ITU-APT Foundation of India (IAFI)

SPACE POLICY CONFERENCE

#ISPC25

24 - 25 JULY 2025

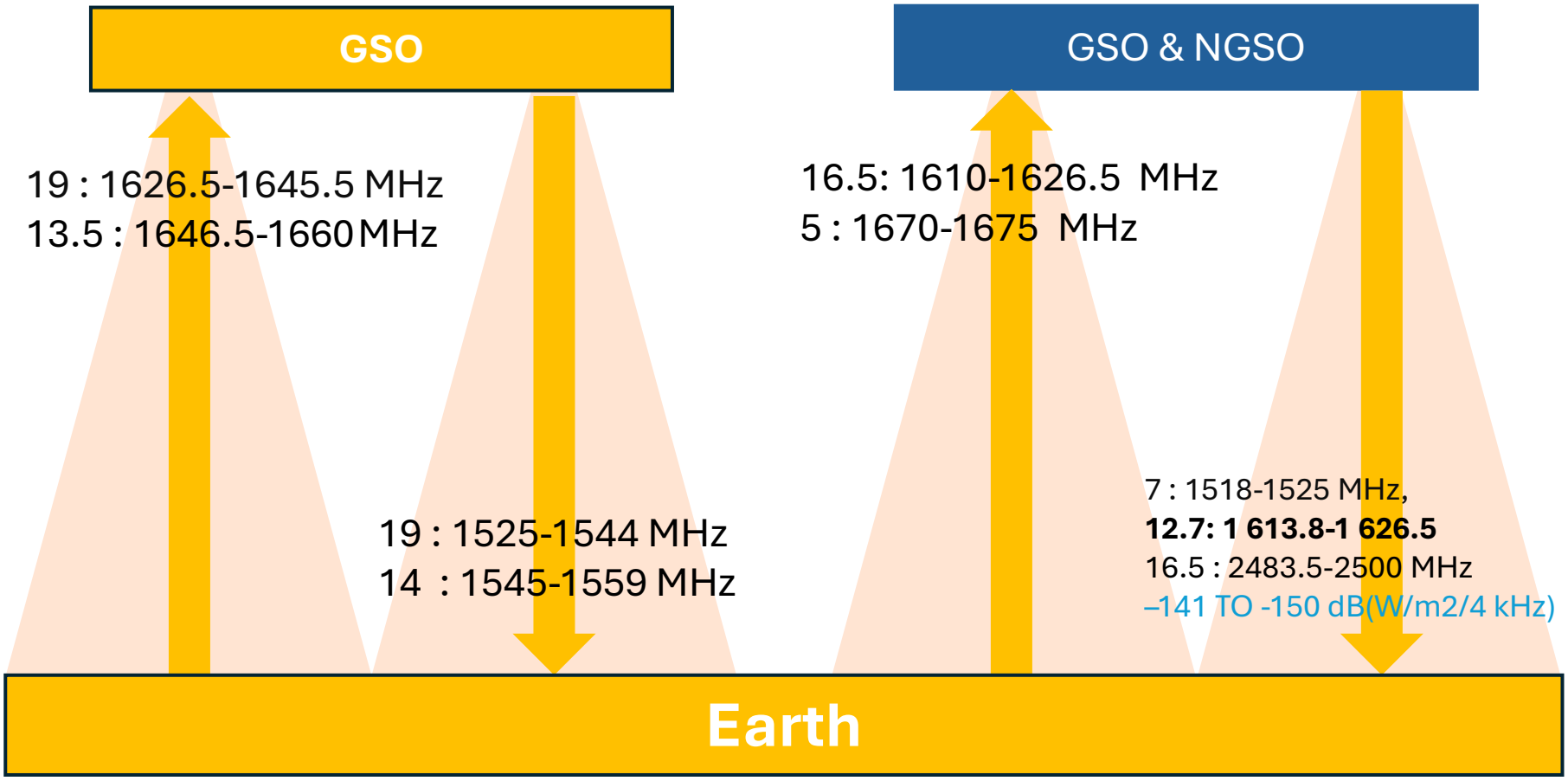
HOTEL THE IMPERIAL, NEW DELHI, INDIA

WRC-27 AGENDA ITEM 1.11. 1.12. 1.13 and 1.14

M. P. S. Alawa
Joint Wireless Advisor
RLO NR, New Delhi
25 July 2025

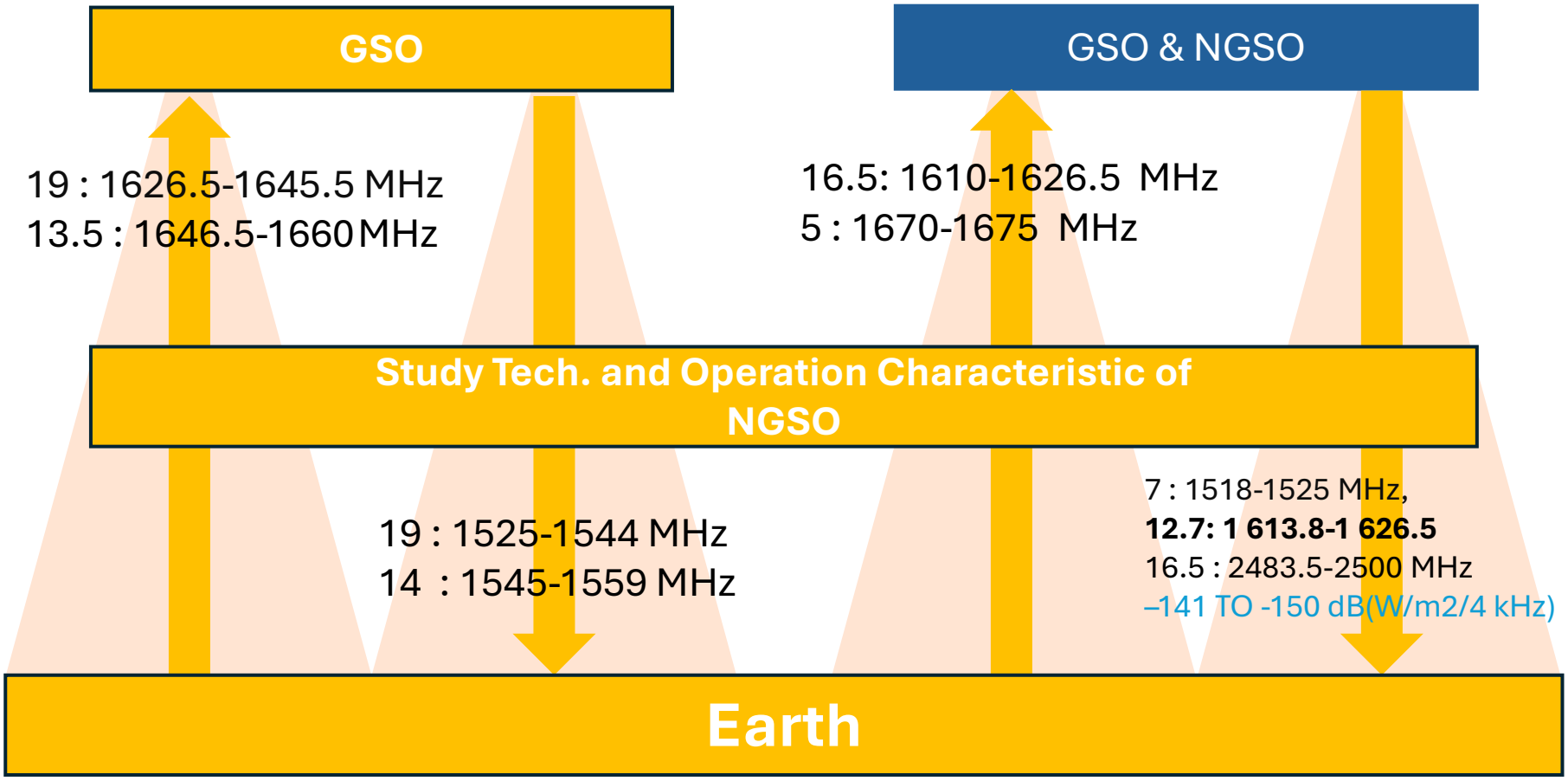
WRC-27 AGENDA ITEM 1.11

Space-to-space links in the frequency bands 1 518-1 544 MHz, 1 545-1 559 MHz, 1 610-1 645.5 MHz, 1 646.5-1 660 MHz, 1 670-1 675 MHz and 2 483.5-2 500 MHz allocated to the mobile-satellite service (MSS)



