GSMA

Spectrum Policy Trends 2025

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Spectrum Policy Trends

Foreword

Economic development will be a global prerogative in 2025. The world is recovering from a period of slow growth, and increasing GDP can help support many of the other prevalent issues facing the planet, whether reducing carbon emissions, creating employment or helping bring people out of poverty.

As we do our job representing the global mobile ecosystem, the GSMA hopes to take part in global efforts to advance digital inclusion and allow mobile to develop economies. All of us in spectrum management have a role to play in trying to boost access to better livelihoods through access to communications technologies. We want to get more people online this year, and our regulatory policies will help shape how we achieve that.

Freeing up spectrum capacity is important. 5G and, in time, its evolution will need wide channels of new mobile spectrum but there is also work to be done migrating older technologies from existing spectrum. Legacy network sunsets will continue to occur gracefully during this year but at an increasing rate. Retiring old technologies like 2G and 3G increases spectral efficiency and saves carbon while producing better quality of service for consumers.

Governments have already begun taking advantage of the new spectrum identified at WRC-23. The first 6 GHz assignment has been completed in Hong Kong with UAE plans also announced for 2025. Saudi Arabia held the first 600 MHz auction in EMEA. Beyond this work, spectrum for mobile evolution going into the 2030s is being discussed. 200-400 MHz channels will be required for 6G in mid-bands, and WRC-27 will begin to define what harmonisation may be found for the next era of mobile.

Our discussions with governments often centre around creating a positive policy environment to encourage long-term investment and, with it, network quality. By doing so, we can give mobile the best chance to help economic growth. The way in which licences are renewed can support network development: regulatory certainty supports robust investment planning. Unlike most industries, mobile does not have guaranteed access to its most critical resource, but governments can work together with MNOs by giving a presumption of renewal and long-term guidance before licences expire.

Spectrum policies in 2025 can support access to connectivity, whether that means people from lower-income segments of the global population making their first 4G or 5G download, an SME factory automating its processes to keep up with multinational manufacturers, or governments using mobile to connect cleaner, greener cities. In Brazil, my home country, we use a variation of a proverb that appears in many cultures: “Don’t give out fish: teach fishing”. Giving people access to affordable connectivity across the world, no matter who they are or where they live, can empower them to help build up the global economy.

Luciana Camargos, Head of Spectrum, GSMA

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6 GHz to dominate mobile capacity planning

In 2025, the scale of 6 GHz development for IMT will continue to grow as more nations deliver a clear roadmap to its use for mobile. This momentum is set to provide telecom operators with the long-term investment certainty they need to drive innovation in future technologies.

Why does it matter?

One of the significant outcomes of the ITU World Radiocommunication Conference 2023 (WRC-23) was the identification of additional mid-band spectrum to meet the growing demand for mobile data. Countries representing 60% of the global population sought inclusion in the identification of the upper part of the band (6.425–7.125 GHz) for licensed mobile, and with decisions after WRC-23 that footprint will now cover 80% of the world's citizens. This band sits above the lower 6 GHz band (5.925-6.425 GHz), which is often assigned for unlicensed technologies, including Wi-Fi. WRC-23 thus made a balanced decision that supported both services.

Mid-bands provide city-wide coverage and cater for around 80% of indoor capacity in urban areas (where mobile is predominantly used indoors). They will also deliver much of the capacity required for enterprise digitalisation and industrial connectivity. Mobile networks will need an average of 2 GHz of mid-band spectrum per country by 2030, and this will be difficult to achieve without 6 GHz, which is the single largest remaining mid-band block. Ensuring its timely availability at reasonable conditions and prices is therefore crucial.

What are the policy considerations?

