be Granted Under the Telecommunications Act, 2023 dated 18.09.2024, whether there is a need to impose certain additional roll-out obligations 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 along with international practice in this regard.	There is no need to impose additional roll-out obligations for the assignment of frequency spectrum, especially for mobile-satellite services.
Q11	Whether there is a need to introduce a provision for surrender of frequency spectrum prior to the expiry of the period of validity of spectrum assigned 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? If yes, what should be the process, and associated terms and conditions such as minimum period of spectrum holding, notice period, surrender fee, etc.? Please provide a detailed response with justifications.	There is no need to introduce a provision for surrender of frequency spectrum prior to the expiry of the period of validity of spectrum assigned and there should be no minimum period of spectrum holding and no surrender fee. Introducing a provision for the surrender of frequency spectrum prior to the expiry of the validity period could hinder innovation and discourage investment. The market for satellite-based data communication and Internet services is still evolving, with uncertain demand and revenue projections. A surrender option provides flexibility to adapt to these changes without being tied to underutilized spectrum and this can free up spectrum for innovative new technologies and services. Allowing operators to surrender spectrum

<table>
<tr><th>No.</th><th>Question</th><th>Response</th></tr>
<tr><td></td><td></td><td>before the expiry of their license without penalties promotes efficient spectrum utilization. This enables TRAI to reassign unused or underutilized spectrum to other operators who can utilize it more effectively, maximizing overall spectrum efficiency.</td></tr>
<tr><td>Q12</td><td>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.</td><td>Establishing clear timelines for processing applications related to the assignment of frequency spectrum is highly recommended as it promotes transparency, ensures accountability, and enhances the efficiency of regulatory procedures. However, if the applicant for the spectrum assignment provides a deficient application or asks to operate under ITU-RR Article 4.4, there should be a mechanism to allow for a pause in the timeline that does not recommence until the applicant addresses the deficiencies in its application or explains the corrective actions it will take under Article 4.4 if there is interference from its system. It should be up to the satellite operator to explain in a satisfactory manner how it will ensure compliance with ITU-RR Article 4.4 so that the Administration of India can continue to meet its ITU obligations under the RR.</td></tr>
<tr><td>Q13</td><td>Whether there are any other suggestions related to assignment of 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.</td><td>Additional frequencies, which may be eligible for allocation now or in the near future for MSS, should be considered and ultimately supported according to WRC-27 Agenda Item 1.14:
<table><tr><th>UE Rx</th><th>UE Tx</th></tr><tr><td>2120-2160 MHz</td><td rowspan="2">2010-2025 MHz</td></tr><tr><td>2160-2170 MHz</td></tr></table>
The growth and proliferation of ‘direct-to-device’ services allowing standard mobile handsets to essentially operate as MSS user terminals means that there will be an emergent growth in demand for MSS bands.</td></tr>
<tr><td>Q14</td><td>Should spectrum charges for NGSO-based FSS providing data communication and Internet services, be levied:
i. On a per MHz basis,
ii. On a percentage of Adjusted Gross Revenue (AGR) basis, or
iii. Through some other methodology?
Please provide a detailed justification for your answer.</td><td>-</td></tr>
<tr><td>Q15</td><td>In case it is decided that spectrum charges for NGSO-based FSS providing data communication and Internet services should be levied on a per MHz basis, should these charges be calculated based on:
i. The Department of Telecommunications (DoT) order dated December 11, 2023, or
ii. An alternative approach (please specify)?</td><td>-</td></tr>
</table>

No.	Question	Response
	Please provide a detailed justification to support your answer.	
Q16	If it is decided that spectrum charges for NGSO-based FSS providing data communication and Internet services should be levied on a percentage of AGR basis: i. What should be the appropriate percentage of AGR? ii. Should a minimum spectrum charge be specified to address the issue of inefficient utilization of spectrum? If yes, what methodology may be used to determine the amount of the minimum spectrum charge? iii. Is there an alternative approach that could be followed to address the issue of inefficient spectrum utilization? Please provide a detailed justification for your answers.	-
Q17	Considering the Adjusted Gross Revenue (AGR) based charging methodology currently followed for Commercial VSAT and in view of the enhanced scope of the Satellite service authorisation, what should be the spectrum charge, as a percentage of AGR, that should be levied on GSO-based FSS? Or, Should some alternative spectrum charging methodology be used for determining spectrum charges for GSO-based FSS? Please provide a detailed justification for your answer.	-
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.	Spectrum charges for GSO and NGSO-based MSS should be levied on a per MHz basis. Charging for spectrum on a per MHz basis is an efficient and transparent approach, since this method directly reflects the amount of spectrum being utilized by an operator. This creates a fair and transparent system where operators pay proportionally to their spectrum usage. It will also encourage operators to utilize their allocated spectrum efficiently. Operators are incentivized to optimize their network design and technology to maximize capacity within their assigned bandwidth. This method aligns with international best practices and it is widely adopted globally, particularly for satellite services.
Q19	If it is determined that spectrum charges for GSO/NGSO-based MSS providing voice, text, data, and Internet services should be levied on a per MHz basis, should these charges be calculated based on: i. The Department of Telecommunications (DoT) order dated December 11, 2023, or ii. An alternative approach (please specify)?	The spectrum charges could be calculated based on the Department of Telecommunications (DoT) order dated December 11, 2023. However, the license fee for wireless stations operating under satellite services should be imposed based on a per license basis instead of on a per station basis. This is especially important because as more and more devices with both