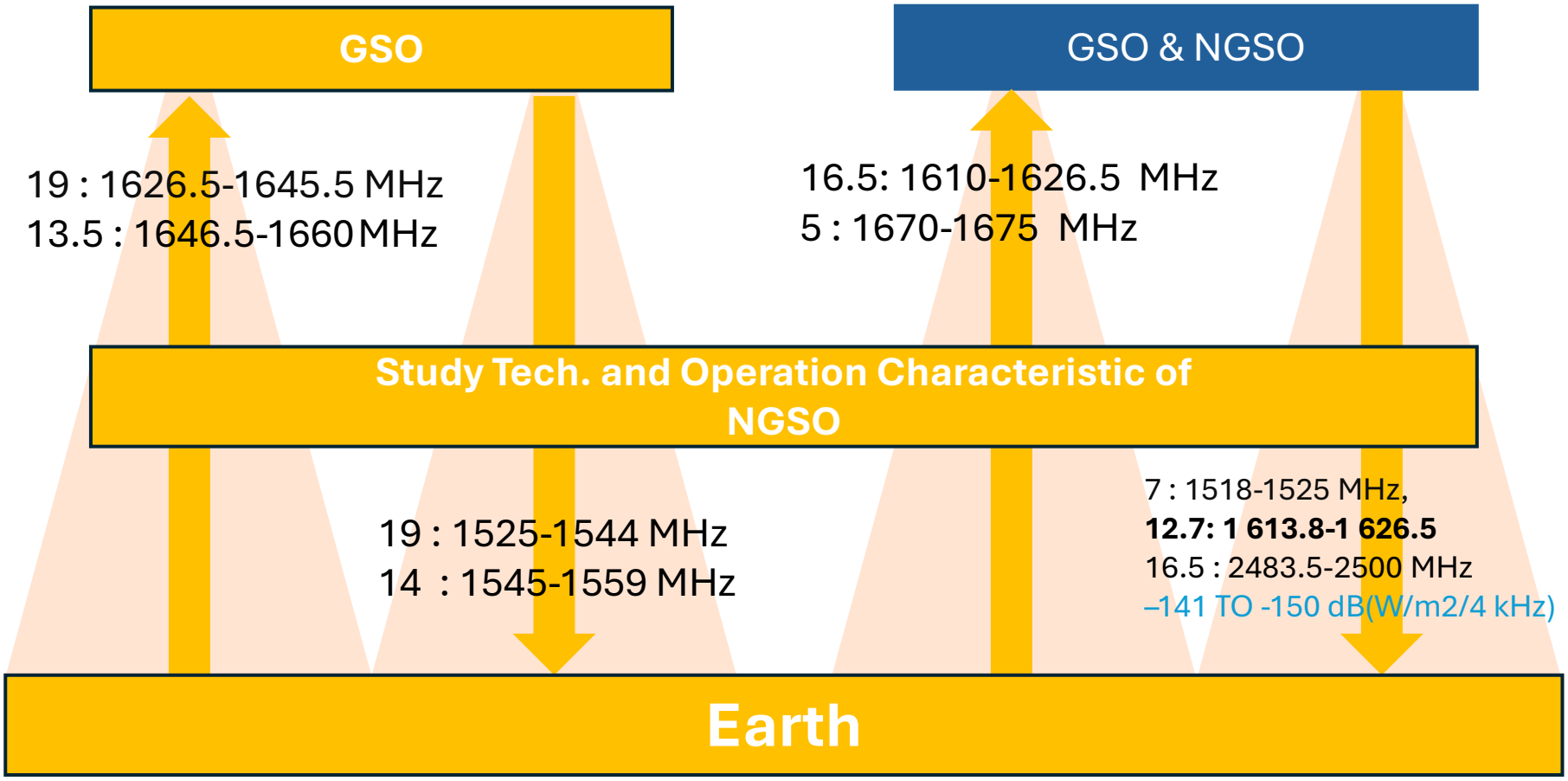
WRC-27 AGENDA ITEM 1.11

Space-to-space links in the frequency bands 1 518-1 544 MHz, 1 545-1 559 MHz, 1 610-1 645.5 MHz, 1 646.5-1 660 MHz, 1 670-1 675 MHz and 2 483.5-2 500 MHz allocated to the mobile-satellite service (MSS)



WRC-27 AGENDA ITEM 1.11

	IDP	C	Hand held (GSPS)	Maritime	Aeronautical
Service	LMSS	MMSS	LMSS	MMSS	AMSS
pfd at GSO service provider (dBW/m^2/Hz)	–182.6	–188.1	–204.1	–192.1	–193.1



WRC-27 AGENDA ITEM 1.11

Space-to-space links in the frequency bands 1 518-1 544 MHz, 1 545-1 559 MHz, 1 610-1 645.5 MHz, 1 646.5-1 660 MHz, 1 670-1 675 MHz and 2 483.5-2 500 MHz allocated to the mobile-satellite service (MSS)

Rx antenna noise temperature (K)

Terminal Noise Temperature	
1 518-1 525 (Downlink)	250 (K) to 917 (K)
Satellite Noise Temperature	
1 668-1 675 (Uplink)	290 (K) to 728 (K)

WRC-27 AGENDA ITEM 1.11

Space-to-space links in the frequency bands 1 518-1 544 MHz, 1 545-1 559 MHz, 1 610-1 645.5 MHz, 1 646.5-1 660 MHz, 1 670-1 675 MHz and 2 483.5-2 500 MHz allocated to the mobile-satellite service (MSS)

pfd thresholds for unwanted emissions from any GSO space station at a radio astronomy station

