Dhruva Space Private Limited
#702, 6-3-1192/1/1, Block 1, White House, Begumpet, Hyderabad, Telangana, India, 500016 I
www.dhruvaspace.com I +91 9440867726 I info@dhruvaspace.com I VU2ISL |
CIN:U74900TG2012PTC150151 I GST: 36AAECD4647F1ZP

Ref: DSPL/R-TRAI/2021/01

9th April, 2021

To,
Shri Syed Tausif Abbas,
Advisor (Networks, Spectrum and Licensing)
Telecom Regulatory Authority of India

Subject: Dhruva Space comments on TRAI's Consultation Paper on Licensing Framework for Satellite-based Connectivity for low bit rate applications
Reference: Consultation Paper No. 1/2021, TRAI, "Consultation Paper on Licensing Framework for Satellite-based Connectivity for low bit rate applications"
Attached: Annexure A - Dhruva Space Comments and Response to TRAI CP No 1/2021

At the outset, we would like to thank the Authority for giving us the opportunity to provide our comments and contribute to this discussion on the Licensing Framework for Satellite-based Connectivity for low-bit rate applications. It is our firm belief that the discussion ensuing from this consultation paper will help to streamline the existing process and encourage growth in the space industry in India.

Dhruva Space is a full-stack space engineering solutions company and one of the first NewSpace startups in India. We have experience in building small satellites and ground stations for low bit-rate applications, as well as with implementation of IoT projects using satellite connectivity.

Please find our comments and responses to the questions for consultation in Annexure A. We humble request and draw your attention to our Key Recommendations and our Responses on Q1, Q4, Q13 and Q14 in the document. We firmly believe these suggestions will contribute to a vibrant and healthy ecosystem in the space-based connectivity sector in India.

Regards,

Chaitanya Dora
Chief Financial Officer,
Dhruva Space Private Limited

DHRUVA SPACE

ANNEXURE A
DHRUVA SPACE COMMENTS AND RESPONSES TO TRAI CP No 01/2021

Key Comments

The New Space industry across the world and India is going through a key phase of evolution and growth. The startups and private companies are using platforms available to them to catapult themselves to success. This is also a time of great change. Several regulatory and industry issues are coming to light and receiving attention that was previously lacking. The technology development has forced the system to regularly and rapidly evolve. This technology itself has taken several forms in the market.

The market, which at one point was simply under the umbrella term of IoT, now encompasses Industrial Internet of Things, Internet of Remote Things, Machine to Machine, and massive Machine Type Communication. Each of them similar yet distinct from one another. Each serving a different purpose. The consultation paper does an incredible job of summarizing the market, so we only touch upon this to emphasize the variety and opportunity present before us. Further, what was earlier only the category of Satellite communication now also includes drones and High Altitude Platform Systems, or now the general category of Non-Terrestrial Networks. As the technology continues to evolve, we anticipate greater diversity and distinction.

However, as diverse as the systems get, some of the challenges they face are common needs and challenges in the industry. These come in the form of regulatory challenges and economical constraints. These require timely review and reconsideration, and on that note, we are delighted with the consultation paper seeking to understand the issues better. We look forward to positive and constructive change in the future.

Key Recommendations

First, that the choice of system architecture (here meant to include any model of connectivity, any orbit, any spectrum used, and any technology implemented) be left open as a business decision, and only require the appropriate spectrum usage be regulated.

Second, that a simplified, single window, sliding scale (based on the scale of the deployment), and time bound with de-facto approval licensing framework be established.

Third, to make special provisions for experimental and demonstration space missions (subject to compliance with Resolution 32 of WRC-19) or IoT projects using satellite connectivity.

It is our firm belief that these suggestions will help create a level playing field for MSMEs.

Dhruva Space Responses to Questions for Consultation

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.

DS Response:
To Q1 (i) - Yes, both models should be permitted. The two models discussed in Chapter 2, Section A cover a significant majority of the IoT system implementation scenarios. The choice of model is based on tradeoffs between factors like throughput, range, scale of deployment, area of deployment, cost of infrastructure, and cost of operation. Since the constraints and considerations of these parameters vary across applications, the choice of model to implement the IoT system must be a business case based decision.

