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Sent: Friday, May 7, 2021 4:17:52 PM
Subject: Consultation Paper No. 1/2021 counter Comments

Respected Shri Abbas

Attached are counter comments in word format. We will try to send a PDF please. Hope they would be duly considered.

best Regards,

Brijendra K Syngal
Senior Principal Dua Consulting

Re: Counter Comments to Consultation Paper dated March 12, 2021 on "Licensing Framework for Satellite-based connectivity for low bit rate application"

From: Dua Consulting

Date: 7th May 2021

I. Issues for Consideration

Before we dwell into specific responses, let me emphasise the unique and ubiquitous quality of communications by the use of satellites. Satellite communications has been through various incarnations from bulk carrier (TV Programmes to Voice) to thin route carriers for V-sat applications, and as a broadcast media for entertainment, multi-address broadcast warnings etc. Satellites over the years, since the Sputnik (1957) was first launched have undergone transformation in information delivery, reaching out to the Arctic and Antarctic locations (Elliptical Orbit Satellites Molniya System 1965) etc. Satellite communications has been in use since August of 1964. Our own satellite system INSAT (GEO) conceived during the late-70s and operationalised circa early 80s, had three payloads, Voice Communications, TV Broadcast and a Dual metrological package for imaging and data gathering from buoys distributed all across, including high seas, used for weather forecasting etc. It also had a disaster management system capability. Therefore, low bit rates communications using satellites by using GEOs is tried and tested.

As result of innovation, evolution and applications, satellites have found niche applications in IoT, M2M communications in addition to disaster management, data gathering, poling, navigation, global positioning satellites, polar orbiting satellites for remote sensing applications yet there is etc. Therefore, it is given that satellites are here to stay to help fill gaps to terrestrial communications, especially when one needs to set up connectivity quick, fast and in an affordable manner. All this has been made possible by user end devices for applications being bandied in this document for low bit rate applications.

Again, questions arise on definitions of low, high, or medium bit rates. It would all depend on applications. Therefore, no one size fits all definition will work, except conceptual use and wisdom of use of satellites, and an upper and lower end definition of low bit rate.

We will also have to examine the satellite and its orbit depending upon applications and locations. In the specific, India scenario, both the GEOs, MEOs and LEOs (Non-GEOs) will work, orbit to be picked by application. Both have their strengths and weaknesses. Briefly, GEOs have proven track record of service for over half a century, covers the globe with three satellites, except higher latitudes north and south of equator; appropriately placed, for India just one is enough with powerful beam formations covering various states of India, whereas for non-GEOs depending upon coverage required, the orbit would have to be decided. In addition, a choice has to be made, whether intelligent system with on-board processing and inter-satellite links are needed or no (a La Iridium) Iridium is a switch in the sky, can possibly cover the universe with one ground station. The routing switching takes place in space by inter-satellite links. Other Non-GEOs are mere amplifiers in the sky for bouncing of signals like Global Star, Orbicom etc.

The satellite constellations can be divided into 4 broad categories:

- GEOs, aplenty, like Intelsat, Inmarsat, Hughes, Eutelsat etc with proven track record
- MEOs, Globalstar, O3b
- LEOs with inter-satellite links, Iridium, and
- LEOs without inter-satellite links like Orbcomm, Oneweb, Starlink

The cost of providing services continues to be less cost effective, because of various policy and regulatory glitches in the availability acquisition of space segment capacities, no matter in GEOs or LEOS, or MEOs. The most important issue to be addressed is reducing input costs to offer affordable delivery to the consumer, causing a multiplier effect all around.

II. Responses to 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.

Response 1

A) Both models are possible in the case of GEOs. **Hybrid model consisting of LPWAN and Satellite and (ii) Direct to satellite connectivity. Direct to satellite connectivity** is ideal for remote area applications. By very definition, in remote areas where there is hardly any infrastructure, direct to satellite is the only option. The devices are small, run on battery power. There are systems operating at L and S bands. There is already a system operating under trail in India Code/Trade name SkyLo, utilising the BSNL infrastructure and Inmarsat satellite in direct to satellite mode.

