

A PERSPECTIVE ON IMT SPECTRUM READINESS TOWARDS 2030 AND BEYOND





Bharat 6G Alliance Whitepaper
A Perspective on IMT Spectrum Readiness towards
2030 and Beyond

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Table of Contents

Executive Summary.....	7
Chapter 1 – India’s Wireless Landscape: Emerging Traffic Trends and Spectrum Strategy	8
1 Background.....	8
2 Telecom Wireless Data Market Outlook	8
2.1 Mobile Wireless Data Traffic Trends in India	8
2.2 Technology Share in Data Traffic	10
2.3 Fixed Wireless Access: The Fastest-Growing Segment.....	11
3 AI on Mobile Networks.....	12
3.1 AI Traffic Characteristics	12
3.2 Estimated AI Traffic Load Profiles to 2034	13
3.3 Implications of Other Key Factors for Spectrum Strategy	14
3.4 Spectrum Requirements for IMT-2030 (6G).....	15
4 Spectrum Strategy Considerations.....	18
4.1 Why Spectrum Is India’s Lifeline for Broadband	19
4.2 Key Elements of an Optimal Spectrum Strategy	20
Chapter 2 – Readiness and Materialisation of Identified IMT Spectrum.....	24
1 Overview	24
2 Current Spectrum Earmarked for IMT Services in India	24
3 Spectrum Opportunities in the Mid-Band	24
3.1 Upper 6 GHz Band (6425–7125 MHz): The High-Capacity Layer	25
3.2 Opportunities in the Core Mid-Band.....	25
3.3 Additional Spectrum above 3670 MHz.....	26
4 Low-Band (Sub-1 GHz) Spectrum	26
4.1 Sub-1 GHz Bands in Commercial Service	26
4.2 600 MHz and L-Band Opportunities.....	27
Chapter 3 – New IMT Spectrum Opportunities for India.....	29
1 6G Spectrum Overview	29
1.1 The Golden Band Opportunity for India	29
1.2 Wide Channels and Sensing: Role of the Upper Mid-Band.....	30
2 Strategic Context of the Candidate 6G Bands	30
2.1 7125–8400 MHz Band	31
2.2 4400–4800 MHz Band	34
2.3 14.8–15.35 GHz Band	36
2.4 Complementary Roles of the Three Candidate Bands	38
2.5 Terrestrial and Non-Terrestrial Network Integration	38

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

2.6 Impact of Agenda Item 1.13 on India's IMT Bands	38
Chapter 4 – Conclusions and Way Forward.....	39
1 India's Data Growth Underscores the Need for Additional Spectrum	39
2 Mid-Band: India's Foremost Priority for 6G Capacity	39
3 Sub-1 GHz Coverage Layer and Refarming of Identified Spectrum	40
4 Network Resilience and Protection of Existing Networks	40
5 Review of Recommendations from the 2024 B6GA White Paper	41
5.1 Review of Short-Term Recommendations	41
5.2 Review of Medium-Term Recommendations	42
6 Towards WRC-27 and Beyond.....	43
References.....	45
Abbreviations	47
List of Contributors	49

List of Figures

Figure 1: Annual mobile data traffic in India, 2018–2025 (calendar years)	8
Figure 2: Average monthly data consumption per wireless data subscriber, 2018–2026	9
Figure 3: Projected total mobile data traffic in India, 2018–2030 (EB/year)	9
Figure 4: Projected average monthly data consumption per subscriber, 2022–2030 (GB/month)	10
Figure 5: Technology-wise mobile data traffic in India, FY 2019-20 to FY 2025-26 (PB/year)	10
Figure 6: 5G data traffic and its share of total wireless data traffic, FY 2023-24 to FY 2025-26	11
Figure 7: Growth of 5G FWA subscribers in India, August 2025 to July 2026 (million)	11
Figure 8: Global WAN traffic projection by traffic type, 2024–2034 (moderate scenario)	13
Figure 9: AI token traffic as a share of global mobile traffic (left) and global mobile traffic forecasts (right), 2026–2034	14
Figure 10: Evolution of data-rate requirements for holographic communication	17
Figure 11: India’s unique dependence on wireless broadband calls for greater spectrum resources	19
Figure 12: Frequency ranges shaping the 6G spectrum mix	21
Figure 13: Global momentum on 6G spectrum	22
Figure 14: India’s spectrum refarming plan (687 MHz)	22
Figure 15: 6G spectrum pipeline in India	23
Figure 16: Spectrum bands earmarked for IMT in India	24
Figure 17: Frequency ranges studied for IMT identification in each ITU Region (WRC-27 Agenda Item 1.7)	29
Figure 18: Services allocated in the 7125–8400 MHz band in Region 3 (Article 5 of the Radio Regulations)	31
Figure 19: Services allocated in the 4400–4800 MHz band in Region 3 (Article 5 of the Radio Regulations)	34
Figure 20: Services allocated in the 14.8–15.35 GHz band in Region 3 (Article 5 of the Radio Regulations)	37

List of Tables

Table 1: Downlink spectrum needs for Cloud XR	16
Table 2: Contiguous bandwidth required for outdoor sensing applications	16
Table 3: Contiguous bandwidth required for selected industrial sensing applications	17
Table 4: Downlink spectrum needs for holographic communication	17
Table 5: Estimated spectrum required per network for the studied IMT-2030 use cases	18
Table 6: Forward-compatible network and spectrum actions by stage	19

Executive Summary

India is entering a decisive digital decade. In just seven years, national wireless data consumption has grown almost six-fold, from 46.40 EB in 2018 to 266.87 EB in 2025, a compound annual growth rate (CAGR) of 28.4% [1]. Spectrum is critical national infrastructure: it is the foundation on which Digital India, financial inclusion, e-governance and the emerging AI economy are built. Ensuring adequate spectrum, at the right time and under the right framework, is therefore a national priority.

At the heart of this endeavour lies the mid-band. Low bands deliver coverage and high bands deliver capacity, but only the mid-band offers the balance of coverage and capacity that high-performance wide-area networks require. Within the mid-band, the 6425–8400 MHz range is India's "Golden Band" and the most important spectrum resource for 6G: its large, contiguous blocks can support AI-native, uplink-intensive and latency-sensitive applications at national scale. With a population density of about 484 persons per km², over 95% of broadband subscribers connected through wireless networks and nearly two-third of all data traffic carried over them, India's spectrum requirements are particularly significant [2, 3]. Securing the Golden Band for IMT will be critical to the evolution of India's 5G-Advanced and 6G networks.

The path forward requires timely action. The National Frequency Allocation Plan 2025 (NFAP-2025) has identified 6425–7125 MHz for IMT, and is now part of DoT's Spectrum Roadmap for 6G Services [4, 5]. At WRC-27, under Agenda Item 1.7, India should pursue the identification of the full 7125–8400 MHz range, enabling the entire 6425–8400 MHz band to be planned as a contiguous wide-area IMT resource. This should be complemented by the 4400–4800 MHz band as an extension of the macro-cell layer, by the use of the 1427–1518 MHz band to meet growing uplink demand, and by time-bound refarming to bring already-identified spectrum into service. **Overall, meeting the evolving requirements of IMT-2030 (6G) will require an additional 500–750 MHz of wide-area spectrum per operator, which translates into an industry-wide requirement of 2–3 GHz of mid-band spectrum.**

Spectrum is also a strategic socio-economic asset. Affordable and ubiquitous connectivity extends access to banking, healthcare, education and government services, while a predictable spectrum framework will support the Bharat 6G Vision by enabling innovation, manufacturing, the creation of intellectual property and greater Indian participation in global 6G standardisation. The decisions taken nationally and at WRC-27 will shape India's ability to meet its future connectivity and digital-economy requirements. Securing the Golden Band and advancing the wider spectrum strategy now will lay the foundation for India's 5G-Advanced and 6G ambitions.

Securing the right spectrum today is essential to building a connected, innovative and globally competitive India tomorrow.

Chapter 1 – India’s Wireless Landscape: Emerging Traffic Trends and Spectrum Strategy

This chapter examines India’s wireless data traffic, the emerging characteristics of AI-driven demand and their implications for spectrum strategy. It then sets out the key elements of an optimal spectrum strategy and reviews the global momentum and national considerations shaping 6G spectrum.

1 Background

In October 2024, the Bharat 6G Alliance (B6GA) released its first white paper on spectrum, *Spectrum Roadmap for 6G in India*, which set out India’s spectrum requirements and roadmap towards 5G-Advanced and 6G, together with the relevant WRC-27 agenda items [6]. Building on that foundation, this follow-up white paper focuses on the practical aspects of readiness: bringing into use the IMT spectrum bands already identified at earlier World Radiocommunication Conferences (WRCs), and proposing national positions on the bands under consideration for IMT at WRC-27.

Accordingly, the white paper begins by examining current mobile data traffic trends and the outlook to 2030, and assesses the role and impact of AI applications on networks. It then examines the readiness of the identified spectrum bands and the spectrum needs of India’s roadmap to IMT-2030 (6G).

2 Telecom Wireless Data Market Outlook

This section examines how wireless data traffic, the technology mix and fixed wireless access have grown in India, and projects demand to 2030.

2.1 Mobile Wireless Data Traffic Trends in India

Total mobile data consumption in India rose from about **46.40 EB** in 2018 to **266.87 EB** in 2025 (calendar years), an almost six-fold (5.75×) increase over seven years, equivalent to a CAGR of about 28.4% (Figure 1) [1].

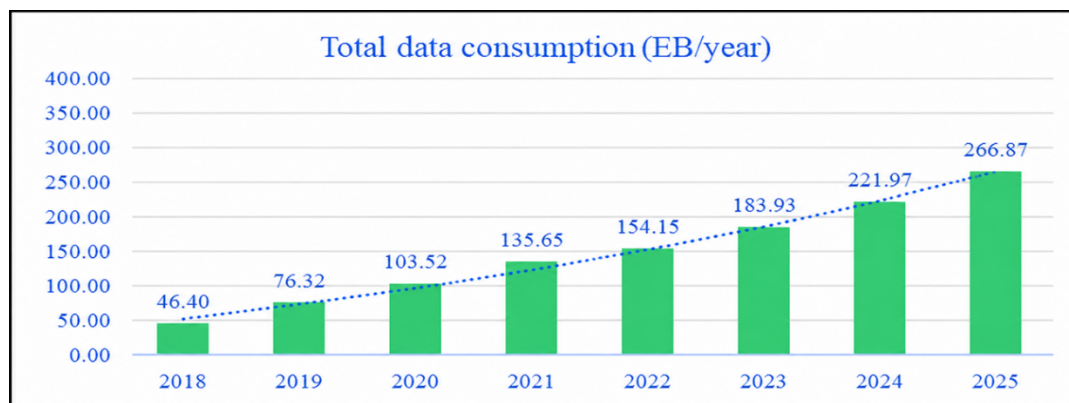


Figure 1: Annual mobile data traffic in India, 2018–2025 (calendar years)

Source: TRAI Performance Indicator Reports [1].

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

Average monthly data consumption per wireless data subscriber nearly tripled over the same period, from 8.74 GB in 2018 to about 25.7 GB in 2025, and exceeded 26.7 GB in the quarter ending March 2026 (Figure 2) [1]. This growth has been driven by the rapid expansion of 5G coverage, the migration to standalone (SA) 5G networks and the sharp rise in 5G device penetration.

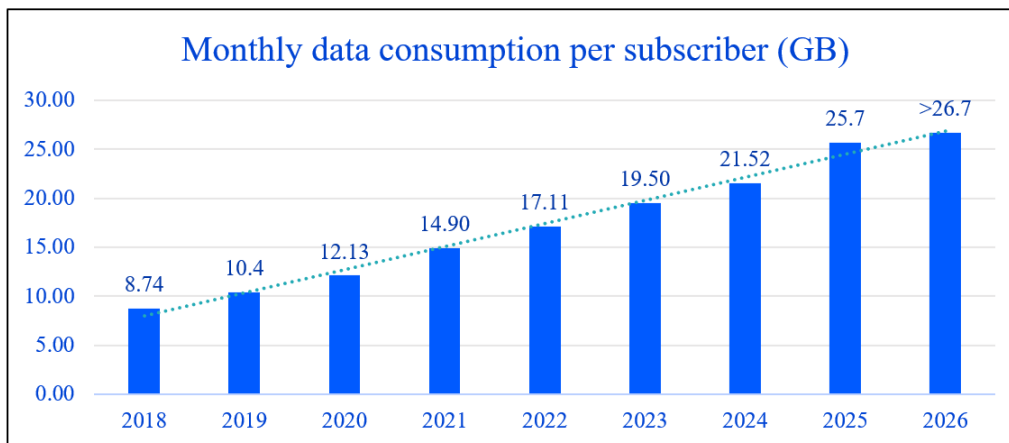


Figure 2: Average monthly data consumption per wireless data subscriber, 2018–2026
Source: TRAI Performance Indicator Reports [1]. The 2026 value corresponds to the quarter ending March 2026.

2.1.1 Traffic Projections to 2030

Smartphone adoption in India has grown rapidly, driven by affordable devices, and 5G device penetration has risen sharply to more than 35% [7]. As 4G subscribers continue to migrate to 5G, data consumption is expected to accelerate further. Traffic grew by about 20% in calendar year 2025 and by about 25% in FY 2025-26 (Figures 1 and 5). Taking into account the continuing migration to 5G, the growth of fixed wireless access and emerging AI-driven demand, the projections in this white paper assume annual traffic growth of 25–28% from 2026 onwards. Figure 3 shows the resulting projection of total mobile data traffic at the upper end of this range (28% per year), and Figure 4 shows the corresponding projection of monthly data consumption per subscriber.

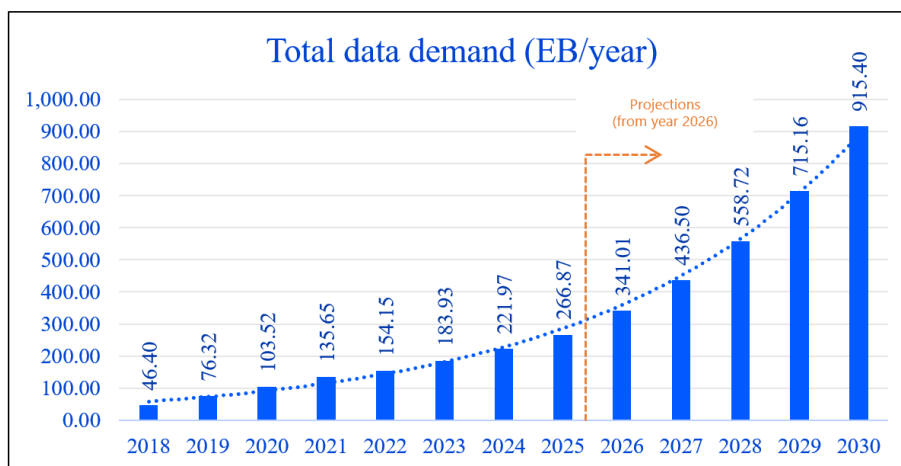


Figure 3: Projected total mobile data traffic in India, 2018–2030 (EB/year)
Source: actual values to 2025 from TRAI [1]; projections from 2026 are B6GA estimates assuming 28% annual growth.

