Spectrum for Next Generation Services - Opportunities & Challenges

by

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The Topic

- The topic of this session is “ Spectrum for Next Generation Services”

- Keynote topic: Spectrum for Next Generation Services – Opportunities and Challenges

- Perspective from Spectrum Manager view point

Next Generation Services

- 6G Services
- LEO & MEO - FSS & MSS services
- V2X
- ITS
- IoT/M2M both Terrestrial and Satellite based
- Industry 4.0
- Inter-Satellite links

Some of these services are already deployed in some countries and some of them are under development

Spectrum for these services

IMT:

- WRC 19 identified the following frequency bands for terrestrial IMT implementation in accordance with specified Resolutions:

  37-43.5 GHz, 47.2-48.2 GHz & 66-71 GHz

- The ultra-low latency and very high bit rate applications of IMT would require larger continuous blocks of spectrum

Space-Based services:

- These bands also crucial for Satellite based services – FSS, MSS, BSS
- Next generation HTS and NGSO Constellations operate in these frequencies

Apportionment of the bands among services

HOW ?

Sharing? Band Segmentation?

Dynamic Sharing?

Paradigm shift - Challenges

- Is this concept new? – **NO**

- Is it first time spectrum is shared by various services – especially two different commercial services – **NO**

- Then what is the Challenge?

- The Challenge:
  - Small/minuscule inter-service guard band
  - No fixed band segmentation
  - Keep off distances
  - Legacy systems with wider front end

Some Examples:

- TVRO receivers getting interference from IMT services operating in the mid-band. This is due to TVRO front end is wide open and have been operating so far without any interference. Once, Mid-band is operational, they are receiving even out of band signals

- The second case is related to safety services. Radio altimeter fitted in the aircraft receiving signals from IMT services operating in the mid-band. Here, again the front end of altimeter is wide open and receiving out of band unwanted signals

Opportunities

- Opportunities for efficient utilization of the available spectrum
- Sharing between satellite gateway earth stations and IMT is feasible by maintaining exclusion zone around gateway stations as these stations are few in number
- Sharing between satellite user terminals and IMT in the same geographic area may not be feasible due to the ubiquitous nature of both the deployments
- Currently, in India IMT spectrum is assigned in LSA basis. However, one may not require huge MM wave band frequencies for the entire service area
- Possibility to assign lesser geographical unit than LSA – Urban, Semi-Urban, Rural. Chance to use the entire spectrum for each of the services simultaneously but separated geographically.

Way Forward

- Sharing and Co-existence is the order of the day
- Learn and open up to the idea of using the same spectrum for different services by utilizing latest technological solutions
- Replace the old legacy systems with spectrum efficient systems
- Carry out India specific sharing and co-existence studies to find out the technical parameters for co-existence of various services in the same frequency band

THANKS!