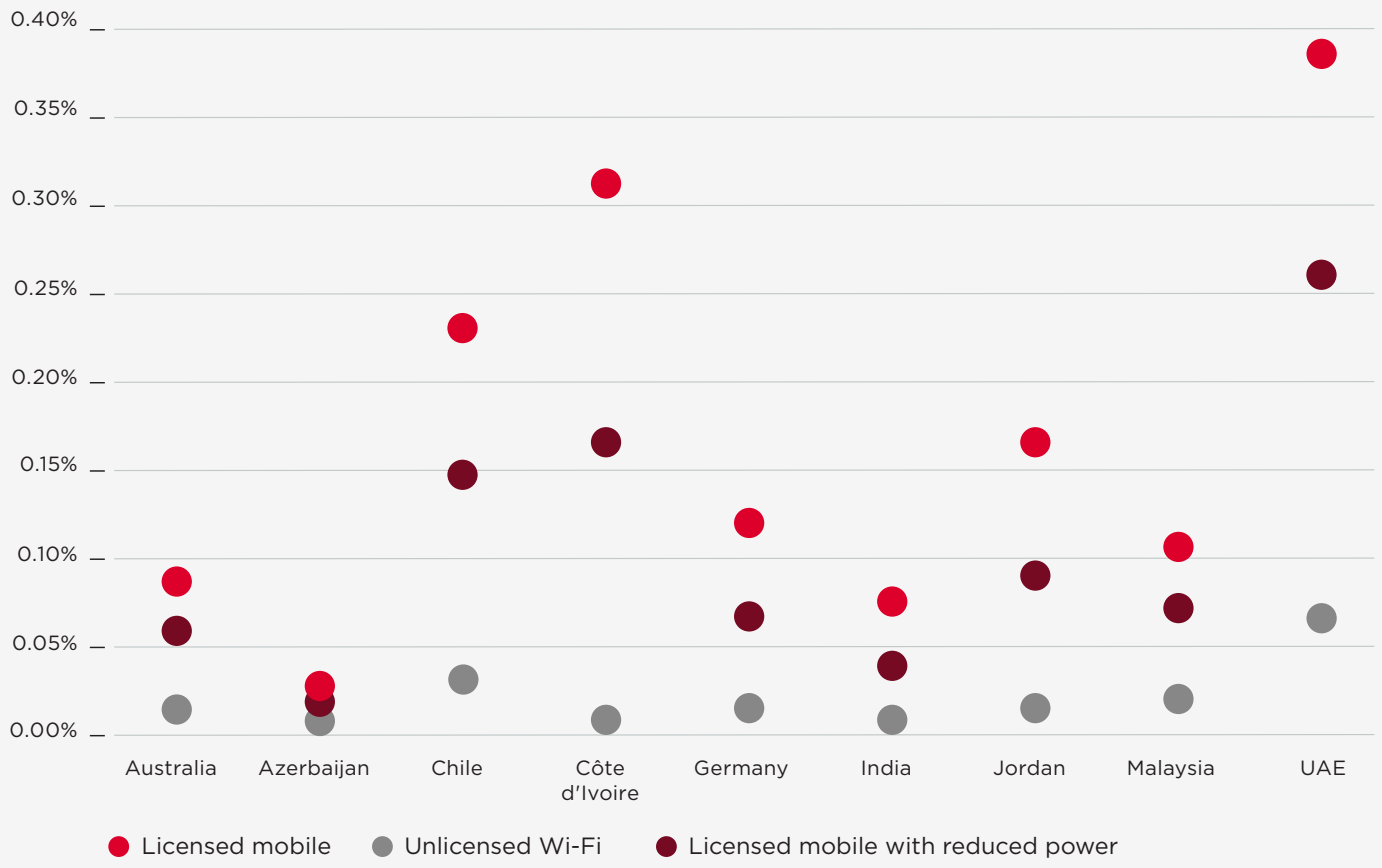
Regulators are now seeking further evidence to inform their decisions on which technology requires additional 6 GHz spectrum. They are considering three different policy options for the upper 6 GHz band:

- licensed mobile use
- unlicensed Wi-Fi use
- enabling shared use by e.g. reducing the power levels of mobile deployments

Option one, where the upper 6 GHz is assigned for licensed, macro-cell mobile with standard power levels, provides the greatest economic benefit because mobile is much more likely than Wi-Fi to be capacity-constrained. This means additional spectrum in the upper 6 GHz band is needed to drive greater improvements in network quality and user experience, leading, in turn, to greater benefits for the wider economy. By assuming efficient utilisation of spectrum, unlicensed assignments in the 2.4, 5 and lower 6 GHz bands are more than sufficient to meet the expected demand for Wi-Fi traffic. This makes further unlicensed assignments unjustifiable.

Regarding option three (shared use), restricting the power levels of mobile base stations in the upper 6 GHz band to facilitate sharing will significantly reduce the additional capacity they can provide. As a result, the economic benefits are lower than having a fully licensed macro-cell band. Furthermore, given that the majority of mobile traffic originates indoors, there is no clear rationale for attempting to enforce sharing environments where mobile is used outdoors and Wi-Fi indoors.

The economic benefits of the three scenarios in nine countries
Proportion of expected GDP in 2035



Source: GSMA Intelligence

Note: The results represent the net present value (NPV) of economic benefits during 2023-2035, expressed as a proportion of expected GDP in 2035 for each country

What to expect in the year ahead

Hong Kong recently concluded the world's first IMT auction of the upper 6 GHz band, and the UAE is assigning the full upper 6 GHz to its operators. Meanwhile, Sri Lanka, Indonesia, Thailand, Bangladesh and Cambodia have added it to their spectrum roadmaps and India is also progressing the use of 6 GHz for mobile.

In 2024, Australia, Brazil, Chile and Mexico moved away from dedicating the entire band for unlicensed use and identified the upper part of the band to IMT in the countries' table of frequency allocations. In 2025, many more nations will make 6 GHz available for IMT. Countries across APAC, the Gulf region and Latin America will help accelerate these regional trends.

These developments confirm 6 GHz as the harmonised home for the future of mid-band capacity. Using 6 GHz to deliver a clear roadmap towards future connectivity can provide fast, affordable mobile broadband, lower the usage gap and narrow the digital divide.

Policy in practice: UAE assigning the upper 6 GHz to its mobile operators

On 27 November 2024, the Telecommunications and Digital Government Regulatory Authority (TDRA), announced the update of the UAE's National Frequency Plan V4.0 that reflects all the outcomes of WRC-23. The update included the allocation of 600 MHz and the upper 6 GHz bands for mobile service identified for IMT. It was also announced that these two bands will be assigned to both operators in UAE.

The UAE will thus be one of the first in the world to offer 6 GHz mobile broadband and one of the earliest movers on 600 MHz in EMEA. This forward-thinking decision positions the UAE at the forefront of superfast connectivity and lays the foundation for groundbreaking innovations in 5G-Advanced and 6G technologies. By unlocking the potential of the 600 MHz and 6 GHz bands, the UAE is set to deliver enhanced connectivity — transforming the digital landscape for businesses and consumers alike. The allocation of the full upper 6 GHz band means that the two operators, e& and DU, will receive channels of 350 MHz each.