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

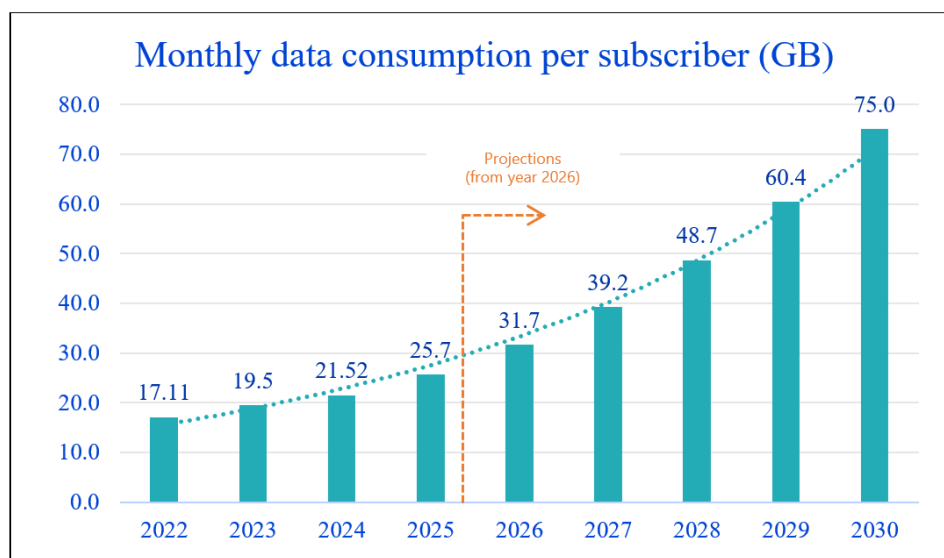


Figure 4: Projected average monthly data consumption per subscriber, 2022–2030 (GB/month)

Source: actual values to 2025 from TRAI [1]; projections from 2026 are B6GA estimates.

2.2 Technology Share in Data Traffic

4G remains the workhorse of Indian mobile traffic, but new growth is shifting steadily to 5G, which was launched commercially in October 2022. Legacy 2G/3G traffic has dwindled to a fraction of one percent of the total. In FY 2025-26, 5G carried about 107,384 PB, 37.6% of the annual total and up about 88% on FY 2024-25, while 4G traffic remained broadly flat at about 177,375 PB (Figure 5) [1].

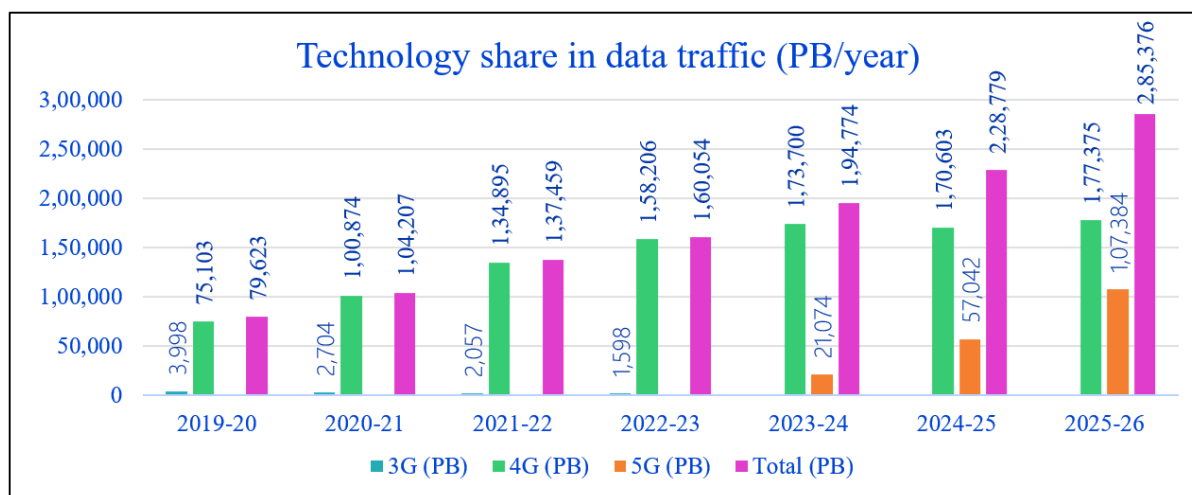


Figure 5: Technology-wise mobile data traffic in India, FY 2019-20 to FY 2025-26 (PB/year)

Source: TRAI Performance Indicator Reports [1].

Figure 5 shows that 5G data traffic nearly doubled year-on-year in FY 2025-26, while 4G traffic plateaued. As Figure 6 shows, 5G accounted for about 38% of all wireless data traffic in FY 2025-26, and 4G for about 62%. The latest quarterly data published by TRAI (quarter ending March 2026) show a 5G share of 42.75%, with 4G at 57.09% and 2G/3G together at just 0.17%

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

[1]. If this momentum continues, 5G is expected to overtake 4G in traffic share within the next few quarters.

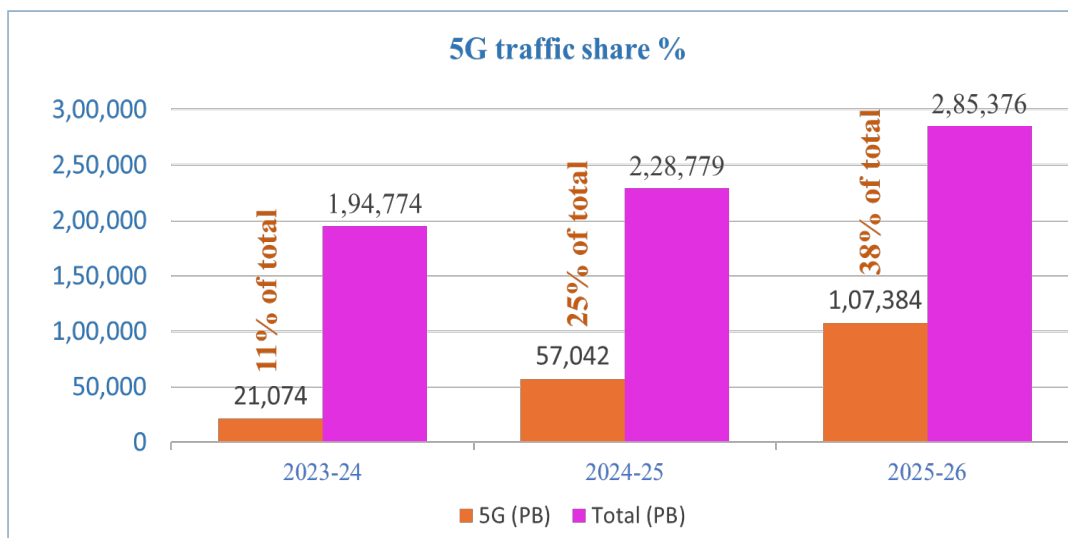


Figure 6: 5G data traffic and its share of total wireless data traffic, FY 2023-24 to FY 2025-26

Source: TRAI Performance Indicator Reports [1].

2.3 Fixed Wireless Access: The Fastest-Growing Segment

Fixed wireless access (FWA) delivers fixed broadband to homes and enterprises over IMT radio networks, predominantly 5G, and is India's fastest-growing access category. The 5G FWA subscriber base grew from about 8.9 million in August 2025 to 13.2 million in July 2026 (Figure 7) [8]. FWA has become a strategic tool for closing India's fixed-broadband gap, extending high-quality connectivity to areas that fibre has yet to reach.

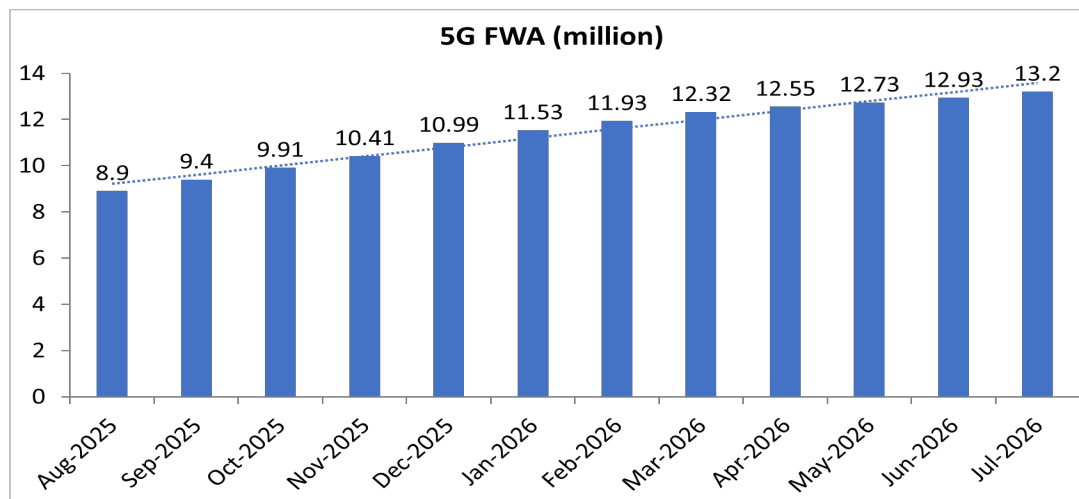


Figure 7: Growth of 5G FWA subscribers in India, August 2025 to July 2026 (million)

Source: TRAI monthly Telecom Subscription Data [8].

As FWA adoption accelerates, the timely availability of sufficient mid-band spectrum will be decisive in sustaining service quality and meeting rapidly growing demand for fixed broadband. **The mid-band is the natural home for FWA capacity, and its early release will directly enable the next phase of broadband inclusion.**

3 AI on Mobile Networks

Artificial intelligence (AI) is reshaping both the volume and the character of mobile traffic. The following subsections describe this new traffic, the load it may place on wide-area networks and its implications for spectrum.

3.1 AI Traffic Characteristics

For the past decade, wireless networks, both globally and in India, have been engineered primarily around conventional mobile broadband (MBB) traffic dominated by video. While video streaming (4K/8K, short-form and live) remains a major driver of traffic volume worldwide, its network footprint is highly predictable, largely downlink-dominated and bounded by human consumption limits such as standard frame rates, resolutions and typical linear download behaviour.

By contrast, the rapid expansion of generative AI (GenAI), large language models (LLMs), multimodal interfaces and agentic AI systems introduces a fundamentally different pattern of demand. Unlike passive video consumption, AI traffic has distinct characteristics that place new and intensive demands on network infrastructure:

- a) **Hyper-burst and irregular traffic patterns:** AI interactions do not follow the smooth, continuous packet delivery of buffered video. User queries and machine-to-machine (M2M) API calls instead generate intense, synchronised bursts of text and media, separated by gaps during computationally intensive processing.
- b) **Compounding and background traffic:** in a conventional broadband model, a video asset is fetched once and streamed. In an AI ecosystem, a single user prompt can trigger a cascade of autonomous agent-to-agent workflows, model-level API calls and continuous background data replication across distributed edge clouds. This produces a compounding multiplier effect on data generation that operates independently of real-time human prompts.

Whereas internet and video traffic consumed the downlink budget of the network, AI increasingly consumes its latency budget. AI traffic is uplink-heavy (camera, voice and sensor streams, and multimodal prompts), latency-critical (agentic chains of many small exchanges), always-on (assistants, wearables and on-device agents) and increasingly local (edge inference). Operators and vendors worldwide report uplink traffic growing faster than downlink traffic as AI, collaboration and content-creation services spread [9]. Networks and spectrum plans built for a downlink-dominated, video-centred traffic profile therefore need to be re-examined. AI traffic is conversational, interleaved in both directions and bursty; it cannot be cached, and it demands conversational responsiveness within strict latency and jitter bounds. The challenge posed by AI is therefore less about “more traffic” than about “different traffic”.

Even at today’s scale of traffic and tokens, AI is already placing significant demand on every segment of the network and tightening its latency and jitter margins. The next section examines the implications if AI traffic grows to about 30% of total wide area network (WAN) traffic. The emerging field of physical AI, covering spatial and temporal applications such as 3D

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

geospatial digital twins, industrial robots and autonomous vehicles, will add further demand for near-real-time assessment and action.

3.2 Estimated AI Traffic Load Profiles to 2034

Total global WAN traffic is expected to grow **three- to seven-fold by 2034**, from roughly 0.7 zettabytes (ZB) per month to **between 2.2 and 4.8 ZB per month** [10]. Within this total, **AI-driven traffic is forecast to grow at a CAGR of 23%**, outpacing non-AI traffic (15% CAGR), and to account for approximately **30% of all global traffic by 2034** (Figure 8). Crucially, by 2034 nearly 37% of the AI data load is expected to be generated autonomously by machines, agents and robots rather than by direct human input [10].

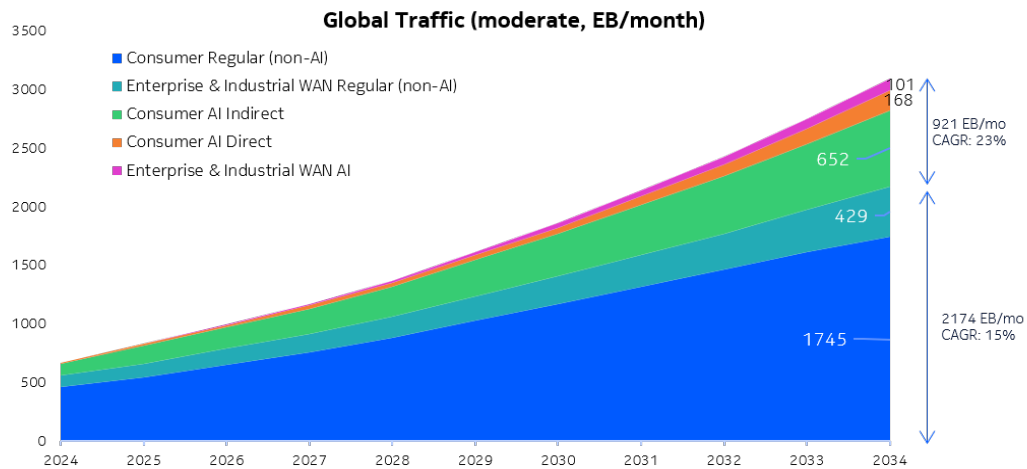


Figure 8: Global WAN traffic projection by traffic type, 2024–2034 (moderate scenario)

Source: Nokia Global Network Traffic Report 2026 [10].

This shift from human-generated to machine-generated and agentic workloads will sharply increase demand for **low-latency, high-capacity and highly responsive networks**, with greater emphasis on uplink capacity and real-time connectivity.

Mobile data consumption per user in India is already among the highest in the world [7]. The compounding effects of AI inference, localised edge applications and M2M workflows will therefore push the air interface towards a critical threshold, making the timely release of mid-band spectrum essential.

