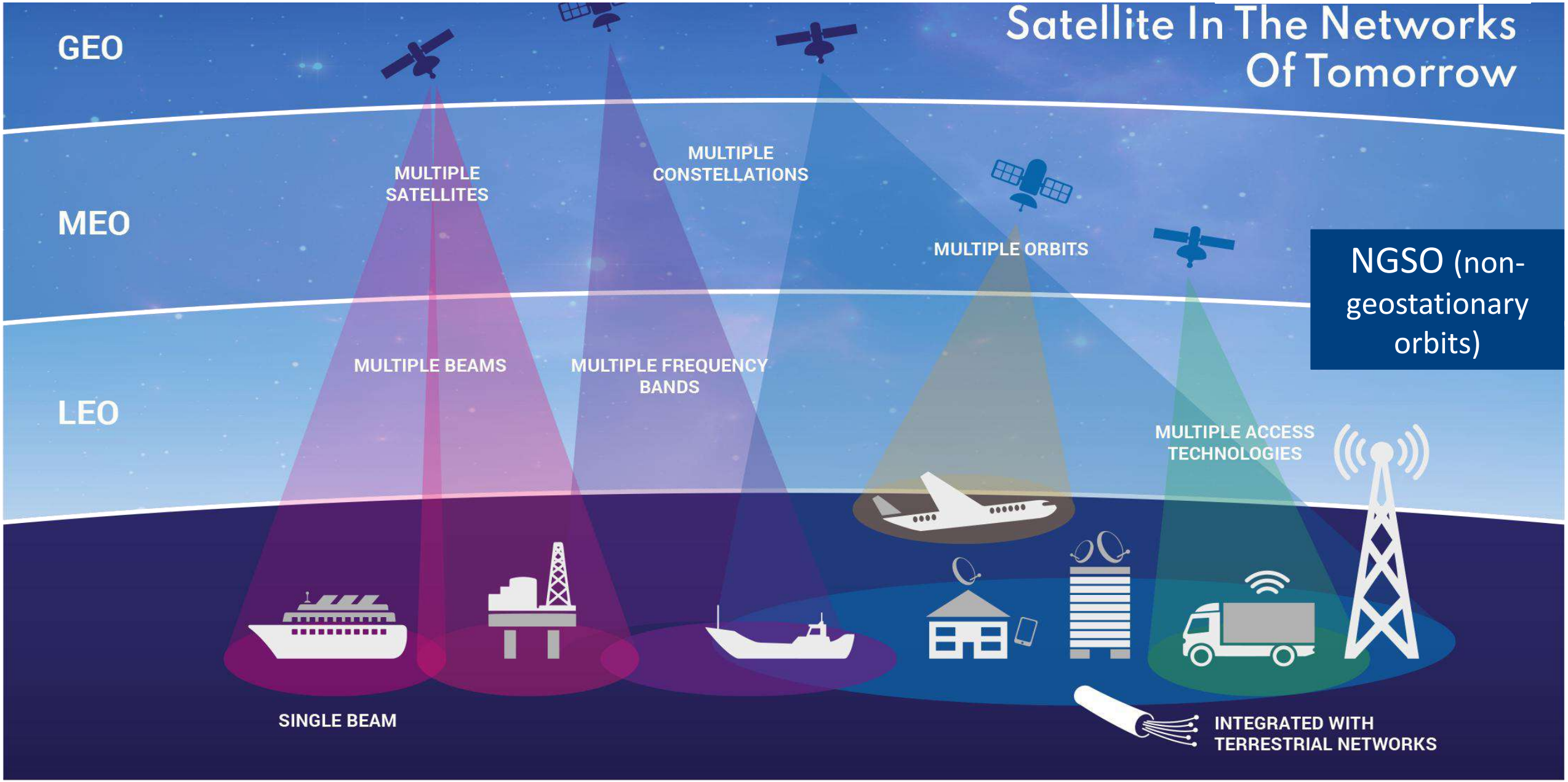
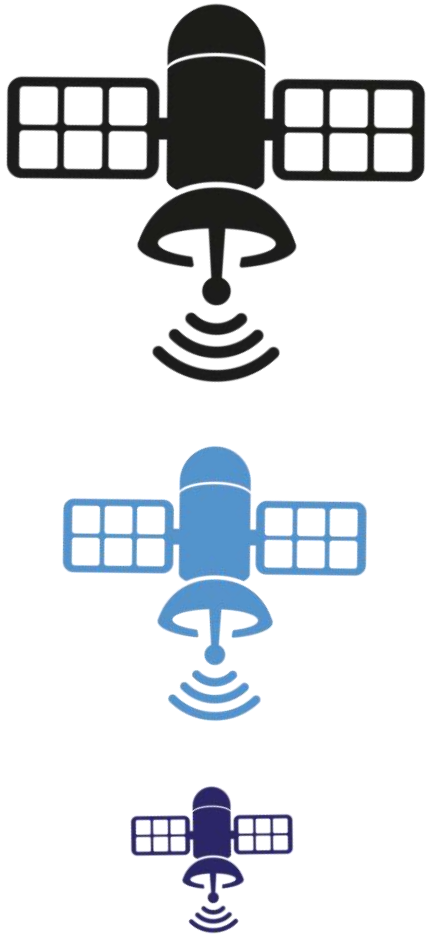
Session 2: Indian Spectrum Landscape – Challenges and Opportunities for Wi-Fi in 6 GHz