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Technology upgrades and legacy network sunsets on the rise

5G adoption has spurred momentum behind network sunsets. This global effort aims to address declining traffic on legacy network generations (2G/3G), the financial burden of maintaining legacy infrastructure, and the need to use spectrum resources efficiently by migrating to newer (4G/5G) technologies. According to GSMA Intelligence, 131 networks are planned to be shut down by 2030, with 61 scheduled for 2025.

Why does it matter?

The continuous evolution of technology increases the demand for additional spectrum resources by different communications service providers. This makes it critical for operators to optimise and efficiently use their existing spectrum assets.

The need for additional spectrum to serve 4G and 5G capacity, alongside the declining traffic on legacy networks, as well as higher maintenance costs, make network sunsets an attractive decision for operators.

What are the policy considerations?

Mobile operators face significant roadblocks in their network sunset journeys in many countries. Common challenges include the lack of technology-neutral policies, reliance on legacy 2G/3G networks for critical services (such as e-call or SOS), public utilities (such as meters and elevators) still being configured to these networks, and affordability of 4G/5G devices.

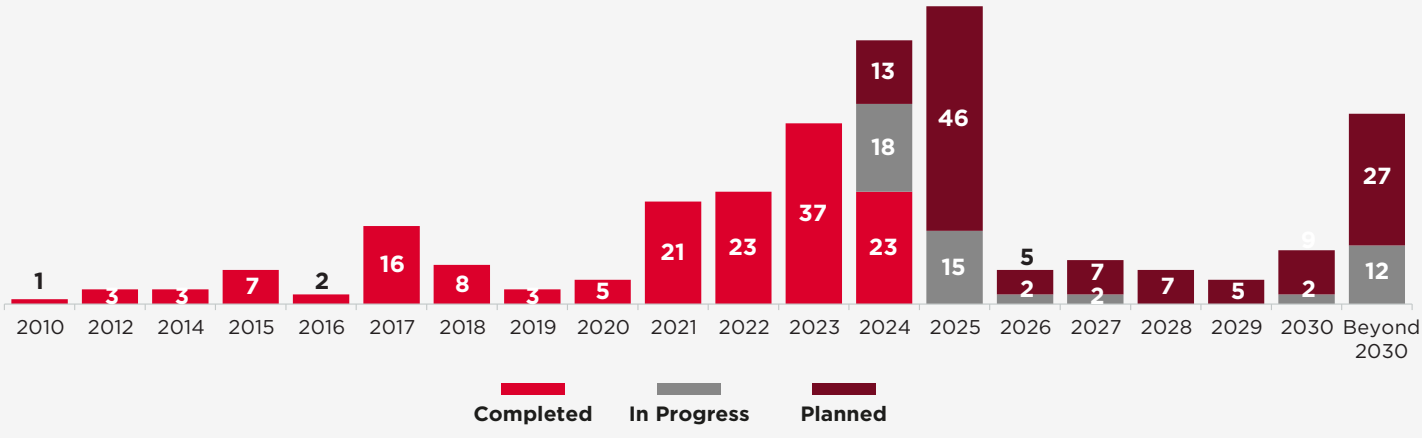
Regulators should provide a guiding framework and implement policy measures to assist operators. Network sunsets can benefit their country's population and enhance user experience. Regulators can implement supporting measures to complement the adoption of 4G/5G networks, facilitating smoother network sunsets.

Technology-neutral licensing is essential for legacy network sunsets. It allows mobile operators to refarm spectrum used for legacy networks for 4G and 5G services at a pace driven by market demand. Regulators must assign bands on a technology-neutral and affordable basis to maximise the efficient use of spectrum and allow the migration of these spectrum resources for future connectivity requirements.

What to expect in the year ahead

The benefit of network sunsets is being increasingly understood, and 2025 will be a big year. According to GSMA Intelligence, 131 networks are planned to be shut down by 2030, 61 of them within 2025. Globally, the 900, 1800, and 2100 MHz bands are often used for 2G and 3G networks, offering a good portfolio of spectrum that can be refarmed. They are ideal bands to migrate in part or fully via network sunsets to enhance telecom operators' 4G and 5G connectivity alongside new spectrum such as 3.5 GHz. While refarmed spectrum will help add capacity, it is important to remember that new spectrum bands are also needed to meet future needs.