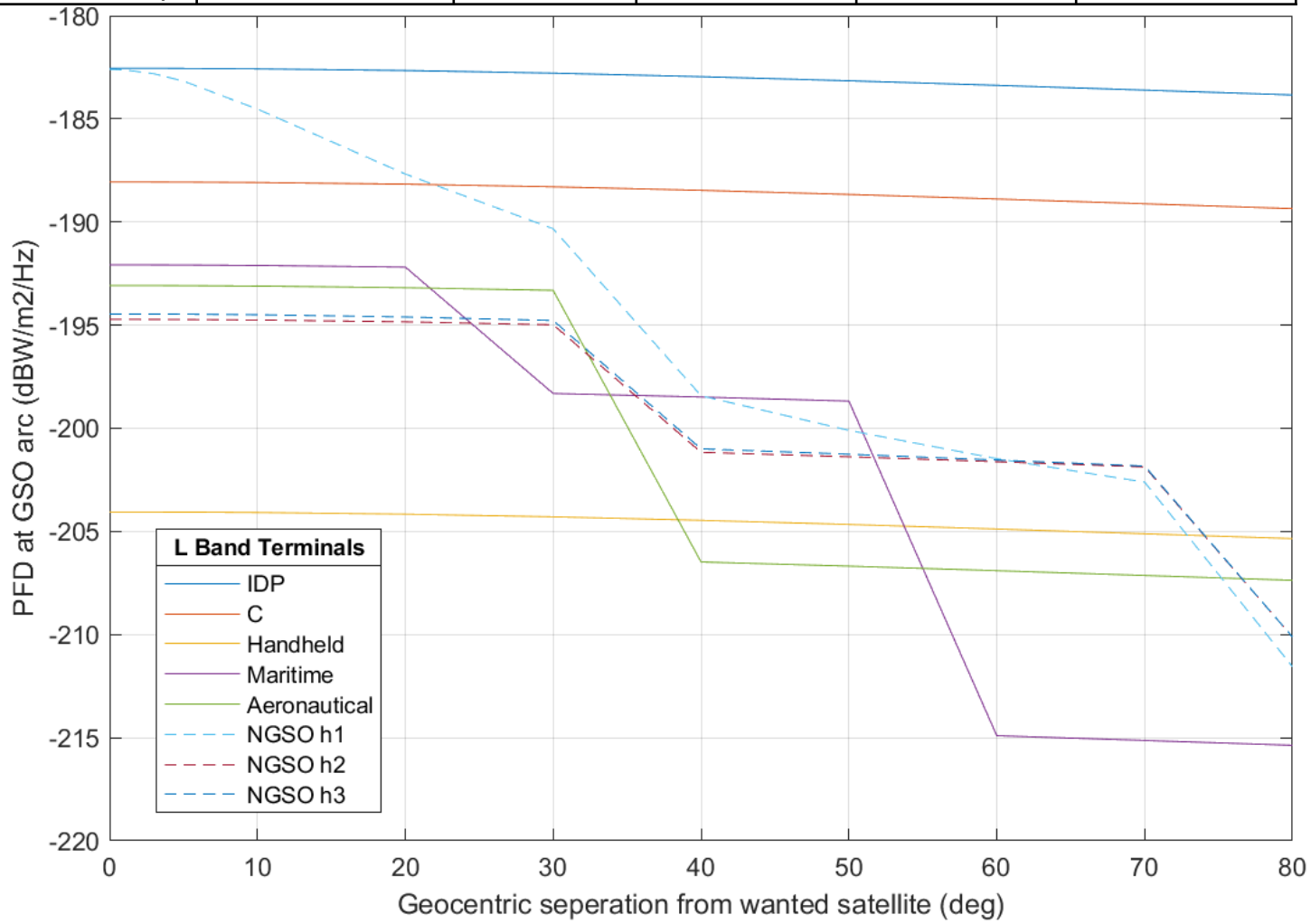
Space service	Space service frequency band	Radio astronomy frequency band	Single dish, continuum observations		Single dish, spectral line observations		VLBI		Condition of application: the API is received by BR following the entry into force of the Final Acts of:
			pfd(1)	Reference bandwidth	pfd(1)	Reference bandwidth	pfd(1)	Reference bandwidth	
	(MHz)	(MHz)	(dB(W/m²))	(MHz)	(dB(W/m²))	(kHz)	(dB(W/m²))	(kHz)	
MSS (space-to-Earth)	387-390	322-328.6	−189	6.6	−204	10	−177	10	WRC-07
BSS MSS (space-to-Earth)	1 452-1 492 1 525-1 559	1 400-1 427	−180	27	−196	20	−166	20	WRC-03
MSS (space-to-Earth) MSS (space-to-Earth)	1 525-1 559 1 613.8-1 626.5	1 610.6-1 613.8	NA	NA	−194	20	−166	20	WRC-03
RNSS (space-to-Earth)	1 559-1 610	1 610.6-1 613.8	NA	NA	−194	20	−166	20	WRC-07
BSS FSS (space-to-Earth)	2 655-2 670	2 690-2 700	−177	10	NA	NA	−161	20	WRC-03
FSS (space-to-Earth)	2 670-2 690	2 690-2 700 (in Regions 1 and 3)	−177	10	NA	NA	−161	20	WRC-03
	(GHz)	(GHz)	–	–	–	–	–	–	
BSS	21.4-22.0	22.21-22.5	−146	290	−162	250	−128	250	WRC-03 for VLBI, and WRC-07 for other types of observation

NA: Not applicable, measurements of this type are not made in this frequency band.

(1) Integrated over the reference bandwidth with an integration time of 2 000 s.

WRC-27 AGENDA ITEM 1.11

	IDP	C	Hand held (GSPS)	Maritime	Aeronautical
Service	LMSS	MMSS	LMSS	MMSS	AMSS
pfd at GSO service provider (dBW/m^2/Hz)	–182.6	–188.1	–204.1	–192.1	–193.1



h1: 27 033 km,
h2: 450 km ,
h3: 1 220 km

AI 1.12 : Studies on potential new allocations to, and regulatory actions for, the mobile-satellite service in the frequency bands **1 427-1 432 MHz (space-to-Earth), 1 645.5-1 646.5 MHz (space-to-Earth) (Earth-to-space),** 1 880-1 920 MHz (space-to-Earth) (Earth-to-space) and 2 010-2 025 MHz (space-to-Earth) (Earth-to-space) required for the future development of low-data-rate non-geostationary mobile-satellite systems

1 400-1 427	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.341
1 427-1 429	SPACE OPERATION (Earth-to-space) FIXED MOBILE except aeronautical mobile 5.341A 5.341B 5.341C 5.338A 5.341
1 429-1 452 FIXED MOBILE except aeronautical mobile 5.341A 5.338A 5.341 5.342	**1 429-1 452** FIXED MOBILE 5.341B 5.341C 5.343 5.338A 5.341

Giant Metrewave Radio Telescope, Pune 30x45m antenna

?

?

Giant Metrewave Radio Telescope, 30 x 45m antenna, Pune, Maharashtra India	**19° 05' 26.32" 74° 02' 59.65" 642 to 690 m**	**15**	**43.5**	**https://www.gmrt.ncra.tifr.res.in/, Broad plains with some hills towards the periphery**

1 626.5-1 660	MOBILE-SATELLITE (Earth-to-space) 5.351A 5.341 5.351 5.353A 5.354 5.355 5.357A 5.359 5.362A 5.374 5.375 5.376

?

AI 1.12 : Studies on potential new allocations to, and regulatory actions for, the mobile-satellite service in the frequency bands 1 427-1 432 MHz (space-to-Earth), 1 645.5-1 646.5 MHz (space-to-Earth) (Earth-to-space), **1 880-1 920 MHz (space-to-Earth) (Earth-to-space) and 2 010-2 025 MHz (space-to-Earth) (Earth-to-space)** required for the future development of low-data-rate non-geostationary mobile-satellite systems

1 710-1 930	FIXED MOBILE 5.384A 5.388 5.388A 5.149 5.341 5.385 5.386 5.387	?

1 980-2 010	FIXED MOBILE 5.388 MOBILE-SATELLITE (Earth-to-space) 5.351A 5.389A 5.389B 5.389F	
2 010-2 025 FIXED MOBILE 5.388 5.388A	**2 010-2 025** FIXED MOBILE 5.388 MOBILE-SATELLITE (Earth-to-space) 5.389C 5.389E	**2 010-2 025** FIXED MOBILE 5.388 5.388A ?
2 025-2 110	SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space) 5.392	

AI 1.12 : Studies on potential new allocations to, and regulatory actions for, the mobile-satellite service in the frequency bands 1 427-1 432 MHz (space-to-Earth), 1 645.5-1 646.5 MHz (space-to-Earth) (Earth-to-space), 1 880-1 920 MHz (space-to-Earth) (Earth-to-space) and 2 010-2 025 MHz (space-to-Earth) (Earth-to-space) required for the future development of low-data-rate non-geostationary mobile-satellite systems

Threshold levels of interference detrimental to radio astronomy continuum observations (R-REC-RA.769)

Centre frequency (MHz)	Spectral pfd (dB(W/(m2 ·Hz)))	Spectral pfd (dB(W/(m2 ·4kHz)))
1 413.5	–255	-218

