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20th December 2021

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

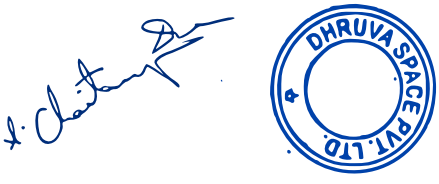
Subject: Dhruva Space comments on Consultation Paper on Licensing Framework for Establishing Satellite Earth Station Gateway

Dear Sir,

At the outset of this letter, we would like to express our sincere appreciation for taking the initiative to streamline the regulatory policy and licensing framework for the establishment and operations of Satellite Earth Station Gateway in line with the needs of the industry. In response to the same, we are keen to provide our inputs and humble contribution to this policy formulation process.

To briefly introduce ourselves, Dhruva Space is the first space technology startup in India and a recipient of the National Startup Award in the category of Space & Satellite Technology in 20202. As one of the front runners in the New Space economy in India, Dhruva Space is actively working with several Government players such as Defence Research and Development Organisation (DRDO), Research Centre Imarat (RCI), Military College of Electronics and Mechanical Engineering (MCEME), etc., in conceptualising and realising strategic space assets for the country.

In the course of our growth, we have collaborated and worked with several international and domestic players on different aspects of establishing and operating Ground Stations. We are currently partnering with Swedish Space Corporation (SSC), Sweden, the second largest ground station operator in the world, to enable a global network of Ground Stations for various client mission operations.



It is with the learnings from this experience of having engaged in the Ground Segment business, and as a New Space start-up leading the emerging space technology market in India; we have consolidated a few relevant points pertaining to the market scenario to facilitate the understanding of our comments as attached with this letter.

We are humbled to present these inputs and firmly believe that our comments will contribute to building a dynamic and healthy ecosystem for Space Technology and Telecom business in India.

Thanks and Regards,

Chaitanya Dora
Director & Chief Financial Officer
Dhruva Space Private Limited

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Comments on Consultation Paper on Licensing Framework for Establishing Satellite Earth Station Gateway

Background: Market Scenario

1. **Satellite Spectrum Allocation**
   The new generation of satellites are being placed into what is called the Low-Earth Orbit (LEO). This extends from 400 km to 1200 km altitude from the Earth. The nature of this orbit is such that the satellites go around the poles 14 times a day as they revolve around the earth. Due to round-the-globe coverage of these satellites the spectrum allocation is done in coordination with the International Telecommunication Union (ITU) through the respective National Nodal Agencies, in order to avoid any RF Collision with other space assets. The spectrum allocated for the satellite operator is for both uplink and downlink of the data from the satellites.

2. **Use of Earth Station for Satellites**
   The Earth stations are set up on the ground to communicate with the satellites for broadly the following purposes:
   a. **Telemetry & Tracking of Satellite (Space-to-Earth)**
      This involves reception of satellite health data to understand and track the satellite operations against intended orbit and working conditions.
   b. **Telecommand of Satellite (Earth-to-Space)**
      Transmission of telecommand data to operate satellites and maintain the intended orbit and working conditions.
   c. **Payload Data Reception (Space-to-Earth)**
      Reception of the data created by the sensors on the satellites in space. These data sets are key to evaluate success of the mission and the operational lifetime of the satellite. In case of non-reception of the payload data or non-useful data, the satellite can be categorized as mission operational or an equivalent of Debris in active state. An example of this are the Remote Sensing missions, Earth Sciences missions or Interplanetary missions.
   d. **Data Relay Node/Communication (Space-to-Earth)**
      Reception of the data collected by the satellites, for which the data originated on the ground based sensors/terminals and the satellite is used as a tool to transfer the data and not create the data. This is typically the case for communication satellites

such as IoT, Internet, VSAT, Direct-to-Mobile, etc.The first three above listed uses of the Earth Station are an integral part of the Satellite Mission itself and have to be considered as part and parcel of the satellite operations license itself, especially taking into account the nature of operations in research, earth observation, deep space exploration and any other missions which are covered under the remote sensing policy.