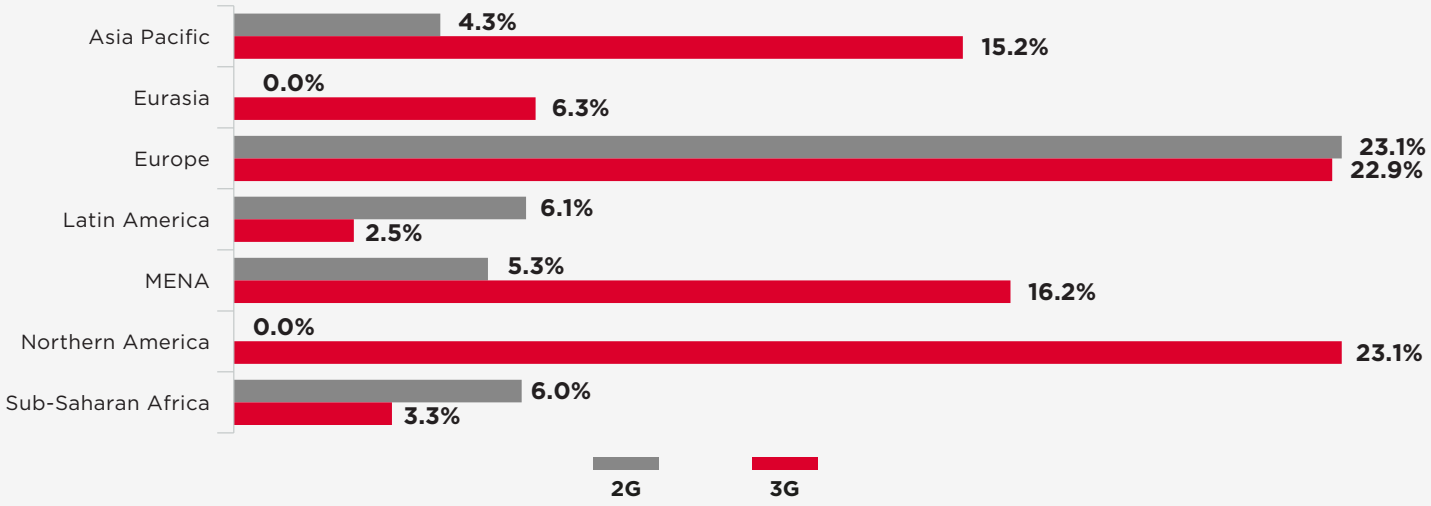
Network sunsets by completion year



Data correct to 24 October 2024
Source: GSMA Intelligence

So far, Asia Pacific and Europe have been at the forefront of network sunsets, accounting for around 70% of shutdowns. By 2030, Europe will lead in network sunsets, with 62% of European countries participating, compared to 34% of Asia Pacific countries. 3G will outnumber 2G shutdowns, accounting for 55% of the total sunsets by 2030.

Planned network sunsets in the region percentage of active networks in the region



Source: GSMA Intelligence

Policy in practice: Kuwait and Qatar aim to sunset 3G in 2025

Kuwait and Qatar's telecommunication regulatory bodies have mandated telecom operators to shut down 3G networks by June 2025 and December 2025, respectively. To support the shutdown and customer transition, Qatar also banned the import of mobile phones that only support 2G and 3G technologies.

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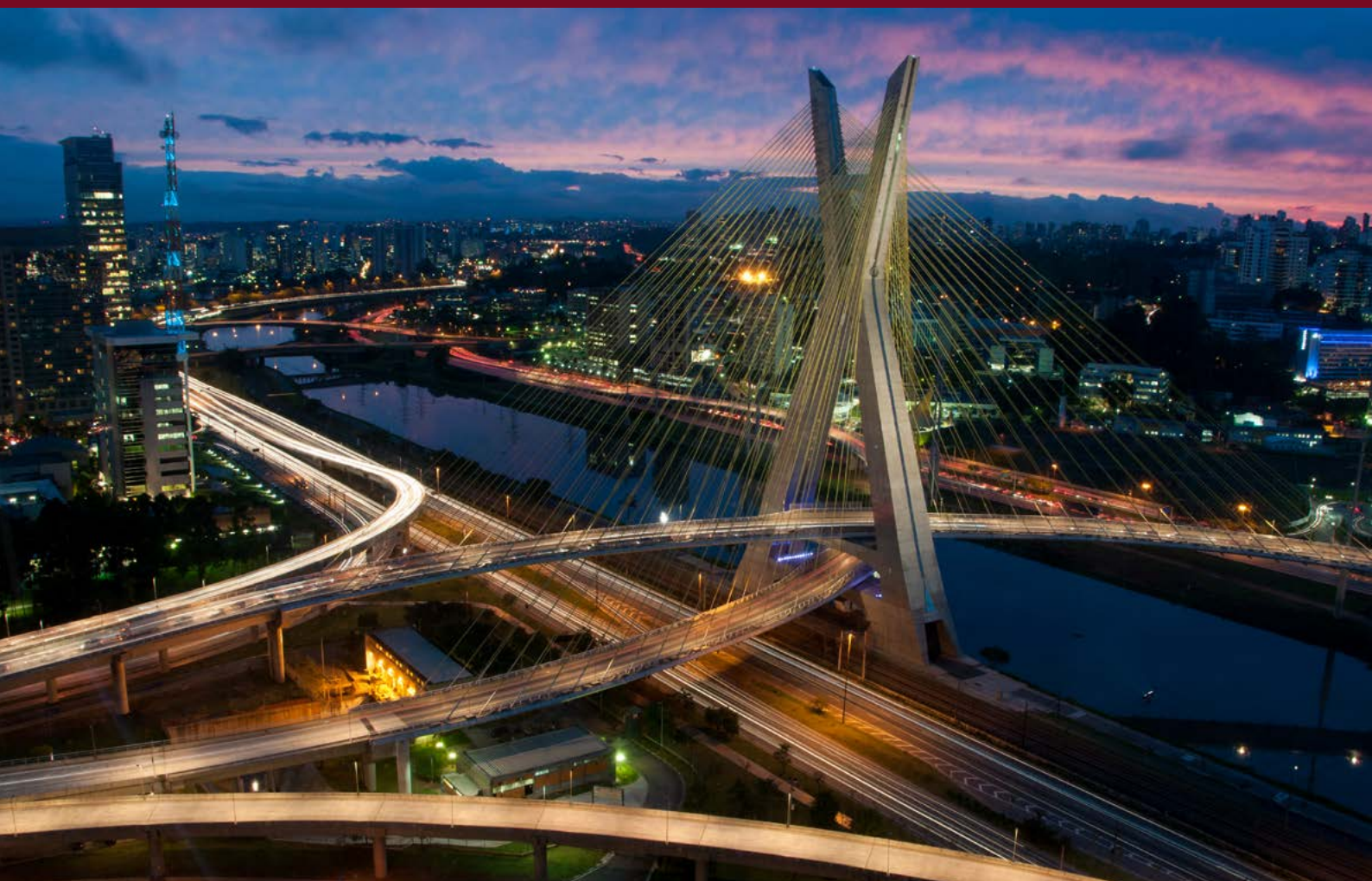
The year of spectrum renewals



