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Session 8: Spectrum

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Spectrum for novel NGSO systems in Ka-band

by


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Telesat

Regulatory developments in India

Recent changes

India is undergoing a phase of significant changes in the regulatory framework for satellite services

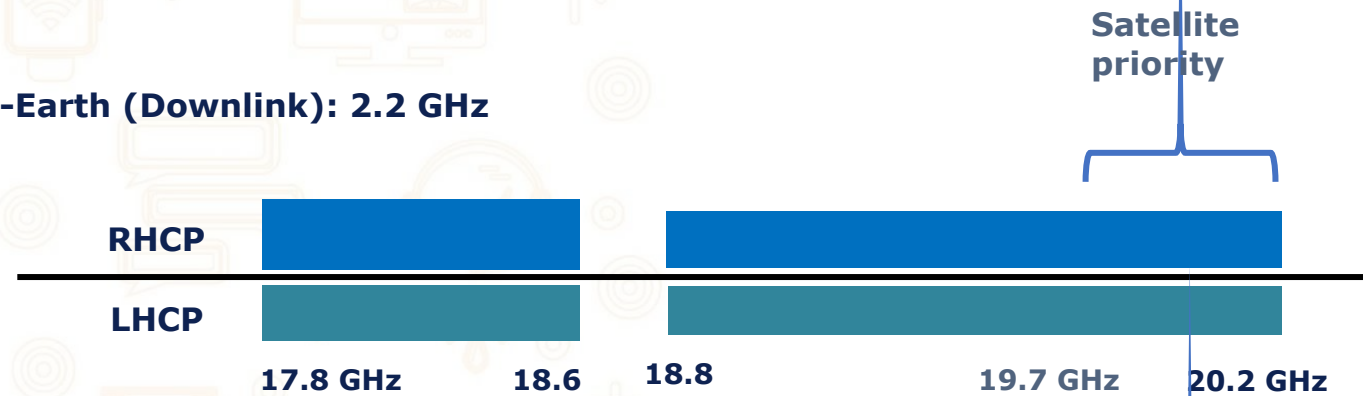
- TRAI consultation (e.g. Consultation Paper on Licensing Framework for Establishing Satellite Earth Station Gateway)
 - Considerations on the need for a separate license for gateway earth stations and the need for revision of licensing fees. Addressing also the very important issue of spectrum allocation
 - National Frequency Allocation Plan – Oct 2022
 - IND 16, 27.5-28.5 GHz identified for IMT. However, Note 7 (ii): The frequency range 27.5-28.5 GHz may be allowed for shared use by IMT and Satellite services subject to feasibility
 - IND 17 The bands 14-14.5 GHz, **28.5-30 GHz**, 10.7-11.7 GHz, 12.5-12.75 GHz and **18.7-20.2 GHz** may be used for earth-stations on land transportations, ships and aircrafts, as per the applicable provisions of the Radio Regulations
 - Satellite Communication Reforms – Oct 2022
 - NOCC (Network Operation and Control Centre) charges removed
 - Online portal for license applications
 - Enable Earth Stations in Motion
 - Draft Telecommunication Bill – Consultation in Oct 2022
 - Issue of spectrum allocation/refarming
 - Regulatory “sandbox” to facilitate licensing for demo/testing
 - Revision of Space Policy
 - Forward thinking attitude towards the development of the Space Industry and the involvement of the private sector
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- Clear/straightforward texts with a general trend towards streamlining and simplification of the regulatory process

