Hughes Response to TRAI CP on Licensing Framework for Satellite-based connectivity

for low bit rate applications

About Hughes

Hughes is the largest provider of satellite broadband to consumers, enterprises and Governments. Hughes has a mobile satellite division that powers some of the world's narrow band satellite networks like Globalstar, LightSquared, Thuraya, INMSARSAT, MEXSAT and other similar networks through its technology. Hughes has a very vast experience in the area of satellite IoT. Hughes is pleased to offer its comments to the Telecom Regulatory Authority of India's consultation paper on Licensing Framework for Satellite based connectivity for low bit rate applications.

PREAMBLE

Satellite connectivity has been the preferred connectivity option for providing broadband in the unserved and underserved areas of the world. Satellite connectivity has many different flavours. For broadband connectivity, satellite networks are deployed in the Ku, Ka bands. Satellite gateway stations today use Ku, Ka, Q & V bands for the feeder links. Satellite connections have been used for providing SCADA & M2M connectivity for many decades. Today satellite based IoT networks have become prevalent and are being deployed in a number of geographies. Satellite narrowband networks operate typically in the L & S Bands. Hughes has developed many such networks and has deployed the same for many service providers around the world. Such networks provide handheld voice, spot messaging, wifi connectivity among its services.

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.

Hughes is of the opinion that both the models are suitable for different use cases and can work under different environments

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 LPWA technologies have been standardized by 3GPP. The LPWA 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 LPWA 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 the 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 Australian-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.

However, many of the existing satellite networks are not commercially suitable for supporting millions of direct connections, which are required in IoT applications. For commercial applications that require numerous devices, it is desirable that the end device costs should be very low, they should consume very low power and should require very low maintenance. Many of the existing satellites may not be suitable for direct satellite to device connections. At present, only a few companies are looking to explore such direct satellite to device connections.

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.

Yes –all of these satellites can be used

Low-Bit-Rate 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. GEO satellites provide high density coverage and higher speeds of communication. They can also accommodate larger onboard antennas that can help reduce the size of terminals. On the other hand LEO/MEO satellites can provide wider coverage and lower latency that is suitable for real time communications. Depending on the orbit chosen, the satellites can target a set of applications that is most suitable for the GEO/LEO or MEO orbits. In our opinion all of these orbits need to be permitted for satellite usage in the country.

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.

All existing Satellite Frequency bands should be exploited to provide satellite services.

Possible frequency bands for Satellite-Based IoT Connectivity:

IoT connectivity using direct satellite connections needs a terminal that has a very small footprint and very low power consumption. For some of the IoT applications, directional antennas may not be suitable. On the other hand the bandwidth available on the L & S band is very limited. As an example an ATM installed by a bank is supposed to use low bit rate connectivity. However, banks install a wide range of applications along with the ATMs. Some of them are Digital Signage & Surveillance. So a low bit rate connectivity is not going to be able to serve the needs of the ATM. As a result the choice of band should be based on the application that is being served and the service provider should be allowed to choose any of the bands mentioned above to serve the needs of their customers.

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.

Hughes is of the opinion that there should be a common and simple licensing framework for satellite connectivity needs to be established wherein all kinds of satellite-based connectivity solutions should be available under a single authorization. The Commercial VSAT service authorization may be considered for such kind of authorization. The word CUG & VSAT should be removed and replaced with "Satellite". Essentially the authorization should be termed as "Satellite service authorization". It will boost the effective utilization of existing infrastructure, 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 should also be able to provide services to the new UL M2M service providers. The satellite service authorization should be allowed 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 should expand to providing access and backhaul. The only restriction that may be placed on satellite service providers is the ability to provide PSTN voice. They should be able to provide this only in conjunction with an access service provider.

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.

Yes. Enabling provisions may easily be incorporated in the scope of this authorization to enable the licensee to provide IoT connectivity. 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.

Global Mobile Personal Communication by Satellite (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 providers may provide voice, SMS (text) and internet service (data services) on satellite phones using satellite systems*. **Provision of connectivity to IoT devices is not mentioned in the scope of service.** However, it will be easier for a GMPCS service

provider, having a Land Earth Station Gateway in India, to provide connectivity to the IoT devices in its service area. Hence, there is a need to enhance the scope of the authorisation to include IoT based connectivity and also connectivity to the internet.

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 the 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.

Yes- As answered in Question 4, the VSAT CUG Service authorization should be named as Satellite Services Authorization. The scope of this authorization should encompass all forms of satellite connectivity using satellites in various orbits such as LEO, MEO & GEO. It should also be possible to provide connectivity using different satellite bands such as L, S, C, XC, Ku, Ka, Q/V bands. It would be prudent to make this authorization band agnostic and let the NFAP decide what frequencies can be used for satellite communications. With the exception of PSTN voice and broadcasting services, it should be possible to do any other voice, data & video applications including low bit rate data applications. This unified approach would help optimize both infrastructure and spectrum that is being deployed for such services. The removal of the word CUG would also enable satellite service providers to provide backhauls to wireless networks that are based on cellular and/or wifi technologies. This will also permit the aggregation of terrestrial and satellite services by an access service provider who can be the one stop shop when it comes to enterprise communications. Depending on the type of satellite orbits, the bands and the applications, suitable TEC IR documents may be adhered to by the satellite service providers for technical specification conformance. In the case of on the pause and on the move applications, satellite service providers should be allowed to provide services to land mobility applications in addition to flight and maritime connectivity. The low bit rate applications have immense potential in the case of automobiles and other services that need connectivity on the move.

