BIF Response to TRAI CP on Licensing Framework for Satellite-based connectivity for low bit rate applications

About BIF

Broadband India Forum (BIF) functions as an independent policy forum and think-tank that works for the development & enhancement of the entire broadband ecosystem in a holistic, technology-neutral and service-neutral manner. BIF's endeavour is to promote, support and enhance all policy, regulatory and standards initiatives for the proliferation of high-quality broadband in the country to empower consumers with efficient and economical broadband to realize the true Digital India.

PREAMBLE

The proliferation of wireless sensors and devices and networks will extend well beyond urbanized and rural areas, where there is tremendous opportunity for satellite service providers to get in. For low bit applications, satellite connectivity opens a range of possibilities, which is perhaps not possible with terrestrial M2M connectivity solutions. Satellite operators can offer strategic advantages to traditional operators, especially for fields and applications that cross disciplines and borders, particularly in remote locations.

To keep up its position in the global market, India needs participation in the Satcom space both from the public as well as from the private sector. In fact, it is believed that vigorous private competition is needed here similar to that in the telecom sector, where it enabled huge customer benefits, market growth and drastic reduction in prices (much below the global benchmarks).

Another important issue is the lack of freedom for free market forces to operate, which will ensure direct negotiation between the buyer and seller (from approved/authorised satellites). This will enable healthy competition and better choice for the buyer, thereby helping bring down the prices and also improve quality of service.

The sector also suffers from the high price of satellite capacity which primarily stems from lack of adequate competition and lack of sufficient use of latest technologies viz. Ka band, High Throughput Satellites (HTS) as well as use of latest technologies like NGSO (Non-Geo Satellites viz. LEO/MEO/HEO, etc.) Technologies, flexible payloads, flat panel antennas, etc.

Many benefits can accrue to the Satcom sector if policy liberalisation, permission of interplay of market forces between buyer and seller, ease of doing business, simplification of licensing framework and rules and permission for infra sharing between the VSAT CUG services and the NLD services particularly in rural, remote and geographically challenging terrains are permitted.

It is necessary that DoT sets out a clear time frame for issuance of license and clearance for gateway and land earth stations. Currently these approvals take inordinately long time. In order to promote ease of doing business, it is urged that DoT and ISRO be asked to work together and specify a clear time frame of say 60 to 90 days for final clearance.

Reduction of NOCC charges, Spectrum Usage Charges and other levies too need to be reviewed. BIF has several times during earlier consultations, recommended that SUC may be brought down to cover the cost of administration which barely amounts to 0.1 or 0.2% of the AGR.

In light of the above backdrop, kindly find below our responses to the Questions of the Consultation paper:

Q1. There are two models of provision of Satellite-based connectivity for IoT and low-bit-rate applications — (i) Hybrid model consisting of LPWAN and Satellite and (ii) Direct to satellite connectivity. (i) Whether both the models should be permitted to provide satellite connectivity for IoT devices and low-bit-rate applications? Please justify your answer. (ii) Is there any other suitable model through which the satellite-based connectivity can be provided for IoT devices? Please explain in detail with justifications.

BIF RESPONSE

We are of the opinion that both the models are suitable for different use cases and can work under different environments. Satellite communication, because of its ubiquitous reach and better uptime, conceptually is best suited for IoT kind of applications. The present artificial barriers like antenna size, non-permission of land mobility, and restriction of service options in certain bands like L-band, S-Band, Ku/Ka bands should be removed and suitable regulations should be made to enable it.

IoT Networks based on typical deployment scenarios for mMTC, and URLLC analyzed in the 3rd Generation Partnership Project (3GPP) technical report[1] (1. **https://www.etsi.org/deliver/etsi_tr/138900_138999/138913/14.02.00_60/tr_138913v140200p.pdf)**

are intended to be implemented in smart cities, where the goal is to maintain continuous and ubiquitous coverage with high traffic loads. In this context, satellites could help alleviate the traffic congestion of terrestrial 5G infrastructure during peak hours by being able to broadcast large amounts of delay agnostic data. However, in urban environments, the satellite signals sometimes being blocked by the high density of buildings, result in considerable attenuation of the received signal. In such areas LPWAN+Satellite (2.. https://ieeexplore.ieee.org/document/8286975)may be suitably deployed.

A few features of the satellite-based solutions which are ideal for IoT traffic are as follows:
(i) Satellite networks can have global coverage allowing the IoT to be connected to remote locations, where terrestrial connectivity is not reasonably accessible either due to cost or terrain constraints.
(ii) The IoT ecosystem needs ubiquitous, resilient and seamless connectivity for the devices to run efficiently. Satellites, in conjunction with terrestrial services, have a proven track record of resilient services.
(iii) Satellite communications have broadband, narrowband and broadcast capabilities. Accordingly, the global network of satellite operations can support the needs of IoT devices with different bandwidth and capabilities.

Satellite Connectivity Models for Low-Bit-Rate Applications

There are at least two models for provision of satellite-based connectivity for IoT and low-bit-rate applications:
(i) **Hybrid model consisting of LPWAN and Satellite** and
(ii) **Direct to satellite connectivity.**

These networks communicate with low-cost localized gateways to concentrate larger numbers of IoT devices in their vicinity, even thousands. But this limits the area of deployment as it is confined to the coverage of the gateway node on ground. The LPWAN technologies have been standardized by 3GPP. The LPWAN technologies possess several characteristics that make them particularly attractive for applications requiring low mobility and low levels of data transfer (100s of bps to several 100s of kbps).
Their main characteristics are as below:
• Low power consumption (to the range of nanoamp) that enable devices to last for 10 years on a single charge
• Optimized data transfer (supports small, intermittent blocks of data)
• Low unit device cost
• Simplified network topology and deployment
• Improved outdoor and indoor penetration coverage compared with existing wide area technologies •Secured connectivity and strong authentication
• Integrated into a unified/horizontal IoT/M2M platform, where operators have this in place
• Network scalability for capacity upgrade.

Some LPWAN technologies suitable for IoT are LoRa, Sigfox, LTE-M or NB-IoT. These are specifically designed to share the properties of WPAN and cellular networks, i.e., low power and long range (more than 10 km). The NB-IoT technology operates on licensed spectrum, which is a subset of LTE Bands. On the other hand, LoRaWAN uses linear frequency modulation in the unlicensed frequency range in sub-1 GHz band. For example, it operates on unlicensed 900 MHz ISM frequency band in South America and unlicensed 868 MHz ISM frequency band in Europe

Direct to Satellite Model

This type of architecture allows devices to directly communicate with the satellite without the need of any intermediate ground gateway. The satellite receives data from IoT devices and transmits the data to the ground station nearest to the device and the data gets stored in the application server for further processing. This model can be used for wide area sensor network with sensors spread over wide geographical territory. Myriota (an Australia-based startup), Hiberband Direct (a Netherlands based startup), Astrocast, etc., are some of the global providers in low-cost, low-power, secure direct-to-orbit satellite connectivity for the Internet of Things.

Direct-to-satellite is a more preferred solution in challenging scenarios such as: (i) During disaster or natural calamities in areas where fast deployments are required and not much hardware is available or possible to arrange; (ii) In areas where the devices are on the move, placement of a LPWAN node would not be economically viable and preferred; (iii) In areas where only a few devices are to be connected and therefore, a LPWAN node is not economically viable.

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CASE STUDY:3

(3https://www.inmarsat.com/content/dam/inmarsat/corporate/documents/enterprise/insights/Inmarsat%20Case%20Study%20-%20Smart%20Cities.pdf.coredownload.inline.pdf)

A pilot experiment was carried out in the Rwandan capital of Kigali, where the Inmarsat consortium is deploying a network of LoRa-based IoT devices (such as sensors in water resources), using satellite communications exclusively as the backhaul. In addition to illustrating the concept, the project will serve as a blueprint for the quick development of smart cities in areas where the terrestrial 5G infrastructures are not mature enough or need to be complemented (e.g., in temporary deployments for massive public events).