Furthermore, in both the above models, the IoT systems will utilize specific, and usually well established, communication technologies. Therefore, the spectrum resources utilized by the system can be clearly identified and any potential interference can be predicted and prevented. Therefore, Dhruva Space strongly recommends that both models should be permitted.

To Q1 (ii) - Yes, there are other models through which satellite based connectivity can be provided. The other models may use any combination of communication technology for fronthaul and backhaul. For example, they may use an LPWAN technology (or for that matter, any terrestrial communication technology) for fronthaul and both satellite and terrestrial backhaul simultaneously. Another possible model may use a Direct-to-Satellite and Indirect-to-Satellite simultaneously. Yet another example would utilize a LPWAN gateway in motion on the ground using satellite connectivity for backhaul.

We would also highlight the possibility of using HAPS (High Altitude Platform Systems) for fronthaul, where the high altitude platform serves as the gateway, and satellite connectivity as backhaul. We would like the Authority to observe that this case is different from the “Indirect-to-Satellite” system described in the consultation paper which describes the LPWA gateway being on the ground. In this case, however, the gateway is in the atmosphere at a high altitude, and more importantly is in flight. Since both technologies are non-terrestrial networks this model would offer the simultaneous advantage of a much wider coverage area as well as a high net throughput for the system.

In summary, there are already several possible models for providing satellite connectivity using innovative applications of existing and upcoming technology. We request that the regulator leave the choice of model (or technology or system architecture) open as a business decision, and only require the appropriate spectrum usage be regulated.

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

DS Response:
To Q2 - Yes, all the above orbits for satellites and satellite networks should be permitted. We reiterate that the choice of technology and system architecture are a business case based decision. Each choice of orbit for a satellite offers a different tradeoff in terms of coverage, bit-rate, power, and even spectrum used. We would also like to emphasize that the choice to use a constellation of satellites or a single satellite, in any orbit, also comes under the umbrella of choice of technology and system architecture. The regulator should, therefore, permit systems to use satellites (or satellite networks) in any orbit, requiring only that all relevant spectrum and orbit usage regulations be fulfilled.

However, we recognize the scarcity of orbital resources and the possibility that keeping all orbits open can lead to hoarding of orbital slots. In light of this, we suggest that the regulator use the ITU's bringing-into-use obligations (either directly or as adapted to the Indian context) as a method to curtail the orbit slot hoarding problem.

Further, we recommend that special provisions be made to allow for experimental and demonstration applications of satellites (or satellite networks) subject to compliance with Resolution 32 of WRC-19, otherwise known as ITU's definition of 'short duration missions'. Such a provision would greatly encourage growth and innovation in the sector, while preserving the scarce resource, complying with international obligations, and protecting the national interests. We firmly believe this method will provide for the appropriate balance between creating equal opportunity for the MSMEs and preventing wastage of precious resources.

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.

DS Response:
To Q3 - Yes, all these bands should be allowed, and in addition, VHF and UHF bands should also be included in this list and allowed for providing satellite based connectivity. It is imperative that the already limited spectrum resource not be further curtailed. Every band from VHF to W Band (and higher) has multiple allocations for satellite services.

Higher bands are generally associated with higher throughput, and also offer the advantage of a smaller antenna. But they are also subject to relatively higher atmospheric interference and therefore require higher power. They are, therefore, better suited for the “Indirect-to-Satellite” model of IoT connectivity. However, in order to truly enable the “Direct-to-Satellite” model of IoT connectivity, lower bands are more likely to be used. This is because they offer lower throughput but are less susceptible to atmospheric interference and can thus operate on lower power. This also makes them very economical to both the satellite operator and the end user of the satellite connectivity service. In particular VHF (from 137 MHz to 146 MHz) and in UHF (from 390 MHz to 470 MHz), are of crucial importance. These bands have several suitable allocations for satellite-based services. Furthermore, some of the constellations referenced in the consultation paper use this very spectrum to provide their services. Therefore, we strongly recommend these be included in the list and be allowed for providing satellite based connectivity.

We further recommend that a provision be made in each such band to have sub-bands allocated for experimental purposes. The size of the sub-bands may be determined based on the available spectrum but be large enough to meaningfully serve the purpose of experimentation. In order to prevent misuse of this provision we suggest that any mission using such spectrum be subject to compliance with Resolution 32 of WRC-19, otherwise known as ITU’s definition of ‘short duration missions’. We reiterate our firm belief that this will be of immense benefit to MSMEs in the country to participate in and create a level playing ground with Telecom giants.