3.2.1 Sensitivity Analysis of AI Tokens and Mobile Traffic

The projection above rests on certain assumptions about token generation by AI applications. However, AI is evolving rapidly, and newer agentic forms of AI are driving a substantial multiplication of tokens.

While a token is tiny, a few bytes representing part of a word, a code fragment, an image patch or an audio segment, but the pace at which tokens are multiplying, especially with agentic AI, means that these small units can aggregate into very large volumes. The following sensitivity analysis illustrates the potential impact on global mobile traffic, based on three assumptions:

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

- a) AI token traffic is 200×10^{12} tokens per day today [11], growing 3.5 to 4-fold every year till 2034;
- b) each AI token is 4 bytes; and
- c) mobile networks carry 25% of AI token traffic.

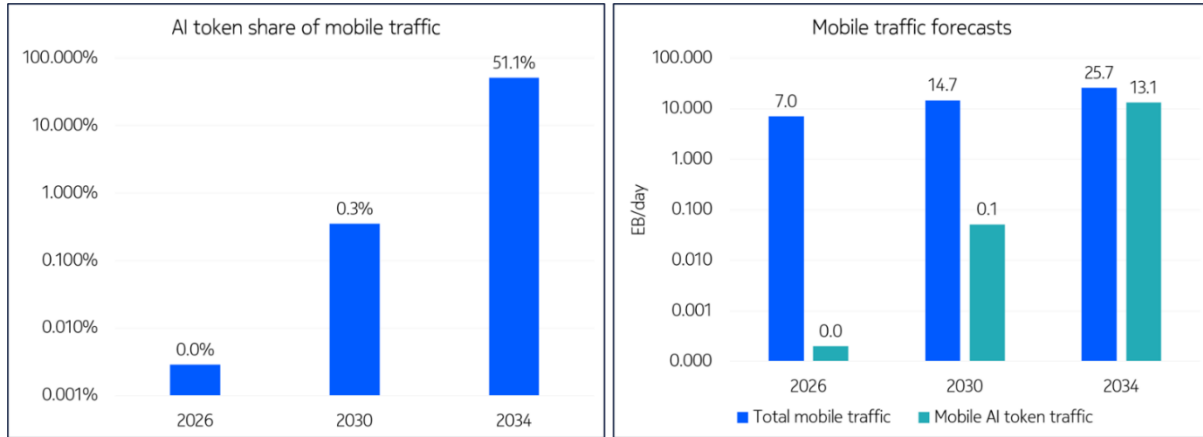


Figure 9: AI token traffic as a share of global mobile traffic (left) and global mobile traffic forecasts (right), 2026–2034

Source: B6GA sensitivity analysis illustrations based on the assumptions in section 3.2.1.

Today, the AI token traffic carried on mobile networks is below 0.001 EB per day. Even after growing four-fold per year till 2030, it would still represent less than 1% of global mobile traffic. However, if this rapid growth continues (about four-fold per year), AI token traffic could assume a significant share of all other mobile traffic by 2034, hence can no more be neglected. Network architecture and spectrum decisions should be taken with this trajectory in mind, so that networks are future-proofed for AI growth.

To maintain domestic technological momentum and secure global leadership in the 6G era, India's spectrum policy must anticipate these AI-driven transformations. Achieving the required low-latency, high-throughput network fabric depends on identifying and clearing large, contiguous blocks of spectrum, most critically in the mid-band. Strategic expansion of mid-band spectrum is an absolute prerequisite for ensuring that the wireless interface never becomes a bottleneck for AI adoption.

3.3 Implications of Other Key Factors for Spectrum Strategy

The traffic analysis above and the IMT-2030 use-case analysis in Section 3.4 indicate how much spectrum 6G will need, and in which ranges. A further factor is **where intelligence sits in the network**. Edge AI moves inference, rendering and control from the central cloud to the radio edge and the device. This changes latency and uplink profiles, but it does not reduce the need for IMT spectrum.

Traditionally, traffic was carried to distant data centres, so the binding constraints were backhaul and core capacity. With edge AI, decisions for autonomous mobility, industrial automation, smart cities, XR and mission-critical services are taken in real time at the edge. Local processing reduces unnecessary backhaul and can prioritise critical sessions, but the radio path still carries sensor streams, model updates, HD maps, selected video and device–

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

edge synchronisation. **Spectrum strategy must therefore provision the air interface for this edge loop**, rather than assume that “compute at the edge” can substitute for spectrum.

The same shift supports AI-native operations: predictive resource allocation, energy-aware RAN and self-optimising use of assigned spectrum blocks. These tools raise the value of the spectrum already held, but they cannot create the contiguous mid-band spectrum that outdoor coverage, uplink-limited devices and low-latency network slices require. For India, securing sufficient mid-band and upper mid-band spectrum is as essential as the assignments that made 4G and 5G possible.

3.4 Spectrum Requirements for IMT-2030 (6G)

The analysis in this section is based of GSA’s input to APG23-5/INF-26 [12] which examined the spectrum requirements of below three new 6G use cases:

1. Immersive XR communication;
2. High-accuracy sensing and positioning; and
3. Holographic communication.

The evaluation rests on two basic assumptions:

- the spectral efficiency of IMT-2030 is taken to be twice that of IMT-2020; and
- for immersive XR, an advanced video codec, Versatile Video Coding (VVC), is assumed, together with an optimistic compression ratio of 800:1.

3.4.1 Spectrum Requirements

The GSA estimates for each use case is shown below and the combined result for wide-area and local-area use are presented in Section 3.4.1.4.

3.4.1.1 Immersive XR Communication

In 6G, cloud technologies and extended reality (XR) will be brought together to deliver a superior experience through cloud-based platforms, known as Cloud XR, greatly reducing the computing load and energy consumption of XR devices. To estimate the spectrum needs of IMT-2030, this method assumes 10 active users in a cell, one of whom is at the cell edge. Although several users are served simultaneously, the cell-edge user is expected to dominate spectrum needs owing to the lower spectral efficiency at the cell edge. The required bandwidth is given by:

$$B = D / S \quad (1)$$

where:

- B is the amount of spectrum (Hz) required to support a data rate D ;
- D is the data rate (bit/s) required by a user or device, here a single active user at the edge of a dense-urban macro eMBB cell; and
- S is the fifth-percentile spectral efficiency (bit/s/Hz/cell), i.e. the cell-edge spectral efficiency.

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

IMT-2020 Cloud XR supports a motion-to-photon (MTP) latency of less than 20 ms and an end-to-end latency of up to 70 ms. Towards 2030 and beyond, IMT-2030 technology is expected to reduce the end-to-end latency of Cloud XR to below 10 ms. A fully immersive XR experience requires a resolution of $16K \times 6K$, with each pixel represented by 12 bits, and a frame rate of at least 60 Hz per eye, with higher frame rates needed to reduce motion sickness. On this basis, and with an 800:1 compression ratio, the required throughput is approximately 0.45 Gbit/s.

Table 1 shows the bandwidth required for Cloud XR, derived using Equation (1) with a link throughput D of 450 Mbit/s and a cell-edge spectral efficiency (SE) of 0.45 bit/s/Hz/cell outdoors and 0.6 bit/s/Hz/cell indoors.

Table 1: Downlink spectrum needs for Cloud XR

Downlink spectrum needs for Cloud XR (GHz per network)	
Indoor	Outdoor
0.75	1.0

Source: [12]

3.4.1.2 High-Accuracy Sensing and Positioning

For high-accuracy sensing and positioning, the required bandwidth is given by:

$$B = c / (2\Delta r) \quad (2)$$

where:

- B is the required bandwidth (Hz);
- c is the speed of light (m/s); and
- Δr is the range resolution (m).

The sensing range resolution, Δr , is the resolution with which the location of objects can be determined, and is one of the key technical performance indicators for sensing applications. Different applications have different range-resolution requirements.

Table 2 shows the bandwidth required for different values of sensing range resolution in outdoor scenarios, such as traffic management and collision avoidance, where more relaxed accuracies (e.g. at decimetre level) may be sufficient. Such outdoor scenarios are particularly relevant to this white paper, since they are the ones that add to wide-area mobile network traffic.

Table 2: Contiguous bandwidth required for outdoor sensing applications

Sensing range resolution, Δr (cm)	50	20
Required contiguous bandwidth, B (GHz)	0.3	0.75

Source: [12]

By contrast, certain industrial use cases, mostly in local-area and indoor environments, may require millimetre- or centimetre-level range resolution, with the correspondingly larger spectrum needs shown in Table 3.

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

Table 3: Contiguous bandwidth required for selected industrial sensing applications

Sensing range resolution, Δr (cm)	1	<1
Required contiguous bandwidth, B (GHz)	15	>15

Source: [12].

It should also be noted that, because sensing and communication are integrated, sensing can be performed on a time-division basis or directly using reference signals shared with communication. The spectrum needs of integrated sensing and communication (ISAC) are therefore not expected to add to the overall spectrum needs arising from other IMT-2030 use cases, such as XR and holographic communication.

3.4.1.3 Holographic Communication

Holograms are generated mainly by image-based or volumetric methods. Image-based holograms (e.g. light field video) offer high-fidelity images and are conceptually simple, but require significant storage and transmission bandwidth, of up to 1 Tbit/s. The alternative approach bases the holographic representation on volumetric media (e.g. point clouds), in which objects are represented as sets of 3D volume pixels (voxels). The image is then rendered dynamically from any viewing angle at the local endpoint, greatly reducing the bandwidth requirement.

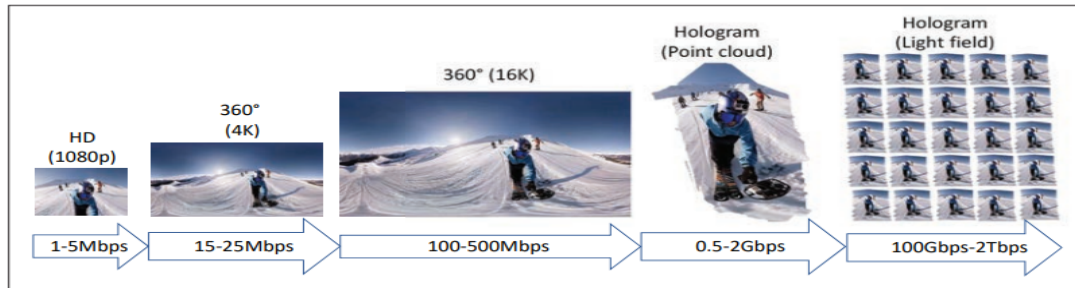


Figure 10: Evolution of data-rate requirements for holographic communication

Source: [12].

As Figure 10 shows, networks must support a throughput of approximately 500 Mbit/s or more for the volumetric (point-cloud) method. This figure illustrates the data rates required and does not represent a typical outdoor use case of holographic communication.

Assuming a required data rate of 500 Mbit/s and cell-edge spectral efficiencies of 0.45 bit/s/Hz/cell outdoors and 0.6 bit/s/Hz/cell indoors, the downlink spectrum needs for holographic communication, derived using Equation (1), are shown in Table 4.

Table 4: Downlink spectrum needs for holographic communication

Downlink spectrum needs for holographic communication (GHz per network)	
Indoor	Outdoor
0.83	1.1

Source: [12]

If image-based holograms (e.g. light field video) are used instead, data rates of between 100 Gbit/s and 1 Tbit/s would be required, implying very large spectrum needs (of the order of tens

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

of GHz), together with either a high-resolution LCD panel with optics or a projector-array display system.

3.4.1.4 Summary of Spectrum Needs for the Studied IMT-2030 Use Cases

As Table 5 indicates, the aggregate spectrum needed to support mobility and outdoor applications of the studied IMT-2030 use cases is of the order of 1 GHz per network. Assuming three to four networks per country, and that existing mid-band spectrum will in the long term be reused for IMT-2030 wide-area use cases, the overall additional spectrum need is approximately 2–3 GHz for the studied wide-area use cases (for three and four operators, respectively).

Table 5: Estimated spectrum required per network for the studied IMT-2030 use cases

Use-case category (GHz per network)	XR	Holographic communication	ISAC/JCS
Wide-area use cases	1.0	1.1	0.3–0.75
Local-area use cases	–	>10s	>15

Source: [12]

Note: XR and holographic communication would not be used at the same time by the same user, but a given cell could serve a mixture of these use cases for different users. Where some use cases are used simultaneously by the same user, their spectrum needs should be added together.

For simplicity, this estimate assumes that all existing mid-band spectrum available for IMT (about 1 GHz) is devoted solely to the studied IMT-2030 wide-area use cases, setting aside existing MBB usage. On this basis, **the estimated additional wide-area spectrum need per network can be rounded to 500–750 MHz, depending on the existing mid-band spectrum available for IMT and the number of networks in a given country.** Because propagation characteristics differ across bands, and lower frequencies are preferable for coverage and mobility, this finding reinforces the strategic importance of mid-band spectrum for wide-area 6G. The estimated spectrum needs of local-area and indoor use cases are of the order of tens of GHz, which suits short-range use in much higher frequency bands.

4 Spectrum Strategy Considerations

Several developments merit attention and coordinated action so that networks continue to respond seamlessly to AI-driven demand. Data traffic continues to grow rapidly, and AI is placing new demands on every layer of the network, calling for sustained investment, continuous optimisation and steady advances in energy and cost efficiency. In this context, timely access to adequate spectrum, and to mid-band spectrum in particular, is the single most powerful enabler: it allows operators to expand capacity efficiently, improve returns on network investment and deliver differentiated AI-era services rather than merely carrying them.

A robust and efficient spectrum strategy is therefore essential. Two ideas define the operator vision:

1. self-optimising, energy-aware radio and core networks that raise spectral efficiency and reduce the cost per GB; and

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

- low-latency, uplink-capable connectivity with distributed compute, enabling operators to deliver AI services rather than merely transport them.

Both require spectrum, edge compute and standalone core capability to be in place together. The steps in Table 6 are proposed so that each stage remains forward-compatible and aligned with standards timelines: the first implementable 6G specifications are expected around end-2028 or early 2029, with initial commercial deployments around 2030 [13].

Table 6: Forward-compatible network and spectrum actions by stage

Stage	Network actions	Spectrum actions
Now: 5G / 5G-Advanced	Standalone 5G, carrier aggregation, uplink enhancements, edge breakout, and RAN energy and capacity optimisation.	Identify additional bands for refarming; prioritise spectrum for FWA and capacity hotspots.
Near term (to about 2028)	APIs and network slicing for AI and enterprise use, integrated sensing trials and AI-native operations.	Release additional mid-band spectrum for licensed IMT; plan spectrum trials in the upper 6 GHz band; finalise the national position for WRC-27.
6G (about 2030 onwards)	AI-native air interface and core, integrated sensing and communication, and terrestrial-satellite integration.	Assign upper mid-band spectrum in large contiguous blocks (at least 400 MHz per operator), working towards the 500–750 MHz of additional spectrum per operator as mentioned in Section 3.4; promote the device and equipment ecosystem for new bands so that it is ready at launch.

Source: B6GA.