Satellite Industry Perspective - Current and future use of the 6 GHz band

Evolving Demand for Satellite Systems



Changing Economics of the Satellite Industry



Demand

Increasing need for universal broadband connectivity

⇒ Digitisation & demand for access to data is exploding

⇒ Pandemic & "Building Back Better with Broadband" to achieve SDGs

⇒ Connectivity on the move (land, maritime, and aero)

Rapidly evolving government policies & investment landscape for connectivity

Supply

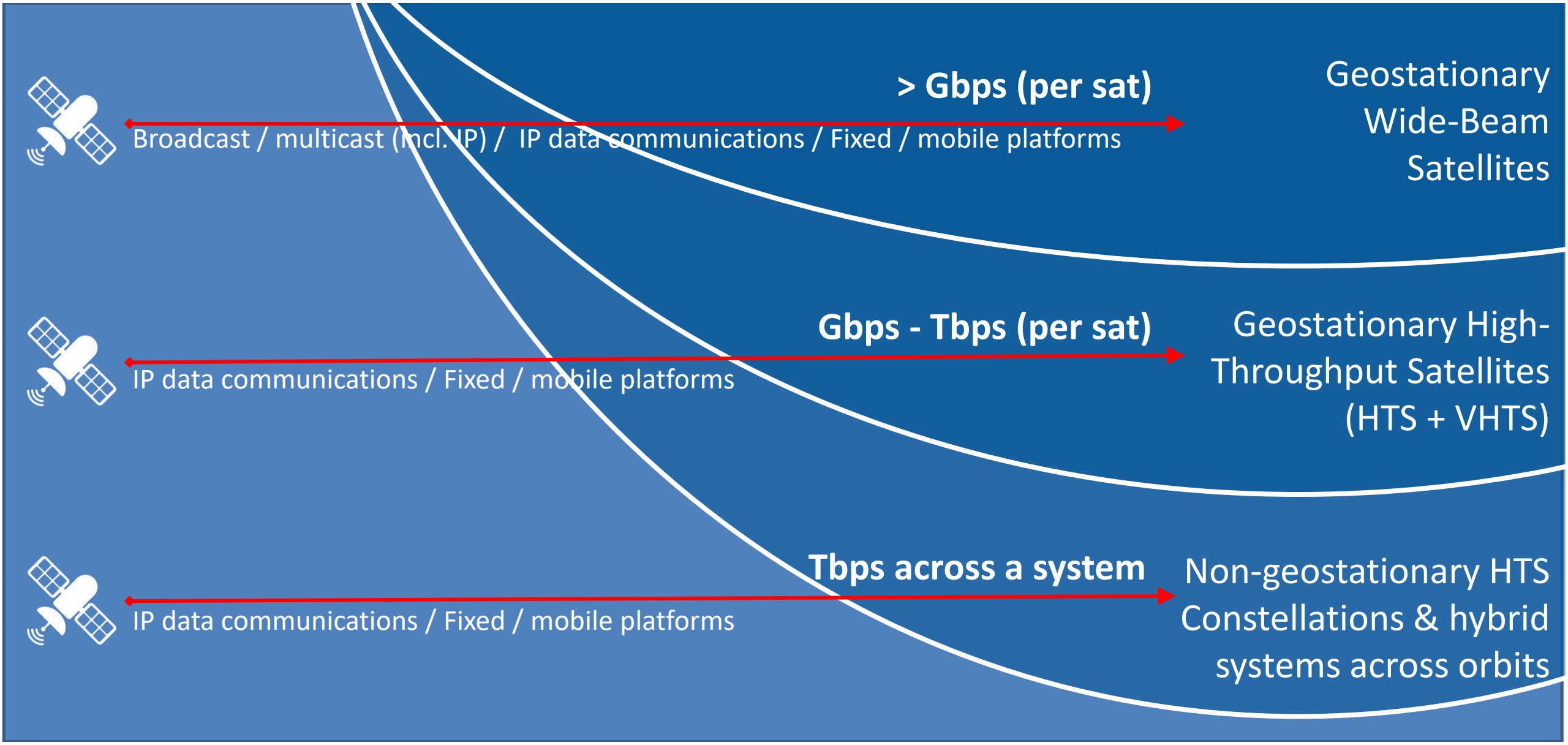
Technology advancement is driving down costs:

⇒ Lower production costs & different designs mean that more can be done with a smaller form factor

⇒ Lower cost to launch & increasing choice of launchers

Lower barriers to entry - more systems being launched

Demand for Spectrum and Regulatory Certainty



A multi-orbit range of satellite capabilities to support broadband connectivity

Satcom Applications

airborne intelligence, surveillance for Unmanned vehicles

High-throughput connectivity

Land to Maritime based applications

Real-time operations & monitoring

Global narrowband satellite network – ideally suited for IoT

The latest Evolution of C/L/Ku/ka bands networks


DEMAND FOR
SPECTRUM &
REGULATORY
CERTAINTY

Critical use of the 6 GHz band - 1

Typical uses:

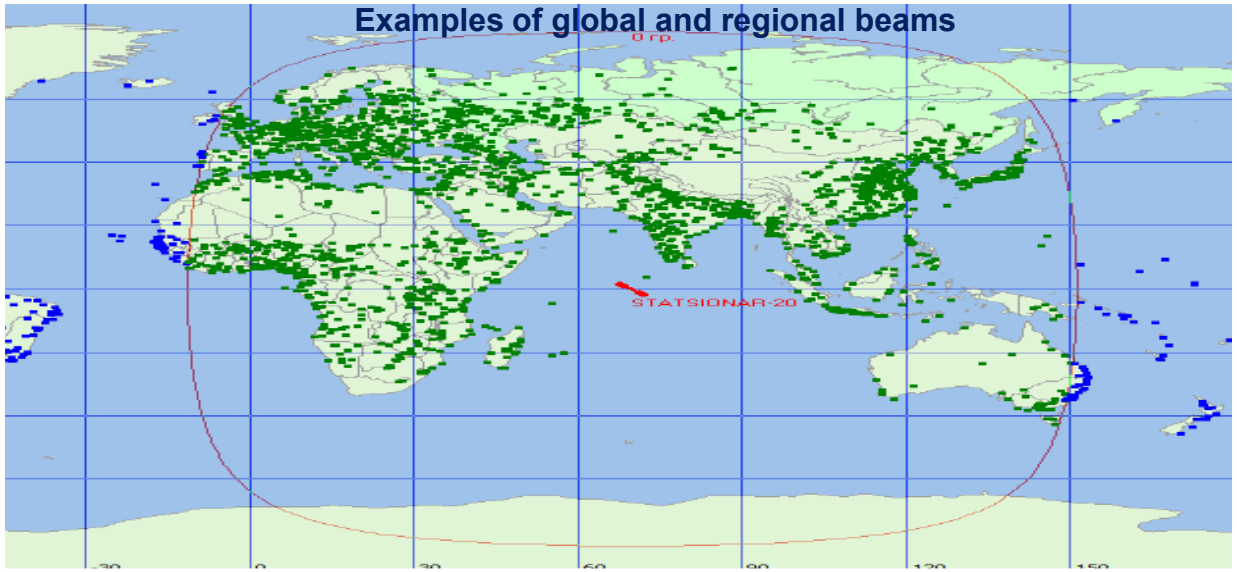
- MSS feeder uplinks (supporting safety services)
- Video distribution
- Planned national systems