Spectrum for Telesat NGSO system

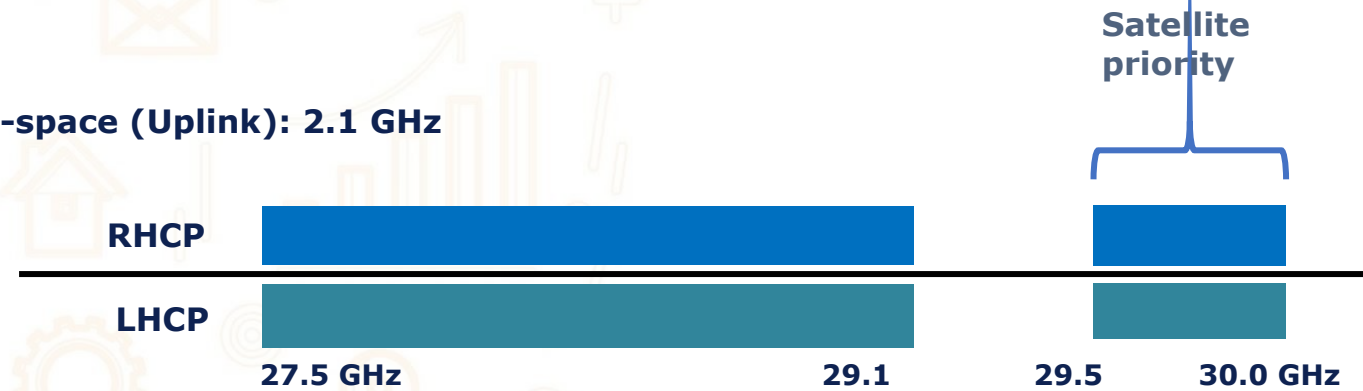
Telesat Lightspeed

Ka-band spectrum for both User Terminals (service) and Landing Station (gateway) links

Space-to-Earth (Downlink): 2.2 GHz



Earth-to-space (Uplink): 2.1 GHz

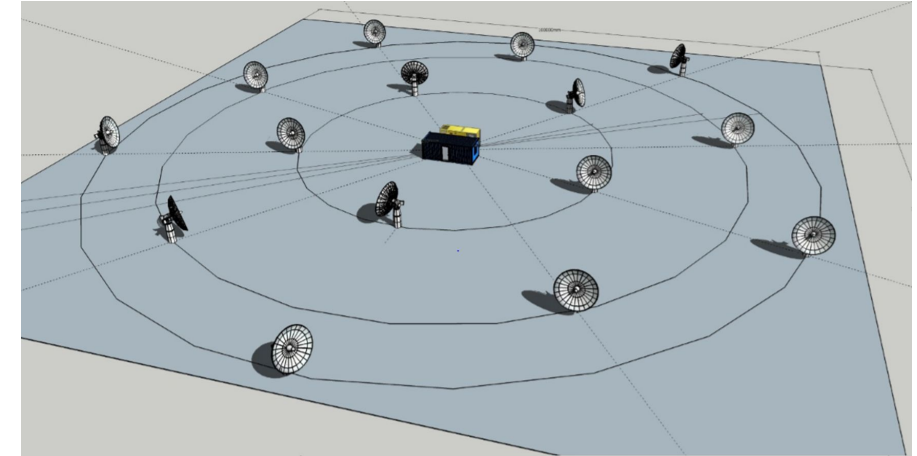


NGSO Gateways

Feeder link connectivity for NGSO systems is ensured via “landing stations/antenna farms” consisting of sites with multiple identical full motion antennas

As it is the custom elsewhere, the gateway license is normally separate from the service provision license

- gateway license does not confer any right for the provision of services
- level playing field for service providers and optimization of ground infrastructure deployment
- possible for the satellite operator or the teleport operator or a service provider to acquire it



While each antenna will be tracking a different satellite at any one time, the overall range of pointing angles, power and frequencies will be within the same envelope (i.e. the interference scenario and spectrum use is not different from a single antenna)

- no multiple fees should be imposed for each additional antenna on the same “antenna farm”
- principle already adopted by Australia, Italy, Portugal, UK, US, Colombia, Canada, etc

Gateways are typically considered as infrastructure: a revenue related formula, while suitable for service providers, is not applicable

Novel satellite systems in Ka-band use ~4GHz of spectrum: either a flat fee or a reasonable spectrum-dependent fee

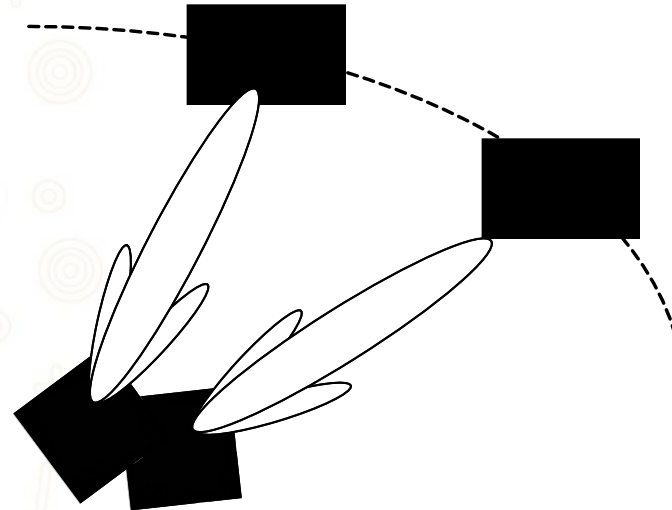
In line with international practices, there are typically no applicable technical standards for gateway earth stations (while standards exist for the user terminals): the requirement for compliance with a TEC technical standards should be reconsidered for NGSO gateway earth stations