Q7. (i) What should be the licensing framework for Captive licensee, in case an entity wishes to obtain a 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 the requirement of a large number of ground terminals to connect a large number of captive IoT devices?

Satellite IoT applications can be exploited by organizations who wish to setup captive networks under the captive license. The scope of the captive license should be enhanced and re-modelled in the lines of the Satellite Services Authorization as mentioned above.

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.

Hughes is of the opinion that this service authorization is of very little relevance in the current context and the scope of this service authorization can be subsumed under the satellite services authorization and this authorization can be done away with.

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.

All of the satellite services should be covered under a single authorization. As the satellite services authorization can provide backhauls to access service providers, it is of little relevance to permit NLD service providers to deploy satellite networks under the NLD authorization. Suitable time should be given for existing service providers using the NLD authorization to migrate satellite networks into the satellite services authorization. So the choice available to service providers are 1). Satellite Services authorization if no public switched voice is to be provided. 2) GMPCS authorization if a public switched voice is to be provided. Similarly, the access service authorization can also be dealt in the same way as in the satellite context LSAs do not make any sense.

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.

Both the satellite service providers and TRAI have always advocated for an open sky policy. Any such policy adopted by the Government should extend to the low bit rate and IoT applications as well. It certainly does not warrant for a differentiated approach as far as these applications are concerned.

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.

The FCC model for the allocation of satellite bandwidth can be adopted for this purpose. The FCC model puts out a list of approved satellites from which service providers can choose to lease capacity. Satellite operators can get on the approved list based on application for authorization and a technical and security evaluation. Criteria such as establishment of Indian subsidiaries, bilateral trade relationship with the country of registration for orbital slots can be put for satellite operators and their satellites to be added to the list. Once added, the satellites should be in the list for the lifetime of the satellite without having to go through the trouble of renewals. The gateway of operation should be in India. Mirror copy gateways and point of presence where the physical gateway is outside and only an interconnect point is available in the country should not be allowed.

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.

Hughes recommends the following:

1. In the short term augment GSAT capacity with foreign capacity. There is a lot of capacity that is lying idle and can be of immense use to provide satellite based broadband connectivity.
2. Increase the period of capacity leases (for the lifetime of the satellite or 10 years, whichever is earlier) in order to provide certainty to the satellite operators. This will bring down the capacity leasing costs.
3. Allow direct contract of capacity between the service provider and the satellite operator. This will not only cut down on the overheads charged by Antrix/NSIL, but also let service providers hedge foreign exchange.
4. Follow the FCC model of creating a list of satellites from which capacity can be availed. Follow the well laid out telecom model of DoT as the licensor, TRAI as the regulator and TDSAT as the adjudicator for satellite communication services as well.
5. Eliminate duplicate monitoring roles of NOCC/WPC & MCF (ISRO) and reduce the charges of monitoring. Today a number of satellites are not monitored at all, but the charges still remain across all satellites. Make this as a service fee based on a deliverable rather than a statutory fee. Today the NOCC monitoring fee is 3% of the satellite transponder cost for a conventional satellite. In the case of HTS, this 3% increases to 10% because of the sharp reduction in the transponder cost. The authority should recommend to retain the 3% level of monitoring fee across all satellites and bands.
6. As already recommended by TRAI, reduce the SUC charges for satellites from 4% to 1%.

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.

Hughes would like to make the following recommendations

1. Implement a single window system at the apex committee level. Once the single window provides approvals, the need for a service provider to again go to the agencies part of the apex committee to obtain individual approvals should be done away with.
2. Satellite spectrum can be classified into shared spectrum and exclusive spectrum. Spectrum used for satellite communications in the C, XC, Ku, Ka, Q/V are shared spectrum. The same spectrum can be used across many orbital slots. In the case of shared spectrum, the entire band can be licensed instead of licensing spot frequencies. This will eliminate the need of administrative delays in obtaining permissions/licenses for each and every network change.
3. A clear policy guideline needs to be established for the allocation of satellite spectrum. The current method of adhoc allocation creates a lot of uncertainty for the service provider and makes the service provider liable for stringent penalties for delayed execution by customers. When the approvals for adhoc allocation of spectrum expires, approvals are stopped, while DoS continue to bill the service providers for capacity.

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

1. Today the LF that is being charged has a component of USOF. While satellite service providers provide connectivity in the rural and far flung areas, they are deprived of any funding from the USOF. There should be a mechanism for satellite service providers to tap into the USOF for rural connectivity in addition to the Government's own rural connectivity projects.

2. Inclusion of land mobile connectivity into the scope of satellite services authorization for provision of services to automobiles, trains and other on the move applications.