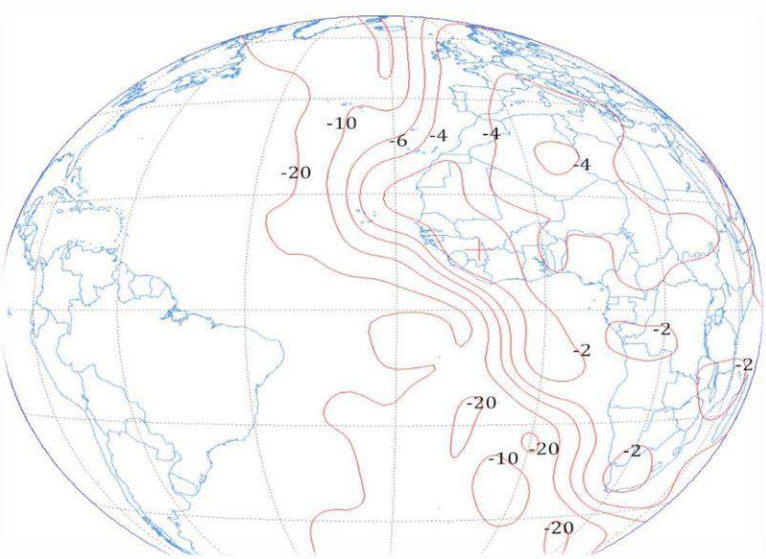
Key satellite characteristics:

- Use of global beams (covering approx 1/3 of the Earth)…
- …or regional beams (cover multiple countries)
- In all cases, aggregate interference to the satellite could be from terrestrial systems in numerous countries

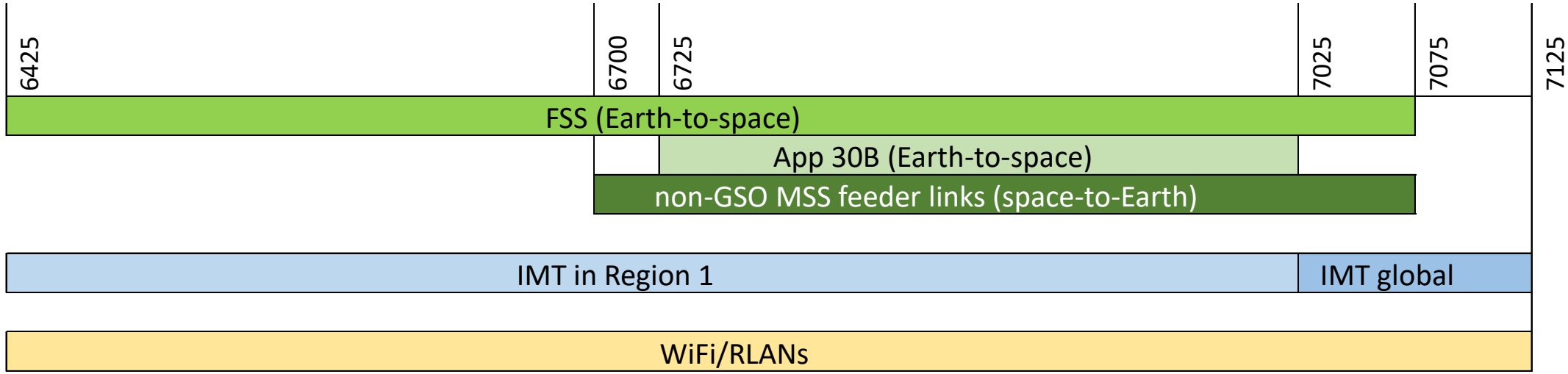
Future use:

- Satellite systems will continue to use 6425-7075 MHz for the foreseeable future
- And the need to protect the use of the planned FSS networks seems inescapable.