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.

DS Response:
To Q4 (i) - We are ambivalent to whether a new licensing framework is proposed or the existing one is suitably amended. For the space segment, we find the framework proposed under ISRO’s Indian National Space Promotion and Authorization Centre (IN-SPACe) policies is new and has received positive response. So we would also support the UL licensing framework being suitably amended to seamlessly incorporate the new IN-SPACe policies to enable provision of satellite based connectivity as discussed in this consultation paper.

However, we would like to point out that provision of satellite-based connectivity requires streamlining of not just the service provision licenses but also the satellite operation licenses. In case this may not seem obvious, we would like to point out that simplifying the service provision license without addressing the satellite operation license would not be fruitful. So we take a step further and recommend that any new or amended licensing framework be made to encompass

all these segments - the satellite operation space segment, the satellite operation ground segment, the service provisions, the spectrum charges, and any other licenses and clearances needed.

This recommendation comes first and foremost from DoT's acknowledgement (reference to paragraph 3.2 of the consultation paper) of the limitations of the existing licensing framework. But we find it important to point out such a change is needed because of the lack of any coherent existing framework (in the context of satellite based connectivity). This is specially true for Non-GeoStationary Orbit satellite systems.

The new policies released by DoS to open the space sector to the Indian industry is certainly a step forward from the era of the CAISS framework. But even as of this submission, the new policies proposed by DoS under IN-SPACe do not include the approvals and licenses required to begin providing satellite connectivity as a service. (Refer To Draft SpaceCom NGP 2020, clause 4.3.6). We also direct the Authority's attention to the fact that this is not limited to only the space segment but also the ground segment. We further highlight that both, the draft SpaceCom policy and the draft SpaceCom NGP, state that a "timely and responsive regulatory environment" as a goal. But neither provides any concrete timeline or any redressal mechanism for the applicant in case of a delay in the processing of the application.

So, under the existing 'framework', any aspiring private satellite operator must apply for connectivity under this new IN-SPACe system, but there is no clarity on when such an approval may be expected or any redressal mechanism in case of a delay. In addition to this, they must also go through the process of acquiring a Unified License. Even after obtaining both such approvals, the applicant is still left needing a pile of approvals and licenses from other ministries to begin provision of services. In our humble opinion, this is not a framework by any stretch of that term. Hence, we agree with the DoT in pointing out that there are 'limitations' to the existing 'framework'.

Therefore, we most certainly recommend a change - either as a new licensing framework or an amendment of the UL frameworkbeing suitably amended to seamlessly incorporate the new IN-SPACe policies to enable provision of satellite based connectivity.

To Q4 (ii) - We will not be able to suggest specific values for the fees listed in the question with reasonable justification. However, we would like to request that the Authority and the regulator consider the fact that the private satellite connectivity industry in India is still in its formative stage. For this to become a healthy and growing sector, a level playing ground needs to be provided for MSMEs with Telecom giants.

In this light, we first provide a brief description of the licensing framework we envision. A detailed description is provided in our responses to Q13 and 14. The licensing framework must, first and foremost, be a single window system. We cannot understate the importance of this characteristic. Any licensing framework that fails to be a single window system will be doomed

to face the same limitations as we have today. Other characteristics of the envisioned licensing framework are that it must be transparent. The applicant must know at all times the state of their application. It must be timely, and not so in name only. To ensure this, we recommend a de-facto approval system - a system where a lack of response at a certain stage provides implicit approval. The framework must also be responsive (and that too in a timely manner).

Next, we would like the Authority to note our following observations in determining appropriate fees and charges under any licensing framework.

First, we feel it is important to recognize that the industry is in its nascent stage. The industry members are mostly startups and as a result of their early stage, are not capable of offering large financial guarantees. Moreover, there is a lack of a developed and competitive market for space related insurance products, implying any applicant would be unlikely to get competitive rates. In light of this and in alignment with the effort to stimulate industry participation in the space sector, we suggest that the government should create and offer an insurance product at competitive rates for such missions. This will also help create the market for such products.