Technical characteristics of non-GSO LDR MSS system (space-to-Earth) in

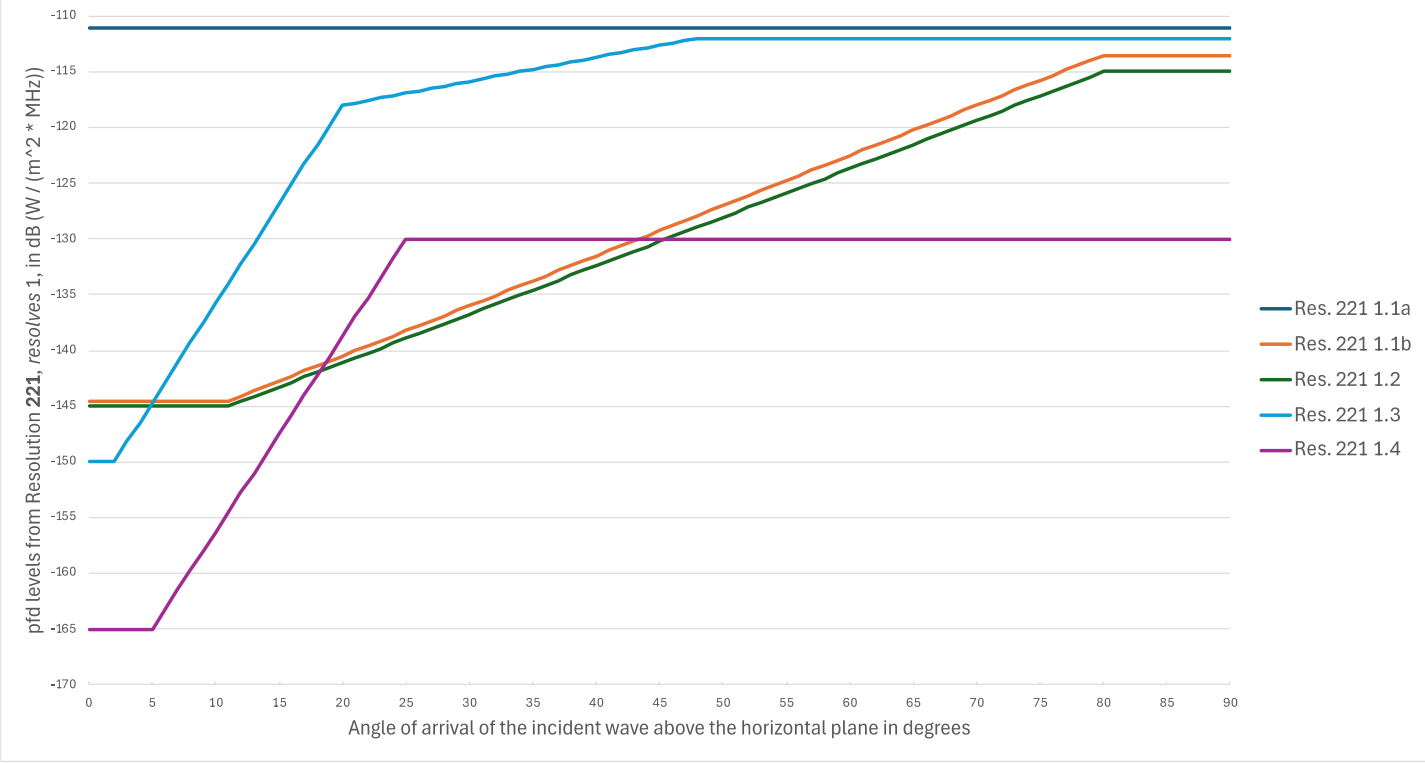
1 427-1 432 MHz (space-to-Earth **–145 to – 135 (dB(W/(m2 ·4kHz)))**

Eg. of technical characteristics of non-GSO LDR MSS system (space-to-Earth) in 1 645.5-1646.5 MHz, 1 880-1 920 MHz and 2 010-2 025 MHz

Parameters	Configuration A	Configuration B	Configuration C	Configuration D	Configuration E
Range of pfd (dB(W/(m^2 · 4 kHz)))	–160.8 - –150.5	–174.7 - –164.5	–174.7 - –164.5	–174.7 - –164.5	–174.7 - –164.5

AI 1.12 : Studies on potential new allocations to, and regulatory actions for, the mobile-satellite service in the frequency bands 1 427-1 432 MHz (space-to-Earth), 1 645.5-1 646.5 MHz (space-to-Earth) (Earth-to-space), 1 880-1 920 MHz (space-to-Earth) (Earth-to-space) and 2 010-2 025 MHz (space-to-Earth) (Earth-to-space) required for the future development of low-data-rate non-geostationary mobile-satellite systems

Use of HIBS in the frequency bands 1 710-1 980 MHz, 2 010-2 025 MHz and 2 110-2 170 MHz : RESOLUTION 221 (REV.WRC-23)



WRC27 AI 1.13 RESOLUTION 253 (WRC-23)

To studies on possible allocations to the MSS in the frequency range between 694/698 MHz and 2.7 GHz, taking into account the IMT frequency arrangements addressed in the most recent version of Recommendation ITU-R M.1036;

...

resolves

1. studies on possible allocations to the MSS in the frequency range between 694/698 MHz and 2.7 GHz, taking into account the IMT frequency arrangements addressed in the most recent version of Recommendation ITU-R M.1036;
2. studies on spectrum requirements and on technical, operational and regulatory matters related to the implementation of the mobile-satellite service for direct connectivity to the IMT user equipment to complement the terrestrial IMT network coverage,

further resolves

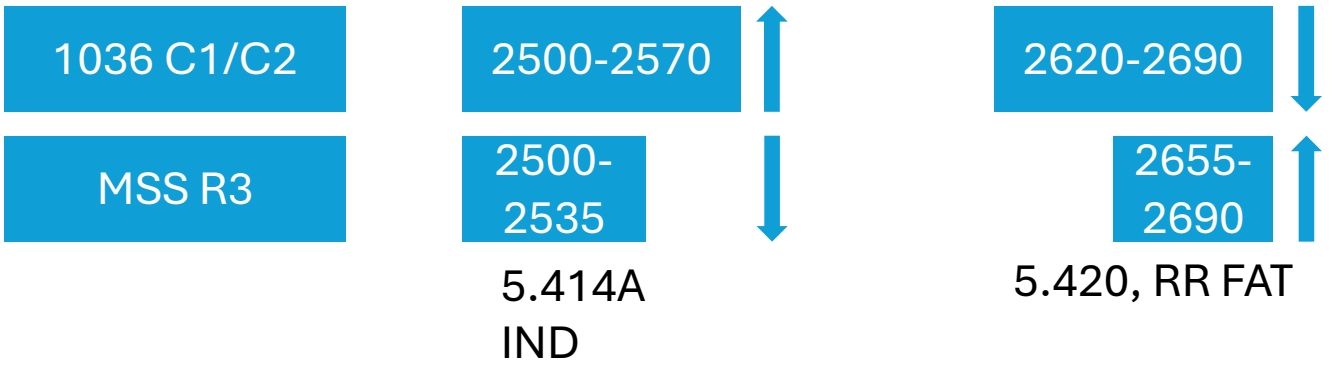
1. to conduct studies on sharing and compatibility between incumbent services, including in adjacent frequency bands, ensuring the protection of incumbent services in accordance with the Radio Regulations;
2. to study possible technical and operational measures to ensure that the stations in the MSS do not cause harmful interference to, or claim protection from, stations operating in the mobile service,

...

ITU Rec. M.1036 frequency arrangements for bands in the range between 694/698 MHz and 2.7 GHz.