Critical use of the 6 GHz band - 2



6425-7075 MHz – FSS E-S)

- For geostationary uplinks
- Includes feeder links for MSS systems
- Main concern is interference to satellite receiver
- Plus, uplink earth stations need to co-exist with terrestrial systems

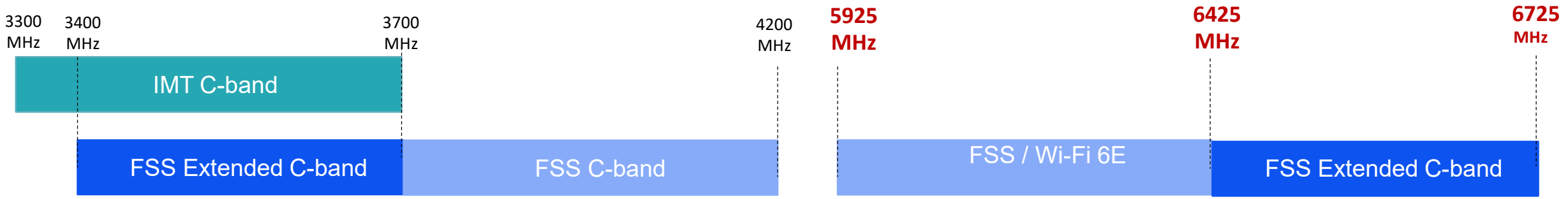
6725-7025 MHz – Appendix 30B

- Planned band for FSS, objective to "...guarantee in practice, for all countries, equitable access to the geostationary-satellite orbit..."
- Provides every administration with a preserved orbital slot and frequency allotment.
- Interference concern with respect to current and planned satellite receivers

6700-7075 MHz – Non-GSO MSS downlinks

- Gateway earth stations deployed around the world
- Earth station could receive interference from terrestrial system
- New earth stations will need to be deployed