Second, we observe that one of the goals of the new policy is to promote the participation from the industry. To achieve this goal, we suggest that the government should create a program to waive or subsidize the financial guarantee and insurance requirement for missions which are of non-commercial nature and support national development objectives. For example, missions of technology demonstration, research, and academic satellites.

Third, we observe that there is a large and increasing interest in CubeSats. We further observe that there is no historical evidence of debris impact created by CubeSats. In light of this and in alignment with the goal of stimulating the industry, we suggest that the government create a program to waive the financial guarantee and insurance requirement for CubeSat missions.

We request the Authority keep in mind these considerations when recommending fees and charges under any licensing framework.

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.

DS Response:
To Q5 - Yes, the scope of GMPCS authorization may be enhanced to include satellite based connectivity for IoT devices. The significant part of our justification can be found in our response to Q1 above. Further, we feel that this may be a method to quickly begin enabling the satellite-based IoT connectivity in the interim while other systemic changes are being implemented.

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.

DS Response:
To Q6 (i) - Yes, the scope of Commercial VSAT CUG Service authorization may be enhanced to use any technology and any kind of ground station. The significant part of our justification can be found in our response to Q1 above. We reiterate that the choice of technology, type of ground station, system architecture, etc should not be limited by the regulator. The regulator must regulate, monitor, and enforce the appropriate use of national resources. but should refrain from limiting the choice of technology. Further, this too may be a quick enhancement of the existing system to enable satellite-based IoT connectivity in the interim while other systemic changes are being implemented.

To Q6 (ii) - We suggest the removal of restrictions on data rate - that this be left to the choice of technology. We then suggest removing the restriction that there must be only one Closed User Group. We recommend allowing more closed user groups so as to enable different architectures. We also suggest the removal of restrictions that limit the architecture in any way (reference to para 3.12 in the consultation paper). These suggestions are also based on the above justification in our responses to part (i) of this question.

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?

DS Response:
To Q7 (i) - The licensing framework used here must first allow for more than one Closed User Group. This is because the nature of IoT systems tends to be distributive, and therefore it may require multiple ‘Hubs’, and different Terminals. The usage of such a system, for captive use, may even be allowed for multiple purposes including internal communication and IoT connectivity.

To Q7 (ii) - Yes, the scope of Captive VSAT CUG Service license should be modified to include satellite based connectivity for IoT devices.

To Q7 (iii) - The charges for spectrum and license fee should be reduced. We first refer the Authority to our response to Q4 (ii) for the considerations we suggest in making such a determination. We suggest the licensing fee for terminals be on a sliding scale based on volume. We refrain from comment on spectrum fee.

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.

DS Response:
To Q8 - Yes, the scope of INSAT MSS-R service authorization should be modified to provide satellite based connectivity for IoT devices. While the transmit only nature may seem limiting, it can serve a variety of use cases when that may often be the only mode of communication. Particularly in case of remote areas where communication infrastructure is lacking or in the aftermath of a natural disaster where such infrastructure may be damaged, such options would be immensely useful to monitor the status of remaining critical infrastructure.

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.

DS Response:
To Q9 - No response.

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.

DS Response:
To Q10 - Yes, we strongly recommend that licensees should be permitted to obtain satellite bandwidth from foreign satellite operators. This is of course, subject to the licensee and the satellite operator complying with the respective regulatory framework applicable to them, including payment for spectrum usage charges.

This is because different satellite connectivity providers offer different advantages. The satellites (or satellite networks) have different orbits and operate in different spectrum bands. Further, their technology implementation will vary, like type of antenna, modulation, encryption, etc. Each of these offers a different tradeoff. The consumer should be able to choose an option best suited for their application. Moreover, neither an aspiring entrant nor the consumer should face a monopoly (or an oligopoly) in the market.

We would like to highlight that the inter-beam roaming and inter-satellite roaming issues are again strictly technical issues. The regulator should require the operator to register the complete satellite network, including all the beams, the spectrum occupied, and any inter-satellite links (all of this would be covered by their ITU filings). Assuming all or only some beams receive regulatory approval, the regulator's role should be only to monitor compliance on appropriate spectrum usage. Once this is done, the regulator should refrain from managing inter-beam or inter-satellite, so long as within the same satellite network roaming. Note, that inter-satellite-network roaming is a different case and will require further regulatory intervention.