Q2. Satellite-based low-bit-rate connectivity is possible using Geo Stationary, Medium and Low Earth orbit Satellites. Whether all the above type of satellites should be permitted to be used for providing satellite-based low-bit-rate connectivity? Please justify your answer.

BIF RESPONSE

Yes –all of these satellites can be used as there are many developments taking place in each of these – mainly GEO and LEO satellites, which can help in Satellite communication in general as well as for IoT applications.

Low-Bit-Rate Applications or IoT applications require low power, low cost and small size terminals that can effectively perform the task of signal transfer with minimum loss. The selection of satellite orbit depends on the requirements of the IoT application. Satellite orbits can be generally categorized as GEO (Geostationary Earth Orbit), MEO (Medium Earth Obit) and LEO (Low Earth Orbit).

LEO satellites are small satellites located at 500–1500 km from Earth and weigh <10 kg. They orbit the Earth multiple times a day (orbital time period — 10 to 40 minutes). **GEO satellites**, on the other hand, are traditionally heavier satellites (weighing <10,000 kg) positioned at an altitude of more than 35,786 km from the Earth, resulting in a propagation delay of approximately 250ms (500ms for the round the earth orbit -once in every 24 hours)**. MEO** is the space between GEO and LEO. Compared to GEO satellites, MEO satellites are much easier to manufacture and to launch. LEO satellites have very low latency and low atmospheric path loss as compared to GEO and MEO satellites. However, the cost of operation for LEO satellites is more as compared to MEO and GEO satellites, due to inherent requirement of a greater number of satellites for LEO constellation. MEO and GEO satellites provide efficient density of coverage in comparison to LEO satellites.

CubeSats are also IoT specific satellites. Owing to their limited power, costs and small size, they can be launched into Low Earth Orbit for remote IoT applications making satellite communication more economical and technically feasible. New CubeSats technology can be used in the range of UHF, VHF, S-band and Ku-bands to bring down the recurring service costs. CubeSats often use Binary Phase Shift Keying (BPSK) as a modulation technique because of its simplicity and robust performance compared to other modulation techniques. In spite of the limitation in amount of data that can be communicated using BPSK modulation, it is a suitable modulation technique for remote IoT applications as many of the IoT applications are required to send only small status update messages at periodic intervals.

(i) GEO Satellites Enabling IoT Applications

GEO satellites appear to be stationary when seen from a fixed point on Earth. They are very valuable for the applications that do not require near real-time connectivity as they provide more coverage in such situations when compared to LEO satellites that are continuously moving. GEO satellites can also be a good choice for the hybrid approach, where terrestrial networks can do data collection and satellites serve as the backhaul. Due to their large distance from the Earth, the communication through GEO Satellites suffers from a major propagation delay which may limit their use for the IoT applications. To avoid this, large terminal antennas are required for increasing gain, directivity and for mitigating potential interference from the adjacent satellites. Further, a fixed number of satellites can be operated in the GEO orbit due to limited number of orbital slots. There are many organisations which use GEO satellites for IoT/M2M connectivity like Eutelsat

(European Organisation of Telecommunications by Satellite S.A.), Intelsat, Inmarsat, etc. Eutelsat offers GEO-based IoT services with transfer speeds up to 1 Mbps in the satellite-to-ground communication (download) and up to 128 kbps in the opposite direction (upload) Inmarsat also uses ultra-reliable geostationary L-band network globally to connect mission-critical applications. Eutelsat and Inmarsat provide M2M services for applications with stringent timing requirements normally associated with massive synchronization of sensors and other devices. BGAN M2M, IsatM2M and IsatData Pro (IDP) are different M2M / IoT services being provided by Inmarsat using GEO satellites.

[5]GEO satellites provide high-bandwidth and high-reliability. Furthermore, a single GEO satellite can broadcast communications over wide areas, including remote rural zones where terrestrial infrastructure is unavailable. However, they are not suitable for applications that require a low latency, as the altitude of GEO satellites above sea level is about 36,000 km, and therefore the propagation delay from the satellite to the earth is budgeted at approximately 125 ms.4 (4.https://www.mdpi.com/1424-8220/20/2/475/htm)

(ii) NB-LEO Satellites Enabling IoT Applications

LEO satellites are deployed closer to the earth's surface and are much smaller than GEO satellites. Communication enabled by LEO satellites reduces path loss, requires less terminal power and needs less antenna directivity and antenna gain. These characteristics are well-suited for designing an IoT application around low cost, low power, low latency and small size terminal solutions. Unlike GEO, the LEO satellites move speedily in reference to the Earth's ground surface and have small ground coverage in comparison to GEO. The continuous motion of LEO satellites poses a challenge in smooth signal transmissions for IoT applications and in forms of increased number of handoffs from one satellite to another for seamless connectivity. Hence, they require relatively dense constellation of satellites to ensure that any particular ground terminal is always covered by at least one LEO satellite of the constellation. Therefore, global commercial deployments usually consist of more than a hundred satellites. For example, One Web, Kepler, Telesat and Starlink constellations have planned 650, 140, around 300 and between 12000–42000 satellites, respectively.

IoT applications leveraging LEO satellite communications require steerable antennas with designs optimized for specific use cases. Few other complexities with the use of LEOs are as below:

- There is a need for developing techniques to manage complex frequency synchronization with large number of LEO satellites in the orbit.
- Antenna technologies and increased number of ground gateways will be required for the LEO ecosystem, which will add to the overall cost.

While there are developments on the Broadband LEO satellites like OneWeb, Starlink, Telesat etc., which will provide bandwidth in Gbps, there is equal development on the Narrowband satellites specific for IoT usage in multiple bands starting VHF, L-band, S-band, Ku to Ka band. These are called NB-IoT satellites.

Some of the organizations currently using NB-LEO satellites for IoT/M2M connectivity include Iridium, ORBCOMM, Globalstar, Kleo, Myriota, Helios Wire, Swarm Technologies, Fleet Space Technologies and Kepler Communications. Other operators having LEO satellite constellations are OneWeb (which is partnering Bharti Group and has confirmed its operation in India by early 2022), Telesat and Starlink. Some startups, such as, Myriota, Beijing Commsat Technology Development Co. Ltd. (Commsat), are also implementing a constellation of LEO satellites with a network of global gateway stations and a range of user terminals to provide IoT connectivity.

(iii) <u>MEO Satellites Enabling IoT Applications:</u>

MEO satellites are located at an altitude of 2000 km to 35,786 km. They have wider service coverage area and longer orbital time period as compared to LEO satellites. They have the advantage of lower path loss and are less costly, lighter and have less latency as compared to GEO satellites. However, they also have a drawback that their location keeps on changing with respect to a point on earth. Hence, they give rise to a highly time variant communication channel and therefore need steerable antennas. A suitable antenna design is necessary for maintaining synchronization with the MEO satellites. The SES O3b ('Other 3billion', referring to the world's population which do not have network uses MEO constellation for IoT applications. The MEO satellite constellation orbits at approximately 8,000 km above the Earth's surface which is less than a quarter of the altitude of GEO satellites.