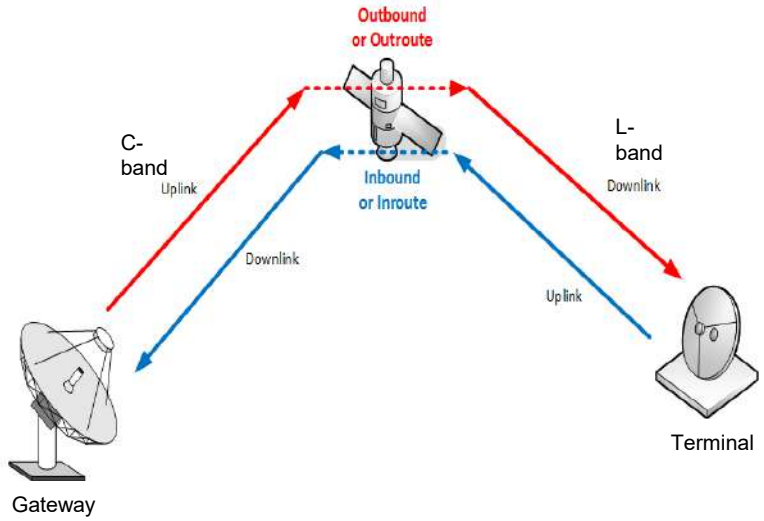
Critical use of the 6 GHz band - 3



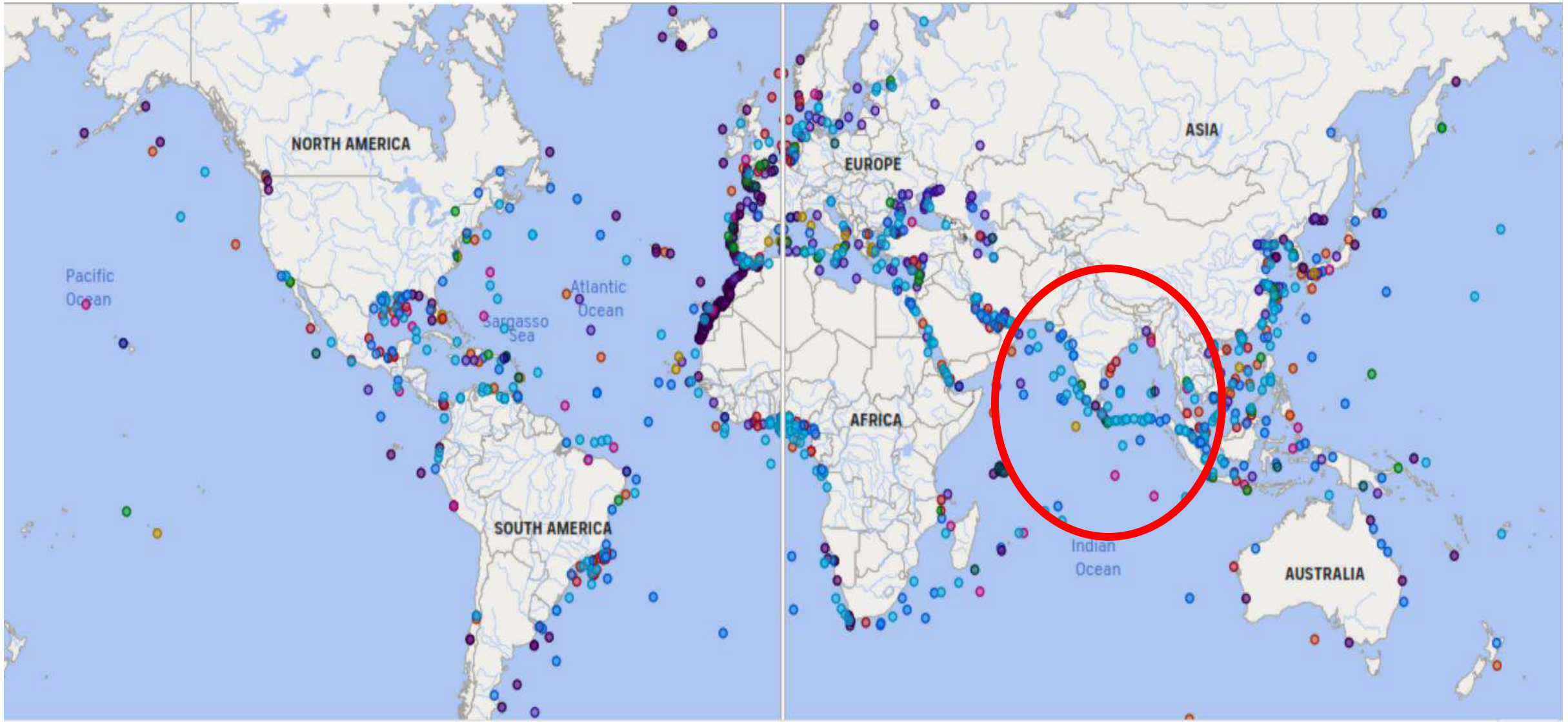
C-band uplink and downlinks:

- **Used by "global beam" antennas, to allow use by gateway stations in almost any country**
- **Use the band 3550-3700 MHz for downlinks (150 MHz)**
- **Use the band 6425-6575 MHz for uplinks (150 MHz)**
- **Used for feeder links for GNSS augmentation (SBAS) on some satellites**
- **Used to support the L-band service uplinks and downlinks**
- **Used for Feeder links to carry safety-related information for Maritime (GMDSS)**
- **and Aeronautical operations (GADSS)**

Critical band for current & future satellite feeder links



GMDSS Distress Calls Map



Issue of Compatibility with FSS

IMT

- Report ITU-R S.2367 – studies of IMT compatibility with respect to **FSS** (5 850-6 425 MHz)
- Concludes interference from IMT-Advanced stations would need to be limited to around 10-15 dBm EIRP and stations limited to indoor use.
- Example separation between IMT station and earth station: “10-78 km to protect outdoor macro cell in a suburban environment”

RLAN (WiFi)

- ECC Report 302 established power limits and deployment limits adequate to protect **FSS** uplinks in 5925-6425 MHz
- Indoor 23 dBm EIRP; outdoor 14 dBm EIRP
- The results of these studies indicated that outdoor usage of standard power RLANs is not feasible