B) **Hybrid model consisting of LPWAN and Satellite is** an option where there is some last mile connectivity available from user to the integrator hub and to the Ground station. The integrator hub could be collocated with ground station or long lined to the ground station. To be up linked, and onward transmission to processing centres. However, be mindful of the fact the indirect to satellite (LPWAN) mode is unlikely to be cost effective in the case of non-GEOs by sheer number of tracking ground stations required. Creating point of presence for indirect to satellite mode is ideally suited for GEOs.

C) In the case of Non-GEOs, because of visibility issues the number of hubs will have to be dependent upon user concentration or by using concentrators, integrators at various clusters to be connected to a hub with antennae farms. The antennae farm is needed for seamless continuous coverage. In US alone Starlink speaks of some 20 ground stations to provide seamless services. [1]

D) If my memory serves me right for iridium, we made provisions for 5 tracking stations to be able to use at least three planes of satellites in the visible LEO orbit. Iridium continues to be direct to satellite mode. Similar was the case with Globalstar, O3b and ICO (Defunct, but being revived). Iridium is a spider web of satellites in the sky of interlinked satellites in front, back and sideways. Satellite linkages are yet to be considered in OneWeb and Starlink.

[1] Source: https://en.wikipedia.org/wiki/OneWeb_satellite_constellation#List_of_launches

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.

Response 2

Is there a simple answer, No. However, GEOs are good for both direct and indirect communications, especially in L and S bands. Iridium is good for direct to satellites with a proven track record. In the case of the other three much will depend upon, link budgets to achieve an adequate C/N ration and SNR depending upon the design of the front-end receiver. Of Course, the ability to track the satellites will be needed. As alluded to in my response to Q1, integrator, concentrator nodes using various terrestrial technologies and connecting them to one or two nodes is one way to proceed. The so called indirect to indirect and to satellites. All systems have their own idiosyncrasies, therefore, one size fits all will not work out of the box solution would have to be found. For example, long lining, groups of clusters via integrators to a hub, or using Wi-Fi connectivity in a cluster and extended that to the hub (use PM-WANI). If you were to seek my advice OneWeb and Starlink?[2] The way to go is GEOs, perhaps Iridium (Proven and Unique unlike the other two Leos, and O3b).

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.

Response 3

Ideal is L and S band both in GEO and Iridium look alike configuration. Ku and Ka for GEO, but not for LEOs. We are discussing low bit rates unless the definition of low bit rate is revised to 50Mb/s as in OneWeb and Starlink.

If one were to view from the evidence contained, the manifestation for the bang for the buck is at L and S bands. Proven technology has been providing low bit rate services, both one way like The Global Maritime Distress and Safety System (**GMDSS**), is an automated ship to shore system using satellites and digital selective calling technology and internationally agreed-upon set of safety procedures, types of equipment, and communication protocols used to increase safety of life at Sea and make it easier to rescue distressed ships, boats, and aircraft by alerting rescue agencies in real time.

[2] Source: https://gizmodo.com/starlink-vs-5g-which-could-be-the-better-home-interne-1846262512

There is also **Inmarsat-C,** a two-way (2.4kB/s service used for tracking and polling) , packet data service operated by the telecommunications company Inmarsat which operates between mobile earth stations (MES) and land earth stations (LES), uses an omni-directional antenna. The service is approved for use under the Global Maritime Distress and Safety System (GMDSS), meets the requirements for Ship Security Alert Systems (SSAS) defined by the International Maritime Organization (IMO) and is the most widely used service in fishing Vessel Monitoring Systems (VMS).

The service works with a store-and-forward method which enables interface with data network transfer including; e-mail; SMS; telex; remote monitoring; tracking (position reporting); chart and weather updates; maritime safety information (MSI); maritime security; GMDSS; and SafetyNet and FleetNET services; two-way messaging; data reporting and polling; Safety/Emergency alerting. The service was used by Indian railways in the initial stages for tracking of rakes.

An indigenous system was being developed by entrepreneurs but bombed in the face due to adverse lobbying by competitors. The question one begets is that there is so much track record available, why venture into new territories, unchartered territories, unproven, untested.

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.

Response 4

Before hazarding a guess or attempting one, let there be clear definition of what low bit rate is, applications, availability of devices or eco system as they say. Let the existing licensing framework be amended. Why re-invent a wheel? All statutory charges get subsumed into larger scheme of things. After all existing infrastructure only is to be used. Infrastructure sharing should also be permitted.