We fully endorse TRAI's recommendation for an 'Open Sky' policy. We greatly appreciate the Authority's observation in para 3.26 "this is the only way forward if we are serious about delivery access to otherwise remote and inaccessible areas or those with difficult terrains." Therefore, we feel the Authority should extend the Open Sky recommendation to satellite-based connectivity for IoT systems.

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.

DS Response:
To Q11 - We reiterate that such permission of using bandwidth from a foreign satellite operator be subject to compliance with the applicable regulatory framework. We make some suggestions as to what this framework may look like below.

We suggest that the foreign satellite operator be required to partner with a local company or establish a subsidiary in India. We further suggest this entity be required to obtain relevant regulatory licenses for the provision of such services in India. We refrain from commenting on the composition of such a partnership or subsidiary, the extent of FDI permitted, and other peripheral regulations. We only suggest the Authority consider the state of the industry and the goal of the policy in determining these requirements.

We are in favour of the requirement of an Earth Station Hub in the country, but we recommend that there be no restriction on system architecture. In this case, whether there is a single satellite with one beam, a single satellite with multiple beams, or a network of satellites with multiple beams, there should be at least one (but no restriction on more) Earth Station in the country acting as Hubs. We also recommend allowing the initial downlink to be at an Earth Station outside the Indian jurisdiction subject to the condition that the data be re-routed to the Earth Station Hub in 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.

DS Response:
To Q12 - The adoption and usage of satellite connectivity service is higher in other countries because the regulatory environment is open and seamless, as well as economical. For the lack of the same, costs are higher in India, and therefore adoption is lower.

However, it is imperative to note that India is a very large market, and if adequately tapped can create a large positive disruption. In brief, we need to have a liberal policy and support local industry. We would like to highlight that in practice, the cost of production and launch of satellites is higher in other countries. This is an opportunity for India since we can offer lower production costs of satellites and as well as lower launch costs.

To do this, the regulator must make production of satellites and launch easier in India. This means reduction of the entry barrier by simplification and streamlining licenses, easing import restrictions, promoting exports through a line of credit, and trade agreements focused on key sectors. The upstream industries are also important here, and their growth and development must also be supported.

A key recommendation here is on national technology capability development. The telecommunication and space sectors are extremely capital intensive. Because of limitations in the nation's technology capability, there is a dependency on external providers. Reducing this would require investment in several different segments to create meaningful growth, and will only offer long term returns. But such a risk cannot be taken by MSMEs and the government alone cannot be expected to foot the bill. Further, it is inadvisable to have duplication of such key infrastructure, especially when there are other segments still requiring investment.

The solution here is to create a national roadmap for technology capability development. The government and the industry identify the technology capability that they believe will be needed by the country fifteen years later. This is released as a roadmap of in three year plans, and is reviewed at five year intervals. Each identified technology is broken down and contributing upstream industries and infrastructure needed are identified. The government then guides national investment to ensure that all the contributing segments see development. It encourages industry participation by providing a small assured order for those investing in developing such technology or infrastructure. This also provides a sense of security to private investors and MSMEs to invest in these because of an increased confidence in a return on said investment. Most importantly, this leads to an efficient utilisation of public funds and sustainable growth of the industry. It also reduces the external dependency and distributes the weight of capital investment across the board.

One more suggestion is that the use of foreign satellite components or subsystem or ground segment subsystems from foreign providers should be justified, permitted only if it is demonstrated that this does exist in India.

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.

DS Response:
To Q13 - Yes, there is a lot of scope for simplification of processes. But we begin by appreciating some positive developments. We refer to and support TRAI's "Recommendations on Captive VSAT CUG Policy" dated 10th April 2020, with special attention to Chapter 2, points 3, 4, and 5. Similarly we appreciate the Official Memorandum dated 23rd July 2019, OM No R-14016/01/2019-NT(Pt.) to simplify the Experimental and Technology Trial licenses, Manufacturing and Testing licenses, and Demonstration licenses. We find these to be indicators of positive change and suggest the Authority use them as references to build a new system.

We first begin by highlighting key features of the licensing framework we envision. This is a reiteration of a part of our response to Q4. Then we explain in some detail how we envision this system would work.