^6LEO and MEO satellites can deliver delay-sensitive services due to their lower orbit altitude, and the signal losses in the radio link power are also smaller for the same reason. Unlike GEO satellites, which remain static to the ground stations, LEO and MEO satellites move at a higher speed, completing their orbits in a short time (about 100 min for LEO satellites). Therefore, they can avoid obstacles near the terminal that might otherwise hinder the communication. The downside is that a constellation of many satellites is required to ensure the global coverage of the Earth surface, increasing the complexity of the system. In addition, handover mechanisms are required as the satellite that disappears over the horizon must be seamlessly replaced with other to maintain the communication.5 (5**https://www.mdpi.com/1424-8220/20/2/475/htm)**

Q3. There are different frequency bands in which communication satellites operate such as L-band, S-band, C-band, Ku-band, Kaband and other higher bands. Whether any specific band or all the bands should be allowed to be used for providing satellite-based IoT connectivity? Please justify your answer.

BIF RESPONSE

All existing Satellite Frequency bands, as per the National Frequency Allocation Plan (NFAP 2018 and/or its latest revision) should be exploited to provide satellite services for IoT Connectivity. We would even suggest bands beyond the ones mentioned above in case there is a service possible on those.

The idea is to let the market decide on which is the best band for a specific IOT/M2M application depending on various factors associated to the bands like:

- Bandwidth requirement - narrowband or low-bit-rate applications can easily be supported by the lower bands, but for higher bandwidth applications higher bands may be better suited.
- Support for parabolic reflectors as part of the satellite terminal, for directivity gain, and the commercial viability due to those
- Availability of power to support RF amplifier requirements as part of the terminals
- Signal penetration through walls, if required
- Reliability and resiliency of a particular band in transmitting the data to the satellite

Possible frequency bands for Satellite-Based IoT Connectivity:

There are different frequency bands which are suitable for IoT connectivity such as L-band, S-band, C-band, Ku-band, Ka-band and other higher bands. All these bands are core frequency bands for satellite industry which are already in use today by many satellite systems.

L-band (1GHz–2GHz) is viewed traditionally as the preferred option for applications involving small amounts of data transfer. Inmarsat uses L-band satellite network as it offers the lowest latency and thus provides resilient and flexible solution for IoT applications. Ligado plans to develop satellite supported 5G services using its L-band spectrum. Another service provider – Thuraya, offers L-band based low-bit-rate services in UAE.

S-band (2GHz–4GHz) can also be used for satellite data transmission owing to its advantage of easy transmission even during rain or adverse weather conditions. This ensures strong service without interruptions. For IoT services, S-band transmission is a cost-effective transmission frequency band compared to other methods.

With reference to S-Band that are currently operational on GSAT in India are:

- Indian Railways, one of the largest Railway network in the world is using S-Band network for Real time tracking of trains (narrow-band/IoT communication). Over 2700 locomotives are equipped with Saankhya Lab's (India's own startup) S-Band modem and hub-side baseband equipment. The network is operational for over two years and has vastly improved the operational efficiency of Indian Railways.

- Vessel Tracking terminals developed by Saankhya Lab have been deployed for Coastal Security. Besides tracking, the Two-way MSS terminals enable Narrow Band data communication over S-band. Plans are afoot to operationalise an end-to-end Satellite network for shore-to-ship and ship-to-shore communication for over 2800 deep-sea fishing vessels for one of the coastal states in India

- Also Satellite Industry's First, Handheld S-Band Satphone terminal has also been deployed. Designed to fit as an add-on handheld device for COTS Smartphone, it supports voice, short messaging and narrow band communication and is currently used by strategic users.

Helios Wire, a Canadian startup, offers bi-directional communication using S-band spectrum (30 MHz). It brings together satellite network, terrestrial network, IoT and blockchain as an efficient value proposition for the growing demand of IoT use-cases. The company's LEO satellite constellation works in combination with the existing terrestrial networks including LPWAN and LoRa allowing actionable insights as a service. Other service providers like Globalstar (US), Iridium (US) also use S-band to provide low-bit data-rate services.

Some of the LEO satellite constellations work in combination with the existing terrestrial networks including LPWAN and LoRa allowing actionable insights as a service.

The C-band frequency range (4GHz–8GHz) has been considered optimal for satellite broadcast operations as it enables lower cost per megabit compared to other frequencies and also offers less signal susceptibility to the effects of rain and interference from other climate related factors, including sea spray in rough conditions. This band is also used for weather radars, the 802.11a version of Wi-Fi devices and Radio LAN in the 5 GHz range. Satellite network operators Intelsat and SES are two key providers of C-band space capacity. Other operators authorized to use portions of the C-band include ABS Global, Eutelsat, Globalstar, Leidos (providing RNSS only), New Skies Satellites and Telesat Canada18.

The Ku-band frequency spectrum (12–18GHz) is a more economical and flexible means for obtaining a high throughput on smaller reflector dishes due to its wider capacity and high availability. Eutelsat Communications Paris has launched satellite based IoT connectivity service named as 'Eutelsat IoT FIRST' operating in Ku-band via Eutelsat's geostationary satellites.

The Ka-band (26.5GHz–40GHz) satellites' architecture is such that it creates overlapping coverage which has opened up the possibility of using smaller antennas on board while still maintaining a strong link. However, Ka-band networks are much more susceptible to rain fade – where moisture and humidity can interfere with the signal. Ka-band service for mobility applications requires a tracking antenna. It is used for satellite broadband by Hughes and Viasat.

[7]L-band has traditionally been viewed as the preferred option for narrowband connectivity, due to the small amounts of data transfer and, hence, low airtime charges. Ku-band, however, will play a growing role as the M2M and IoT phenomenon gains momentum and when the price points for the user devices come down.6 (6.https://tsat.net/wp-content/uploads/2016/07/Satellite-IOT_SM_Mar2016.pdf)

Q4 (i) Whether a new licensing framework should be proposed for the provision of Satellite-based connectivity for low-bit-rate applications or the existing licensing framework may be suitably amended to include the provisioning of such connectivity? Please justify your answer. (ii) In case you are in favour of a new licensing framework, please suggest suitable entry fee, license fee, bank guarantee, NOCC charges, spectrum usage charges/royalty fee, etc.

BIF RESPONSE

BIF is of the opinion that all extant licensing frameworks may be permitted to provide all services without any restriction. However, we would prefer development of a common and simple licensing framework for satellite connectivity, wherein all kinds of satellite-based connectivity solutions should be available under a single authorization.

It is our understanding that the current scope of Global Mobile Personal Communication by Satellite (GMPCS) permits all types of services including IoT.

The Commercial VSAT service authorization could also possibly be considered for such kind of authorization. The words CUG and VSAT may be removed and replaced with "Satellite". Essentially the authorization may be termed as "Satellite service authorization". This would boost the effective utilization of existing infrastructure, and avoid duplicity of creation of similar infrastructure, which can lead to cost reduction of satellite-based services. Using the satellite service authorization, it should be possible to provide voice, data & video applications to both end customers and other service providers, who are licensed/registered by/with DoT. Service providers with satellite service authorization may also be permitted to provide services to the new UL M2M service providers. The satellite service authorization should be permitted to access satellites in L, S, C, Ext C, Ku, Ka and the Q/V bands that are allocated for satellite use by the ITU. The applications may be permitted to expand to provide access and backhaul.

Separately, the scope of VSAT operators should be enhanced as already recommended by TRAI vide its recommendations on 'Provision of Cellular Backhaul Connectivity via Satellite through VSAT Under Commercial VSAT CUG Service Authorization' dated 28th July 2020, wherein it recommended that the Commercial VSAT CUG Service provider should be permitted to provide backhaul connectivity for cellular mobile services through satellite using VSAT to the Access Service providers. The same applies to the Captive CUG Service Authorization as well.