Best use of U6 GHz – 6425-7025 MHz

Key Considerations	IMT	RLANs/Wi-Fi
Availability of existing spectrum	• Below 6 GHz, 2.480 GHz identified (only up to 1 GHz allocated), plus • 17.25 GHz identified in mmWave (very little allocated)	• Initially allocated 580 MHz in total (80 + 500) • Lower 6 GHz band 5925- 6425 MHz (500 MHz) identified • Upper 6 GHz 6425-7025 MHz required for larger channels 3 x 320 MHz for innovative high bandwidth applications
Technical suitability of the band (6425-7025 MHz)	• 6GHz & above propagation characteristics unsuitable for in-building signal penetration in dense urban environments • Unsuitable for coverage of large areas	• Need for contiguous spectrum from 5925 to 7025 MHz. • Principle use for homes and businesses with high-capacity channels if upper 6 GHz is made available
Availability of Equipment	• Equipment eco-system is yet to be developed • 6GHz vendor-supplied equipment unlikely to be available till 2025/26 or beyond	• Equipment ecosystem established for use of 5925 – 7025 with availability of 6E and 7 router technology for use with innovative applications 4K HD TV, AR//VR etc , large stadium/halls etc
Impact on Incumbent services	• Unplanned band 6425 – 6725 critical users FS/FSS users • Planned band AP30B – equitable access to all 6725-7025 MHz	• No impact to existing incumbent services such as FS/FSS both in unplanned or planned bands
Impact Transborder	• Cross-border interference would exist if there is no harmonizing on the use of the spectrum bands between those with national satellite systems and those aim to use it for IMT.	• No cross-border issues if the band is used for indoor applications
Economic / Social impact	• To utilize first, existing available spectrum to minimize MNO investment and costs & minimize impact on incumbent services • 6 GHz can be utilized as per 3GPP's proposed 5G-NRU for the unlicensed band for indoor applications—5925-7025 MHz. • Given low ARPU levels, MNO seeks to build on existing eco-system • Re-farming of 2G/3G spectrum to minimize costs for MNO.	• Given that an existing ecosystem is established – a significant opportunity for economic growth with the introduction of 6E and Wi-Fi 7 for new innovative applications and services such as AR/VR, AI etc. • No conflict with existing FS/FSS users but to enhance their capability and capacity.

The Risks of IMT Identification in 6725-7125 MHz for India

WASTE AND FRAGMENTATION

IMT ALREADY HAS SUFFICIENT SPECTRUM

IMT ISN'T AS EFFICIENT AS WI-FI

GLOBAL FRAGMENTATION

CONNECTIVITY CHALLENGES

A NEGATIVE SIGNAL FOR EQUIPMENT MAKERS

A BRAKE ON INNOVATION

NEGATIVE IMPACT ON EXISTING SERVICES

MAJOR ECONOMIC COSTS

FORGOING TRILLIONS IN FDI

GREATER CONGESTION

CONSTRAINED CONNECTIVITY

Affordability is the key driver

UN Broadband Commission

By 2025, entry-level broadband services should be made affordable in low- and middle-income countries (LMICs) at ***less than 2 per cent of monthly Gross National Income (GNI) per capita***

Developing countries
UP to 80% Prepaid

GNIPC ~4800 USD/year
400/month
2% → 8 USD/month

In rural areas:
Minimum Wage
200/month
2% → 4 USD/month

ICT price baskets		Minimum monthly allowance		
		Voice (min)	SMS (#)	Data
1	Data-only mobile-broadband basket	-	-	2 GB
2	Mobile data and voice low-consumption basket	70	20	500 MB
3	Mobile data and voice high-consumption basket	140	70	2 GB
4	Mobile-cellular low-usage basket	70	20	-
5	Fixed-broadband basket	-	-	5 GB

Satellite Industry Perspective

1. Difficult to see how IMT use of the band 6425-7075 MHz could be compatible with current and future satellite use
2. Use of the band 6425-7075 MHz for WiFi may be feasible (based on introduction of WiFi in the band 5925-6425 MHz)
3. WiFi on a secondary basis with respect to FSS looks a feasible approach for 6425-7125 MHz