4.1 Why Spectrum Is India's Lifeline for Broadband

TRAI traffic data illustrate the scale of demand on Indian networks, which is shaped by demographic and infrastructural conditions that differ markedly from those in China and the United States. India has a substantially higher population density than either country, both nationally and in its major cities, while its fixed-broadband penetration is far lower (Figure 11).

Characteristic	India		China		United States	
 Population Density (Persons/Sq.Km)	484 persons/sq. km		150 persons/sq. km		37 persons/sq. km	
	Mumbai 27,000	Surat 15,000	Shenzhen 7,000	Shanghai 3,900	New York 10,600	Chicago 4,600
 Fixed Broadband Penetration	~15 households/100		~95 households/100		~93 households/100	
 Broadband Delivery	Very High dependency on Spectrum		Lesser dependency on Spectrum		Lesser dependency on Spectrum	

Figure 11: India's unique dependence on wireless broadband calls for greater spectrum resources

Source: [2].

Dense urban populations raise capacity requirements per unit area, while limited fixed infrastructure restricts the offloading of traffic. With over 95% of broadband subscribers connected, and nearly two-third of data traffic carried, over wireless networks [3], every

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

increase in demand translates directly into a greater requirement for spectrum, and above all for mid-band spectrum, which carries the bulk of that traffic.

India's spectrum needs therefore cannot be benchmarked directly against those of countries with mature fixed-broadband infrastructure. This structural dependence on wireless connectivity is now being compounded by the rapid adoption of AI, which is changing the volume, patterns and nature of network traffic. Section 3 set out how AI is reshaping traffic; the next section considers what this implies for the spectrum mix.

4.2 Key Elements of an Optimal Spectrum Strategy

The low, mid and high spectrum ranges are **complementary rather than substitutes**, since each serves distinct coverage and capacity needs. **The mid-band is of particular importance because it provides the critical balance between coverage and capacity, and its extension into the upper mid-band (FR3) is therefore strategically central to future networks.**

India's spectrum needs can be viewed across three layers:

- a) **Low band (below 1 GHz):** essential for nationwide and rural coverage, deep indoor penetration and ubiquitous access to always-on AI services.
- b) **Mid-band (about 1–7 GHz):** the primary capacity layer for 5G-Advanced and 6G, supporting AI-enabled consumer services, enterprise networks, smart cities and transportation. It is, and will remain, the backbone of mobile connectivity.
- c) **Upper mid-band (FR3, 7.125–24.25 GHz, in particular about 7–15 GHz):** emerging as a strategically important range for 6G, offering a better coverage–capacity balance than higher bands and enabling the wider channels needed for AI-native applications, digital twins, XR and autonomous systems.

Spectrum planning for AI-driven traffic must reflect the distinct characteristics of different traffic types. **Sub-1 GHz** spectrum suits wide-area, deep-indoor and rural connectivity, including always-on and uplink-heavy devices constrained by limited handset transmit power. At the other extreme, **centimetre-wave, millimetre-wave and sub-THz bands** provide very high capacity over shorter ranges, supporting dense, ultra-high-speed deployments and localised traffic from edge-AI inference. **No single frequency range can meet the full range of future connectivity requirements; an optimal mix across low, mid/FR3 and high bands is essential, with the mid-band at its core.**

Figure 12 illustrates the spectrum landscape across FR1 (410 MHz–7.125 GHz) and FR3 (7.125–24.25 GHz). The mid-band combines coverage and capacity and is therefore best placed to carry the bulk of AI-driven traffic, including its uplink-intensive and latency-critical components. It already carries the major share of 4G and 5G traffic, and its role will grow further as AI applications scale and 6G is deployed. The range from 6425 MHz to 8400 MHz, spanning the boundary between FR1 and FR3, is regarded as the Golden Band for 6G. NFAP-2025 has identified 6425–7125 MHz, a total of 700 MHz, for IMT; of this, the Spectrum Roadmap for 6G Services provides 400 MHz available in the near term and the remaining 300 MHz by 2030 [4, 5].

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

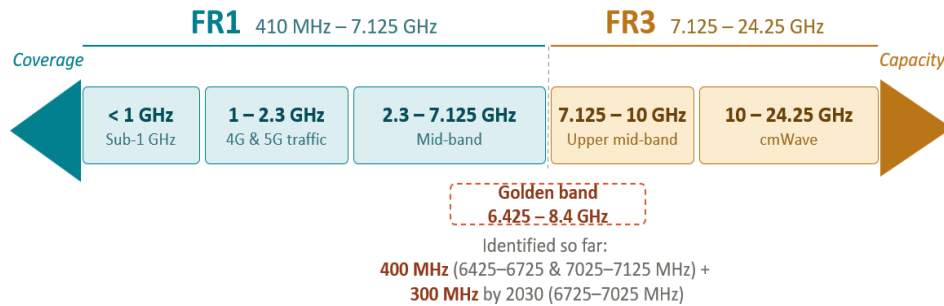


Figure 12: Frequency ranges shaping the 6G spectrum mix

Source: B6GA, based on [4, 5].

The identification of the 7125–8400 MHz range is a matter for WRC-27. Given India’s high traffic density, its dependence on wireless delivery and the changing demand profile driven by AI, the timely identification and assignment of adequate mid-band spectrum will be central to sustaining network performance and enabling AI-based services at scale. Mid-band spectrum will be the backbone of 6G services in India.

To support the development and validation of indigenous 6G IMT radio technologies and products, 400 MHz of contiguous spectrum should be made available on a trial basis to eligible Indian entities for controlled laboratory and field trials. This trial spectrum would enable the evaluation of key 6G technologies, including advanced and AI-native air interfaces, massive MIMO, higher-frequency operation, ultra-low-latency communication and other IMT-2030 capabilities.

Adequate contiguous bandwidth during the initial development phase is essential for **prototype development, interoperability testing, performance benchmarking, field validation and the demonstration of indigenous 6G solutions** under realistic network conditions. The trial framework may provide spectrum for a defined period under appropriate technical and regulatory conditions.

4.2.1 Global Momentum on 6G Spectrum

Most major markets are expected to gain new spectrum around 7 GHz, which is highly positive for 6G (Figure 13). Contiguous spectrum blocks unlock greater value than fragmented holdings by enabling higher efficiency and better performance.

Early spectrum roadmaps and clear release timelines are essential to a successful 6G rollout. There is strong global momentum behind the upper 6 GHz band and the 7125–8400 MHz band for 6G macro deployments, and India is well placed to succeed with both. India’s rapid 5G deployment in the 3.5 GHz band demonstrates this potential: following the launch of commercial 5G services in October 2022, India became the world’s second-largest 5G market [15]. The initial 6G target is a minimum of 400 MHz of contiguous spectrum per operator, with a minimum channel bandwidth of 200 MHz.

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

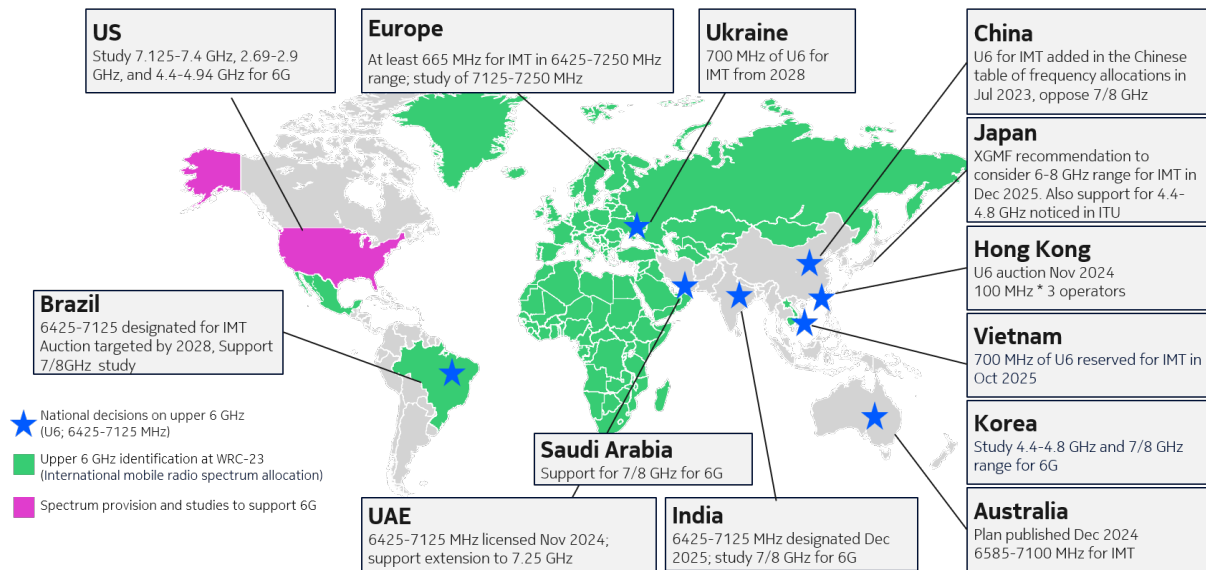


Figure 13: Global momentum on 6G spectrum

Source: [14]

4.2.2 Spectrum Refarming and Mid-band Opportunities for 6G

This section summarises India's refarming decision and the mid-band spectrum on which India's 6G roadmap now rests.

4.2.2.1 India's Refarming Decision

In 2025, the Union Cabinet approved the refarming of 687 MHz of spectrum for IMT [16]. Of this, 320 MHz (6425–6725 MHz and 20 MHz in the 2500–2690 MHz band) was readily available, while 367 MHz (67 MHz in 1451–1518 MHz and 300 MHz in 6725–7025 MHz) is to be released (Figure 14).

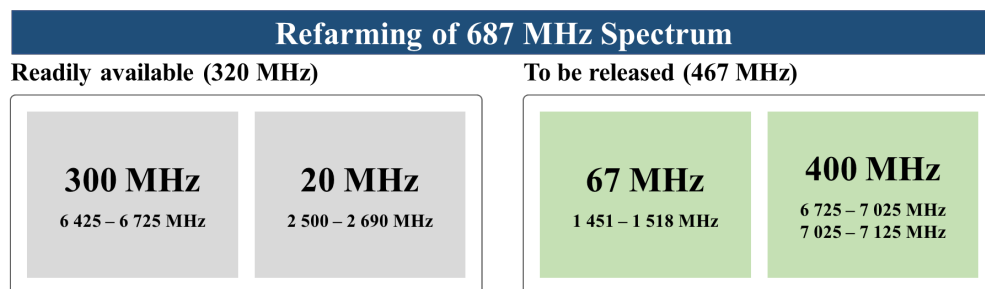


Figure 14: India's spectrum refarming plan (687 MHz)

Source: [16].

NFAP-2025 subsequently identified the complete upper 6 GHz band (6425–7125 MHz) for IMT, and the Spectrum Roadmap for 6G Services also makes 7025–7125 MHz available in the near term [4, 5]. The upper 6 GHz band is regarded as a golden range for 6G, together with 7125–8400 MHz, which falls under WRC-27 Agenda Item 1.7.

4.2.2.2 Mid-band spectrum opportunities

India actively supports the study of the 7125–8400 MHz range under WRC-27 Agenda Item 1.7 and regards it as a golden range for 6G, offering an ideal combination of coverage and

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

capacity that is critical to an affordable and accessible 6G ecosystem. For the 4400–4800 MHz band, India supports the sharing and compatibility studies under way in ITU-R; to make this band viable for IMT macro deployment, it is important that it be identified for IMT without undue technical or regulatory constraints. As the adjacent 4200–4400 MHz band is used by aircraft radio altimeters, the viability of the 4400–4800 MHz band will depend on the final conditions agreed at WRC-27. The 6425–8400 MHz range should be treated as a single continuous range, so that at least 400 MHz of contiguous spectrum can be earmarked per network paving the way for assigning significantly greater mid-band spectrum of 500–750 MHz per operator.

By 2030, India's spectrum pipeline in mid-band is expected to take form shown in Figure 15.

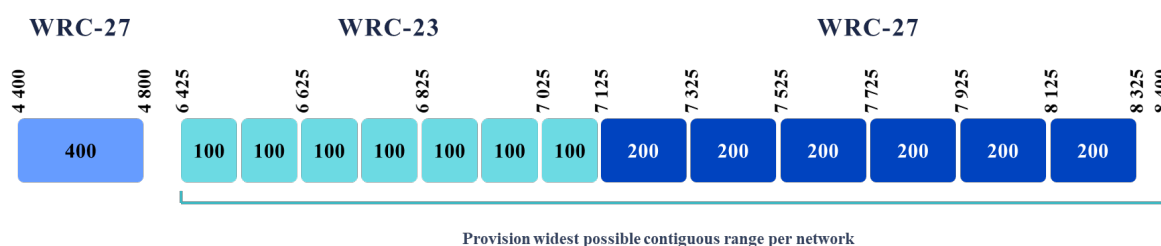


Figure 15: 6G spectrum pipeline in India

Source: B6GA.

The objective is to secure the widest possible contiguous block per network and to treat 6425–8400 MHz as one continuous range: the step that turns identified mid-band spectrum into usable capacity for 6G services.

Chapter 2 – Readiness and Materialisation of Identified IMT Spectrum

This chapter examines how far the spectrum already identified for IMT has been brought into use, and what remains to be assigned and made contiguous.

1 Overview

India's mobile data growth continues to lead global indices and places sustained demand on the capacity of wide-area terrestrial radio access networks (RANs). To carry this momentum into the 5G-Advanced and early 6G eras, the Department of Telecommunications (DoT) has put in place a multi-tier framework for bringing spectrum into use [5]. This chapter sets out the opportunities to add spectrum in large, contiguous blocks suited to macro coverage.

2 Current Spectrum Earmarked for IMT Services in India

Over recent years, DoT has made spectrum available to operators for IMT across several frequency ranges, as summarised in Figure 16. These bands fall into three groups: sub-1 GHz (600, 700, 800 and 900 MHz); the mid-band between 1 GHz and 7 GHz (1800, 2100, 2300 and 2500 MHz, and 3300–3670 MHz); and the millimetre-wave band at 26 GHz. The mid-band carries the major share of current 4G and 5G traffic and remains the priority layer for future capacity. In some bands identified for IMT in NFAP-2025, portions are also used by non-telecom and government users. The upper 6 GHz band (6425–7125 MHz), identified for IMT in NFAP-2025 but not yet assigned, is discussed in Section 3.1.