More specifically – the Commercial and Captive CUG Service Authorizations should:

- No longer be restricted to provide service to a CUG only – especially in light of the discussion in the CP around how IOT/M2M applications could go beyond a CUG
- Be allowed to operate IOT/M2M Services on L-Band, S-Band, and any other band
- Be allowed to operate IOT/M2M Services on GSOs and NGSOs
- Have a separate TEC IR/GR for such low-bit-rate service without any restrictions on the terminal size, network design and on the provisioning of such IOT/M2M services. This should also include the mobility of terminals for such applications – which should be distinct from the IFMC Service Authorization which delivers broadband access to mobile terminals.

IoT and M2M devices require connectivity to send the data to their application servers. IoT devices operate mostly on wireless connectivity as the number of devices is usually very large. The common terrestrial wireless network for IoT connectivity may be cellular networks operating in the licensed frequency bands and Low Power Wide-Area Network (LPWAN) operating in unlicensed frequency bands. TRAI in its recommendations dated 5th September 2017, on 'Spectrum, Roaming and QoS related requirements in Machine-to-Machine (M2M) Communications' has recommended that access service providers and LPWAN service providers may provide terrestrial wireless connectivity for IoT/M2M devices. However, for the remote areas where the terrestrial networks are not available or for such IoT devices which are on the move and frequently go out of reach of terrestrial networks, satellite-based connectivity plays an important role for providing crucial communication infrastructure. Satellite-based connectivity services are already being provided by various operators under the respective authorization of Unified License. Therefore, there is a need to examine and enlarge the scope of various authorizations of Unified License which permit provision of satellite-based services.

At the same time, it is necessary to relax certain requirements in relation to the terminals licensing to make the business case viable for IoT/M2M and to encourage the uptake of these services. For instance, IoT/M2M terminals are expected to be very large in number in many use cases, and imposing licensing fees per terminal would be a huge burden to IoT/M2M providers. Accordingly, we are of the view that enlarging the existing licensing framework that enables satellite services under all existing licenses and exemption of per terminal licensing fees in the particular case of IoT/M2M would be a suitable approach to make these services available to end users in a manner that will guarantee their success and rapid offtake.

Aspects under (ii) of this question have been provided/covered under response to Q12 below.

Q5. The existing authorization of GMPCS service under Unified License permits the licensee for provision of voice and non-voice messages and data services. Whether the scope of GMPCS authorization may be enhanced to permit the licensees to provide satellite-based connectivity for IoT devices within the service area? Please justify your answer.

BIF RESPONSE

In order to facilitate ease of doing business, there should be a simplified licensing framework which through a single authorization permits all kinds of satellite-based connectivity solutions to be made available. It is our understanding that the current scope of Global Mobile Personal Communication by Satellite (GMPCS) permits all types of services including IoT. The existing infrastructure, ground segment as well as space segment, may be effectively utilized to provide this niche service. By expanding the scope of GMPCS service authorization, it can be made more commercially attractive for providing IoT based connectivity.

It is also necessary that DoT sets out a clear time frame for issuance of license and clearance for gateway and land earth stations. Currently these approvals take inordinately long time. It is necessary that in order to promote ease of doing business, DoT and ISRO be asked to work together and specify a clear time frame of say 60 to 90 days, for final clearance.

GMPCS Service authorization envisages provision of satellite phone service. The scope of GMPCS Service authorization, as provided in Clause 2 of Chapter XII of Unified License, is as below:

Clause 2.1 *The licensee may provide, in its area of operation, all types of mobile services including voice and non-voice messages, data services by establishing GMPCS Gateway utilizing any type of network equipment including circuit and/or packet switches.*

Clause 2.2 *The Licensee shall establish Land Earth Station Gateway in India for the purpose of providing Global Mobile Personal Communication by Satellite (GMPCS) Service. GMPCS Service may be provided using one or more Satellite Systems provided that the Land Earth Station Gateway Switch is established separately in India for each Satellite System. The scope of GMPCS service includes voice and non-voice messages and data services. Therefore, GMPCS service provider may provide voice, SMS (text) and internet service (data services) on satellite phones using satellite system.*

It is understood that GMPCS Authorisation already permits all services including IoT.

Q6. Commercial VSAT CUG Service authorization permits provision of data connectivity using VSAT terminals to CUG users. (i) Whether the scope of Commercial VSAT CUG Service authorization should be enhanced to permit the use of any technology and any kind of ground terminals to provide the satellite-based low-bit-rate connectivity for IoT devices? (ii) Whether the condition of CUG nature of user group should be removed for this authorization to permit provision of any kind of satellite-based connectivity within the service area? Please justify your answer.

BIF RESPONSE

Yes. In order to facilitate ease of doing business there should be a simplified licensing framework which, through a single authorization permits all kinds of satellite-based connectivity solutions to be made available. The Commercial VSAT service authorization may be considered for such kind of authorization. It will boost the effective utilization of existing infrastructure, and avoid duplicity of creation of similar infrastructure, which can lead to cost reduction of satellite-based services. As already recommended by TRAI while enhancing the scope of VSAT operators on 'Provision of Cellular Backhaul Connectivity via Satellite Through VSAT Under Commercial VSAT CUG Service Authorization' dated 28th July 2020, wherein it has recommended that the Commercial VSAT CUG Service provider should be permitted to provide backhaul connectivity for cellular mobile services through satellite using VSAT to the Access Service providers. By virtue of such a recommendation, it has already suggested removal of the CUG nature of the user group, thereby permitting more liberal usage of the existing authorisation.

More specifically – the Commercial CUG Service Authorizations should:

- No longer be restricted to provide service to a CUG only – especially in light of the discussion in the CP around how IOT/M2M applications could go beyond a CUG
- Be allowed to operate IOT/M2M Services on L-Band, S-Band, and any other band
- Be allowed to operate IOT/M2M Services on GSOs and NGSOs
- Have a separate new TEC IR/GR for such low-bit-rate service without any restrictions on the terminal size, network design and on the provisioning of such IOT/M2M services. This should also include the mobility of terminals for such applications – which should be distinct from the IFMC Service Authorization which delivers broadband access to mobile terminals.

Commercial VSAT CUG Service Authorization

The Commercial Very Small Aperture Terminal (VSAT) Closed User Group (CUG) Service authorization envisages to provide data connectivity service to Closed User Groups. The scope of Commercial VSAT CUG Service authorization, as enumerated in Clause 2.1 of Chapter XIV of Unified License, is as below: *Clause 2.1 (i) the scope of service is to provide data connectivity between various sites scattered within territorial boundary of India using VSATs. The* *users of the service should belong to a 34 Closed User Group (CUG). However, the VSAT licensee after obtaining ISP license may use same Hub station and VSAT (remote station) to provide Internet service directly to the subscribers and in this case VSAT (remote station) may be used as a distribution point to provide Internet service to multiple independent subscribers. (ii) Long distance carriage rights, granted for NLD, ILD and Access service, are not covered under the scope of this service. (iii) The Closed User Group Domestic Data Network via INSAT Satellite System using VSAT shall be restricted to geographical boundaries of India. (iv) the Licensee can set up a number of CUGs using the shared hub infrastructure. (v) PSTN/PLMN connectivity is not permitted.*

Data Rate, as specified in TEC Interface Requirements No. TEC-IR/SCB-08/02-SEP.2009, is allowed, subject to the compliance of the Technical parameters as specified in TEC Interface Requirements No. TEC-IR/SCB-08/02-SEP.2009, as modified from time to time. The scope of the Commercial VSAT CUG service authorization currently includes provision of data connectivity between various sites. However, the user should belong to a Closed User Group. **Therefore, it is already within the scope of Commercial VSAT CUG service authorization to provide satellite-based connectivity solutions. The satellite-based low-bit-rate connectivity for IoT devices may also be provided under the scope of this license. However, scope of services permitted under this authorization is to be made technology agnostic and data speed agnostic and more liberalised by removing the restrictions of the CUG.**

Currently, the Commercial VSAT CUG Service licensee is permitted to provide data connectivity solutions to a Closed User Group only. Even in CUG, the connectivity may be point to point for a single link or many links in single CUG. While envisaging satellite-based low-bit connectivity for IoT devices, there may be a CUG nature of user or it may be a non-CUG also. It will depend upon the architecture being followed by the IoT provider who will obtain the satellite-based connectivity to its IoT devices through satellite.

