Pursuitex/2021-22/ 05 **23rd April 2021**

To

The Chairperson
Telecom Regulatory Authority of India
Mahanagar Door Sanchar Bhawan
Jawahar Lal Nehru Marg
New Delhi-11002

Kind Attn. Shri Syed Tausif Abbas, Advisor (Networks, Spectrum and Licensing) TRAI

(email advmn@trai.gov.in**)**

Sub: **Consultation Paper on Licensing Framework for Satellite-based connectivity for low bit rate applications(Consultation Paper No. 1/2021) -Submission of Comments reg.**

Dear Sir,

We take this opportunity to introduce **Pursuitex Advisory Services,** a recently registered LLP. Pursuitex is an emerging Think Tank on Policy and Governance matters, led by experts across multiple Industry verticals and policy domains. We are a group of professionals who gained varied experience from Industry, Academics, PSUs, Government, and Regulatory Institutions. We are working actively towards high-quality research on Policy formulation, Advocacy, Infrastructure development, Industry research etc .Our mission is to develop Pursuitex as a center of Research, Analysis and Engagement Institution that generates Policy recommendations and advice on domestic and international issues enabling both Policymakers and other stakeholders to make informed decisions.

Our comments on the consultation paper on " **Licensing Framework for Satellite-based connectivity for low bit rate applications(Consultation Paper No. 1/2021)** " are attached herewith. We thank TRAI in giving this opportunity to respond to this consultation paper. We hope our suggestions will be taken into account while finalizing the Regulation. We will be happy to provide any further clarification /information, if required, in this regard.

Address for Correspondence
Bangalore:B-1/606, Provident Welwoth City, Yelahanka –Doddaballapur Road, P.O Marasandra, Bangalore -563 201
Gurgaon: *Plot 758, First Floor, UdyogVihar Phase V, Gurgaon – 122016*
Email :pursuitexllp@gmail.com , kv.damodaran@gmail.com

We look forward to the opportunities in working with TRAI and assure our continuing co-operation and support.

Thanking you,

Yours faithfully,
For Pursuitex Advisory Services.LLP

Dr. KV Damodharan
Managing Partner and CEO

Mob: 91-98182 48540

Encl: Comments on Consultation Paper.

Response of PURSUITEX LLP on the Consultation Paper
"Licensing Framework for Satellite-based connectivity for Low Bit Rate Applications"

At the outset, we thank the TRAI in providing an opportunity to give our comments on this very pertinent issue impacting the Country's technological development. This Consultation Paper is based on the reference from DoT wherein it has been mentioned that there are constraints in the existing provisions in respect of proposed Satellite based low bit-rate services which are used for IoT services in the remote and inaccessible areas and there is a need for suitable licensing framework for providing such services both for commercial as well as captive usage.

Our views on the Consultation Paper are furnished below against teach question.

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.
Whether both the models should be permitted to provide satellite-based connectivity for IoT devices and low-bit-rate applications? Please justify your answer.
Is there any other suitable model through which the satellite-based connectivity can be provided for IoT devices? Please explain in detail with justifications.

Ans:
It is seen that satellites will integrate with other networks rather than be a stand-alone network to provide 5G enabled services like IoT etc. Satellite systems are fundamental components to deliver reliably 5G services in all regions of the world, all the time and at an affordable cost. Thanks to their inherent characteristics, the satellite component will contribute to augment the 5G service capability and address some of the major challenges in relation to the support of multimedia traffic growth, ubiquitous coverage, machine-to-machine (M2M) communications and critical telecommunication missions whilst optimising the value for money to the end users.

Emergence of Internet of Things (IoT) and the vision of millions of objects being connected to the internet is a key driver for 5G rollout which is a prime enabler to 'smart cities' and other such 'smart' environments and the emergence of what is called 'Big Data' applications where massive amounts of data can be processed to feed a plethora of new applications. For 5G, this implies being able to handle large quantities of low-data communications efficiently covering widespread sensor networks and M2M communications.

