GSMA

VISION 2040

Spectrum for the future of mobile connectivity

Questions and answers

GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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Frequently asked questions

FREQUENTLY ASKED QUESTIONS

Why is the GSMA talking about 6G spectrum needs, when most people do not even have 5G yet? Should mobile operators not just focus on 5G?

It is true that most mobile users are not yet using 5G, while even in countries that have 5G, many have not deployed 5G SA, which is needed to realise the full benefits of the technology. 5G (and by extension 5G SA) remains the immediate priority of the mobile industry.

However, while these short-term objectives should be addressed, long-term technological progress should not be ignored. Mobile network deployment and spectrum harmonisation operate on extended timescales that necessitate long-term planning. Research, equipment development, standardisation processes and regulatory coordination can take many years to complete. For operators to be ready to deploy 6G networks commercially by 2030, the underlying spectrum requirements should be established well in advance.

In short, technological progress in the mobile industry requires discussion and identification of necessary spectrum bands today, but this does not (and should not) detract the industry and governments from their efforts to deploy and expand 5G SA and 5G-Advanced.

Why do you present a range of spectrum needs rather than an exact figure?

Given the inherent uncertainty in making long-term forecasts over a period of 10–15 years, particularly in a fast-changing and technology-driven industry, our analysis considers multiple scenarios for both demand and supply factors. This includes low-, medium- and high-demand forecasts as well as a range of network assumptions. We therefore run multiple simulations based on different assumptions to produce a lower- and upper-bound of spectrum needs in the 2035–2040 period, which acknowledges forecasting uncertainty.

Why do you present spectrum needs based on a range of years (2035–2040) rather than a single year (e.g. 2035 or 2040)?

We estimate spectrum needs over a period of years because our forecasts are not fixed based on a specific trajectory. For example, suppose one forecast scenario is that global traffic will reach 1,000 EB/month by 2035. We want to reflect the possibility that this milestone may happen more quickly (e.g. by 2032) or more slowly (e.g. by 2038). This is in addition to having low-, medium- and high-growth scenarios (i.e. we want to reflect those scenarios following different paths).

Do your results mean that mobile operators will not need any new spectrum until 2035?

Mobile operators will need new spectrum available well before 2035. The implication from our analysis is that at least 2 GHz of mid-band spectrum (in frequencies between 1 GHz and 10 GHz) must be allocated, assigned and operational well in advance of 2035 to ensure networks can handle expected traffic. Delays in availability could lead to network congestion in high-demand areas, reducing service quality and negatively impacting user experience, as mobile operators need sufficient lead time to deploy and optimise the spectrum effectively. Having the spectrum earlier will also be critical in countries that will face network congestion by the time that 6G is deployed from 2030. Our analysis suggests that cities with over 50% of the world's urban population will be capacity-constrained by 2030 if mid-band spectrum remains at today's levels. Having 2 GHz of mid-band spectrum by 2030 is therefore critical.

Why do you emphasise the weighted average in the results?

The weighted average reflects the spectrum needs based on where urban populations live. In other words, it means that from a global perspective, the spectrum needs in countries such as China, India and the US are given more weight than in smaller markets, such as islands in the Caribbean and the Pacific. While a simple average is a useful metric for considering spectrum across countries, reflecting their diversity, a weighted average reflects spectrum needs for global and regional populations, giving each person equal weight.

What is the justification for your data growth figures? Why would mobile traffic continue growing at 10–25% each year?

Our higher growth assumptions are driven by the emergence of new use cases in the 6G era – including XR (e.g. smart glasses), autonomous vehicles and potentially even holographic communication – and the increasing use of AI, which will involve greater downlink and especially uplink requirements. However, even if such use cases remain niche with limited take-up and current video applications remain the predominant traffic driver, data demand will continue to grow as more users migrate to 5G (and eventually 6G) and utilise higher-speed networks. Beyond that, demand will continue growing with more power users, especially as younger generations that are more frequent and intense users of mobile get older and drive a power-use boom. Currently, 10% of mobile users generate 60–70% of total network traffic, but the consumption rates of these power users could become the norm in the future.