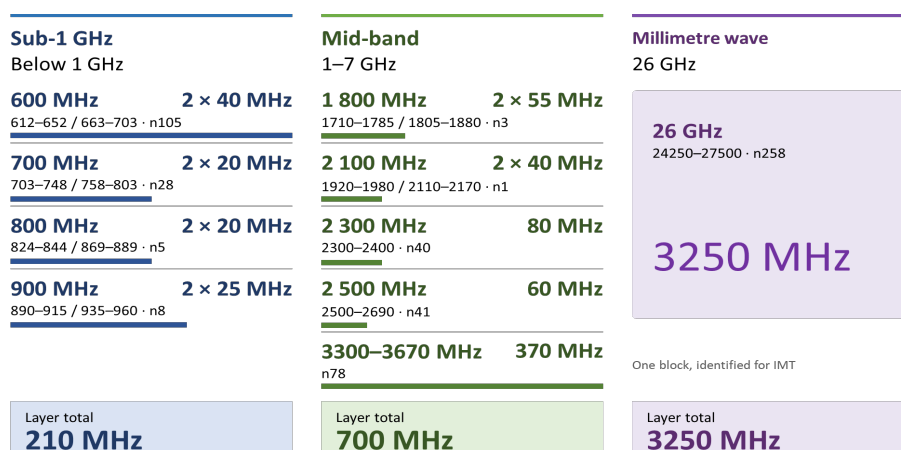


Figure 16: Spectrum bands earmarked for IMT in India
Source: B6GA, based on [4, 5].

3 Spectrum Opportunities in the Mid-Band

The mid-band, spanning roughly 1 GHz to 7 GHz, is the backbone of India's mobile networks: it combines wide-area coverage with high capacity and carries most of the nation's data traffic. It is also the layer on which 5G-Advanced and early 6G will be built. Securing adequate, contiguous mid-band spectrum, above all in the upper 6 GHz band, is therefore the single most

important step in preparing India for 6G. This section addresses the flagship upper 6 GHz band first, then the core mid-band and its extension above 3670 MHz.

3.1 Upper 6 GHz Band (6425–7125 MHz): The High-Capacity Layer

The upper 6 GHz band offers 700 MHz of contiguous spectrum, an exceptional opportunity to expand 5G-Advanced and move towards 6G. Operators can deploy a very high-capacity layer alongside the 3.5 GHz band. Of the 700 MHz, the Spectrum Roadmap for 6G Services provides 400 MHz available in the near term (6425–6725 MHz and 7025–7125 MHz) and the remaining 300 MHz (6725–7025 MHz), where incumbent licences remain in force, by 2030 [5]. Clarity on access to the whole of 6425–7125 MHz will determine whether this high-capacity layer can be introduced on time. Extended with additional spectrum in the 7125–8400 MHz range, subject to the outcome of WRC-27, the band would place India in a uniquely strong global position, with a minimum of 400 MHz per operator across the entire 6425–8400 MHz range.

NFAP-2025 has identified 6425–7125 MHz for IMT, and that identification should stand. On 24 February 2026, TRAI recommended that the upper 6 GHz band be reserved for IMT, that 6425–6725 MHz and 7025–7125 MHz not be included in the forthcoming auction, and that the auction of the band be re-examined after WRC-27 [17]. This timing does not weaken the identification; rather, it avoids locking in a partial assignment before the studies on 7125–8400 MHz under Agenda Item 1.7 establish how wide a contiguous block can be planned across 6425–8400 MHz. TRAI has also recommended trials, involving all access providers, around the 34 satellite-uplink earth station locations, so that the required separation between IMT base stations and these earth stations can be determined. Coexistence with these earth stations should be achieved through location-specific measures, keeping the IMT identification of the band intact.

3.2 Opportunities in the Core Mid-Band

The core mid-band between 1 GHz and 3.67 GHz carries most of India's data traffic and serves as the combined coverage and capacity layer. The 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz and 3300–3670 MHz bands are identified for IMT and are in commercial use.

Spectrum in the 800 MHz, 900 MHz, 1800 MHz and 2100 MHz bands that is currently locked in insolvency proceedings before the National Company Law Tribunal (NCLT) or the National Company Law Appellate Tribunal (NCLAT) should be brought back into the spectrum pool at the earliest and auctioned in a timely manner [17].

In the 3300–3670 MHz band, the unassigned spectrum ranges from only 20 MHz to 100 MHz across licensed service areas (LSAs) [17], and in several FDD bands only 5 MHz or 10 MHz (paired) remains. The way forward is to assign what is still available and to harmonise holdings into contiguous blocks: the entire available spectrum in these bands should be auctioned, the band plans already adopted in India should be retained, and harmonisation should be completed in a time-bound manner. Spectrum above 3670 MHz and the upper 6 GHz band together will add the capacity and bandwidth that the evolving requirements of 5G-Advanced and 6G demand.

3.3 Additional Spectrum above 3670 MHz

In many countries, the 3500 MHz range for IMT extends up to 3800 MHz or 4200 MHz, where a mature device ecosystem already exists: 3GPP band n78 covers 3300–3800 MHz and band n77 covers 3300–4200 MHz, and both are in widespread 5G use [18]. Globally, operators use this range as a nationwide 5G capacity layer. Extending IMT above 3670 MHz in India calls for a national roadmap with a clear timetable for migrating the remaining incumbents to other bands or optical fibre, including satellite reception for television distribution, as viewing increasingly moves to OTT and DTH platforms.

A defined timeline is also needed for the upgrade of radio altimeters in commercial aircraft, in line with practice in other countries. The relevant constraint near 4200 MHz is the use of the 4200–4400 MHz band by radio altimeters under No. 5.438 of the Radio Regulations [19]; this is not a reason to withhold the identification of the upper 3500 MHz range. A time-bound retrofit of legacy altimeters, discussed in Section 2.2.3 of Chapter 3, is what will allow the upper part of the mid-band to be used for macro-cell 5G without permanent exclusion zones. Establishing this roadmap promptly will give licensed service areas the contiguous mid-band spectrum that a nationwide capacity layer requires.

4 Low-Band (Sub-1 GHz) Spectrum

Sub-1 GHz spectrum is the coverage layer of India's IMT networks, providing wide-area reach, deep indoor penetration and a stronger uplink than the mid-band: qualities that matter for rural and semi-urban service and for devices limited by handset transmit power. The 600, 700, 800 and 900 MHz bands are already identified for IMT. The task now is to put that identification into effect: assign what is still available, keep holdings contiguous, and refarm legacy or captive use where the underlying mission can be met without permanently withholding spectrum from public IMT. This spectrum will remain essential throughout the IMT-2030 period, since voice, sensors and other uplink-heavy uses cannot be carried on the capacity bands alone. The low band complements, rather than substitutes for, the mid-band capacity layer.

4.1 Sub-1 GHz Bands in Commercial Service

Three sub-1 GHz bands are already in commercial service: 700 MHz, 800 MHz and 900 MHz. The 600 MHz band, identified for IMT but not yet assigned, is addressed in Section 4.2.

4.1.1 700 MHz Band

A total of 45 MHz (paired) per LSA is allocated for IMT and is used by mobile network operators (MNOs) and government users as follows:

- 20 MHz (paired): assigned to and used for IMT by two MNOs (one private sector and one public sector) in all LSAs;
- 10 MHz (paired): government user in all LSAs;
- 5 MHz (paired): Indian Railways, for the Kavach automatic train protection system;
- 5 MHz (paired): reserved for Indian Railways; and

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

- 5 MHz (paired): National Capital Region Transport Corporation (NCRTC), for the Regional Rapid Transit System (RRTS).

The 700 MHz band (3GPP band n28) is the principal sub-1 GHz coverage band and is already in commercial 5G use. The use of the 10 MHz (paired) retained for government and defence users may be reviewed.

4.1.2 800 MHz Band

Between 15 MHz and 20 MHz (paired) per LSA is earmarked for IMT in the 800 MHz band (3GPP band n5), of which 10–20 MHz (paired) has been assigned for commercial use, leaving 10 MHz (paired) available in only a few LSAs. As the unassigned remainder is small and uneven, the priority is not a new identification but the harmonisation of existing holdings into contiguous carriers and the assignment of whatever remains available, including spectrum returning to the pool from insolvency proceedings, as recommended by TRAI on 24 February 2026 [17].

4.1.3 900 MHz Band

Between 23.2 MHz and 24.8 MHz (paired) per LSA is earmarked for IMT:

- assigned: 16.4–23.2 MHz (paired) per LSA to MNOs, and 1.6 MHz (paired) to Indian Railways in 14 LSAs; and
- available: 0.8–4.4 MHz (paired) per LSA, and 6.8 MHz (paired) in one LSA.

The 900 MHz band (3GPP band n8) is the legacy coverage band and is already extensively assigned, including to BSNL. The few megahertz remaining in most LSAs will not create a new coverage layer; their value lies in completing existing carriers or in harmonisation that removes fragmentation within the band. Technology-neutral use for 4G and 5G should continue, and the band should remain identified for IMT.

4.2 600 MHz and L-Band Opportunities

Two bands identified for IMT are yet to be brought fully into service: the 600 MHz band and the L-band (1427–1518 MHz).

4.2.1 600 MHz Band (2×40 MHz)

40 MHz (paired) per LSA is allocated for IMT and is available to commercial operators in all 22 LSAs. No bids were received for this band in the 2022 auction, as the equipment ecosystem has not yet fully developed [17].

India is actively promoting the harmonisation of the APT 600 MHz (APT600) arrangement in Region 3 through the APT Wireless Group [20], and its recognition in Recommendation ITU-R M.1036 [21]. The band should be assigned as 3GPP band n105, in blocks of 5 MHz (paired), with a minimum bid of one block. Rollout obligations should mirror those of other sub-1 GHz bands. The identified 40 MHz (paired) in every LSA should be maintained, and retained for IMT while the device ecosystem matures. DoT's work in the APT Wireless Group and in ITU-R is the international complement to a domestic auction of band n105.

4.2.2 Strategic Roadmap for the L-Band (1427–1518 MHz)

In the 1427–1518 MHz band, only a 67 MHz segment (1451–1518 MHz) is earmarked for commercial IMT, alongside a contiguous 24 MHz block reserved for government use, even though the entire band is supported by 3GPP and used for IMT in other countries. The band carries several 3GPP designations: n75 and n76 for NR supplementary downlink (SDL), and n74 as a 2×43 MHz FDD arrangement [18]. In the APT region, Report APT/AWG/REP-113(Rev.1) sets out possible implementations of IMT in this band [22]. The band is scheduled to be refarmed for IMT after 31 December 2026, once institutional and government requirements have been met [5, 20]. Reserving a contiguous 24 MHz block makes the FDD arrangement (n74) not feasible to implement.

In its recommendations of February 2026, TRAI did not recommend a final band plan for 1427–1518 MHz. Instead, it recommended that the band plan be re-examined when the Government decides to auction the band; that DoT take up with regional and global standardisation bodies the creation of a suitable band plan for supplementary uplink (SUL), so that assignment to MNOs can proceed; and that, when 24 MHz is assigned to the government user, a contiguous 67 MHz block be kept for IMT [17]. This last condition is essential: a reservation that split the commercial block would render the IMT identification unusable. The 67 MHz earmarked for commercial IMT should remain contiguous, and the standardisation effort for SUL should be pursued so that the band can relieve uplink demand rather than remain idle.

Owing to its superior propagation compared with higher mid-band frequencies, Indian operators and several APT administrations have proposed using this band to increase uplink capacity rather than for SDL. This requires support for a new frequency arrangement in Recommendation ITU-R M.1036 and in 3GPP, with SUL enabling the band to be decoupled and used flexibly to relieve uplink bottlenecks. Efforts are under way to engage global standardisation bodies to formalise a SUL band plan and introduce it in ITU-R.

Chapter 3 – New IMT Spectrum Opportunities for India

This chapter moves from the spectrum already identified for IMT to the bands under study for WRC-27, and sets out the role of each in the national roadmap.

1 6G Spectrum Overview

India’s spectrum opportunities for 5G-Advanced and IMT-2030 comprise both the spectrum already identified for IMT and additional bands under consideration for future identification. NFAP-2025 has identified 700 MHz in the upper 6 GHz band (6425–7125 MHz) for IMT, and the Spectrum Roadmap for 6G Services, issued by the Wireless Planning and Coordination (WPC) Wing of DoT, provides for the phased availability of this 700 MHz [4, 5].

In parallel, WRC-27 Agenda Item 1.7, under Resolution 256 (WRC-23), is studying the 4400–4800 MHz, 7125–8400 MHz and 14.8–15.35 GHz ranges for possible identification for the terrestrial component of IMT (Figure 17) [23]. Of these, the 7125–8400 MHz range is the mid-band opportunity of greatest strategic value to India, as it completes the Golden Band.

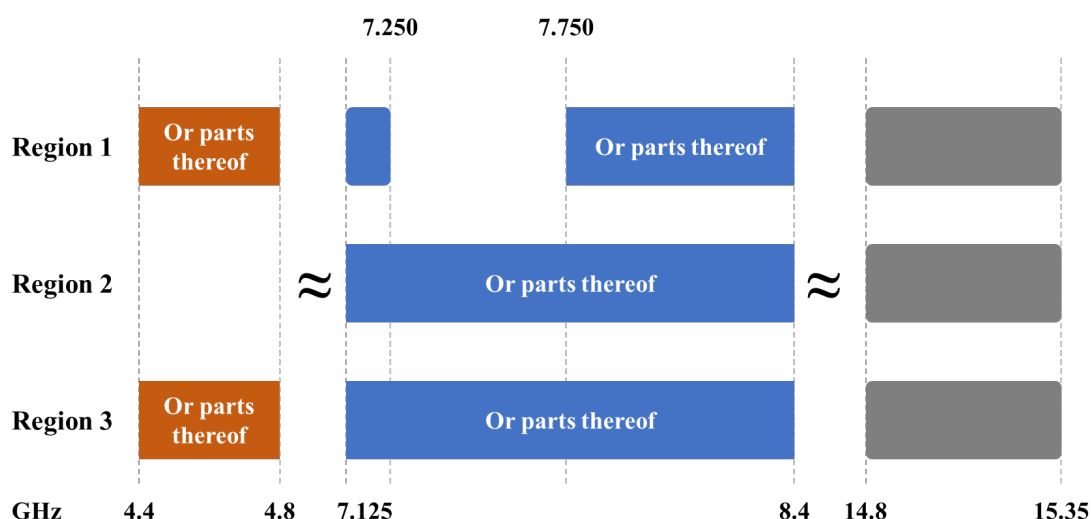


Figure 17: Frequency ranges studied for IMT identification in each ITU Region (WRC-27 Agenda Item 1.7)

Source: Resolution 256 (WRC-23) [23].

1.1 The Golden Band Opportunity for India

The Bharat 6G Alliance has described the 6425–8400 MHz range as the “Golden Band”, recognising it as the priority wide-area spectrum opportunity for 6G in India. Its lower part, 6425–7125 MHz, is already identified for IMT in NFAP-2025, while its upper part, 7125–8400 MHz, is under study for possible IMT identification at WRC-27 under Agenda Item 1.7.

The strategic value of the range lies in the large, contiguous bandwidth that its two parts can together provide, in propagation that can still support a wide-area macro-cell layer, and in the opportunity to reuse the site infrastructure already deployed for the 3.5 GHz band. Wide channels in this range can meet the capacity and performance requirements of IMT-2030, including emerging high-capacity uplink applications and integrated sensing. The ongoing

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

studies should therefore seek technical and regulatory conditions that enable efficient, practical deployment of this spectrum as part of India's IMT-2030 networks.