We are of the opinion that different IoT use-cases and solutions have different connectivity requirements. Currently, terrestrial services (cellular, Wi-Fi, Bluetooth, LoRA, Sigfox) are driving IoT deployments. The wider coverage of satellite-based solutions, however, can be a key enabler for the extension of IoT services in remote areas where cellular connectivity is unavailable or sparsely available. We believe that each model has its own advantage***, both the models are suitable for different use cases and can work under different environments.*** For example, Hybrid model is suitable for urban/ semi urban geographies at underground

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Gurgaon: *Plot 758, First Floor, UdyogVihar Phase V, Gurgaon – 122016*
Email :pursuitexllp@gmail.com , kv.damodaran@gmail.com

locations/tunnels where direct to satellite connectivity will be difficult, whereas Direct connectivity is suitable in rural and far-flung areas where terrestrial deployment would be costly. Further, it is necessary to consider all types of satellites (LEO, GEO, MEO) in its recommendations to provide low bit rate applications.

The LPWA technologies been standardized by 3GPP 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).

On the other hand, direct-to-satellite will be more of use in a 5G delivery architecture in the backhaul segment of the network. High throughput satellites (HTS) can be used here to complement terrestrial provision and provide backhaul in areas where it is difficult to do so terrestrially. HTS can provide a high-speed connectivity complement (include multi-cast content) to wireless towers, access points, and the cloud.

In general, a very high-speed satellite link (up to 1 Gbps or more) direct to base stations, from GEO and or non-geostationary satellite will complement the existing terrestrial connectivity to enable:

- Backhaul connectivity to individual cells with the ability to multi-cast the same content (e.g., video, HD/UHD TV, as well as non-video data) across a large coverage area.
- Efficient backhauling of aggregated IoT traffic to multiple sites.

Besides direct-to-satellite is a preferred solution in challenging scenarios such as:

- During disaster or natural calamities in areas where fast deployments are required and not much hardware is available or possible to arrange
- In areas where the devices are on the move, placement of a LPWAN node would not be economically viable and preferred.
- In areas where only a few devices are to be connected and therefore, a LPWAN node is not economically viable.

Many of the existing satellite networks are not commercially suitable for supporting millions of direct connections, which are required in IoT applications.. Many of the existing satellites may not be suitable for direct satellite to device connections. For encouraging commercial applications the important requirement is that the end device costs should be very low and efficient enough to have low maintenance cost.

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.

Ans:

IoT using GEO satellites

Existing GEO satellites provide terabytes of capacity worldwide, mainly used for direct-to-home broadcast and internet over satellite connections. The challenge for using such GEO

satellites in IoT applications is the path loss between earth and satellite and the slotted nature of the GEO orbit. This results in the need for rather large terminal antennas, with enough gain to close the link and with sufficient directivity to avoid interference into adjacent satellites and systems. IoT applications, on the other hand, typically require low cost and small size terminals and should not necessitate any manual pointing toward a satellite.

IoT in LEO/HEO constellations

LEO and certain HEO constellations operate much closer to earth than GEO satellites. Therefore there is less path loss and thus less terminal power and antenna directivity is required to close the link. This is advantageous in terms of terminal cost and size. However, LEO and HEO constellations come with the drawback of moving satellites, causing a highly time variant communication channel and the need for steerable antennas. Thus an IoT terminal operating in a LEO or HEO network requires both a waveform tailored for the specifics of this communication channel and a suitable antenna design.

Hybrid terrestrial-satellite systems

Whenever the number of IoT devices in a given network or application is high, controlling the cost per device is of essence for commercial success. For such a scenario, hybrid systems using many low cost terrestrial-only IoT devices in combination with few satellite connected aggregation terminals are worth considering. Use of terrestrial-only IoT technology allows meeting the cost point while the few satellite-connected aggregation terminals provide ubiquitous connectivity. Designers of such systems need to understand both terrestrial IoT and satellite communication, to mix and match the best of both worlds.

With the ongoing trend to unify communication protocols and systems, hybrid terrestrial-satellite systems are increasingly proposed. This trend can be clearly observed in the 3rd Generation Partnership Project (3GPP) efforts to expand 5G into satellite communication services.

Q3. There are different frequency bands in which communication satellites operate such as L-band, S-band, C-band, Ku-band, Ka-band 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.