VSAT is a specific technology through which the data connectivity solutions are being provided under this authorization. Provision should be made to permit use of any other latest technology to provide data connectivity solutions and for any speed denomination. Satellite-based IoT connectivity required in the hybrid model (LPWAN + Satellite) can easily be provided by the Commercial VSAT CUG service providers using the existing infrastructure of ground segment and space segment. For direct-to-satellite connectivity, the antenna size and the technology used may be different from VSAT technology. This will require a liberal approach in prescribing the technology or antenna size. Requirement of 'antenna on moving platform' will also be needed to be considered under VSAT authorization. TEC's Interface Requirements (IR) too, as mentioned in the scope of service, need to be revised accordingly.

Q7. (i) What should be the licensing framework for Captive licensee, in case an entity wishes to obtain captive license for using satellite-based low-bit-rate IoT connectivity for its own captive use? (ii) Whether the scope of Captive VSAT CUG Service license should be modified to include the satellite-based low-bit-rate IoT connectivity for captive use? (iii) If yes, what should be the charging mechanism for spectrum and license fee, in view of requirement of a large number of ground terminals to connect large number of captive IoT devices?

<u>BIF RESPONSE</u>

The Captive VSAT CUG service authorization may be considered for such kind of authorization for low-bitrate IOT/M2M services. It will boost the effective utilization of existing infrastructure, and avoid duplicity of creation of similar infrastructure, which can lead to cost reduction of satellite-based services.

More specifically – the Captive CUG Service Authorizations should:

- Be allowed to operate IOT/M2M Services on L-Band, S-Band, and any other band
- Be allowed to operate IOT/M2M Services on GSOs and NGSOs
- Have a separate new TEC IR/GR for such low-bit-rate service without any restrictions on the terminal size, network design and on the provisioning of such IOT/M2M services. This should also include the mobility of terminals for such applications – which should be distinct from the IFMC Service Authorization which delivers broadband access to mobile terminals.

Besides, the Captive CUG Service Authorization is ideally no different than the Commercial CUG VSAT Service Authorization – the only difference being that the end use of the entire network is for a single CUG. Logically the technology, network, terminal, carrier speeds and other technical parameters for the Captive VSAT CUG service should be the same as the Commercial VSAT CUG service. The TEC guidelines should also be the same for the two.

The only difference, if at all, could be in the Government levies – License Charges, Spectrum Fees, NOCC Charges etc. - in order to manage and monitor the Captive VSAT CUG.

It is definitely felt that the Captive VSAT CUG Networks have stopped operating ever since the Rs. 10,000 per terminal annual license charge has been levied. This seems excessive for a VSAT Network especially if the VSAT Terminal is going to be used for a narrowband service like the low-bit-rate IOT/M2M service. This license charge should be done away with entirely.

As mentioned in case of Commercial VSAT CUG service authorization in the previous question, the Captive VSAT CUG service license too will require certain changes and amendments, to enable the provision of captive data connectivity for low-bit-rate applications and IoT devices. The terms and conditions related to scope of service, technology used, antenna size, data bit rate, mobility of antenna, TEC's IR specifications, etc. need to be examined and reviewed. Further, as the annual license fee for captive VSAT license is Rs. 10,000/- per VSAT Terminal/Earth Station and expected number of IoT devices would be too large, the issue of license fee needs to be examined and a mechanism is to be developed for a reasonable license fee.

Captive VSAT CUG Service License

Organizations like State Transport Authorities, Indian Railways, other fleet owners, disaster management agencies, etc. may also need to setup a Captive network for their own use (and not for selling the service).

These Captive networks may be of the following two types:

- Government owned entities like Police & security Agencies/PSUs/boards
- Private companies.

Currently, the captive use of satellite-based connectivity is covered under the Captive VSAT CUG license. The scope of Captive VSAT CUG Service License is as below:

- The captive VSAT Closed User Group Domestic Data Network via INSAT Satellite System shall be restricted to geographical boundaries of India.
- Network will be used only for internal communication and non-commercial purposes of Licensee.
- Neither users other than Licensee shall be given access to the network, nor third-party traffic shall be carried on the network.
- The intent of this License is not to grant long distance carrier rights.
- The scope of the service is to provide data connectivity between various sites scattered throughout India using VSATs. However, these sites should form part of a Closed User Group (CUG).
- Captive VSAT service licensees can set up only one CUG for their own use.
- A maximum Data Rate up to 2 Mbps per VSAT for Star configuration and 4 Mbps for Mesh configuration (including all carriers) is permitted subject to the compliance of the Technical parameters as specified in TEC Interface Requirements No. TECIIR/SCB-08102 October 2013. The technical parameters mentioned in Interface Requirement for CUG Domestic VSAT Network namely No. TEC IR'SCB-08/02 Oct 2013 issued by T.E.C. are to be strictly compiled with. Any other notification or modification thereof issued from time to time in this regard shall be binding.

Q8. Whether the scope of INSAT MSS-R service authorization should be modified to provide the satellite-based connectivity for IoT devices? Please justify your answer.

BIF RESPONSE

BIF is of the opinion that since this authorisation is not in use currently, the service is no more live from ISRO (INSAT –MSS, no licenses have been issued under this authorization, this authorisation should be done away with. Other service authorisations are available whose scope should be enhanced (as requested) to cover the scope of its authorisation.

Q9. (i) As per the scope mentioned in the Unified License for NLD service Authorization, whether NLD Service providers should be permitted to provide satellite-based connectivity for IoT devices. (ii) What measures should be taken to facilitate such services? Please justify your answer.

BIF RESPONSE

Yes. Provision of satellite-based connectivity to IoT devices is well within the purview of the scope of NLD service authorization, subject to the licensee having a satellite Earth station in India in order to facilitate such connectivity. Ease of doing business by simplification and reduction of the SUC charges as recommended by TRAI must be implemented, as per details given below.

The scope of NLD Service authorization, as enumerated in Clause 2.1 of Chapter X of Unified License, inter alia, includes provision of Leased Circuit/Virtual Private Network services. Accordingly, NLD service providers may provide point-to-point bandwidth or point-to-multipoint bandwidth using wireline or wireless media including satellite-based bandwidth. Such bandwidth or connectivity can be provided for connecting IOT service provider aggregation location NLD service providers are already permitted to provide satellite-based bandwidth. However, the spectrum charges are very high as it is calculated on a formula basis involving the quantum of spectrum and number of terminals deployed.

Accordingly, in its recommendations on 'Provision of Cellular Backhaul Connectivity via Satellite Through VSAT Under Commercial VSAT CUG Service Authorization' dated 28th July 2020, TRAI has recommended the following in respect of provision of satellite-based bandwidth by NLD service providers: a) Replacing the existing formula-based mechanism, Spectrum usage charges for using satellite frequencies under the NLD service license/authorization should be prescribed as 1% of AGR excluding the revenue from the licensed services other than satellite-based services; and b) The NLD service licensees should be asked to do the accounting separation and maintain the revenues accruing from the satellite based services and other licensed services separately.

Q10. Whether the licensees should be permitted to obtain satellite bandwidth from foreign satellites in order to provide low-bit-rate applications and IoT connectivity? Please justify your answer.