With spectrum licences approaching expiry in more than 30 countries in 2025, more nations are expected to adopt innovative licensing frameworks to advance connectivity and reduce the financial burden on operators. Operators will need to proactively and transparently articulate their requirements to regulators, backed by clear use cases.

Why is it important?

The mobile industry differs from most other industries in that the ongoing right to a critical resource is often not guaranteed but is subject to periodic reviews by authorities. Many countries continue to license the use of the spectrum for finite and/or short periods. Depending on the approach to licence renewals, this may lead to uncertainty for operators and customers, harming investment, innovation, competition, and efficiency.

Governments and regulators are increasingly mindful of this and are adopting innovative pricing and licensing models to ease the financial pressure on operators while encouraging investments in connectivity and coverage. For instance, Spain has extended spectrum licences by 10 years at no additional cost, incentivising investments.

What are the policy considerations?

Various renewal approaches are available to regulators when spectrum is already licensed to an operator. Operators may not invest in their networks or compete as much for customers if there is uncertainty over future spectrum rights. Regulators thus serve consumers best by creating that certainty by ensuring licence renewal decisions are made five years ahead of the renewal date. Uncertainty can be further minimised by creating a presumption of renewal unless a breach of licence condition has occurred, a fundamental reallocation of spectrum to a new service is required, or an overriding policy need arises.

Renewal tools	Advantages	Disadvantages	Recommendations
Presumption of renewal	• Offers certainty for future investment in the sector • Minimises customer service disruption from operators losing spectrum and needing to reconfigure networks or exit the market • In conjunction with trading, supports efficient spectrum use over time	• In extreme circumstances, spectrum may be better re-assigned (for spectrum replanning, a serious breach of conditions, or if spectrum is left idle)	Minimise uncertainty by creating a presumption of renewal unless there is a serious breach of conditions or if the spectrum is left idle.
Re-auctioning	• Promotes efficient outcomes / efficient use of spectrum (i.e., those that value it most are assigned spectrum)	• Discourages long-term network investment • May be disruptive to users and existing businesses as current operators risk losing critical spectrum • May be subject to 'gaming'; therefore, auction design is critical • Auction prices carry a greater risk of the licence cost undermining operators' investment capabilities	The details of the implementation should be transparent and focused on future certainty.
Hybrid solution	• Attempts to balance achieving some predictability and some flexibility	• May discourage long-term network investment • Risk of customer service disruptions and QoS challenges • Potential costs associated with reconfiguring networks can hinder benefits • Trading off predictability for flexibility would only be beneficial in some circumstances	Prioritise the objectives of promoting efficient use of spectrum and network investment while also ensuring effective competition.

What to expect in the year ahead

Spectrum assignments in different bands, such as the 900 MHz, 1800 MHz and 2100 MHz, often used for 2G and 3G, are approaching expiry in over 30 countries in 2025. At the same time, 61 network sunsets are planned for 2G and 3G technologies within the same year.

These bands are ideal candidates for migration, in part or fully, via network sunsets to enhance telecom operators' 4G and 5G connectivity.

Renewals should happen on a technology-neutral and affordable basis, considering new methodologies to incentivise investments and allow for migrating these spectrum resources for future connectivity requirements.

Policy in practice: Brazil implements automatic renewals

In 2021, Brazilian regulator ANATEL launched a multi-band spectrum auction for the 700 MHz, 2300 MHz, 3500 MHz, and 26 GHz bands to encourage market interest and incentivise network investment.

To achieve this, significant changes to licence terms were introduced based on public-private dialogue, including:

- **licence terms were increased to 20 years to provide investment certainty.**
- **to further strengthen certainty, licences included clauses for automatic renewal subject to fulfilling coverage and service obligations.**
- **operators could make yearly payments over the licence term, reducing the one-off financial impact of spectrum acquisition.**
- **the cost of compulsory licence obligations was deducted from the spectrum price to promote investment in rural areas.**
- **bids over the reserve price could be converted into voluntary investment obligations.**

The positive effects of the increased investment certainty and incentives were visible through a vast market interest in the auctioned spectrum and immediate 5G network rollouts by successful bidders beyond licence requirements.