No predefined large separation distance required between NGSO antenna farms

Microwave spectrum assignment

Satellite use

Microwave spectrum assignment for satellite use should be based on an administrative process, which is standard procedure elsewhere



Spectrum assignment by auction is not suitable for spectrum that can be shared between multiple satellite operators (such as in Ku/ Ka band) thanks to the directivity of antennas

- Satellite operators can coexist geographically in the same frequency range (different from terrestrial mobile operators)

A satellite microwave spectrum auction would lead to:

- Artificial limitation of the the number of satellite operators sharing the spectrum and their exclusion from the market (possible monopolistic situation)
- Inefficient and unnecessary partitioning of the spectrum

Protection of GSO networks and NGSO-NGSO coordination

In most of the Ka-band (17.7-18.6GHz, 19.7-20.2GHz, 27.5-28.6GHz and 29.5-30GHz) there are equivalent power flux density (epfd) limits on NGSO to protect GSO (RR. 22.2)

- These limits are established by ITU, ensure non-interference and therefore no coordination is required

For the remaining Ka-band spectrum (18.8-19.7 GHz and 28.6-29.1 GHz) coordination between NGSO and GSO systems is required under the relevant ITU provisions

Coexistence between NGSO systems can be ensured by complying with the coordination provisions set out in the ITU Radio Regulations

- Consideration of ITU filing priority allows for a system to be designed by taking into account a defined interference environment, represented by those systems whose with higher priority

Analysis is carried out by operators of different NGSO systems in bi-lateral coordination discussions

- The required simulations take into account deployment information, power levels, the constellation design, etc

WRC-23 AI 1.16

NGSO ESIM in Ka-Band (1/2)

“... to facilitate the use of the frequency bands

17.7 – 18.6 GHz and 18.8 – 19.3 GHz and 19.7 – 20.2 GHz (space-to-Earth)

27.5 – 29.1 GHz and 29.5 – 30 GHz (Earth-to-space)

by NGSO FSS ESIM, while ensuring due protection of existing services in those bands...” – Resolution 173 (WRC-19)

Allowing NGSO ESIM in Ka-band will provide a much required harmonized international framework with certainty to protect existing services

Technical and regulatory provisions for the operation of ESIM under this Agenda Item are limited to aeronautical and maritime ESIM

WRC-23 AI 1.16

NGSO ESIM in Ka-Band (2/2)

Sharing studies are confirming that the same conditions as for GSO ESIM would also protect terrestrial services from non-GSO ESIM

- Aeronautical ESIM (A-ESIM): PFD limits at the surface of the Earth
- Maritime ESIM (M-ESIM): 70km distance from the coast and the power limits

Support the adoption of harmonized regulatory framework as well as technical and operational measures similar to those for GSO ESIM, while ensuring protection of existing services in-band and adjacent frequency bands

Supports the development of a methodology regarding examination by the Radiocommunications Bureau of compliance with PFD limits by non-GSO aeronautical ESIM or of adequate transitional measures in case WRC-23 could not finalise the methodology

WRC-23 AI 1.17

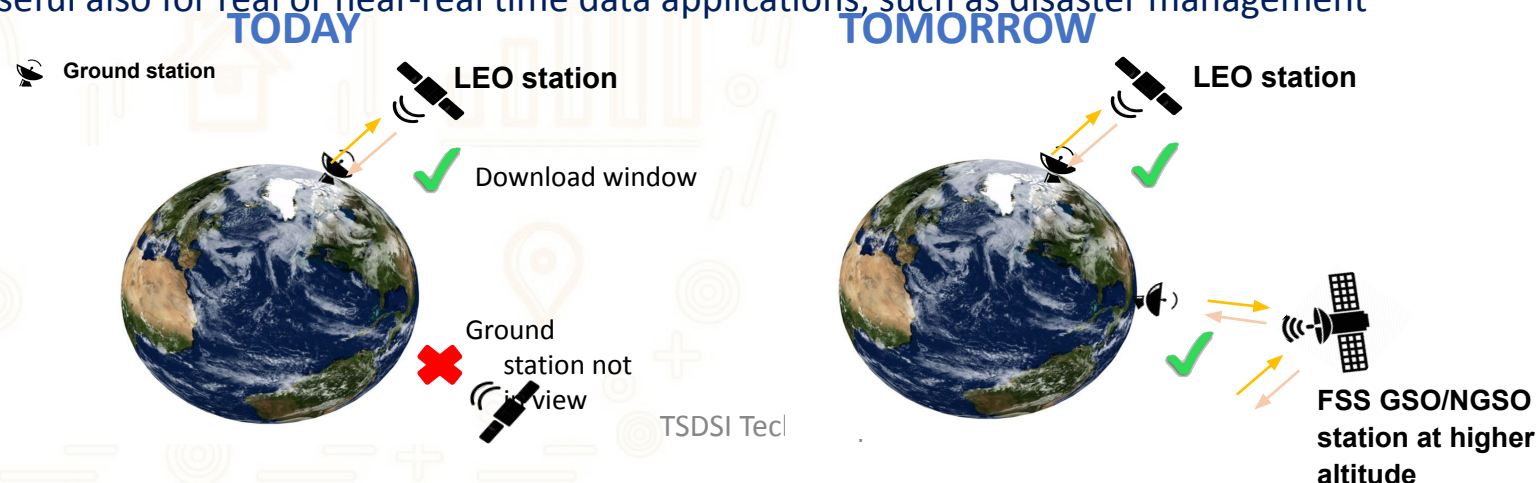
Inter-Satellite Links (1/2)