3. **Segmentation of the Ground Segment Business**

   The owners of Earth Stations can be predominantly classified as:

   a. **Satellite Owners:**

      These entities own the satellites and have the clearance for operating space assets from the relevant regulatory authorities. The Earth Station ownership would be fostered by Satellite owners themselves typically for captive usage for their set/constellation of satellites.

   b. **Earth Station Service Providers:**

      These entities own the Earth Station, and may/may not have any ownership of space assets. The Earth Station is used for providing services to Satellite Owners. These services range from reception of Payload Data, reception of Telemetry & Tracking Data, and transmission of Telecommand Data, either as individual services or as packaged solutions.

4. **Ground Resource Sharing to combat Capex Investment/Regulatory Challenge**

   With the increased number of satellites being launched into Space, there is a demand for ground infrastructure for Satellite Operations. The orbit and inclination of the satellite missions determine the required locations for Earth Stations. For example, most of the Remote Sensing/Earth Observation missions are launched into what is called the Sun Synchronous Orbit (SSO), creating a greater demand for Earth Stations in the polar regions more than those close to the Equator.

   Each satellite may have a window of 2 minutes to 15 minutes to communicate with an Earth Station per orbital pass. For SSO, in the geographic context of India, we may look at 2 passes per day against a possibility of 8-10 passes in Sweden or Norway. This creates under utilisation of Earth Station without a significant number of Satellites to use the resources. Hence, Earth Stations, especially in countries outside of the Satellite Owner location, are used as shared resources, with service fee pricing based on the number of satellite passes that may be received on the said Earth Station. The Earth Station Service Provider invests in setting up the infrastructure to recoup the same investment through providing services for multiple satellites.

5. **New Technologies and Future Readiness**

   The earth stations have been the prime conduits of communication with the satellites. In recent years, in consideration of the above summarised difficulties in satellite passes, new solutions are being developed for payload data transmission. This includes Data Relay Networks. The data from Satellite is passed on to another satellite through Inter-Satellite Links, creating a network infrastructure in space. Space-to-Space communication technologies are becoming a vital part of LEO-to-LEO networks and there is an increased demand for LEO-to-MEO/GEO communication.

   While the data may be created in Space using LEO Satellites for applications like remote sensing, science missions, etc., the reception on earth will happen through communication satellites in LEO/MEO/GEO, resulting in sharing of resources with terrestrial users. The other ongoing technology advancements include free-space lasers for transmission of ultra-high speed data sets using optical receiving stations on earth. Laser optic communication is used both in Space-to-Space and Space-to-Earth communication.

6. **Regulatory Complexity**

   The current policy framework is too complex for SMEs and start-ups to navigate their regulatory obligations in line with the innovative and dynamic business models. Considering the cost of setting up the Earth Station in itself high, the simplification of the Regulatory approach is required for creation of this 'enabling infrastructure' which shall then promote building and usage of more satellite assets.

7. **Charges and Fees for Earth Stations**

   The Earth Stations are an integral part of the Satellite Operations. As the Satellite license would come with allocation of Space-to-Earth and Earth-to-Space frequencies, no separate charges are required for Satellite Operations using Earth Stations. Globally, the license fee for linking a space asset with earth station is limited to only application/administrative processing fee and does not entail any spectrum based fee.

   Considering that no such charges are levied in the international market, introduction of such in the policy and licensing framework will be detrimental to development of indeginous capabilities and enabling infrastructure for launch and operations of space assets from India. It is to be noted that the User Terminals and Services provided to customers for applications such as Internet, IoT, VSAT, etc., may not be considered as a part of Earth Station License. The Earth Station Gateway, as described in the above point 2 (d), where the satellite is being used as a conduit and is not the actual point at which the data is created, may be considered as separate classes of licensing framework.