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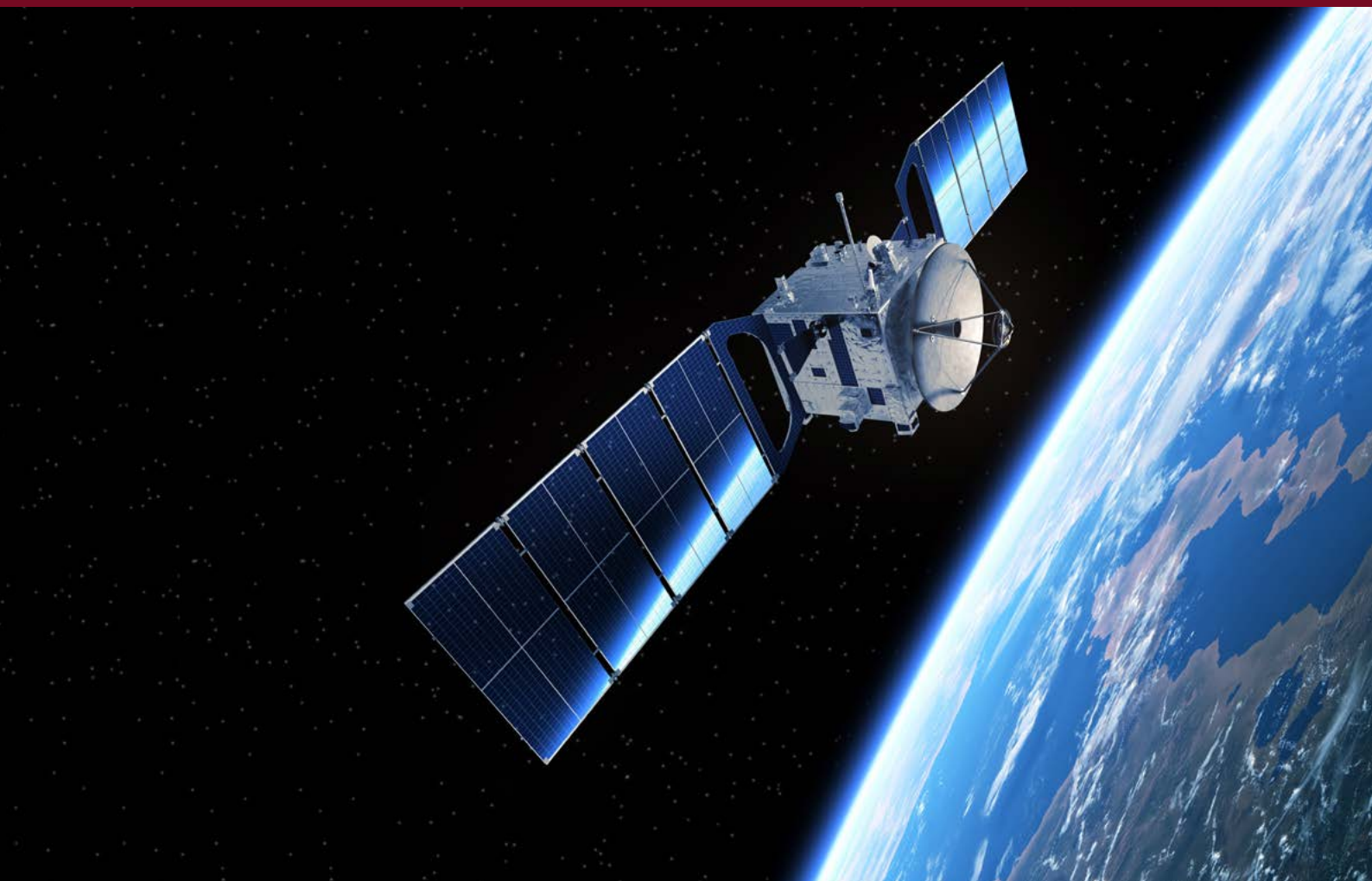
Spectrum policy to shape the future of D2D



Direct-to-device (D2D) connectivity from satellite continues to attract attention from policymakers at a time when new low Earth orbit (LEO) players are expanding capacity and established satellite operators are assessing their relevance to D2D. Mobile operators remain enthusiastic about safely bringing a possible new technology into their access networks but remain cautious about interference and realistic about the limits of D2D's use in expanding connectivity. D2D regulation is one area that requires definition, but it is not the only one.

Why is it important?

D2D has some strong potential use cases, but the exact nature of its importance is one of the issues that requires definition. 4% of the world's population currently live outside mobile coverage, while 37% live within coverage but do not use it. D2D can potentially help address the 4% coverage gap but not the 37% usage gap.

For mobile network operators (MNOs), there are two broad use case categories in which D2D could be beneficial. Firstly, customers in some areas (typically higher-income countries) may be willing to pay more for connectivity outside populated areas, including outdoor enthusiasts or drivers on rural roads. Secondly, MNOs may be able to offer D2D services to provide basic coverage where base stations are not economically viable, allowing them to not only fulfil regulatory commitments but also offer new services such as agricultural IoT.

What are the policy considerations?

D2D may operate in mobile spectrum, on standard handsets, using the chipsets also used for terrestrial mobile (IMT), or on handsets that have chipsets to use the 3GPP satellite bands (e.g. n255/6 for L-band and S-band satellite D2D respectively).

D2D is already available using more complex handsets, such as recent iPhones or the Google Pixel 9, and mobile satellite spectrum. However, the chipsets used for this connectivity are not on cheaper phones and are unlikely to be affordable for a lot of the global population. D2D will operate in mobile satellite and in IMT spectrum, and the latter's promise is that genuinely standard handsets can be used: simpler handsets will tend to come at a lower cost.

Spectrum issues concerning D2D present substantial challenges. International and cross-border coordination will be critical for D2D's operational sustainability. D2D will not be a benefit unless it can coexist safely alongside terrestrial mobile and other services. The ITU World Radiocommunication Conference (WRC-27) addresses each of those topics separately, and there are a lot of technical and regulatory aspects that need to be resolved.