“to determine and carry out... the appropriate regulatory actions for the provision of inter-satellite links in specific frequency bands, or portions thereof, by adding an inter-satellite service allocation where appropriate” - Resolution 773 (WRC-19)

Frequency bands in consideration under this AI: 11.7 – 12.7 GHz, 18.1 – 18.6 GHz, 18.8 – 20.2 GHz, 27.5 – 30 GHz

There is a growing interest for utilizing ISLs for a variety of applications, or example

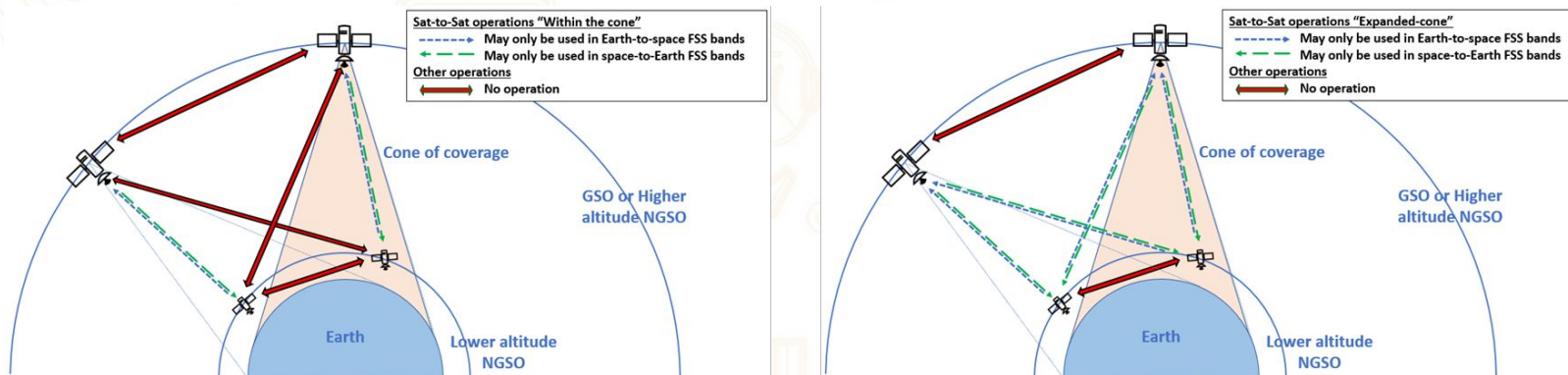
- As a data transport layer, where there is limited access to Earth stations (e.g. over the oceans)
- For most Earth observation and space science missions, data-download to the ground is a bottleneck as well as a key design driver. The possibility of relaying data to the ground via satellite-to-satellite links is a possible remedy to the existing limitations
- Useful also for real or near-real time data applications, such as disaster management



WRC-23 AI 1.17

Inter-Satellite Links (2/2)

- Direction of transmission is limited to those of the existing FSS allocation
- Two Concepts of Operations have been discussed, as illustrated below



Possible introduction of a new ISS allocation.

Different methods proposed for protection of some the incumbent systems (e.g. GSO and NGSO FSS, EESS) for the various frequency slots

Complex draft CPM text which takes into account all the various combinations

Support the introduction of satellite-to-satellite transmissions and ensuring the same level of protection for incumbent services as currently provided in the Radio Regulations in the relevant frequency bands

Thank You
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