Three main WRC-23 Agenda Items related to GSO broadband satellite networks

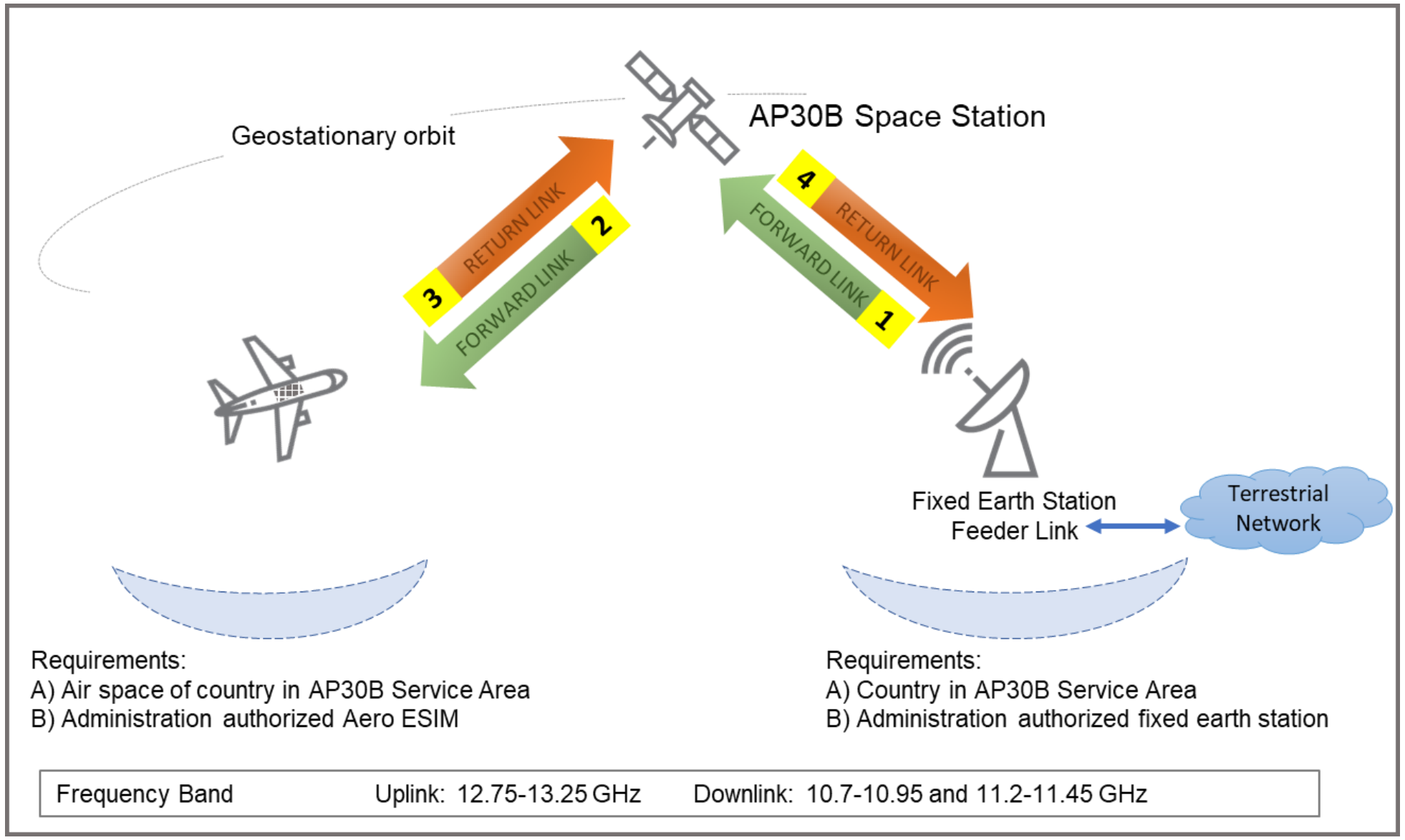
- **AI 1.15**: Use of the frequency band 12.75-13.25 GHz (Earth-to-space) by earth stations on aircraft and vessels communicating with GSO space stations in the FSS globally (Resolution 172)

- **AI 1.17**: Technical and operational issues, and regulatory provisions for satellite-to-satellite links in the frequency bands 11.7-12.7 GHz, 18.1-18.6 GHz, 18.8-20.2 GHz and 27.5-30 GHz (Resolution 773)

- **AI 1.19**: Primary allocation to the FSS in the space-to-Earth direction in the frequency band 17.3-17.7 GHz in Region 2

AI 1.15

- Calls for studies on the possible operation of A-ESIM & M-ESIM communicating with GSO in the FSS in 12.75 – 13.25 GHz
- It is **Planned band** and is subject to regulatory procedures and technical criteria as per **Appendix 30B of RR** which is different from other bands
- It requires explicit agreement of an administration for the partially or wholly inclusion of its territory in the service area of a proposed AP**30B** assignment
- Generally the service areas of AP**30B** networks are non-contiguous and the number of countries in these service areas ranges from one to fifty countries
- Additionally, RR AP**30B** provides that an administration may at any time exclude its territory from the service area of an AP**30B** assignment. Hence, these ESIMs need to have the capability to restrict operations in territories where agreements have been obtained


Geostationary orbit
AP30B Space Station
RETURN LINK
FORWARD LINK
3
2
4
1
Fixed Earth Station
Feeder Link
Terrestrial Network
Requirements:
A) Air space of country in AP30B Service Area
B) Administration authorized Aero ESIM
Requirements:
A) Country in AP30B Service Area
B) Administration authorized fixed earth station
Frequency Band
Uplink: 12.75-13.25 GHz
Downlink: 10.7-10.95 and 11.2-11.45 GHz

AI 1.17

- There is growing interest for utilising inter-satellite links relaying data to/from Earth using a GSO or non-GSO FSS space station operating at an altitude greater than the non-GSO user space station generating the data
- As most of these non-GSO missions are LEO, the user space station download is
  - mostly short-duration access (10 Mins/orbit) they have to their respective earth stations
  - Acceptable time delay for low latency applications like weather forecasting, disaster risk reduction
- Through inter-satellite links, data can be available in near-real time across a much greater portion of the user space station's orbit, enhancing the availability and value of instrument data for low latency applications
- Both small and large satellite missions would benefit from satellite-to-satellite transmission services. Even nano-satellites (1-25 kg) may carry a satellite-to-satellite transmission payload