No.	Question	Response
	Please provide a detailed justification to support your answer.	terrestrial and satellite connectivity are brought to market, there will be more 'stations' (i.e., devices) that have connectivity through the NTN component but may not be using the satellite component nearly as much as the terrestrial component. Because Skylo's 'direct-to-device' (D2D) service is live across four continents, with more than 50 million square kilometers of coverage, Skylo has had a unique opportunity to assess regulations for D2D services in a wide range of countries. Because Skylo is a D2D Non-Terrestrial Network (NTN) service provider that powers end-to-end satellite service for phones, wearables and Internet of Things (IoT) devices using dedicated, licensed mobile-satellite service (MSS) L- and S-band spectrum and geostationary satellites, Skylo has found that often the same regulatory framework applies for D2D using MSS spectrum as for existing mobile-satellite services. The 'user terminal' is simply a standard smartphone or IoT device, as the case may be, allowing existing regulations for mobile-satellite service to perfectly cover the scope of D2D. Skylo encourages TRAI to adopt a light touch regulatory framework to allow all capable cellular devices to take advantage of D2D/NTN, by using a blanket license approach consistent with how terrestrial-only cellular devices are licensed today. In addition, because 3GPP standardized NTN devices will quickly become ubiquitous and will be in the same hand-held devices used for terrestrial cellular communications, we encourage the Government of India to not assess additional fees because these devices can provide both terrestrial cellular and satellite access. The public policy benefits of access to coverage anywhere for emergency, location-based, and messaging service when outside the coverage of terrestrial networks far outweigh any possible monetary benefit to the government from fees on satellite connectivity. One of the most important benefits for people and businesses in India is that D2D networks like Skylo's make satellite connectivity affordable, reliable, ubiquitous, and – most importantly – that it works from the same device that consumers have today. Because Skylo uses standardized cellular modems to connect to satellites, these services benefit from much larger economies of scale and therefore can be deployed into many more devices because of the lower cost compared to traditional satellite phones that are more limited in scale and therefore more costly. Additionally, by building to 3GPP standards, Skylo is fully interoperable with the terrestrial mobile ecosystem, allowing satellite and terrestrial mobile

No.	Question	Response
		services to operate no differently than standard roaming today. D2D services offer a crucial enhancement to connectivity across India, especially in areas where terrestrial networks fall short, and in geographies such as mountains or maritime where terrestrial networks are not economically viable. By providing reliable connectivity in vast regions with limited or no coverage, D2D services can significantly improve emergency and disaster response. D2D services also support IoT applications across industries like logistics, agriculture, fishing, shipping, energy and environmental monitoring, animal tracking, and enabling data-driven decision-making and operational improvements. These are all critically important sectors of India's vibrant economy, therefore Skylo encourages the Government of India to allow for the efficient deployment of a widespread proliferation of new devices. Skylo has seen an exponential increase in the take-up of its service and the interest in deploying Skylo's connectivity has skyrocketed with the recent introduction of Skylo in all Google Pixel 9 smartphones (https://www.skylo.tech/newsroom/skylo-connectivity-enables-new-satellite-sos-feature-on-google-pixel-9-series), and recent partnership announcement with Verizon (https://www.verizon.com/about/news/verizon-skylo-launch-direct-device-messaging-customers). Given these recent developments and the market opportunity for D2D services in India, Skylo is interested in providing D2D services in India as quickly as possible.
Q20	If it is decided that spectrum charges for GSO/NGSO-based MSS providing voice, text, data, and Internet services should be levied on a percentage of AGR basis: i. What should be the appropriate percentage? ii. Should a minimum spectrum charge be specified to address the issue of inefficient utilization of spectrum? If yes, what methodology may be used to determine the amount of the minimum spectrum charge? iii. Is there an alternative approach that could be followed to address the issue of inefficient spectrum utilization? Please provide a detailed justification for your answers.	It is important to distinguish between spectrum fees based on the number of MHz (or GHz) used versus a fee on an Adjusted Gross Revenue (AGR) basis. The two are very different mechanisms to provide revenue to the government and both are valid from a governmental perspective. However, it would be advisable that the two mechanisms not be conflated because of the distinct differences between the two approaches.
Q21	Whether there are any other issues/suggestions relevant to the spectrum charging for: i. NGSO/GSO based FSS providing data communication and Internet services.	As mentioned in the answer to Q19, the 'user terminal' may simply be a standard smartphone or IoT device, which allows existing regulations for mobile-satellite service to cover the scope of D2D. However, in most countries, there is no regulatory

No.	Question	Response
	ii. NGSO/GSO based MSS providing voice, text, data, and Internet services. The response may be submitted with proper explanation and justification.	framework for type acceptance or type approval of the actual devices, particularly for D2D, that are being deployed using 3GPP Release 17 NTN standards. This can create a delay in obtaining the appropriate licenses or equipment certification for the devices which are becoming available on a day-to-day basis. Therefore, Skylo encourages TRAI to adopt a light-touch regulatory framework to allow all capable cellular devices to take advantage of D2D/NTN in the equipment certification area.