1.2 Wide Channels and Sensing: Role of the Upper Mid-Band

IMT-2030 radio designs assume much wider carriers than 5G. Pre-standard 6G prototypes shown at MWC 2026 used a 400 MHz component carrier with 30 kHz subcarrier spacing in the 6–8 GHz range, in line with 3GPP Release 20 study assumptions [24], and also demonstrated carrier aggregation between existing mid-band spectrum (around 2.5 GHz) and new spectrum around 7 GHz. Contiguous blocks of 400 MHz per network, compared with the 100 MHz typical of 5G at 3.5 GHz, can be provided only in the upper 6 GHz band and the 7–15 GHz candidate ranges, underlining the importance of securing this spectrum.

Bandwidth also governs integrated sensing and communication (ISAC), which ITU-R has recognised as one of the six usage scenarios of IMT-2030 [25]. Applying Equation (2) in Section 3.4.1.2 of Chapter 1 ($\Delta r = c/2B$), a 100 MHz carrier at 3.5 GHz gives a range resolution of about 1.5 m, whereas 400 MHz gives about 0.375 m and 750 MHz about 0.2 m. Sensing trials on today's 3.5 GHz networks are useful for establishing baselines, but decimetre-level outdoor sensing for drone corridors, traffic monitoring and perimeter security will depend on the wider channels available in the upper mid-band.

National evidence will strengthen India's position in ITU-R and 3GPP. India-specific propagation and sensing measurement campaigns should be commissioned in the upper 6 GHz band and the 7–15 GHz range, covering representative dense-urban, urban and rural terrain and clutter profiles (for example, around ten metropolitan and five rural clusters). The results would inform channel models in 3GPP, realistic clutter-loss assumptions in the WP 5D sharing studies under Agenda Item 1.7, and national deployment planning for large-array (massive MIMO) radios co-sited with the existing 3.5 GHz grid.

2 Strategic Context of the Candidate 6G Bands

As India advances the Bharat 6G Vision, wireless networks are evolving into intelligent, distributed computing fabrics. Meeting the ultra-low-latency and high-capacity requirements of IMT-2030 depends on identifying and securing large blocks of harmonised spectrum well ahead of commercial deployment, with the mid-band, led by the Golden Band, as the priority. The candidate ranges are examined below, beginning with 7125–8400 MHz and 4400–4800 MHz in the mid-band, followed by 14.8–15.35 GHz and by the integration of terrestrial and satellite networks.

Across all three ranges under Agenda Item 1.7, the same regulatory principle applies: Resolution 256 (WRC-23) requires the sharing and compatibility studies to protect services allocated on a primary basis, and services in adjacent bands, without imposing additional regulatory or technical constraints on them [23]. Each range remains a study item: any identification is a decision for WRC-27, and any national assignment would follow both that decision and the domestic assessment set out in the Spectrum Roadmap for 6G Services.

2.1 7125–8400 MHz Band

The 7125–8400 MHz range is the largest of the three ranges under Agenda Item 1.7 and the one most directly connected to spectrum that India has already identified. Together with the 6425–7125 MHz band identified for IMT in NFAP-2025, it forms a continuous upper mid-band range from 6425 MHz to 8400 MHz: the Golden Band. In the Spectrum Roadmap for 6G Services, DoT has placed 7125–8400 MHz, or selected portions of it, in the medium-term window (2027–2030), with refarming to be assessed after identification at WRC-27 [5].

The Bharat 6G Alliance supports identifying the range as a whole, rather than treating 7125 MHz as a hard boundary, so that planning across 6425–8400 MHz can provide at least 400 MHz of contiguous spectrum per network to begin with.

2.1.1 Candidate Band Overview

The range is under active study in ITU-R Working Party 5D (WP 5D). The following sub-bands are in scope for potential IMT identification on a region-by-region basis [23]:

- 7125–7250 MHz: all three Regions;
- 7250–7750 MHz: Regions 2 and 3; and
- 7750–8400 MHz: all three Regions.

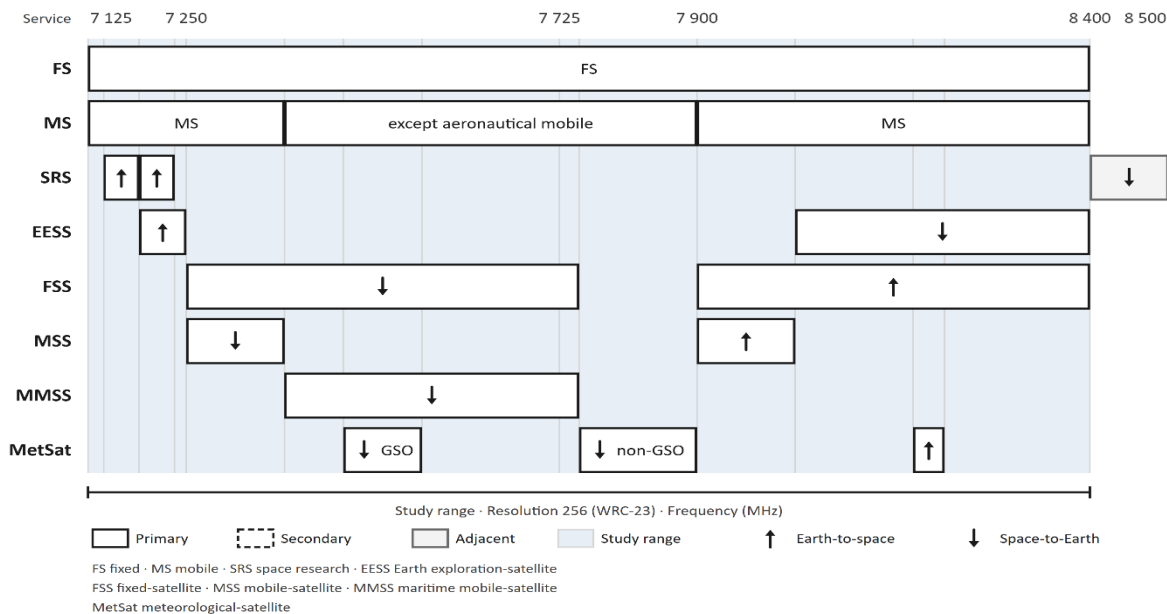


Figure 18: Services allocated in the 7125–8400 MHz band in Region 3 (Article 5 of the Radio Regulations)

Source: Allocations illustrated as per ITU Radio Regulations [19].

The range currently hosts several primary incumbent services, and WP 5D is studying sharing and compatibility with each of them and with certain adjacent-band services (Figure 18). The principal considerations are:

- **Fixed service:** allocated across 7125–8400 MHz. In India, 7125–7725 MHz carries microwave backhaul links, so introducing IMT would require a transition plan for these links alongside the coexistence conditions emerging from the ITU-R studies.

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

- **Satellite downlinks:** in 7250–7750 MHz, the principal space services to be protected are the fixed-satellite service (FSS, space-to-Earth); the mobile-satellite service (MSS, space-to-Earth) in 7250–7375 MHz (No. 5.461) and the maritime mobile-satellite service in 7375–7750 MHz; and the meteorological-satellite service (MetSat, space-to-Earth) in 7450–7550 MHz, with a further MetSat downlink in 7750–7900 MHz.
- **Satellite and science uplinks:** towards the lower edge of the range, the space research service (SRS, Earth-to-space) operates around 7145–7235 MHz, including deep-space links, and the Earth exploration-satellite service (EESS, Earth-to-space) around 7190–7250 MHz (No. 5.460A). From about 7900 MHz the dominant use is uplink: FSS (Earth-to-space) in 7900–8400 MHz, MSS (Earth-to-space) in 7900–8025 MHz and MetSat (Earth-to-space) around 8175–8215 MHz. The EESS (space-to-Earth) allocation in 8025–8400 MHz serves downlinks to a limited number of earth stations and is studied separately.
- **Adjacent bands:** SRS earth stations in the adjacent 8400–8500 MHz band, including those used for deep-space operations, are a compatibility consideration for Agenda Item 1.7. A possible EESS (passive) allocation in 8400–8500 MHz is a separate matter under Agenda Item 1.19.

From a sharing and compatibility perspective, discussions within WP 5D show the following high-level trends across the sub-ranges (these indicate momentum, not decisions of the Conference):

- **7125–7250 MHz:** the most consistently supported, with widespread regional and global alignment on potential identification;
- **7250–7900 MHz:** a mixed-to-positive overall trend, with discussion focused on clutter-loss assumptions; and
- **7900–8400 MHz:** the satellite-uplink range shows a diverse set of study results, so the WRC-23 study experience should inform realistic assumptions and workable coexistence conditions.

2.1.2 Direction of the Agenda Item 1.7 Studies

The sharing and compatibility studies for 7125–8400 MHz are being conducted in WP 5D and have progressed through recent meetings, addressing compatibility with the principal incumbent services in the band and in adjacent bands. The objective is to establish appropriate technical conditions for the use of the band by the terrestrial component of IMT while protecting existing primary services, in accordance with Resolution 256 (WRC-23). For India, these conditions should enable 7125–8400 MHz to support macro-cell IMT deployments, should WRC-27 identify the band.

A key consideration is the use of realistic deployment and propagation assumptions. Rather than applying uniform worst-case assumptions to all locations, the analysis should reflect the actual locations of earth stations, terrain and clutter conditions, antenna discrimination and other engineering factors, protecting incumbent earth stations effectively while avoiding unnecessarily restrictive conditions on IMT deployment. Under NFAP-2025, the fixed service

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

is allocated throughout 7125–8400 MHz, and satellite services operate in specific portions for both space-to-Earth and Earth-to-space links; the studies are accordingly examining coordination, separation distances, protection criteria and other measures to facilitate coexistence.

The transition of the existing microwave backhaul links in 7125–7725 MHz should be treated as an implementation requirement, met through a clearly defined transition and refarming plan, rather than as a reason to defer or withhold identification. The priority for wide-area capacity through 2030 is the upper 6 GHz band already identified for IMT, planned together with 7125–8400 MHz so that 6425–8400 MHz can be treated as a single block once WRC-27 identifies the upper part.

2.1.3 International Regulatory Landscape (WRC-27)

India is in Region 3, for which Resolution 256 (WRC-23) invites WRC-27 to consider the identification of 7125–8400 MHz, or parts thereof, for the terrestrial component of IMT [23]. For Region 1, the same Resolution invites consideration of 7125–7250 MHz and 7750–8400 MHz. The 7250–7750 MHz portion is therefore within the invitation for Regions 2 and 3 but not for Region 1, while 7125–7250 MHz and 7750–8400 MHz are within the invitation for all three Regions. A Region 3 position covering the whole range can seek the widest harmonisation on the common portions while retaining 7250–7750 MHz for regional identification where the studies support it. Early clarity on the WRC-27 outcome, and on the domestic refarming timeline, is essential if radios and devices are to be ready within the medium-term window set out in the Spectrum Roadmap for 6G Services.

2.1.4 Recommended Actions

India should actively champion the identification of the full 7125–8400 MHz range at WRC-27, consistent with the position developed in Bharat 6G Alliance discussions, so that the identification covers the range, or the largest practical parts of it, without undue technical or regulatory constraints. Specifically, India should:

- a) advocate realistic study assumptions for earth-station location, terrain, clutter, network loading and antenna discrimination, drawing on WRC-23 experience, so that the coexistence case is assessed soundly, particularly the clutter-loss parameters central to the 7250–7900 MHz discussion and the uplink assumptions in 7900–8400 MHz;
- b) pursue the widest harmonisation on the portions invited in all Regions (7125–7250 MHz and 7750–8400 MHz) while retaining 7250–7750 MHz for identification in Region 3;
- c) reaffirm the protection of incumbent services under Resolution 256 (WRC-23), demonstrating that identification and incumbent protection can proceed together;
- d) align the domestic refarming timeline with the assessment in the Spectrum Roadmap for 6G Services, so that an identification translates quickly into deployable spectrum; and
- e) submit India-specific evidence and prepare the device ecosystem, contributing national propagation and coexistence results to WP 5D and 3GPP, particularly on clutter loss

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

and on the transition of fixed links in 7125–7725 MHz, and engaging chipset vendors so that support for 7–8 GHz enters modem roadmaps alongside band n104.

2.2 4400–4800 MHz Band

The 4400–4800 MHz range is a candidate for IMT identification in Region 3 under Agenda Item 1.7. As an extension of the mid-band, its strategic value for India, the international regulatory position and the recommended national approach are set out below.

2.2.1 Candidate Band Overview

The range offers 400 MHz of contiguous spectrum above the mid-band spectrum already assigned for 5G in India (3300–3670 MHz), and its propagation remains compatible with a macro-cell capacity layer.

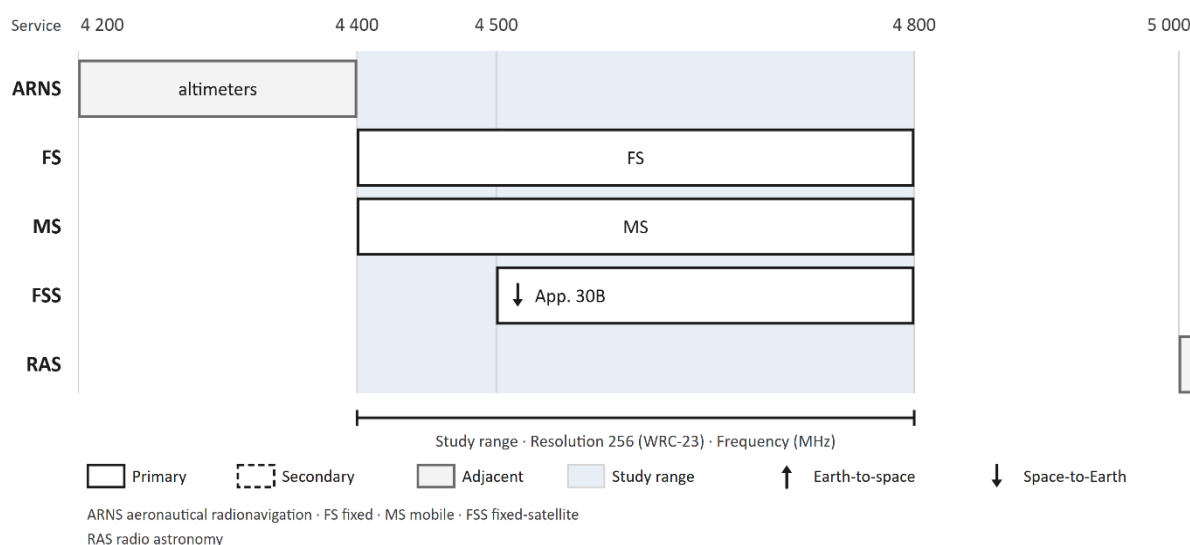


Figure 19: Services allocated in the 4400–4800 MHz band in Region 3 (Article 5 of the Radio Regulations)

Source: Allocations illustrated as per ITU Radio Regulations [19].

Although path loss is higher than at 3.5 GHz, the propagation characteristics of this range are closer to those of 3.5 GHz than to those of the upper 6 GHz and 7–8 GHz ranges, so existing macro-site grids can be reused to a substantial extent.