Ans:
At the outset, we wish to submit that since satellite based low bit rate applications require a very small amount of spectrum, therefore, spectrum from across various bands with proper guard band should be allocated for these applications.

Further, it is suggested that possibility of using the shared Industrial Scientific Medical (ISM)band for IoT access by sharing this band with existing terrestrial wireless services. Shared radio bands can significantly reduce spectrum acquisition hurdles along with the associated spectrum leasing costs because of the license-free nature of this band. However, such a sharing scheme might come at the cost of the reduced performance due to the mass-interference generated by millions of incumbent terrestrial sources. Therefore, to develop a model of predicting the performance of IoT-over-Satellite communication systems using a shared spectrum is of utmost importance for the IoT-over-satellite industry.

We would suggest, as per the National Frequency Allocation Plan (NFAP) 2018 or its latest revision, available bands should be exploited to provide satellite services for IoT Connectivity. We would even propose usage of bands beyond the ones mentioned above, in case there is a service possible on those. And these should be used both for Geo-Stationary Satellites and Non-Geo-Stationary Satellites, not only for Low-speed IoT applications but also for broadband connectivity.

Although the 1.6 GHz (L band) and 2.5 GHz (S band) is a suggestion by the 3GPP there is no restriction on what frequency bands to be used in IoT-over-satellite communication, and it is interesting to explore the use of a license-free spectrum, such as the ISM band for shared terrestrial-satellite access use since the ISM band devices are commonly used by the public.

In order to simplify the structure of the IoT satellite system and reduce its cost, LEO satellites using a shared band is considered to be the most suitable solution for IoT satellite communication, and it is suggested by many researchers.

This is because the slant range in LEO is shorter when compared with other orbits. Thus, the path-loss in LEO satellite communication is minimized, leading to a host of useful traits such as; lower transmission power, longer battery life, simpler satellite architecture, lower launch costs, and simpler antenna designs on both the satellite and the IoT device, and it highly reduces the complexity of the ground IoT devices and satellites allowing the construction of Nano-satellite, low power consumption and direct communication from IoTs to satellite system. In such cases, it would be feasible for the IoT device to have a small aperture antenna or a wire antenna without the need for the costly and sometimes infeasible, parabolic antenna setup. Despite all the pros of using LEO satellites for low-power IoT communication, several challenges are currently hindering the full deployment of shared-spectrum LEO satellites, including; (i) the high interference level from terrestrial devices when sharing the spectrum, (ii) a reduced satellite availability time due to the inherited reduction in the low orbit nature, (iii) Doppler shifts due to the relatively large relative velocity of LEO satellites.

The extension of terrestrial LPWAN technologies for satellite access is taking a new momentum in various studies address this possibility, with special focus on Narrowband IoT (NB-IoT) and Long Range Wireless Access Network (LoRaWAN) as these technologies have been widely used and these devices are publicly available.

As an extension for Land Mobile Services (LMS) usually utilize the L-Band spectrum, IoT-over-LEO Satellite is suggested by international organization 3GPP (3GPP: Third generation Partnership Project coordinating major cellular technologies are standardized) to enable easy deployment and compact devices. Sharing terrestrial bands with satellite IoT access becomes an attractive option because of the reduced spectrum fees and faster access to the market. This has captured the attention of 3GPP that is currently working to extend the cellular network to hybrid terrestrial-satellite services. In the 3GPP technical report, various types of IoT-over-Satellite enabling 5G network architectures and the solution of terrestrial-to-satellite network integration in 5G had been suggested. Furthermore, a 3GPP task force has been working on satellite-to-NB-IoT integration. While 3GPP systems operate in the licensed spectrum, it is interesting to explore the use of a license-free spectrum, such as the ISM band for shared terrestrial-satellite access use.

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.

Ans:

Satellite-based connectivity services are already being provided by various operators under the respective authorization of Unified License. There is no need for any new licensing framework for Satellite based low bit rate applications; the existing licensees providing Access Service, NLD Service, ILD Service, Internet Service, Commercial VSAT CUG Service, GMPCS Service or INSAT MSS-R Service should be allowed to provide these services and accordingly, amendments may be done in these licenses.