BIF RESPONSE

The satellite systems, capable of providing connectivity to IoT devices, are operating in all the three orbits, that is, Low Earth Orbit (LEO), Medium Earth Orbit (MEO) and Geostationary Earth Orbit (GEO). These satellite systems are using various permissible satellite frequency bands viz. L-band, S-band, Ku-band, Ka- band, for providing the satellite-based bandwidth and connectivity. Under the GMPCS service authorization, the licensee is permitted to use any Satellite System (domestic or foreign satellite system) provided that the Land Earth Station Gateway Switch is established in India for each Satellite System. Under the Commercial VSAT CUG Service authorization, the required space segment shall be obtained by the Licensee from Department of Space (DOS) on INSAT satellite on terms and conditions as specified by Department of Space (DOS) from time to time.

Further, as per Flight and Maritime Connectivity Rules, 2018, issued by DoT on 14th December 2018, the In-Flight and Maritime Connectivity (IFMC) service provider shall be permitted to use either Indian satellite system or foreign satellite system capacity duly authorized through the Department of Space and the satellite gateway Earth station should be located within India. It is also mentioned that a spectrum neutral approach shall be adopted in satellite system being used for providing IFMC services.

From the above, it is quite evident that there are unnecessary restrictions in extant license conditions, which are against the spirit of liberalisation.

BIF has been advocating for liberalisation i.e., liberalised usage of both domestic and foreign satellites for past several years. TRAI too has been advocating an 'Open-sky policy' for several years and had made recommendations in 'Accelerating Growth of Internet and Broadband penetration' dated 29th April 2004, which clearly stated that "*An Open Sky policy should be adopted for VSAT operators and that VSAT service providers should be allowed to work directly with any international satellite*". This view was further reiterated by TRAI in its recommendations on 'Delivering broadband quickly: What do we need to do?' dated 17th April 2015. It was also recommended, inter alia, that "A decision on the recommendation of the Authority on 'Open Sky' policy needs to be taken in the next 6 months. This will allow TSP/DTH/VSAT operators access to International Satellite Operators. This is the only way forward if we are serious about delivery access to otherwise remote and inaccessible areas or those with difficult terrains."

As the satellite technology is evolving very fast, an important innovation in satellite technology is the increasing use of HTS (High Throughput Satellites) and NGSO satellites, which are amongst the latest state-of-the-art satellite technologies for connecting the unconnected. There is a requirement of a suitable regulatory framework for timely deployment and use of both HTS and NGSO systems. The satellite-based connectivity for IoT devices is possible through appropriate satellites in both GSO and NGSO satellite systems. It is, therefore, necessary that adequate satellite resources should be made available, either through domestic satellite systems or through approved/authorised foreign satellite systems, so that the telecom service providers/VSAT Operators may be given the desired freedom and choice to select the appropriate technology, satellite system and the desired bandwidth - without delay and at market competitive prices.

In conclusion, BIF is of the strong opinion that the licensed service providers may be permitted to obtain satellite bandwidth from any satellite - be it Indian or approved foreign satellite. This will foster a sense of competition between them and will help bring down the satellite bandwidth prices, thereby making satellite services affordable. It is also desired that all the 4 Service Authorizations discussed in this paper under the DOT UL, should be brought on par.

Q11. In case, the satellite transponder bandwidth has been obtained from foreign satellites, what conditions should be imposed on licensees, including regarding establishment of downlink Earth station in India? Please justify your answer.

<u>BIF RESPONSE</u>

Clear guidelines as regards procurement of bandwidth from authorised suppliers on existing satellite systems must be laid down which should be 'on par' with domestic satellite systems. This would provide a 'level playing field' to both the foreign satellite systems, provide the necessary and much needed choice to the customers (service providers), as well as permit interplay of market forces to enable better quality of services at affordable rates. We clearly urge the authorities to permit direct negotiations from approved/authorised satellites.

The licensee must be mandated to create the gateway in India for delivering the services, as is the current practice. This is important to ensure that there are adequate measures to ensure the security of the country. The gateways should be able to access capacities on Indian and foreign satellites.

Necessary rationalisation of the SUC (Spectrum Usage Charges) must be done to ensure that the services are enabled/facilitated and not restricted, as at present due to high imposition of levies. Other measures could possibly include nominal levy of license fees, doing away with the USOF component of the license fee once these services are being deployed in areas (viz. Rural and remote) for which USOF Component of levy are meant.

BIF is of the opinion that SUC must be rationalised. This should be in line with the existing TRAI Recommendations of March 2017 on SUC and P-AGR for ISPs & Commercial VSAT SPs, and in accordance with the NDCP guidelines for rationalisation of levies and spectrum charges.

Also, we support the move to migrate SUC for VSAT services from formula based to AGR based with a nominal percentage. DOT and the Service Providers can together work out a methodology for accounting/revenue separation for satellite based VSAT services. The current formula wherein the spectrum charges are directly proportional to the number of VSATs with same number of carriers and bandwidth is quite restrictive for the growth of Satellite based services in India, as it tends to penalise spectrum sharing, instead of promoting it. If at all the WPC needs to be adequately covered for their administrative efforts, then it should be based on a fixed fee per location which is in the order of INR 500 or INR 1000 per annum, rather than multiplying the spectrum by the number of VSATs. This formula-based approach is more than 90 times that of the AGR based charging and such a high cost of administration makes satellite based backhauls unviable. Secondly, the formula-based charging is an administrative nightmare. Every time even if a carrier is expanded or shrunk, it triggers a revision in the Decision Letter and WOL (Wireless Operating License) issued by WPC. As spectrum payment under the formula-based scheme is paid annually, reconciling any changes becomes extremely difficult.

Q12. The cost of satellite-based services is on the higher side in the country due to which it has not been widely adopted by end users. What measures can be taken to make the satellite-based services affordable in India? Please elaborate your answer with justification.

BIF RESPONSE

In order to make the satellite-based services affordable, the following need to be done amongst other things:

1. **Long term Bandwidth Agreements up to say 10-15 years**: If the capacity is hired from the satellite system for longer term period, the cost of satellite bandwidth will probably be lower than that for shorter contract periods.
2. **Providing choice to the VSAT operators to directly negotiate and execute agreement with the satellite operator** will also help in arriving at flexible commercial terms and making the satellite-based services affordable.

3. **Reduction of NOCC charges, Spectrum Usage Charges and other levies** too need to be reviewed. BIF has several times in its earlier consultations recommended that SUC may be brought down to barely cover the cost of administration. As taken from DoT's Annual Report, this works out to a fraction of 1% - approximately 0.2% of the AGR. TRAI too, in its earlier recommendations of 3rd October 2005 on 'Growth of Telecom services in rural India — The Way Forward' had recommended that for Commercial VSAT CUG service there should be a single rate of WPC fee (Spectrum Usage Charges) and the ceiling of 4% should be lowered to 1% to cover administrative charges only. Subsequently, TRAI reiterated its earlier recommendations that there should be a single rate of SUC and it should be only 1%, to cover the administrative charges vide recommendations dated 7th March 2017 on 'Spectrum Usage Charges and Presumptive Adjusted Gross Revenue for Internet Service Providers and Commercial Very Small Aperture Terminal Service Providers'. It was reiterated again in TRAI recommendations on 'Provision of Cellular Backhaul Connectivity via Satellite Through VSAT Under Commercial VSAT CUG Service Authorization' dated 28th July 2020.
4. In the recommendations dated 28th July, 2020, TRAI also recommended that the **NOCC charges should be rationalized and it should be independent of the number of carriers** assigned.
5. **Slab wise pricing**: The **bandwidth per unit price should go down with higher volume of bandwidth**. This will be possible when the VSAT operators are allowed to directly negotiate with the satellite operators and arrive at mutually agreeable commercial contracts.
6. In order to promote use of satellite technologies, the Government also needs to consider **reduction on custom duties & levies on satellite-based devices, user terminals and equipment** necessary for set up of gateway earth stations.
7. Satellite spectrum used in C, XC, Ku, Ka are all shared spectrum. In a shared spectrum, the same frequencies are shared by multiple service providers across different orbital slots. In such a case, the developed countries follow a principle of licensing the entire band rather than just spot frequencies, for a given orbital slot. This way, every time there is a change in spot frequencies due to augmentation of the network, the service provider does not have to go back to WPC. This, if followed, would make the process more efficient and drastically reduce overhead costs on both the service provider side as well as on the WPC side.
8. **Open up the choice of the frequency bands to the Service Provider**: This would allow the Service provider to choose the satellite capacity depending on the service requirements of reliability, resiliency, terminal type, QOS, SLA etc. rather than being forced to operate on the available bands in the inventory.
9. **Technical restrictions imposed through the TEC IR/GR for the VSAT Services – as well as the IFMC Service or even the low-bit-rate IoT/M2M service discussed here,**