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Comments on Issues for Consultation

The key consideration points not clearly addressed in the Consultation paper are as below to set context and clarity for the comments made on the identified issues are as below:

a. One Satellite Earth Station may be used by various service licenses on a limited or long-term basis. Instituting a Spectrum Allocation and charging mechanism in relation to a Earth Station license will substantially increase the complexity of the business and administrative costs for TRAI and allied bodies as well. The spectrum bandwidth licensee may pay additional royalties as may become applicable under the existing mechanism.
b. The Earth Station Licensee may propose to install such RF equipment and capabilities as they may deem fit in line with their assessment of commercialization opportunities. The fundamental approval required is on the permissible spectrum of operations for determining hardware allowed to be possessed and installed under the Non-Dealer Possession License, not tied to a specific bandwidth being allocated to them or any potential satellite operator.

1. **Whether there is a need to have a specific license for establishing satellite Earth Station Gateway in India for the purpose of providing satellite-based resources to service licensees?**

   With reference to the background provided and as recognized in the consultation paper, it is already established that setting up of infrastructure and ownership/operations of Earth Station Gateway is an independent business. The Satellite Operator or End User, as the case may be across services, is charged for accessing the services of the Ground Station. The Ground Station owners/operators are not Satellite Operators. Therefore, a separate license for establishing satellite Earth Station Gateway which is not tied to any preceding condition except a Non-Dealer Possession License should be granted. The spectrum allocation should be made based on the Satellite operators requirements on a case to case basis, while setting up of antennas should be allowed in a Ground Station for all requested bands.

2. **If yes, what kind of license/permission should be envisaged for establishing Satellite Earth Station Gateway in India? Do provide details with respect to the scope of the license and technical, operation and financial obligations, including license fee, entry fee, bank guarantees and NOCC charges, etc.**

   a. A separate framework should be set up, wherein Satellite Owners from across the globe can get Satellite Operation rights in collaboration with an Earth Station owner in India,

which also includes the permission to utilise such spectrum as allocated to the Satellite Owner through ITU.

b. The framework recommended in the Consultation Paper on Ease of Doing Business in Telecom and Broadcasting Sector and the Draft Remote Sensing Policy should be sufficient.
c. Earth Stations should be allowed to be set-up without having due frequency allocation or Satellite details. Upon successful qualification of the application criteria for setting up a Ground Station, a Non Dealer Possession License should be granted to the applicant along with a NOC for the proposed area where such an Earth Station is to be set up.
d. Earth Stations which are enabled by Antenna Farms should be allowed to be set up in a single application process, whereas currently in lieu of the limitations in application process each antenna is regarded to be as a single Earth Station itself.

3. **Whether such an Earth Station license should be made available to the satellite operator or its subsidiary or any entity having a tie-up with the satellite operator?**
Yes, it is self-explanatory from the process as mentioned above. The license to establish Earth Station should be made available regardless of the status of being a Satellite operator or any relation with thereto. Satellite communication should only be allowed after due application by the Satellite Operator through such an Earth Station in line with the process as proposed in Point 2. The spectrum allocation should be made based on the Satellite operators' requirements on a case-to-case basis, while setting up of antennas and transponders should be allowed in a Ground Station for all requested bands.

4. **What mechanism/framework should be put in place to regulate the access to satellite transponder capacity and Satellite based resources of a Satellite Operator/Earth Station Licensee by the service licensees so as to get the resources in a time-bound transparent, fair and non-discriminatory manner?**
a. The Earth Station licensee should be mandated to keep a record of all transmissions and receptions with details.
b. The Satellite Operator and/or Service Licensee should also be mandated to keep a record of the same.
c. Time bound provisioning of service should be ensured by building mutual understanding between the Earth Station Licensee and Satellite Operator.
d. Additional Antennas should be allowed in the same Earth Station License Framework with application revision mechanism.
e. Instituting Spectrum Monitoring services should be encouraged to map and monitor all unauthorized use which would also aid in taking actionable intelligence on improving data feed thereby promoting sustainable RF usage.