WRC-27 spectrum discussions related to direct-to-device and mobile satellite

Direct-to-device	New mobile satellite
Mobile satellite in IMT bands between **694/698 MHz** and **2.7 GHz**	**1 427-1 432 MHz** 1 645.5-1 646.5 MHz **1 880-1 920 MHz** **2 010-2 025 MHz** **2 120-2 170 MHz**

Note: The bands in bold are already used for IMT

What to expect in the year ahead

While there is much enthusiasm to continue driving the technology forward, it is also vital that governments that wish to introduce D2D before WRC-27 (and before the parameters and regulations for coexistence are agreed) should do so cautiously and with the primary goal of avoiding interference. At a national level, licensing mechanisms may require change – and new definitions for regulatory frameworks governing hybrid D2D services will need to be developed.

Consumers care about service quality – not the underlying technology – and so a cohesive regulatory framework that ensures coexistence between terrestrial and non-terrestrial networks is critical. It is paramount that D2D has a positive impact on mobile connectivity, and it must not cause interference into terrestrial networks.

The US has already developed its first D2D regulations through the FCC. The Australian telecoms regulator (ACMA) has also announced that IMT-based satellite direct-to-mobile services can operate under Australia-wide spectrum licences. Other regulators have sought industry input on satellite-based communication services, although most are waiting until ITU guidelines are developed through the WRC-27 cycle.

Policy in practice: FCC adopts rules to facilitate the deployment of supplemental coverage from space (SCS)

D2D policy development should be done with caution. While a small number of governments have progressed in this area, they are large countries without significant cross-border interference issues. This new policy area will not have the technical details for proper governance until after WRC-27.

The Federal Communications Commission (FCC) has developed its own regulations for D2D through its 'supplementary coverage from space' (SCS) regulation. D2D regulation development in the US was possible due to its continent-wide size (4,500km) and limited cross-border interference issues.

The SCS regulation picked up two important issues regarding D2D in mobile bands:

1. D2D in IMT bands should be secondary

   "SCS will be authorized pursuant to a secondary MSS allocation in the U.S. Table. These operations may not cause harmful interference to—and shall not claim protection from—any station operating in accordance with ITU provisions, whether in the United States or internationally."

2. D2D in IMT bands should be delivered through the terrestrial licence holder

   "We authorize SCS only where one or more terrestrial licensees … lease access to their spectrum rights to a participating satellite operator."

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Mobile evolution: spectrum for 6G

Boundless, seamless connectivity. Networks and devices that connect everything and everyone, everywhere. Applications and services delivered with new levels of sustainability that help move the planet towards net zero. This is the vision for 6G.

The strides taken forward on digitalisation and new IoT applications during 5G can become prevalent in the 2030s as the computing power of an enterprise connects automatically with its workforce or integrated technologies enhance consumer experience. These technologies can enhance productivity, increase competitiveness and, of course, help us have fun.

The journey towards 6G is beginning, and as wireless connectivity continues to expand from connecting the phones in our pockets to the machines in our factories and the vehicles on our roads, this potential requires spectrum – delivered in wider 200-400 MHz channels - to cater for demand.

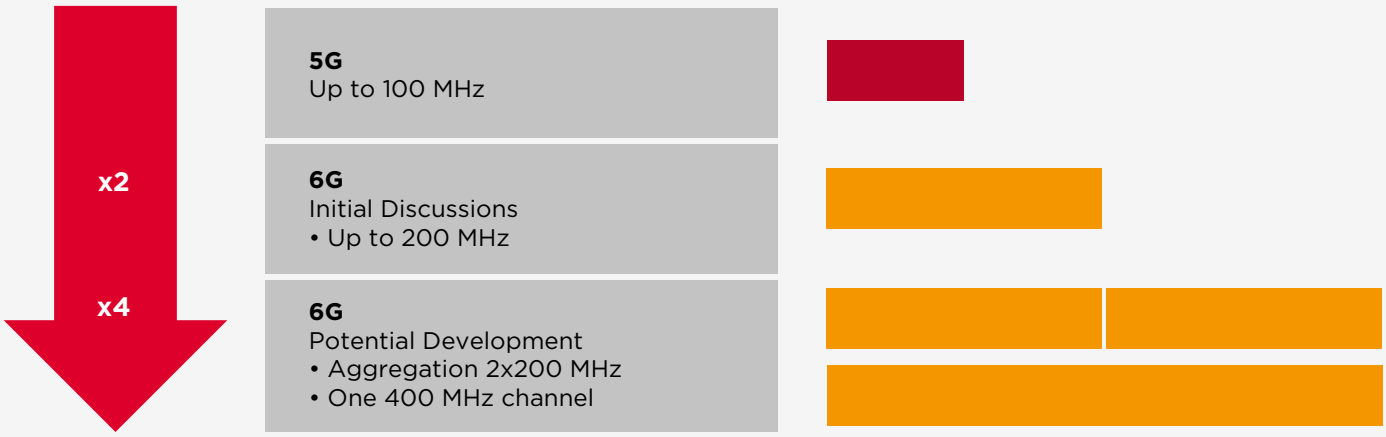
Why is it important?

Mobile connectivity can help provide socio-economic growth. On the economic side, 5G alone can provide nearly US$1 trillion of GDP benefit by 2030. Mobile evolution will have enhanced social benefits, too. Ericsson says of 6G: “By delivering ever-present intelligent communication, 6G will contribute to the creation of a more human-friendly, sustainable and efficient society.”