Section	Band	Freq Arrangement
SECTION 3	470-960 MHz	Table 2 (A1 to A13)
SECTION 4	1 427-1 518 MHz	Table 3 (G1 to G3)
SECTION 5	1 710-2 200 MHz	Table 4 (B1 to B7)
SECTION 6	2 300-2 400 MHz	Table 5 (E1)
SECTION 7	2 500-2 690 MHz	Table 6 (C3)

For Region 3 in part of Band 2 500-2 570 MHz and 2 620-2 690 MHz the direction of MSS communication is opposite to that of M.1036 freq. arrangement



Frequency Bands in use by Indian Telecom operators

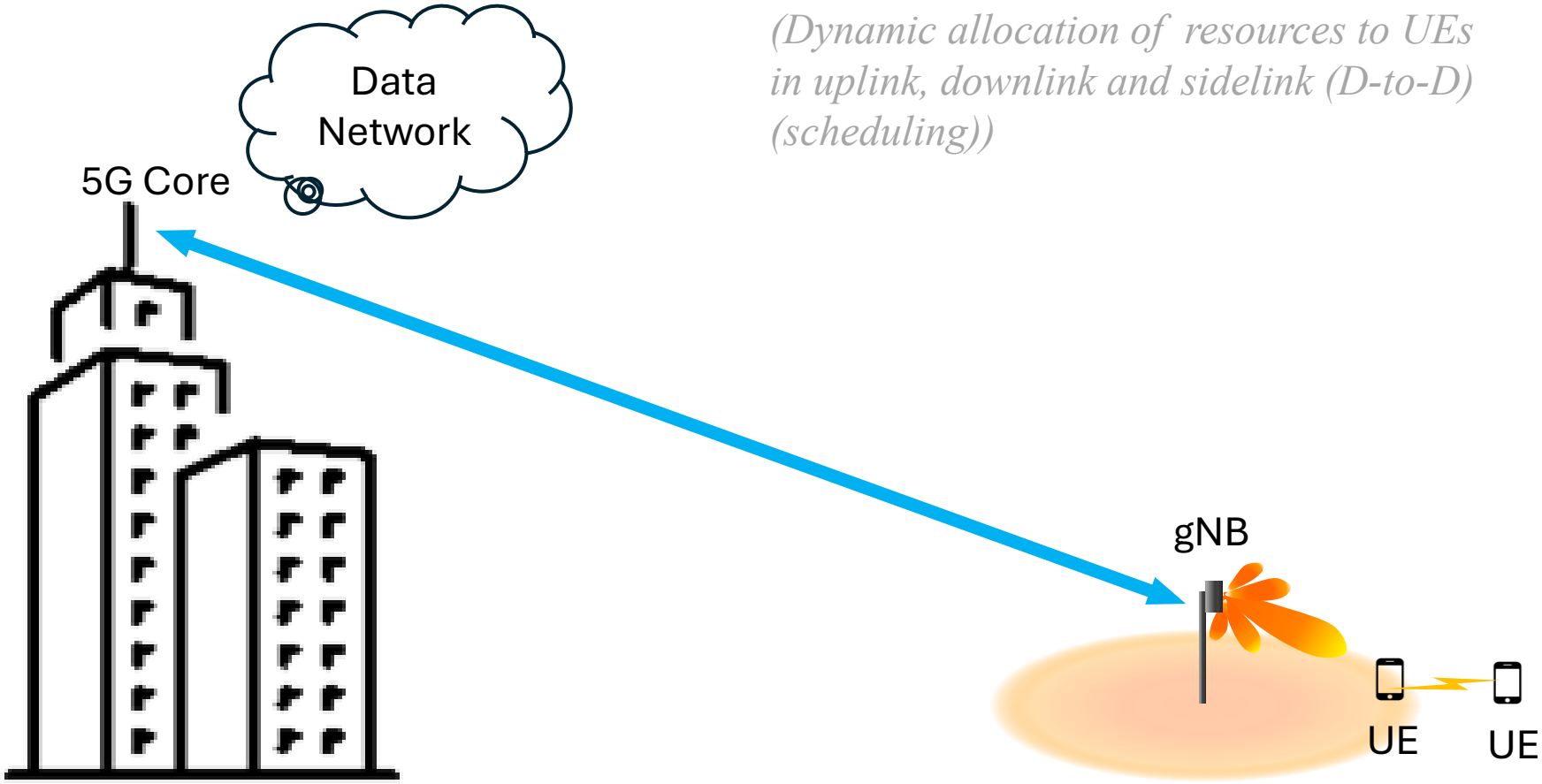
Band MHz	M.1036 Freq Arr	Up-Link MHz	Down-Link MHz	Total Band MHz	Remarks M.1036
600	A13	663-703	612-652	40+40	**A6:698-806 TDD**
700	A5 Part	718-748	773-803	30+30	45+45 703-748 & 758-803 **A6:698-806 TDD**
800	A1 Part	824-844	869-889	20 +20	25+25 824-849 & 869-894
900	A2 Part	890-915	935-960	25+25	35+35 880-915 & 925-960
1800	B2 Part	1710-1765	1805-1860	55+55	75+75 1710-1785 & 1805-1880
2100	B1 Part	1939-1979	2129-2169	40+40	60+60 1920-1980 & 2110-2170 **B3 &5: 1920-1930 TDD**
2300	E1 Part	2300-2380		80	100 2300-2400
2500	C1 Part	2535-2555	2635-2655	20+20	170+170 2500-2570 & 2620-2690 **C3 : 2500-2690 TDD/FDD**

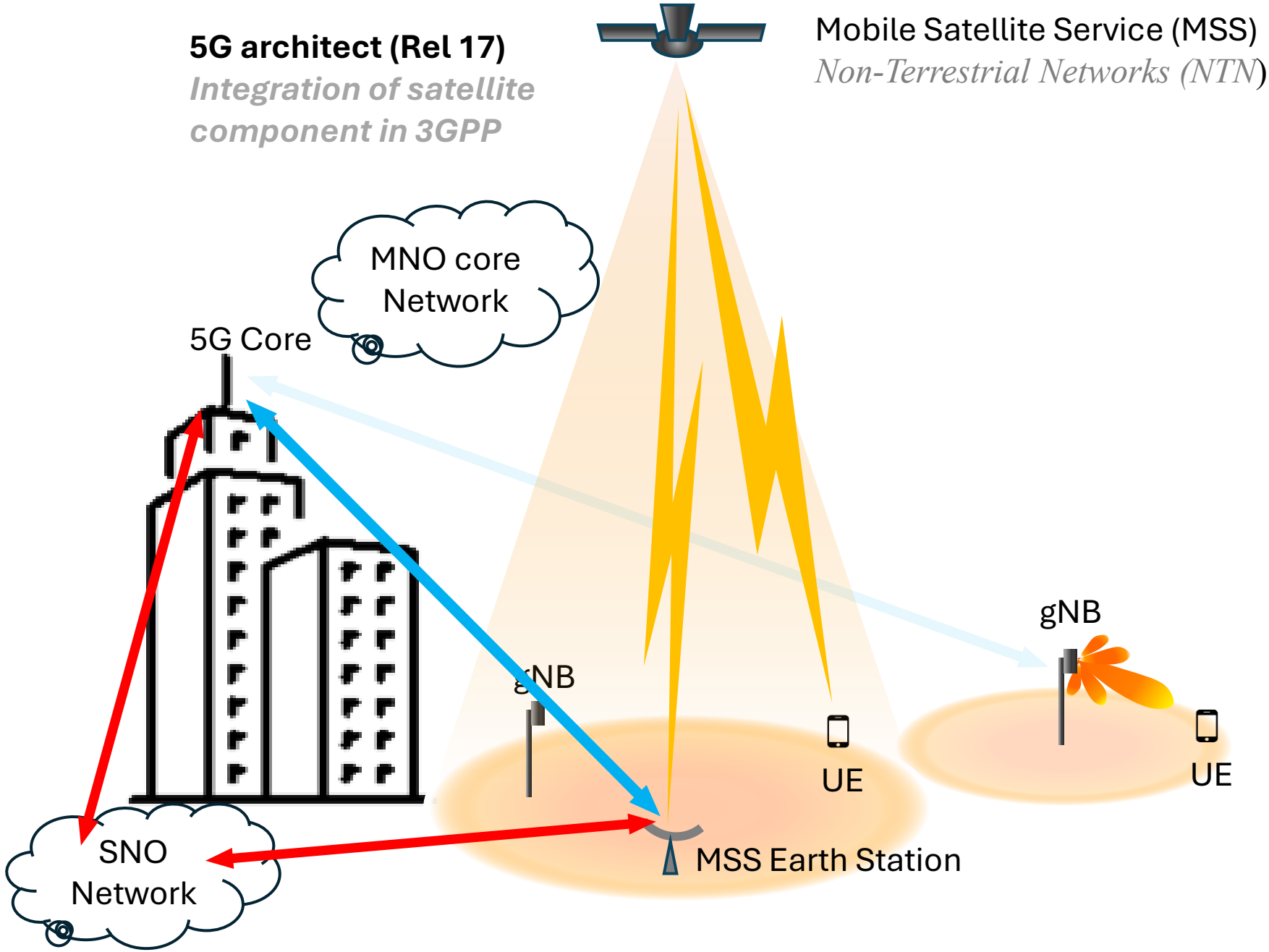
5G architect

Next generation NodeB (gNB)