Does your analysis take into account usage on fixed networks? Can operators not just off-load more traffic to fixed networks instead of using new licensed spectrum?

Our spectrum-needs analysis is based on the amount of time users spend on mobile networks and so it reflects the fact that in many (though not all) regions, users already spend the majority of their time on fixed networks. Globally, fixed broadband accounts for around 80% of traffic, although mobile delivers more traffic than fixed in countries accounting for almost 40% of the global population (mostly in South Asia and Sub-Saharan Africa).[1]

However, fixed broadband and Wi-Fi are not always available or suitable, so consumers and enterprises should have the option to access the type of connectivity that best meets their needs at any given time. It has also been suggested that operators could deploy their own Wi-Fi networks (along with other small cells) to increase network capacity at lower cost. In practice, however, Wi-Fi does not provide a widespread capacity solution because the traffic is unmanaged and cannot be coordinated. When deploying 5G and eventually 6G, given the demanding performance requirements, operators will need to use licensed spectrum that they have complete control over.[2]

Can mobile operators use mmWave spectrum to meet growing demand instead of new mid-bands?

mmWave bands are well placed to support extreme capacity in very localised deployments, either in ultra-high-density environments, certain local enterprise networks (e.g. smart factories) or specific events that drive high mobile usage (e.g. music concerts and sporting events). We therefore assume that such bands will address 5–10% of dense urban traffic in the long term. However, it is not realistic for mmWave bands to meet significantly more than this, due to their higher path loss and lower propagation (especially indoors). To meet increased demand using only mmWave bands would require operators to densify networks to a degree that would be both technically and economically unsustainable.

Does the GSMA include FWA in its traffic forecasts and spectrum needs?

FWA and IoT are included in our traffic forecasts. FWA has been one of the main 5G use cases, and we expect it to continue growing in the 6G era, meaning operators need enough spectrum to meet demand from consumers and enterprises. However, we model FWA in a different way to mobile by assuming a smaller proportion of traffic is in dense urban areas, and we also assume operators can more efficiently provision FWA capacity per unit of spectrum. This reflects the different nature of FWA, which has predictable links, stable channels and directional antennas and avoids mobility, interference and handover overheads that impact cellular systems.

1 See Mobile Evolution in 6 GHz, GSMA, 2024
2 For further details on this, see The socioeconomic benefits of the 6 GHz band: Considering licensed and unlicensed options, GSMA Intelligence, 2022

If mobile demand is concentrated in small areas, do operators need exclusive spectrum access on a national basis? Could they share it with other users?

The impact of sharing spectrum between users is ultimately determined by the type and terms of sharing. Some of the recent proposals to share the upper 6 GHz band between licensed mobile and unlicensed radio local area networks (RLAN) do not incentivise efficient spectrum use.[3] Any approach to spectrum sharing therefore needs to carefully consider the costs and benefits of implementation. If the technical conditions for sharing are too stringent and costly for one or more users, the sharing framework will lose value.

Going forward, it is important to thoroughly consider the topic of spectrum sharing in new bands between mobile operators and other users, but whether it works effectively depends on the type of sharing framework. It is likely to be more feasible in a scenario where other spectrum users utilise frequencies outside of the locations where mobile traffic is mostly concentrated (e.g. sharing on a geographic basis). Furthermore, sharing should not be used as a tool to continue inefficient incumbent uses longer than their need is justified and any sharing solution should be informed by a cost-benefit analysis.

Operators have said that 6G should not require a hardware refresh, so how will they deploy in new frequency bands without this?

While the mobile industry agrees that 6G should not necessitate a forced hardware refresh (instead, using software upgrades in existing bands), new radio equipment is expected to be required for new frequency bands. This is not the same as a full hardware refresh, which would include replacing all existing RAN equipment and core network infrastructure.

3 For further analysis of this, see Mobile Evolution in 6 GHz, GSMA, 2024

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