Therefore, need of hour is to examine the scope of various authorizations of Unified License which permit provision of satellite-based services besides taking proper regulatory interventions in order to address the limitations in the existing licensing framework in respect of the proposed satellite-based low bit-rate applications.

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.

Ans:

The GMPCS services should be expanded for facilitating ease of doing business, enabling provisions may easily be incorporated in the scope of this authorization to enable the licensee to provide IoT connectivity. A framework through which a single authorization permits all kinds of satellite-based connectivity solutions should be the objective.

In case the existing GMPCS service providers can provide IoT-based Low bit rate satellite connectivity within their licensed area, that could be the most cost-effective way of starting this service most easily. The GMPCS service providers may be permitted to provide satellite-based connectivity for the IoT devices within their service area for a nominal charge.

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 thesatellite-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.

Ans:

The Commercial VSAT CUG service authorization permits 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 should be enhanced to permit the use of any approved technology and user terminals to provide satellite-based Low Bit Rate connectivity for the IoT devices within their authorized CUG service area. While envisaging satellite-based low-bit connectivity for IoT devices, there may be a CUG nature of user or it may 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. Thus, the condition of CUG should be removed to permit any kind of satellite-based connectivity under this Authorization.

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 captiveuse?
(ii) Whether the scope of Captive VSAT CUG Service license should be modified to include the satellite-based low-bit-rateIoTconnectivity for captive use?
(iii) If yes, what should be the charging mechanism for spectrumand license fee, in view of requirement of a large number ofground terminals to connect large number of captive IoT devices?

Ans:
The Captive VSAT CUG service licensee should be permitted to provide Satellite based low bit rate applications while ensuring that under this license the network services should be restricted to Indian Geographical boundaries and should be permitted only for internal and non-commercial use. Accordingly, amendments may be done to Captive VSAT CUG licenses to enable the provision of captive data connectivity for low-bit-rate applications and IoT devices. The spectrum charges should continue to be formula based and license fee should be charged only for VSAT terminals not for IoT devices.

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.

Ans:

We feel that there is a need to have a fresh look into the viability of this service. There is also a requirement to incorporate the necessary provisions of authorization to enable the licensee to provide low-bit rate IoT connectivity.

Q9. (i) As per the scope mentioned in the Unified License for NLDservice 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.

Ans:

(i) We are of the view that a provision of satellite-based connectivity to IoT devices is well within the purview of scope of NLD service authorization, subject to the licensee having a satellite Earth station in India ,

(ii) With a separate hub for providing satellite-based connectivity to IoT devices and using backhaul bandwidth, mechanisms should be evolved for effectiveness. Increased competition through private sector participation

(iii) Spectrum usage charges (SUC) 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. VSAT providers should also be required to pay single rate of SUC at 1% of AGR.

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.

Ans:

We are of the view that the licensees should be permitted to obtain satellite bandwidth from foreign satellites in order to provide low-bit-rate applications and IoT connectivity. Necessary precaution need to be taken to address cyber security concerns and availability of interference monitoring capability in India.

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.

Ans:
Licensed TSPs should be allowed directly enter into agreement with foreign satellite providers for Satellite based communication services.
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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.

Ans:
With the entry of private sector participation in fabrication and launching of satellites within the country, there is increased competition to lower the cost of satellites and their launch, which should benefit the service providers and end-users. The Government should act as an enabler by lowering the administrative and monitoring charges to the bare minimum and allowing free competition in all aspect of the value chain regarding satellite connectivity to the IoT devices. Competition in the market is the key driver to make the prices move downwards

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

Ans:
As far as possible the entire process of licensing should be made online. It should be user friendly, and all required approvals should take place in a stipulated time-bound manner through a single portal. Deemed approval system must be after say 15 days

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

Ans:
In order to encourage and promote this service to make itself sustaining, viable and competitive the funding support from the Government is required in the initial period. Low Bit rate Satellite Connectivity to IoT devices, especially in Remote and rural areas, can be considered under Social Obligation and Government can consider supporting funds from USO fund.

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Yours faithfully,
For Pursuitex Advisory Services.LLP

Dr. KV Damodharan
Managing Partner and CEO Mob: 91-98182 48540