Radio resource management :

(Dynamic allocation of resources to UEs in uplink, downlink and sidelink (D-to-D) (scheduling))




5G architect (Rel 17)
Integration of satellite component in 3GPP
Mobile Satellite Service (MSS)
Non-Terrestrial Networks (NTN)
MNO core Network
5G Core
gNB
gNB
UE
UE
SNO Network
MSS Earth Station

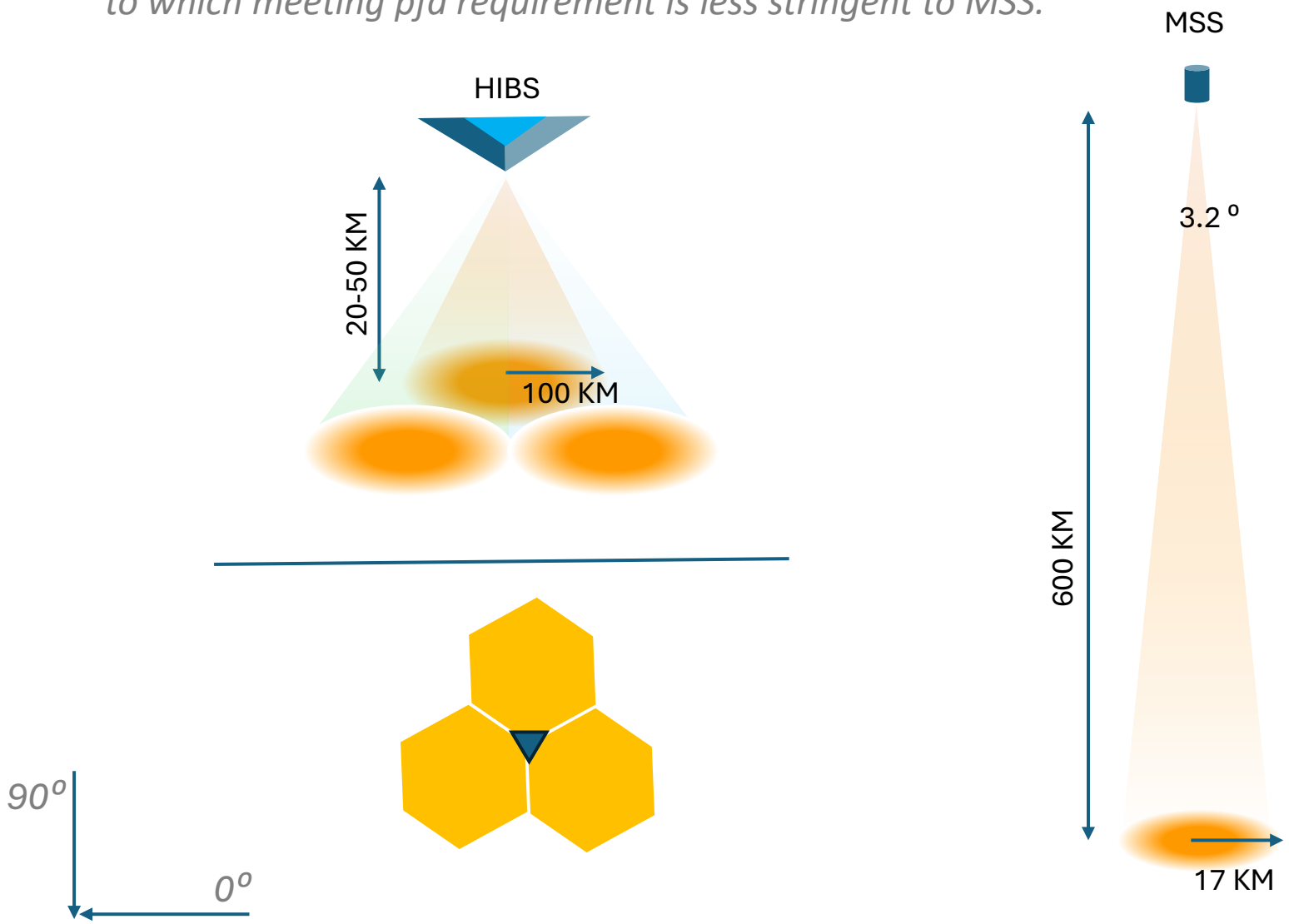
3GPP Rel-17
Satellite NG-RAN : Integration of satellite components in the 5G architecture

Non-Terrestrial Networks (NTN) may support several use cases:

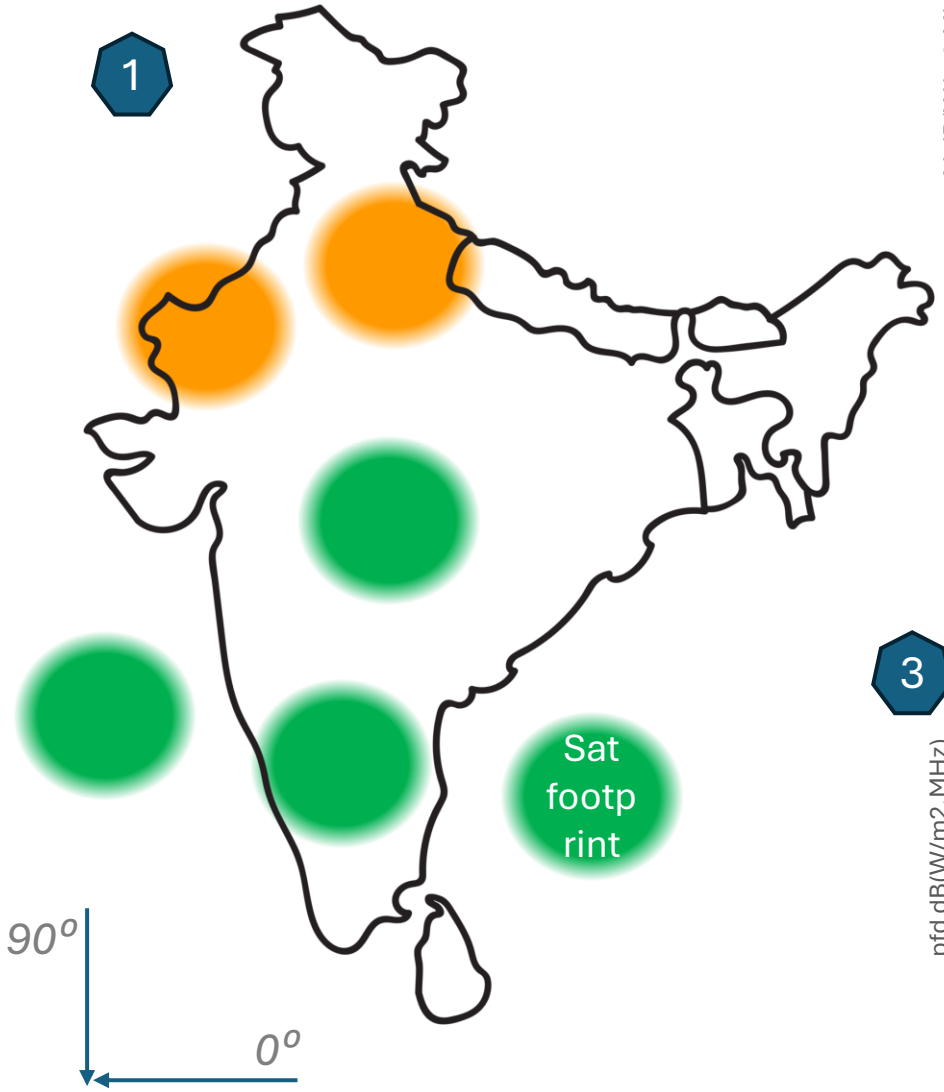
- Coverage extention: Connectivity to underserved communities, in rural and remote areas, in agriculture, mining and forestry area;
- Internet of Things: Monitoring of movable and immovable assets via IoT, e.g, ships, trains, trucks, bridges, pipelines, railway track, agriculture, water level etc;
- Disaster communication;
- Global roaming: Tracking of transportation (Land, Water).