should be removed. With the specifications being updated once only over 3-5 years (last update of Oct-2013, and the previous one of Sep-2009), exploiting today's satellite technology and resources that are available for use to their fullest, is not possible. The size of the terminals and speed denominations should be allowed for the Service Provider on the ground and the Satellite Operator to decide. In any case, the network design and network approval for any network gets cleared through the APEX Committee. Moreover, even after that the network needs a WPC Operating License and an NOCC Approval. All these approvals/permissions could be the checkpoints to ensure the network design is robust and would not interfere with others.

10. **Time to market the service should be reduced by simplifying the processes**. The cost of providing service today includes the cost of delays in getting the Apex Committee approval, getting the Capacity through DOS, getting the NOCC Clearance, WPC Operating License (assuming WPC's window to accept Satellite Capacity allocation requests is open) etc. This assumes that other permissions like WPC import License to get equipment into India, SACFA Clearance for the Gateway sites and the remote terminals, MPVT Certificate, LEA compliance etc. are obtained in a time-bound manner.
11. **Lowering licensing costs**: This can take the form of reducing the current complexity of the licensing journey and simplifying the overall licensing process, as well as reducing the direct licensing costs. It is necessary to mention licensing costs in relation to the terminals licensing to make the business case viable for IoT/M2M and to encourage the uptake of these services. For instance, IoT/M2M terminals are expected to be very large in number in many use cases, and imposing licensing fees per terminal would be a huge burden to IoT/M2M providers. Accordingly, we are of the view that enlarging the existing licensing framework that enables satellite services under all existing licenses and exemption of per terminal licensing fees in the particular case of IoT/M2M would be a suitable approach to make these services available to end users in a manner that will guarantee their success and rapid update.

In spite of the fact that cost of launching a satellite in India is the lowest globally, yet the licensing formalities, technical criteria, lack of 'Open Skies Policy' are significant barriers for the growth of satellite services in the country. The satellite services need to be made affordable for wider acceptability by price sensitive Indian industry and end-users.

Q13.Whether the procedures to acquire a license for providing satellite based services in the existing framework convenient for the applicants? Is there any scope of simplifying the various processes? Please give details and justification.

<u>BIF RESPONSE</u>

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To attract investment and new players in a sector, the most important characteristic is the 'Ease of doing Business'. The processes and permissions should be online, i.e., there should be minimum physical interface, well defined processes with specific timelines and transparency for clarity and ease of operations. There have been inordinately long delays reported in procurement of satellite bandwidth through the existing processes and there is an involvement of multiple agencies for seeking various clearances and approvals. It is requested that a single window time bound online clearance system be adopted for all kinds of satellite-based permissions.

Specifically, for setting up gateway earth stations, the satellite operators should be incentivised through a special spectrum fees formula since such an operation requires huge bandwidth and is assigned for particular location only.

BIF has always supported the recommendations made by TRAI as regards simplification of the processes and ease of doing business. For example, TRAI, its recommendations on 'Ease of doing business' in telecom issued on 30th November 2017, as well as in broadcasting sector issued on 26th February 2018, had recommended that the entire process of clearances, be it SACFA clearance or other approvals, as well as grant of all licenses and approvals that are issued by WPC and various other agencies, should be made paper-less. There should be a single-window clearance system available and executed end-to-end through an online portal.

Necessary rationalisation of the SUC (Spectrum Usage Charges) must be done to ensure that the services are enabled/facilitated and not restricted, as at present due to high imposition of levies. Other measures could possibly include nominal levy of license fees, doing away with the USOF component of the license fee once these services are being deployed in areas (viz. Rural and remote) for which USOF Component of levy are meant.

BIF is of the opinion that SUC must be rationalised. This should be in line with the existing TRAI Recommendations of March 2017 on SUC and P-AGR for ISPs & Commercial VSAT SPs, and in accordance with the NDCP guidelines for rationalisation of levies & spectrum charges.

Further, with the advent of High Throughput Satellite (HTS), it is not economically viable to have gateways separately for VSAT, NLD or for that matter, other services. The same also applies for the upcoming LEO/MEO constellations as well. Therefore, it would be prudent that resources be effectively shared among licenses. Also, we need to cater to a scenario where the gateways are operated by one service provider and the terminals/networks are operated by another service provider. This needs to be adequately addressed as far as the ambit of licensing is concerned.

BIF had also suggested that there should not be any barriers to the carrier speeds or antenna (dish) sizes. This will permit higher data rates which are now possible with advanced satellite technologies, without any restrictions.

The current procedures to acquire licenses/authorizations for satellite-based services in general are very complex with a large number of licensing stakeholders with whom an applicant shall communicate separately. This makes the licensing journey very lengthy, costly, and in some instances confusing. Reducing the number of entities involved in the licensing process and streamlining the overall licensing journey, together with ensuring a non-discriminatory access to domestic and foreign satellite capacity in a level playing field, will be very beneficial to the satellite market in India.

Q14. If there are any other issues/suggestions relevant to the subject, stakeholders are invited to submit the same with proper explanation and justification.

BIF RESPONSE

Note on Broadband through Satellites

Digital India entails broadband connectivity across the length and breadth of the country. While terrestrial connectivity (Mobile Broadband) is feasible and economically viable to deploy in urban areas, when it comes to rural and remote areas, especially those situated in geographically and topographically challenged terrains, the cost of providing terrestrial connectivity shoots up manifold making it economically unviable for terrestrial technologies to reach the last 20% of the population.

While Rural India remains starved of connectivity, there is little realization that a high amount of data bandwidth is going waste all over India from satellites. In such areas, Satcom is quick and economical to deploy as compared to terrestrial technologies. The huge challenge posed due to Right of Way (RoW) in providing terrestrial connectivity to these areas is overcome by Satcom. The present Broadband capacity available through satellite is inadequate to meet the current demand and there is a need to augment the current capacity manifold to meet the current and the potential future demand.

Many of the top economies of the world viz. US, China, Canada, Japan, Germany, UK, France, Italy, Brazil, etc. use Broadband from Communication Satellites. The USA, which is one amongst the most wired broadband countries with almost close to 80% fiberisation of towers, has one of the the highest rates of deployment of Satellite based broadband. India, with its huge geographic spread, inaccessible terrains, remote villages and huge challenges of Right of Way (RoW), needs Satellite broadband many times more than several of these named countries.

The table below shows the Number of Satcom Connections/Mn POP – Comparison of India vis-à-vis Other Developed Countries. We lag way behind the USA and EU, which, though highly fiberized countries, are far ahead of India in terms of number of Satcom users.