The need to realise the promise of 6G is attracting global attention, and spectrum plans are an important foundation. mmWave bands will be used for the busiest locations – stadia, train stations, ports and airports, and busy shopping areas. Low bands will be required to deliver crucial digital equality between urban and rural areas. However, a lot of emphasis will be placed on finding the right mid-band assignments to deliver city-wide connectivity. 6 GHz capacity will be brought into play by many governments to carry the next phase of data growth, and this may be used in the short or medium-term depending on the country. Beyond 6 GHz, other bands are considered, including the 7-8 GHz range.

200-400 MHz channels will be required for each operator in mid-bands for mobile evolution going into the 2030s. The mobile ecosystem is working with governments and international bodies to ascertain which bands may be used for the future expansion of mobile.

Channel bandwidth requirements for 6G

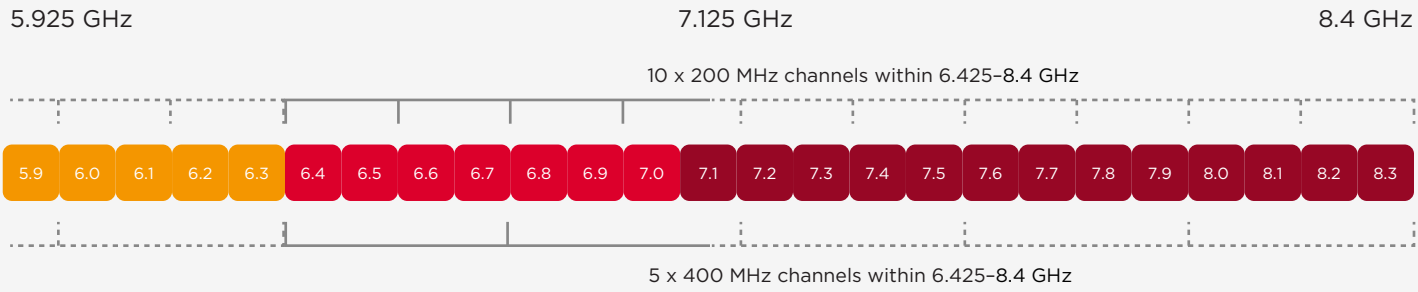


What are the policy considerations?

How do regulators and industry solve the challenge of assigning 200-400 MHz mid-band channels for full-power, macro-cell mobile? Delivering this quantum of spectrum for mobile in the congested sweet spot of mid-band spectrum is the subject of global discussion, but some countries have already moved in the right direction. The UAE will add to its 200 MHz channels in 3.5 GHz, used for 5G today, with 350 MHz per operator in 6 GHz in 2025. Specific country demand will dictate whether the 6 GHz band remains congested with 5G traffic in future or can be used for 6G, which is why international discussions are looking at other bands.

WRC-27 will consider bands in the 4.5 GHz, 7-8 GHz and 14 GHz bands. Particular attention is being given to the 7-8 GHz range as this sits closely above existing 6 GHz assignments and may provide a wider mobile tuning range.

6-8 GHz bandwidth options



The 7-8 GHz band has existing users, as do most spectrum bands. In this case, incumbent government and military use, especially for satellite connectivity, makes coexistence discussions extremely important. Some countries see military presence in the bands as an insurmountable obstacle, but others see potential.

Can we develop a means of sharing between military use and commercial broadband in urban areas while maintaining full-power mobile networks? Is the commercial development of chipsets, produced at scale, in government spectrum ultimately beneficial for government applications and users?

What to expect in the year ahead

2025 is the second of a four-year cycle of discussions at the International Telecommunication Union (ITU) in the build-up to WRC-27. From early technical work, the debate will move further into certain bands' feasibility.

Crucially, some blocs will develop their vision for the spectrum needs of 6G. Europe is doing so through its Radio Spectrum Policy Group. India is developing its 6G programme through the Bharat 6G Alliance. In the UAE, the regulator TDRA has published its own '6G Roadmap.' In Saudi Arabia, research and development on 6G is going through government and universities.

More governments will assign the next portion of mobile spectrum – the upper 6 GHz band – in 2025. Those that do it in the next year are more likely to see this as a short-term requirement for use in the development of 5G, but others may place this band into their long-term roadmaps to bring into use with new 6G technologies around the end of the decade.

Policy in practice: The EU's Radio Spectrum Policy Group to develop 6G spectrum roadmap

How can government and industry understand the future needs of 6G and develop a clear vision of the demand for services and applications? Many in the mobile ecosystem see the biggest challenge not being the need to provide more speed but in delivering consistency across a huge number of devices which require fast, stable connections. Spectrum calculations will consider all elements of likely demand.

Industry and governments will provide their vision for supporting this demand over the coming years. Understanding the requirements related to each country and, importantly, the peak-time use in busy areas within them can help regulators produce robust spectrum roadmaps.

One example is the EU's Radio Spectrum Policy Group, which has created a specific sub-group to provide its '6G Strategic Vision'. It proposes, among other things, to develop a 6G spectrum roadmap over the coming years for delivery by 2027, which will discuss which bands will be the most appropriate for use in the 6G era. Such processes, providing they ensure a period of collaborative consultation between government and industry, will ensure that 6G's promise of connecting everything, everywhere, is realised.

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