1. Single Window System: The licensing framework must be a single window system. We cannot understate the importance of this characteristic. Any licensing framework that fails to be a single window system will be doomed to face the same limitations as we have today.
2. Transparent System: The envisioned licensing framework must be transparent. The applicant must know at all times the state of their application.
3. Timely Response: It must be a timely process in practice, and not so in name only. This implies that once the application is filed, the applicant gets an assured response within a fixed and predetermined time frame.
4. De-facto Approval & De-facto lapse: To ensure timely response, we recommend a de-facto approval system - a system where a lack of response by the stipulated time frame provides implicit approval. Similarly, if the applicant fails to take action within the stipulated time frame, the application is considered lapsed.
5. Sliding Scale: A sliding scale system determines parameters like license fee, bank guarantee, the time frame for processing the application, and the duration of the approval are determined based on the scale of the system. So a small and simple system has low fees and gets rapid approval but only for a shorter duration, whereas a larger and complex system has high fees, longer approval period, but also longer validity.
6. Responsive & Supportive System: The regulatory environment must also be responsive and supportive. This means that they not only answer the applicant's questions but also provide related information voluntarily, suggest corrections or modifications that would be more favourable to the evaluation process, provide a rubric of assessment, and support the applicant in the drafting stage by providing feedback.

Based on the above features, we describe the following system. The licensing framework would be a single-window system implemented completely through an online portal. To be clear, an online portal that actually works and not one in name only. [Normally we would consider it implicit, but our experience has taught us otherwise]. The online portal must itself provide a summary of requisite information and documentation, explain the stages of the application, provide estimates of time for approval (as general numbers), and an estimate of fees. The portal must also enable applicants to reach the regulator for advice and feedback on their application. When the application is submitted and the nominal application fee is paid, the first stage provides a specific deadline for each stage on part of the regulator. The respective departments concerned with each stage will be immediately informed. They must provide a response including a justification within the specified time, or else the application will be considered, and as appropriate, suggestions and feedback. In case a correction or change is needed, the applicant then has a fixed time within which they must make the change (else the application is considered lapsed - and then the applicant must begin a fresh application). The applicant also has to pay the specified fees within the stipulated time frame. Then license is approved and issued (or de-facto approved and issued) accordingly. As explained previously, the process is on a sliding scale basis, with its time and fee estimates increasing with system complexity.

In addition to this, we also recommend the provisioning and establishment of experimental and demonstration licenses. This is described in our response to Q14.

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

DS Response:
To Q14 - We would like to present a case for experimental and demonstration licenses for space based systems. We have made some references to our vision of such a system in our responses to Q2, Q3, and Q13, but we present it here as a coherent response.

Innovation and experimentation is critical for the development of technology in every sector. Similarly, the adoption of such technology is possible only after demonstration. This principle is the basis of OM No R-14016/01/2019-NT(Pt.) which created the new regime for such licenses in context of the 5G technologies. The other reference document we consider for this recommendation is Resolution 32 of WRC-19, titled “Regulatory procedures for frequency assignments to non-geostationary-satellite networks or systems identified as short-duration mission not subject to the application of Section II of Article 9”. In brief the “short duration mission” here refers to a system with the following key characteristics:

- Upto 10 satellites of less than 100 kg each
- Usually in low earth orbit
- On a non-interference, non-protection basis
- With a mission life of less than 3 years

This gives us a reliable international framework for the purpose at hand. [Note, we are not suggesting or implying that the procedures outlined here only be used for the case at hand].

With this background, we recommend that a provision be made for experimental and demonstration licenses for space based systems, with the requirement that they comply with the ITU's definition of a short-duration mission. These licenses must include the needed approval for the ground segment of the space based systems. These systems should be allocated spectrum in the sub-bands reserved for experimental usage in different spectrum bands from VHF to W bands.

The licensing process for these be through the same online portal but conducted in an expedited manner, with less than 3 months of internal processing time, followed by support through the applicable ITU regulatory process. We also recommend that the license fee for such licenses be set at a nominal value of INR 5 lakh. We also recommend that the applicable insurance requirement and launch cost be subsidized.

We strongly believe this system is needed for the growth of the sector in India, as it will innovation and economic activity for MSMEs, large companies, and foreign operators alike.

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