The range is already specified by 3GPP as NR band n79 (4400–5000 MHz, TDD) [18], with portions in commercial 5G use in Japan (4500–4900 MHz) and China (4800–4900 MHz). A harmonised identification in Region 3 could therefore leverage an established device and radio ecosystem rather than a greenfield band.

The Spectrum Roadmap for 6G Services places 4400–4800 MHz in the medium-term window (2027–2030), to be studied for possible IMT identification under Agenda Item 1.7 and, subject to identification, assessed for refarming [5]. NFAP-2025 (in force from 30 December 2025) identified 6425–7125 MHz for IMT but not 4400–4800 MHz, so any national assignment would follow both a WRC-27 decision and the domestic assessment in the Roadmap.

2.2.2 International Regulatory Landscape (WRC-27)

Resolution 256 (WRC-23) invites ITU-R to complete sharing and compatibility studies, and to develop technical conditions, for the terrestrial component of IMT in 4400–4800 MHz, while protecting services allocated on a primary basis, including stations in international waters or airspace that cannot be registered in the Master International Frequency Register, and services in adjacent bands [23]. WRC-27 is invited to consider the identification of 4400–4800 MHz, or parts thereof, in Regions 1 and 3; India, in Region 3, is therefore within the scope of the invitation.

The studies are being carried out in WP 5D and consolidated as Annex 1 of the Agenda Item 1.7 working material. The principal in-band services under study are the fixed service and the mobile service (including aeronautical mobile) throughout 4400–4800 MHz, and the FSS (space-to-Earth) in 4500–4800 MHz (Figure 19). The FSS allocation in 4500–4800 MHz is subject to Appendix 30B of the Radio Regulations, whose Plan any future IMT use would have to respect [19]. Identification, if decided by the Conference, would be an identification for IMT in bands allocated to the mobile service, not an allocation to a service named IMT.

Two adjacent-band questions are distinct from the in-band sharing studies and should be kept separate in the national position. First, No. 5.438 reserves 4200–4400 MHz exclusively for aircraft radio altimeters and their associated ground-based transponders; compatibility between IMT in 4400–4800 MHz and this aeronautical radionavigation use is addressed in a separate attachment to the WP 5D studies. Second, the radio astronomy service in 4800–4990 MHz and 4990–5000 MHz is an adjacent-band matter, outside the candidate range itself. The conditions emerging from these adjacent-band studies will determine whether the band can be used for wide-area IMT without the kind of operational constraints seen around airports in the 3300–3670 MHz band.

2.2.3 Radio Altimeter Retrofitting Plan

Legacy radio altimeters with wideband receivers remain a key consideration for macro 5G deployment around airports in India. Precautionary restrictions currently apply to IMT in the 3300–3670 MHz band near airports and runways [26]. Industry studies indicate that these restrictions stem from the susceptibility of certain legacy altimeters operating in the 4200–4400 MHz band, rather than from any demonstrated harmful effect of 5G transmissions [30].

Internationally, several countries have progressively relaxed airport-related restrictions following technical studies and the retrofitting of legacy aviation equipment, in some cases assigning spectrum closer to 4.2 GHz than India's current upper limit of 3.67 GHz, without comparable exclusion zones [30]. India's exclusion zones can likewise be rationalised as the radio altimeter upgrade programme is completed.

The regulatory experience of countries such as the USA, Japan, Korea and Australia in managing the altimeter-replacement timeline and 5G coexistence is directly relevant to India's future consideration of the 4400–4800 MHz band for IMT. Because this band is immediately adjacent to the radio altimeter allocation (4200–4400 MHz), timely modernisation of legacy altimeters is important to keep this strategically important 6G spectrum free of coexistence

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

constraints. A high-level monitoring committee should conduct periodic reviews to keep the programme on course for its target completion date of December 2027 [27]. Timely completion would allow the existing 5G restrictions near airports to be rationalised, improve the mobile-user experience and provide regulatory certainty for future 6G deployment in the 4400–4800 MHz band, while ensuring the continued protection of aviation systems.

2.2.4 Recommended Actions

It is recommended that India:

- a) **continue active participation in the ITU-R WP 5D studies** under Resolution 256 (WRC-23), using realistic assumptions for IMT deployment and for the incumbent fixed, fixed-satellite and aeronautical mobile services, so that any technical conditions remain proportionate to the protection actually required;
- b) **support an IMT identification that enables effective macro-cell deployment**, recognising the band's role as a capacity layer complementary to 3300–3670 MHz and to the upper 6 GHz spectrum identified in NFAP-2025, without unnecessary constraints;
- c) **keep radio altimeter protection as a separate, time-bound national programme**, rather than letting airport-related issues predetermine India's WRC-27 position on 4400–4800 MHz;
- d) **ensure the timely retrofitting of legacy radio altimeters**, with periodic progress reviews through a high-level monitoring mechanism and completion targeted for December 2027, to facilitate the eventual rationalisation of airport-related 5G restrictions while maintaining aviation safety;
- e) **following WRC-27, assess the feasibility of refarming 4400–4800 MHz for IMT**, in consultation with government, captive and commercial users of the existing fixed and aeronautical mobile services; and
- f) **align any future national channel plan with 3GPP band n79**, enabling India to leverage the existing TDD device and network ecosystem and maximise the benefits of a Region 3 identification.

2.3 14.8–15.35 GHz Band

The 14.8–15.35 GHz range (550 MHz) is the third range under Agenda Item 1.7. Unlike 4400–4800 MHz and parts of 7125–8400 MHz, the invitation to consider the IMT identification of this range extends to all three Regions; like the other ranges, it remains a study item.

2.3.1 Candidate Band Overview

In India, the range lies within the 15 GHz microwave access band. In the Spectrum Roadmap for 6G Services, DoT has grouped 14.8–15.35 GHz with 4400–4800 MHz and 7125–8400 MHz as bands to be studied under Agenda Item 1.7, with refarming to be assessed only after identification at WRC-27 [5]. NFAP-2025 has not identified this range for IMT.

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

India uses the 14.8–15.35 GHz range extensively for primary terrestrial fixed links (backhaul and institutional networks), and IMT deployment in the band would raise coordination and interference issues for these incumbents. Future IMT expansion will itself continue to rely on this band as a primary microwave backhaul layer connecting cellular base stations. Operating at around 15 GHz also entails higher atmospheric and rain attenuation, giving shorter ranges and weaker indoor penetration than mid-band alternatives such as 4400–4800 MHz and 7125–8400 MHz. India should therefore continue to participate in the WP 5D studies to ensure that the protection criteria of the fixed service and adjacent-band services are met.

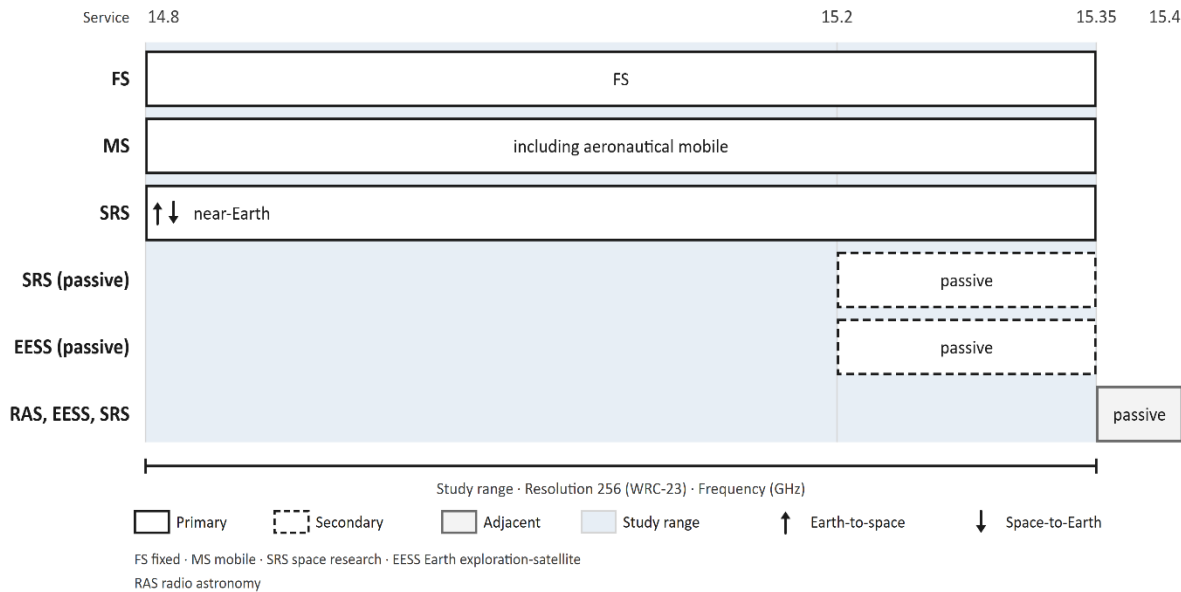


Figure 20: Services allocated in the 14.8–15.35 GHz band in Region 3 (Article 5 of the Radio Regulations)

Source: Allocations illustrated as per ITU Radio Regulations [19].

2.3.2 International Regulatory Landscape (WRC-27)

The sharing and compatibility studies are being carried out in WP 5D and consolidated as Annex 3 of the Agenda Item 1.7 working material. The in-band services under study are the fixed service, the mobile service (including aeronautical mobile) and the space research service (including the provisions associated with No. 5.510A), together with the secondary passive allocations in 15.2–15.35 GHz (Figure 20). Compatibility with the radio astronomy service in the adjacent 15.35–15.4 GHz band is also being considered as a question of unwanted emissions, distinct from the suitability of the 550 MHz in-band range.

The studies are evaluating whether IMT and microwave links, including access backhaul, can coexist under stated protection criteria, antenna assumptions and deployment densities; the results will guide how backhaul is accommodated if the range is identified for IMT.

2.3.3 Recommended Actions

The range is used extensively for backhaul in India, and certain MNOs will continue to use it for backhaul in their IMT networks. India should therefore support the completion of the WP 5D studies, including the protection of the fixed service and the adjacent radio astronomy service, with the national decision on IMT identification to follow the WRC-27 outcome.

2.4 Complementary Roles of the Three Candidate Bands

The candidate bands play complementary roles in India's future spectrum portfolio, led by the mid-band. The Golden Band (6425–8400 MHz) offers the largest and most scalable opportunity for wide-area 5G-Advanced and 6G deployment, supported by large, contiguous bandwidths. The 4400–4800 MHz band extends the existing mid-band ecosystem, adding capacity with propagation broadly comparable to that of the bands supporting today's nationwide deployments. The 14.8–15.35 GHz range is a higher-frequency candidate, already used in India for microwave access and backhaul, which could play a complementary densification role for these wide-area layers. Together, these bands can form a diversified portfolio providing the coverage, capacity and innovation required through the 2030s.

2.5 Terrestrial and Non-Terrestrial Network Integration

IMT-2030 envisages the integration of terrestrial and satellite access, on which its usage scenario of ubiquitous connectivity depends [25]. Two sets of satellite spectrum, distinct from the terrestrial IMT bands, are relevant:

- **MSS spectrum in the L-band and S-band** (around 1.5/1.6 GHz and 2 GHz) for direct-to-cell (D2C) connectivity to standard handsets, specified in 3GPP for NR non-terrestrial networks (NTN) as bands n255 (L-band) and n256 (S-band) [28]; and
- **FSS spectrum in the Ku, Ka and Q/V bands** for satellite broadband and backhaul.

Capacity is the main limitation of D2C: indicative estimates for a 10 MHz FDD channel suggest an area capacity of the order of 0.2 Mbit/s per km² [33], adequate for messaging, voice and basic applications, and for disaster response, maritime and aviation use. D2C should be planned as a resilience and coverage-completion layer integrated with the terrestrial core network, complementing rather than competing with terrestrial mid-band capacity layer.

Readiness requires timely clarity on the assignment framework and conditions for MSS spectrum in the L- and S-bands and FSS spectrum in the Ku, Ka and Q/V bands, handset chipset support for the MSS bands in devices for the Indian market, and coordination arrangements between satellite and terrestrial IMT operations.

2.6 Impact of Agenda Item 1.13 on India's IMT Bands

WRC-27 Agenda Item 1.13, under Resolution 253 (WRC-23), considers possible new MSS allocations for direct connectivity between space stations and standard IMT user equipment [29]. The associated ITU-R sharing and compatibility studies are ongoing: Working Party 4C is continuing these studies and developing draft CPM text on possible regulatory approaches for direct-connectivity MSS-IMT (DC-MSS-IMT) operation in terrestrial IMT bands, while WP 5D is responsible for setting the criteria to protect terrestrial IMT systems. India has large-scale TDD IMT deployments in the 2300 MHz and 2500 MHz bands, where MSS operation could cause interference owing to uplink/downlink synchronisation issues. India's position should therefore seek a regulatory framework and operating conditions that preclude DC-MSS-IMT operation in these TDD IMT bands. In addition, any global DC-MSS-IMT identification in the 800 MHz and 900 MHz ranges should be aligned with India's FDD band plans.

Chapter 4 – Conclusions and Way Forward

This chapter draws together the key findings, India's immediate priorities and the national approach towards WRC-27, and reviews the progress made on the recommendations of the 2024 B6GA white paper.

1 India's Data Growth Underscores the Need for Additional Spectrum

India's mobile data consumption has grown almost six-fold, from about 46.40 EB in 2018 to 266.87 EB in 2025, a CAGR of 28.4% and among the highest growth rates in the world. The 5G FWA base has risen from about 8.9 million connections in August 2025 to 13.2 million in July 2026. Network densification alone cannot keep pace with this growth; timely access to additional contiguous spectrum, most critically in the mid-band, is essential to serve rising data consumption and to enable the transition to IMT-2030 (6G).

2 Mid-Band: India's Foremost Priority for 6G Capacity

The mid-band is the decisive layer for capacity, and securing large, contiguous blocks within it is India's foremost near-term priority. **Sustaining the wide-area use cases of IMT-2030 will require additional wide-area spectrum of the order of 500–750 MHz per network, or 2–3 GHz nationally, in large contiguous blocks.** As AI reshapes demand in both volume and character, making traffic more uplink-heavy, latency-critical and always-on, meeting these requirements depends on the availability of substantial, contiguous mid-band spectrum.

- a) **The Golden Band (6425–8400 MHz):** this range is central to meeting these contiguous-bandwidth requirements and can supply the capacity needed for high-volume, AI-driven and future 6G services. NFAP-2025 has identified its lower part, 6425–7125 MHz (700 MHz), for IMT; the larger wide-area opportunity still to be secured is its upper part, 7125–8400 MHz, so that the full Golden Band can be treated as a single planning range. The identification of 7125–8400 MHz is before WRC-27 under Agenda Item 1.7 and Resolution 256 (WRC-23); as India lies in Region 3, the invitation covers the entire range. The studies under way in WP 5D, which form the technical record for the Conference, remain in progress. India's objective should be an identification free of undue technical or regulatory constraints, based on realistic assumptions for earth-station location, clutter and antenna discrimination, and supported by a transition plan for incumbents, capable of delivering at least 400 MHz of contiguous spectrum per network across 6425–8400 MHz.
- b) **Upper 6 GHz (6425–7125 MHz, band n104):** of the 700 MHz identified, the DoT's Spectrum Roadmap for 6G Services provides 400 MHz available in the near term and the remaining 300 MHz, where incumbent licences remain, by 2030. The macro-cell EIRP conditions, and any location-specific measures for coexistence with satellite-uplink earth stations, should be settled on the basis of coexistence trials. Early engagement with chipset and device vendors is needed to secure band n104 support in devices for the Indian market.