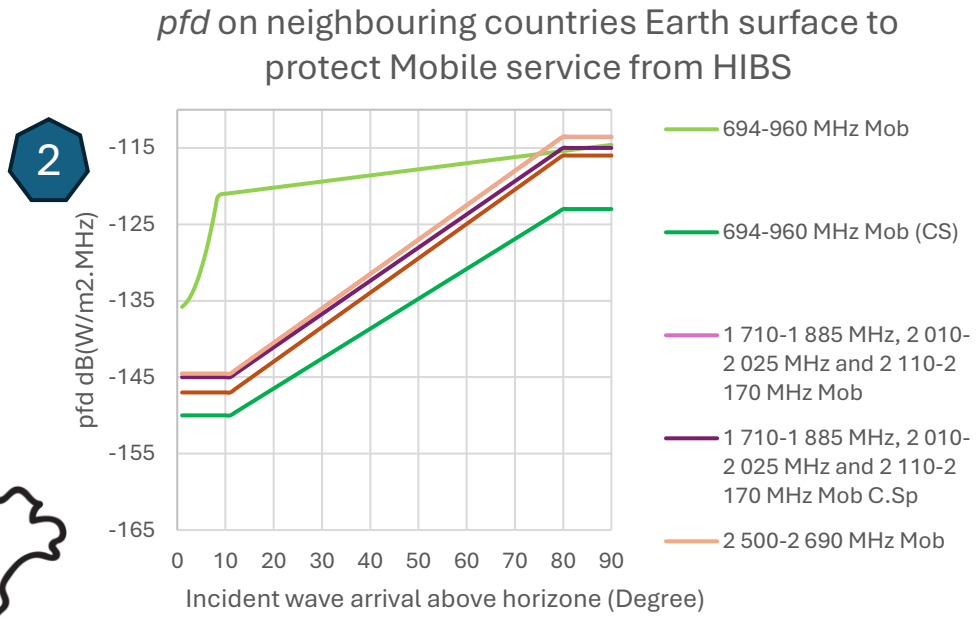
Protection of incumbent services

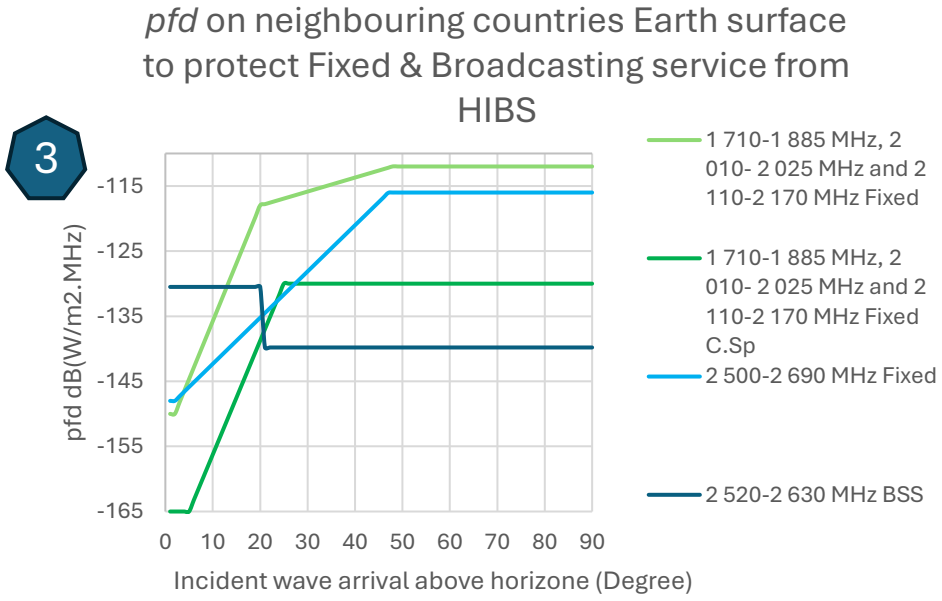
MSS signal angle is closer to 90º in comparison to HIBS due to which meeting pfd requirement is less stringent to MSS.



Protection of incumbent services





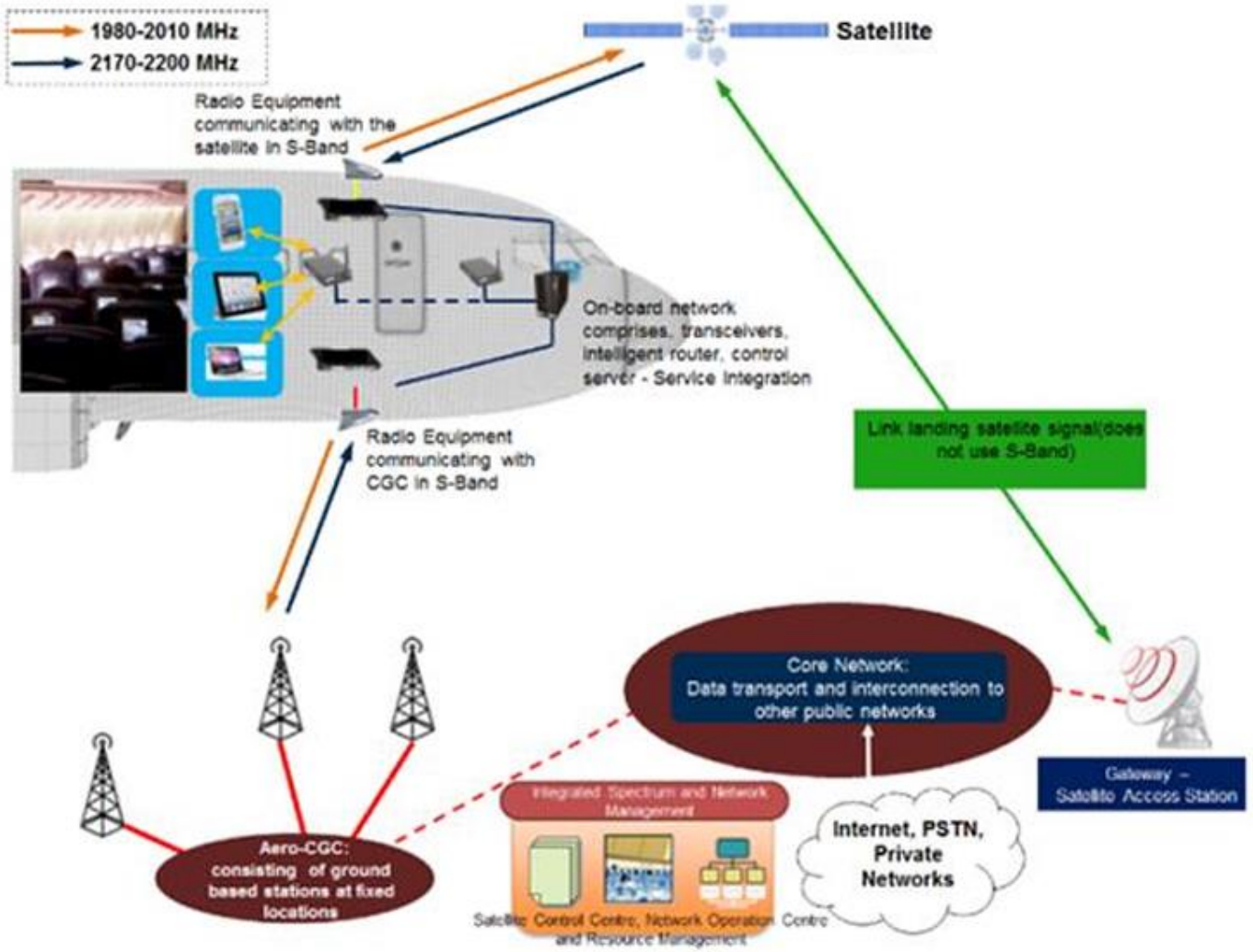


AI 1.14 Studies on possible new frequency allocations to the mobile-satellite service in the frequency bands 2 010-2 025 MHz (Earth-to-space) and 2 160-2 170 MHz (space-to-Earth) in Regions 1 and 3 and 2 120-2 160 MHz (space-to-Earth) in all Regions