5. **Whether the Earth Station Licensee should be permitted to install baseband equipment also for providing satellite bandwidth to the service licensees as per the need?**
   Yes, the crucial consideration point in provisioning Earth Station Infrastructure as a scalable business is that the Service Licensee does not need to indulge by the way of technical planning, maintenance and setting up of any infrastructure which is needed for ensuring efficient and effective communication with the Space Assets.

6. **What amendments will be required to be made in the existing terms and conditions of the relevant service authorizations of Unified License, DTH License/Teleport permission to enable the service licensee to connect to the Satellite Earth Gateway established by Earth Station Licensee/Service Licensee for obtaining and using the Satellite transponder bandwidth and satellite-based resources?**
   Refer to Point 2.

7. **Whether the sharing of Earth Station among licensees (between proposed Earth Station licensee and Service Licensee; and among service licensees) should be permitted?**
   Yes, the intent of proposing a separate license for setting up of Earth Station is not mere regulatory ease. The key consideration is that Earth Station as an infrastructure is a separate business which gains viability only when the cost of setting it up and running it is distributed between various service licensees thereby reducing the Capex burden on all such businesses which seek to utilize Satellite services. However, it should be left to the discretion of the licensees (Earth and Service) to make suitable conditions applicable as deemed necessary for protection of business interests which should not be in violation of any law in force, especially the Competition Act, 2002

8. **To whom should the frequency carriers be assigned: Earth Station Licensee or the Service Licensee or whoever establishes the Satellite Earth Station?**
   The frequency carriers should be assigned to the Satellite owners or operators. The authorization for an Earth Station to transmit or receive in a licensed band should be made by the NOCC upon due application for such authorization to be granted being made by the party who holds the Bandwidth License jointly with the Earth Station Licensee. This is primarily because the Earth Station Licensee would only be the infrastructure owner who shall serve multiple Satellite owners under the mechanism explained in Point 2. The primary business function of the Earth Station Licensee is to set up the Earth Station with antennas and relevant sub-systems to enable Satellite communication, which shall further allow Earth Station Licensees to become Satellite Operators as well, upon successful authorization being

obtained in each case from WPC to utilise frequency allocated to a Satellite Owner by the Earth Station Licensee.

9. **What should be the methodology for assignment of spectrum for establishing Earth Station?**

   There is no ab initio requirement for assignment of spectrum to establish Earth Station. The requirement at setting up stage is only to issue a clearance for setting up of the infrastructure at the proposed location along with a Non-Dealer Possession License to acquire such equipment as needed in line with the technical and business plan submitted by the applicant for Earth Station License. Spectrum Allocation is a process to be participated in by the Satellite Operator/Service Licensee or if such Spectrum Allocation has already been made, the rightful holder of such allocation who seeks to use the Ground Station of the Ground Station Licensee may apply to NOCC in mutually signed application indicating the authorization to the Earth Licensee by the Spectrum Licensee to establish communication with their Space Assets as identified in the application. Such application to NOCC may not be rejected or not approved unless the license of the said spectrum is in question or possesses sanctioned threat to National Security. Refer to Point 2 for a step by step process guide.

10. **What should be the charging mechanism for the spectrum assigned to the satellite Earth Station Licensee?**

    In reference to Point 2 and Point 9, the Earth Station Licensee does not require Spectrum to be assigned to them. The spectrum assignment should continue to be that of the Satellite Owner/Operator. Additional charges if any applicable, should be levied on the Satellite Operator in line with the charging mechanism which exists currently.

11. **Give your comments on any related matter that is not covered in this Consultation Paper.**

    The framework which has been promulgated so far has been with the intent of consolidating all licenses into single license. However, in light of the dynamic nature of the industry and innovative technologies being introduced, such extraordinarily defined sets of criterias render unsolvable challenges. One of the key issues not highlighted in the consultation paper are challenges relating to Data Relay Networks, return on capex investments and the shorter mission life span for LEO satellites. All these issues of concern require more economic, expedient and easy to navigate frameworks for successful business in any jurisdiction. The lack thereof may force players in the Space Technology Industry to look out for alternative jurisdictions for operations. However, we have consolidated all the said issues in the background and comments on issues for consultation.