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

- c) **Extension above 3670 MHz towards 4200 MHz (bands n78 and n77):** this extension can leverage 3GPP bands n78 and n77, subject to incumbent migration and completion of the radio altimeter retrofit, providing a natural build-out of the established 3.5 GHz macro-cell layer.
- d) **4400–4800 MHz (band n79):** this range is the complementary extension of the 3.5 GHz macro-cell layer and is a study item for Regions 1 and 3, although it is not yet identified for IMT in NFAP-2025. As 3GPP band n79 is already specified, a Region 3 identification can draw on an established device ecosystem.
- e) **Radio Altimeter Retrofitting:** timely modernisation of legacy aviation equipment will support 5G–altimeter coexistence. As the 4400–4800 MHz band emerges as a key candidate for 6G, completing the radio altimeter retrofit programme by December 2027 will be important to avoid future aviation-related deployment restrictions, enable efficient use of mid-band spectrum and support seamless nationwide 6G deployment, while maintaining aviation safety.

3 Sub-1 GHz Coverage Layer and Refarming of Identified Spectrum

Sub-1 GHz spectrum will continue to serve as the reliable coverage layer throughout the IMT-2030 period, complementing the mid-band capacity layer. Together with the refarming of other identified spectrum, the following actions are recommended:

- **600 MHz:** maintain the identification of 40 MHz (paired) for IMT in all 22 LSAs while India advances APT600 harmonisation internationally, and offer the band on the terms proposed in Section 4.2.1 of Chapter 2.
- **Spectrum under insolvency proceedings (800, 900, 1800 and 2100 MHz):** this spectrum should be freed at the earliest and auctioned in a timely manner, so that it can be put back into productive use.
- **L-band (1427–1518 MHz; bands n74, n75 and n76):** retain a contiguous 67 MHz block for commercial IMT when 24 MHz is reserved for government use, and pursue an SUL band plan through regional and global standardisation bodies.

4 Network Resilience and Protection of Existing Networks

India should establish a timely spectrum-assignment framework, device ecosystem and coordination mechanisms to enable the seamless integration of non-terrestrial networks (NTN) into 6G, strengthening network resilience under IMT-2030. In parallel, India's existing TDD and FDD IMT networks should be protected: under WRC-27 Agenda Item 1.13, DC-MSS-IMT operation should not be permitted in the 2300 MHz and 2500 MHz TDD bands, and India's 800 MHz and 900 MHz FDD band plans should be safeguarded. The low-band, mid-band and higher-frequency ranges are complementary layers, with the mid-band at the core, each playing a critical role in India's future spectrum portfolio.

5 Review of Recommendations from the 2024 B6GA White Paper

The Bharat 6G Alliance white paper *Spectrum Roadmap for 6G in India*, published in October 2024, set out short-term recommendations to December 2025 and medium-term recommendations to December 2027 in its Sections 8.1 and 8.2 [6]. The review below examines the progress made against these recommendations and the actions still to follow.

5.1 Review of Short-Term Recommendations

The 2024 white paper sought a comprehensive review of the spectrum in use, both licensed and licence-exempt, and a national pipeline of bands for 5G-Advanced and 6G. This has been given effect through NFAP-2025, the Spectrum Roadmap for 6G Services and subsequent TRAI recommendations.

- a) **Golden Band (6–8.4 GHz):** the 2024 white paper identified the 6–8.4 GHz range as the Golden Band and recommended studying the entire range for future mobile use. Part of it, 6425–7125 MHz, is now identified for IMT under NFAP-2025, with 400 MHz available in the near term and a further 300 MHz (where incumbent licences remain) by 2030. The 7125–8400 MHz portion is being studied under WRC-27 Agenda Item 1.7; continued studies and a positive WRC-27 outcome would pave the way for 6425–8400 MHz to be treated as an integrated spectrum range for 6G services.
- b) **Mid-band spectrum for 5G-Advanced:** the 2024 white paper targeted around 200 MHz of mid-band spectrum per operator for 5G-Advanced. TRAI's recommendations of 24 February 2026 propose auctioning the remaining IMT-identified spectrum and harmonising operator holdings, while retaining 6425–6725 MHz and 7025–7125 MHz for IMT, with their auction to be re-examined after WRC-27. Extending IMT use beyond 3670 MHz would move operators towards contiguous mid-band holdings beyond the targeted 200 MHz.
- c) **3700–4200 MHz:** the 2024 white paper recommended studying satellite broadcasting and other incumbent uses to enable IMT expansion beyond 3670 MHz. The ecosystem is supported by 3GPP bands n78 and n77, while the key constraint near 4200 MHz is radio altimeter use in 4200–4400 MHz. A time-bound programme for altimeter retrofit and the migration of broadcast reception, together with arrangements for teleport and VSAT traffic, would provide a basis for planning the extension.
- d) **4800–4990 MHz:** the 2024 white paper recommended exploring this range for IMT while retaining the power conditions in Resolution 223 (Rev.WRC-23). Current attention is focused on 4400–4800 MHz, under WRC-27 Agenda Item 1.7 and supported by 3GPP band n79; the case for 4800–4990 MHz can be reassessed in the light of the technical conditions developed for 4400–4800 MHz.
- e) **L-band (1427–1518 MHz):** the 2024 white paper sought an assignment and band-plan decision for the L-band. The refarming plan earmarks 67 MHz of this range for IMT, to be refarmed after 2026, and TRAI's February 2026 recommendations call for DoT to pursue an SUL band plan with regional and global standardisation bodies and to retain a contiguous 67 MHz for IMT alongside 24 MHz for government use. The policy direction is set; finalising the band plan is the remaining step.

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

- f) **600 MHz:** the 2024 white paper recommended accelerating the commercialisation of the 600 MHz band and the APT600 arrangement, now specified as 3GPP band n105. The band is available as 40 MHz (paired) in each LSA. DoT is advancing the arrangement through the APT Wireless Group and pursuing its recognition in Recommendation ITU-R M.1036; auctioning the band on suitable terms is the next step towards commercial deployment.
- g) **526–582 MHz:** a consultation on 526–582 MHz for IMT and wider coverage was proposed, but efforts have concentrated on the 600 MHz band, which is already earmarked for IMT. Once the 600 MHz auction advances, the case for this additional sub-1 GHz coverage spectrum can be reassessed.
- h) **Coexistence and sharing:** detailed studies of coexistence between 5G, 6G and other radio technologies were proposed. This work is now under way through the ITU-R WP 5D studies under Agenda Item 1.7 and domestic spectrum consultations. The resulting technical conditions aim to protect incumbents while keeping macro-cell IMT viable, and location-specific measures, including around satellite-uplink earth stations, can be built into national sharing guidelines once the studies conclude.
- i) **International engagement:** the 2024 white paper emphasised continued participation in ITU and 3GPP. India's engagement is reflected in the WRC-27 Agenda Item 1.7 studies and in APT work on the APT600 arrangement. Sustained participation through the WRC-27 cycle will be key to securing harmonised outcomes and workable sharing conditions for IMT.

5.2 Review of Medium-Term Recommendations

The medium-term recommendations focused on establishing India's position for WRC-27, advancing sharing and compatibility studies, promoting early trials, strengthening industry participation and creating a clear pathway for future spectrum assignment. Significant progress has been made, although several actions remain.

- a) **WRC-27 and sharing studies:** NFAP-2025 has identified the upper 6 GHz band for IMT, while the Spectrum Roadmap for 6G Services places 4400–4800 MHz, 7125–8400 MHz and 14.8–15.35 GHz in the 2027–2030 study window. WP 5D is progressing the associated sharing and compatibility studies under Resolution 256 (WRC-23). The immediate priority is to develop technically robust conditions that protect incumbent services while enabling macro-cell IMT where identification is agreed at WRC-27. This white paper contributes to finalising India's position for the Conference.
- b) **Trials and prototypes:** early trials were recommended to validate coexistence and deployment assumptions. The trials around satellite-uplink earth stations in the upper 6 GHz band provide an initial implementation, and the experimental licensing framework can support further trials in 4400–4800 MHz and 7125–8400 MHz, providing practical inputs to the ongoing studies. To develop and validate indigenous 6G IMT radio technologies, it is proposed that 400 MHz of contiguous spectrum be made available initially on a trial basis to eligible Indian entities for controlled laboratory and field trials (Section 4.2 of Chapter 1).

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

- c) **Agenda Item 1.13:** the 2024 white paper distinguished the protection of terrestrial IMT under Agenda Item 1.13 from the IMT identification studies under Agenda Item 1.7, and this distinction remains valid. Under Resolution 253 (WRC-23), Agenda Item 1.13 is led by Working Party 4C, with WP 5D contributing on the protection of terrestrial IMT. Work on the two agenda items should therefore continue separately.
- d) **Industry collaboration:** a national platform for coordinated industry participation in spectrum planning was envisaged. The Bharat 6G Alliance, and this white paper, provide an established mechanism for such engagement, and continued coordination through the WRC-27 cycle would help translate industry inputs into India's position for the Conference.

6 Towards WRC-27 and Beyond

India's IMT spectrum readiness depends on two actions pursued together: entering WRC-27 with a settled position on the ranges still under study, and bringing already-identified IMT spectrum into service. **The wide-area demand set out in this white paper, of the order of 500–750 MHz of additional spectrum per network and 2–3 GHz nationally, must be met primarily from the Golden Band (6425–8400 MHz), complemented by the extension of the 3.5 GHz layer.**

- a) **Domestic priorities:** the immediate task is to assign and refarm spectrum already earmarked for IMT, including the upper 6 GHz band (6425–7125 MHz) identified in NFAP-2025, and to complete the radio altimeter retrofit that determines how far the 3.5 GHz layer can extend.
- b) **At WRC-27 (Agenda Item 1.7):** India's objective is an identification under Resolution 256 (WRC-23) that networks can use in practice:
 - **7125–8400 MHz:** as India lies in Region 3, the invitation covers the entire range. This range, or the largest practical part of it, should be pursued as a single planning range together with 6425–7125 MHz, on technical conditions that protect incumbent services while keeping macro-cell IMT viable.
 - **4400–4800 MHz:** this range serves as the complementary extension of the 3.5 GHz layer.
 - **14.8–15.35 GHz:** this range, which falls under the same agenda item, is currently used for microwave backhaul in India; any decision on its use for IMT should await the outcome of the Conference.
- c) **At WRC-27 (Agenda Item 1.13):** to protect existing TDD and FDD IMT networks, the outcome should exclude DC-MSS-IMT operation in the 2300 MHz and 2500 MHz TDD bands and safeguard India's 800 MHz and 900 MHz FDD band plans.
- d) **Terrestrial and non-terrestrial network integration:** IMT-2030 envisages terrestrial-satellite integration, which requires timely clarity on the assignment of MSS spectrum in the L- and S-bands and FSS spectrum in the Ku, Ka and Q/V bands, handset chipset support for the MSS bands in devices for the Indian market, and coordination arrangements between satellite and terrestrial IMT operations.

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

- e) **Beyond 2027:** the measure of success is spectrum in the hands of networks, in blocks large enough to sustain a device ecosystem, alongside coordinated terrestrial–satellite integration. **Within 6425–8400 MHz, the aim should be to provide each network with contiguous spectrum sufficient to meet 6G requirements.** Sustained engagement in ITU-R and 3GPP will be essential to translate identification into assignment, refarming and commercial deployment.

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Abbreviations

Abbreviation	Expansion	Abbreviation	Expansion
2G	Second Generation (mobile technology)	LLM	Large Language Model
3G	Third Generation (mobile technology)	LSA	Licensed Service Area
3GPP	3rd Generation Partnership Project	M2M	Machine-to-Machine
4G	Fourth Generation (mobile technology)	MBB	Mobile Broadband
5G	Fifth Generation (mobile technology)	MetSat	Meteorological-Satellite Service
6G	Sixth Generation (mobile technology)	MIMO	Multiple-Input Multiple-Output
AI	Artificial Intelligence	MNO	Mobile Network Operator
API	Application Programming Interface	MSS	Mobile-Satellite Service
APT	Asia-Pacific Telecommunity	MTP	Motion-to-Photon
B6GA	Bharat 6G Alliance	MWC	Mobile World Congress
BSNL	Bharat Sanchar Nigam Limited	NCLAT	National Company Law Appellate Tribunal
CAGR	Compound Annual Growth Rate	NCLT	National Company Law Tribunal
CPM	Conference Preparatory Meeting	NCRTC	National Capital Region Transport Corporation
D2C	Direct-to-Cell	NFAP	National Frequency Allocation Plan
DC-MSS-IMT	Direct-Connectivity MSS-IMT	NR	New Radio
DoT	Department of Telecommunications	NTN	Non-Terrestrial Network
DTH	Direct-to-Home	OTT	Over-the-Top
EB	Exabyte	PB	Petabyte
EESS	Earth Exploration-Satellite Service	RAN	Radio Access Network
EIRP	Equivalent Isotropically Radiated Power	RRTS	Regional Rapid Transit System
eMBB	Enhanced Mobile Broadband	SA	Standalone
FDD	Frequency-Division Duplex	SDL	Supplementary Downlink
FR1	Frequency Range 1 (3GPP)	SE	Spectral Efficiency
FR3	Frequency Range 3 (3GPP)	SRS	Space Research Service
FSS	Fixed-Satellite Service	SUL	Supplementary Uplink
FWA	Fixed Wireless Access	TDD	Time-Division Duplex
FY	Financial Year	THz	Terahertz
GB	Gigabyte	TRAI	Telecom Regulatory Authority of India
GenAI	Generative AI	TS	Technical Specification

A Perspective on IMT Spectrum Readiness towards 2030 and Beyond

Abbreviation	Expansion	Abbreviation	Expansion
HD	High Definition	UBR	Unlicensed Band Radio
IMT	International Mobile Telecommunications	VSAT	Very Small Aperture Terminal
IMT-2020	ITU designation for 5G	VVC	Versatile Video Coding
IMT-2030	ITU designation for 6G	WAN	Wide Area Network
ISAC	Integrated Sensing and Communication	WP	Working Party (ITU-R)
ITU	International Telecommunication Union	WPC	Wireless Planning and Coordination (Wing of DoT)
ITU-R	ITU Radiocommunication Sector	WRC	World Radiocommunication Conference
JCS	Joint Communication and Sensing	XR	Extended Reality
LCD	Liquid Crystal Display	ZB	Zettabyte

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