1 980-2 010	FIXED MOBILE 5.388 MOBILE-SATELLITE (Earth-to-space) 5.351A 5.389A 5.389B 5.389F √		
2 010-2 025 FIXED MOBILE 5.388 5.388A ?	**2 010-2 025** FIXED MOBILE 5.388 MOBILE-SATELLITE (Earth-to-space) √ 5.389C 5.389E	**2 010-2 025** FIXED MOBILE 5.388 5.388A ?	
2 025-2 110	SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space) 5.392		
2 110-2 120	FIXED MOBILE 5.388 5.388A SPACE RESEARCH (deep space) (Earth-to-space)		
2 120-2 160 FIXED MOBILE 5.388 5.388A ?	**2 120-2 160** FIXED MOBILE 5.388 5.388A ? Mobile-satellite (space-to-Earth)	**2 120-2 160** FIXED MOBILE 5.388 5.388A ?	IMT↓
2 160-2 170 FIXED MOBILE 5.388 5.388A ?	**2 160-2 170** FIXED MOBILE 5.388 MOBILE-SATELLITE (space-to-Earth) √ 5.389C 5.389E	**2 160-2 170** FIXED MOBILE 5.388 5.388A ?	IMT ↓
2 170-2 200	FIXED MOBILE 5.388 MOBILE-SATELLITE (space-to-Earth) 5.351A 5.389A 5.389F √		
2 200-2 290	SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space) 5.392		

AI 1.14 Studies on possible new frequency allocations to the mobile-satellite service in the frequency bands 2 010-2 025 MHz (Earth-to-space) and 2 160-2 170 MHz (space-to-Earth) in Regions 1 and 3 and 2 120-2 160 MHz (space-to-Earth) in all Regions

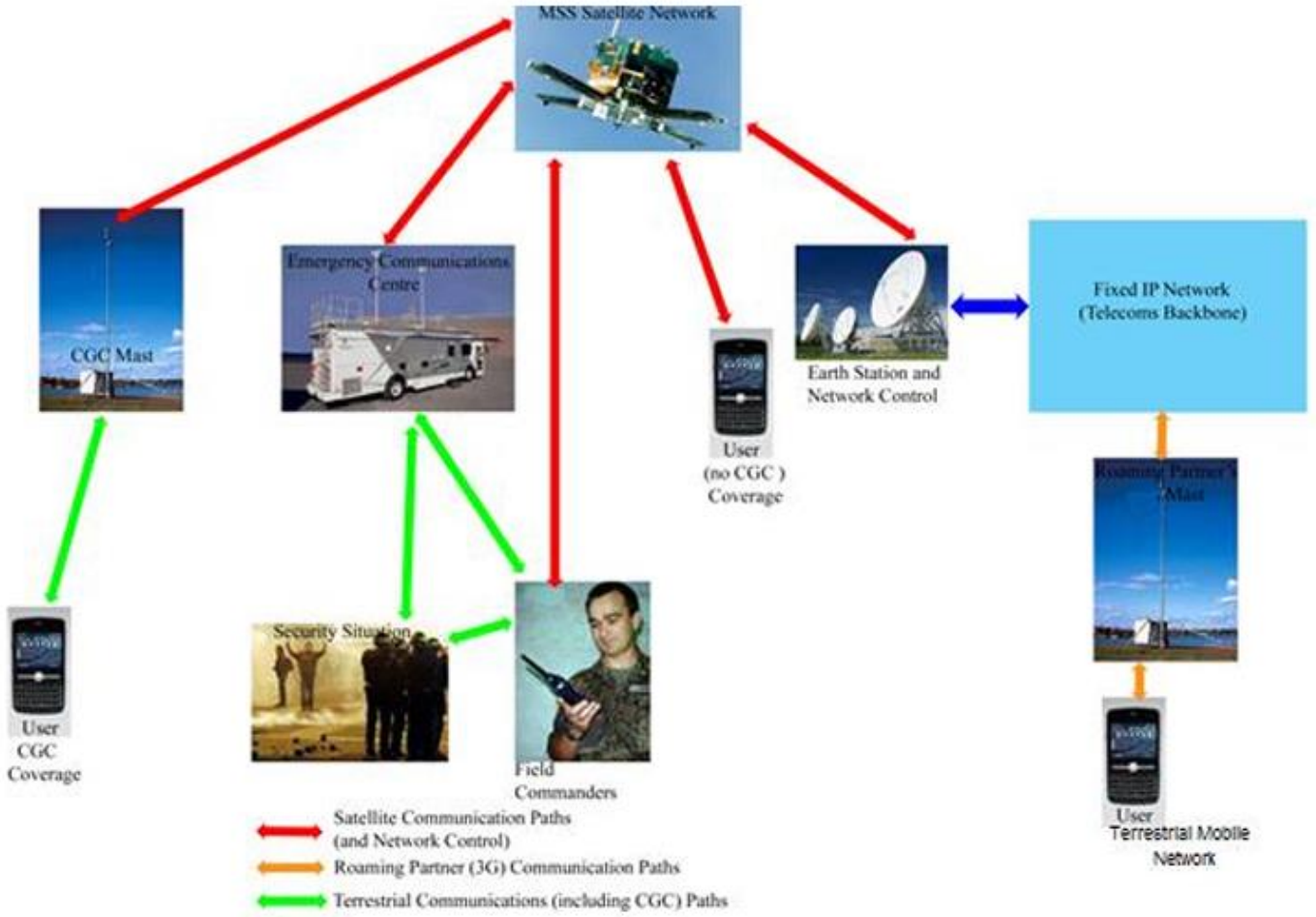
European Aviation Network



Source: https://www.comreg.ie/media/dlm_uploads/2017/03/ComReg-1719.pdf

AI 1.14 Studies on possible new frequency allocations to the mobile-satellite service in the frequency bands 2 010-2 025 MHz (Earth-to-space) and 2 160-2 170 MHz (space-to-Earth) in Regions 1 and 3 and 2 120-2 160 MHz (space-to-Earth) in all Regions

European Aviation Network



Source: https://www.comreg.ie/media/dlm_uploads/2017/03/ComReg-1719.pdf

1. The number of MSS terminals deployed inside the IMT network is increased until the percentage of time p, where I/N exceeds $\left(\frac{I}{N}\right)_{threshold} = -6\ dB$ exceeds 5% in a first step, and 10 % in a second step.

Allowable area (km²) for one MSS terminal, for different IMT systems

Criterion 1 (5 %)			Criterion 1 (10 %)			Activity factor
Rural	**Suburban**	**Urban**	**Rural**	**Suburban**	**Urban**	
109-417	452-1242	171-742	55-218	226-621	86-371	**100 %**
11-42	45-124	17-74	6-22	23-62	9-37	**10 %**

2. The number of MSS terminals deployed inside the IMT network is increased until the degradation d, of the mean spectral efficiency in the IMT networks, exceeds 5% in a first step, and 10 % in a second step.

Criterion 2 (5 %)			Criterion 2 (10 %)			Activity factor
Rural	**Suburban**	**Urban**	**Rural**	**Suburban**	**Urban**	
73-337	79-826	43-515	31-218	53-413	34-258	**100 %**
7-34	8-83	4-52	3-22	5-41	3-26	**10 %**

Thanks

M. P. S. Alawa
Joint Wireless Advisor
RLO NR, New Delhi
25 July 2025