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.

Response 5

Please modify and enhance scope, by adding an additional piece of paper to define additional scope. Please see response to Q3.

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.

Response 6

As mentioned elsewhere, use POP to connect a cluster of devices either directly or (PM-WANI). 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.

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?

Response 7

Allow captive networks, should marketplace demand.

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.

Response 8

They missed the bus, while chickening out of their obligations for use of S-Band. How long would they wish to be the gate keepers or toll collectors?

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.

Response 9

Certainly, they the NLD services must be allowed to be used to carry data from clusters of IOT/M2M devices from the aggregator or integrator to the nearest hub for transmission to satellite for processing to the data centres. The very definition of NLD is National Long Distance.

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.

Response 10

If India does not have capacity, why choke innovation, evolution and applications affecting economic growth. We must become realistic and practical in our approach, especially in the GEOs. In the case of MEOs and LEOs, there is a big question mark. It appears that in the beginning we might have to use foreign satellites.

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.

Response 11

Satellite bandwidth is possible on GEOs, please note. The rest are all "On Demand Mode" For security reasons, own earth station is a preferred option, the other is long lining with a friendly country to begin with, should service take off go in for own facilities. However, in the case of MEOs and LEOs number of earth stations will depend upon the number of planes required to cover entire country, and the spacing of those planes. In addition, depending upon duration of orbit, number of antennae at one ground station will have to be determined. OneWeb, said two. Hopefully, that would cover entire India.

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.

Response 12

By adopting hybrid method of commonality of devices interchangeability for satellite use and terrestrial use as was proposed few years back but abandoned. Reduction in input costs of acquisition of space capacity by reducing the role of Middleman like ISRO. Allow sharing of transponder capacities rather that piece meal for ten users. Get into long term contracts and leasing. Input costs of space segment capacities ha to be reduced. Too many regulatory and policy hurdles. Too much of turf protection.

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

Response 13

No one agency can say ok go ahead, you have DOT, WPC, ISRO, various other agencies from security etc. is there any way to streamline under either ease of doing business or single window clearance. Even the Project Monitoring authority under PM is toothless.

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

Response 14

First and foremost, please do peruse a study by MIT link attached. Although in 2018, but has very valid observations to be aware of **(**https://www.mit.edu/~portillo/files/Comparison-LEO-IAC-2018-slides.pdf **)**

Second, where would all this fit into Digital India, Aatamnirbharta in terms of Devices, Launches and Satellites?

A very clear definition of Bit rate, lower end and upper end should be available. Low bit rate applications have been in existence for a long.

Are these applications-

one way, i.e., transmitting signals from say from Himalayas to observe snowmelting, monitoring flow of water for any flood warning, or from sea surfaces, or moisture etc. in soil etc.;

two, responding to a command;

three, real time interactive;

four, store and forward;

Fifth, is latency an important factor for low bit rates to be ruling out GEOs. More important would be the jitter factor.

Therefore, A clearer definition of applications, A network architecture

It is unclear for example when Oneweb, Starlink tout for mega bandwidth delivery, with some phased array flat antennae system. Where would they fit in the scheme of things?

The satellite constellations can be divided into 4 broad categories:

- GEOs, aplenty, like Intelsat, Inmarsat, Hughes, Eutelsat etc with proven track record
- MEOs, Globalstar, O3b
- LEOs with inter-satellite links, Iridium and,
- LEOs without inter-satellite links like Orbcomm, Oneweb, Starlink

We cannot be all over the place, it is important to choose a cost-effective constellation. Should someone wish to enter Indian market, so be it with riders like adequate ground coverage, minimum quality of service 24x7, and taking into account adequate complimentary ground segment of earth stations antennae farms, with all facilities for Legal Interception Facility.

Starlink should be the last choice. It is self-serving, self-fulfilling, self-benefitting project of an individual at the expense of the rest of the world to fund a hobby to serve some 20million US homes with 50Mb/s bandwidths or above.

The cost of providing services continues to be less cost effective, because of various policy and regulatory glitches in the availability acquisition of space segment capacities, no matter in GEOs or LEOS, or MEOs. The most important issue to be addressed is reducing input costs to offer affordable delivery to the consumer, causing a multiplier effect all around.