Satcom Connections/Mn POP –Comparison of India vis-à-vis Other Developed Countries

COUNTRY/REGION	TOTAL No. OF SATELLITE CONSUMERS (Direct Consumers) in Mn	TOTAL No. OF SATELLITE CONSUMERS (Enterprise Consumers) in Mn	TOTAL No. OF CONSUMERS (including Direct + Enterprise) in Mn	POPULATION in Mn	TOTAL No. OF SATELLITE CONNECTIONS per Mn POP	F I (I 1
US	2.1	2.6	4.7	330	0.0140	7
EU	1.0	1.1	2.1	450	0.0040	2
ASIA (incl. China, Japan, Korea & India)	1.4	1.6	3.0	4500	0.0006	3
INDIA	**NIL**	**0.3**	**0.3**	**1300**	**0.0002**	**1**

Source: NSR 2019 www.nsr.com & TRAI Subscription Data for India December 2019

Some of the **real-time based applications using Satellite for IoT** which could benefit India are as below:

Transportation

Transportation infrastructure is changing. The connectivity within the trucking industry, for example, is making things like fleet management more efficient. In public transportation, tracking and predictive capabilities are also on the rise. Internet of Things (IoT) is enabling applications like geo-fencing for military assets or smart inventory management in shipping.

With satellite connectivity and broadband, the newest generation of transportation-related IoT makes it possible for greater efficiency and fewer network breaks. For large fleet management, this type of stable connection ensures that all moving parts are accounted for.

Mobile Banking and Retail

Point of Sale connections work only with a robust connection to the network, and satellite communications is the driving force. Maintaining predictable and reliable connections for both security and operations is vital to expanding the industry beyond traditional borders and institutions.

Providing banking and retail capabilities to those without traditional access to such technology is another benefit of satellite connectivity. The scale of IoT demands access even in remote locations, which the satellite communication is equipped to handle most efficiently.

Sustainable Cities

With the real prize of reaching sustainable cities, satellite IoT has the potential to boost it from theory to reality. Deploying IoT throughout a smart grid to better manage energy and allocating resources could make smart cities not only possible but probable.

Effective implementation of IoT also enhances security. Satellite connections ensure that the infrastructure remains online by providing integration with terrestrial-based systems. Between the two, terrestrial and satellite communications, the latter provides a broader base of coverage to ensure there are no gaps.

Remote Assets

Consumer-facing IoT gets a lot of face time, but the real payload lies in using sensor networks to explore, monitor, and manage remote assets. Energy, natural gas and oil, and mining operations, among others, are exploring using sensors to maintain operations in geographically remote locations.

Energy and mining companies, in particular, are exploring these sensor networks to aid in exploration. Sensors can report conditions down to the minute with the right satellite networks, and data received could provide insights into new locations for operations.

Satellite Applications and Consumers

Satellite opens a range of applications for consumer-facing products as well. With wearables, for example, consumers suddenly have a range of services right on their bodies – from fitness data to secure purchasing and check-ins.

As consumers increasingly ask for more connected experiences with fewer glitches, satellites offer capabilities for true coverage with fewer issues. Speed and low latency are vital parts of the infrastructure of IoT deployment.

Satellites can also be a cost-effective way to handle the burgeoning numbers of IoT devices on the network. To find the real solution to deployment, satellite tech that can handle more requests while reaching even the most remote parts of the world (and with no interruptions in service) can help make global IoT practical.

Ease of doing Business

Following Points may also be considered and recommended from the Ease of Doing Business point:

1. **Time Delay in Getting Administrative Approvals**
   The first-time approval of a network should be done through the APEX committee. However, the APEX committee should act as a single-window for the entire set of approvals obtained by the licensees. Various formats can be prescribed for individual processing and the licensees can be made to make a consolidated application covering all the aspects of licensing. Today the APEX Committee decision is separately followed by getting approvals for Satellite Capacity and its allocation from DOS, NOCC Approval for the network, WPC Decision Letter that is converted to a WPC Operating license on completion of different conditions, SACFA Clearance for the Hub, Hub Antenna MPVT Certification, and LEA compliance. A lot of these permissions are needed each time new capacity is added on the network, even though it is on the same satellite and the same network. As with the NLD license and the UASL license for satellite operations, any additional augmentation of bandwidth should be dealt with by NOCC and WPC only. SACFA/WPC charges can be combined with the license fee and a demand can be put up together on a yearly basis, eliminating the need for multiple demands by the licensing cell and WPC. The process of adding of sites or bandwidth has to be executed in similar time frames as that of the commercial services. While the captive licenses use these services for more important and mission critical applications that involve citizen services to national security, the extraordinary delay in time taken and the number of multiple administrative agencies to which one has to approach, defeats the entire purpose.

2. **Liberalisation of the CUG License**
   Connectivity of a CUG VSAT Network to PSTN was not allowed back in the 90s, due to potential arbitrage opportunities. In today's era of Whatapp/Skype and VOIP calls, that argument is no longer valid. Enterprise applications that operate today in the cloud, are not a part of a closed corporate network or user group. These applications, even when operating in a classical Client-Server environment, permit Internet connectivity in a seamless manner with enabling technologies viz. Web Interfaces, VPN, Citrix, etc.

   In an earlier era, where most data was generated by an enterprise for its own operational purposes, a Closed User Group for the enterprise made a lot of sense. In comparison today, user-generated data through social media and apps is large enough for networks to address that. Moreover, the user-generated data may not necessarily be generated outside of the workplace as boundaries between the workplace and home/personal space are reducing. This makes the concept of VSAT networks being built only to address CUG data seem outdated.

Hence, we request the Hon'ble Authority to kindly consider review of the liberalisation of the CUG license in view of the emerging technology-based scenario.

3. **Permit Reselling of VSAT Services**
   More and more networks in India are required to have multiple technologies to cater to the complex needs of the customers, as is the trend globally. Considering the difficult terrains in the country, VSAT communication plays an important role in providing reliable connectivity solutions to the remotest parts of the country. Permitting reselling of the VSAT services will help in growth of the industry as a whole.

4. **Removal of Regulatory Barriers on Carrier Speeds**
   Globally the trends for Satellite based Cellular Backhaul is that it is not just used for 2G and 3G but also for 4G backhauls, and would be used in future for 5G backhauls as well. While the speeds needed for Cellular Backhaul in case of 2G & 3G are in the range of 2-4Mbps, for 4G they clearly need to be as high as 10-20Mbps, and the requirement for 5G is likely to go up even higher. Moreover, the architecture for supporting Cellular Backhaul is migrating from Mesh Networks (as defined in TEC specs) to a Star Network. However, as per the extant TEC IR Guidelines, the maximum carrier speed permitted in a Star configuration is 2Mbps and for Mesh configuration, it is 4Mbps. This obviously poses a limitation on supporting all types of Cellular Backhaul requirements in future.

   Today's satellites with their latest technologies provide a lot of connectivity options along with ample power and capacity resources. These need to be optimally exploited to provide the services at the right price points. Such technical barriers defeat the very advantage that new technology brings.

   It is hereby requested that such Regulatory barriers due to the TEC Specifications which impose artificial restrictions on the carrier speeds supported by VSAT terminals, should be completely done away with.

5. **Nominal levies (licence fee and spectrum usage charges) should be imposed to encourage use of** satellite connectivity for rural, remote & inaccessible areas, island communities, and other special requirements, etc. This can be the easiest method to encourage satellite based services, as compared to providing any subsidy or reimbursement for capex & opex of such services.

6. **Permission of interplay of free market forces**: Large satellite capacity from all possible sources should be permitted (indigenous satellite capacity as first preference is already stipulated for satellite services), so that tariffs can come down due to adequate competition.

7. **Remote terminal size**: As of now, as per TEC recommendation, the minimum antenna size is restricted to 1 meter. Considering the much more powerful satellites available, this condition should be relaxed to allow smaller size antenna within link budget calculations.

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