GSMA

5G Spectrum

GSMA Public Policy Paper

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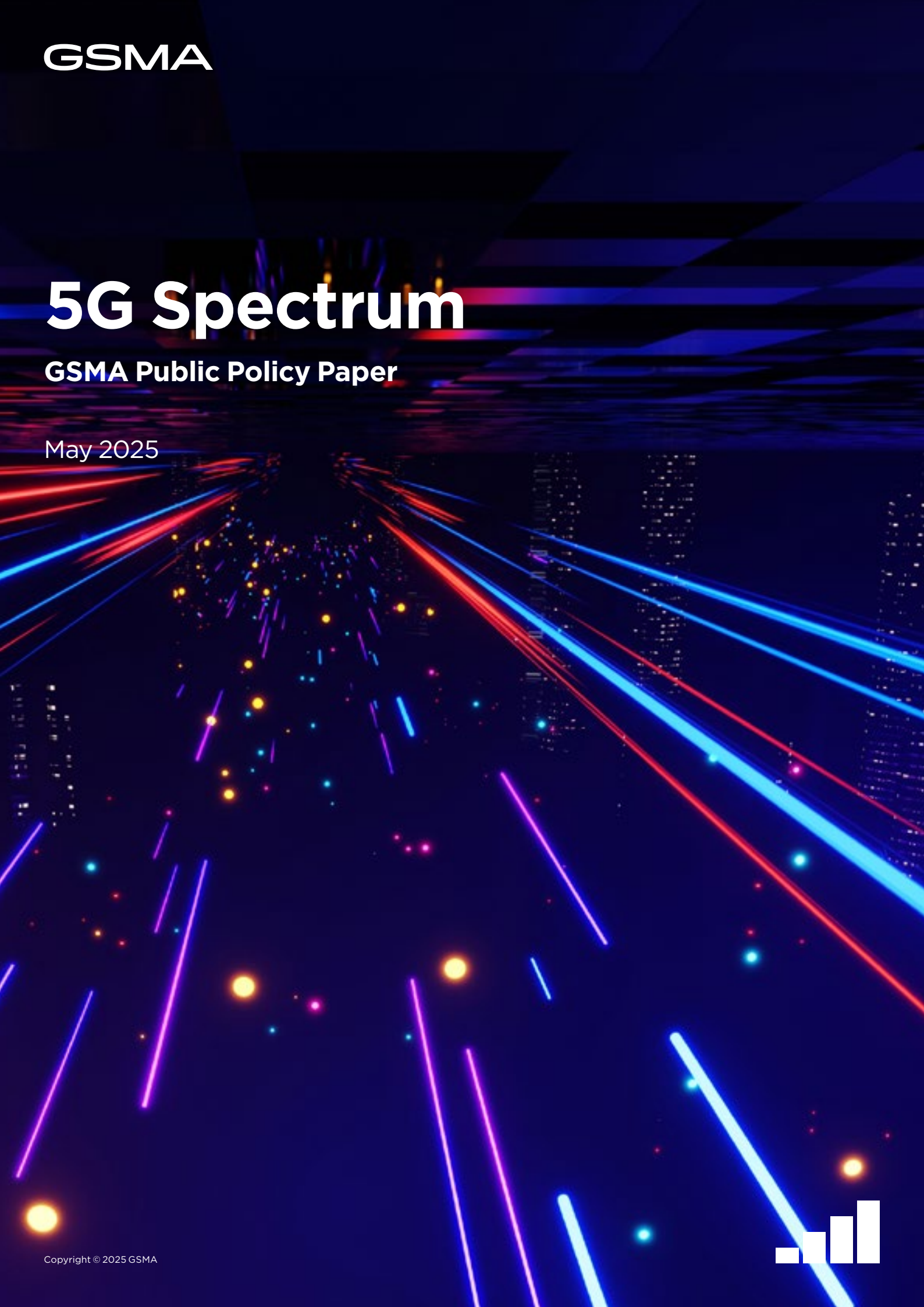

GSMA™

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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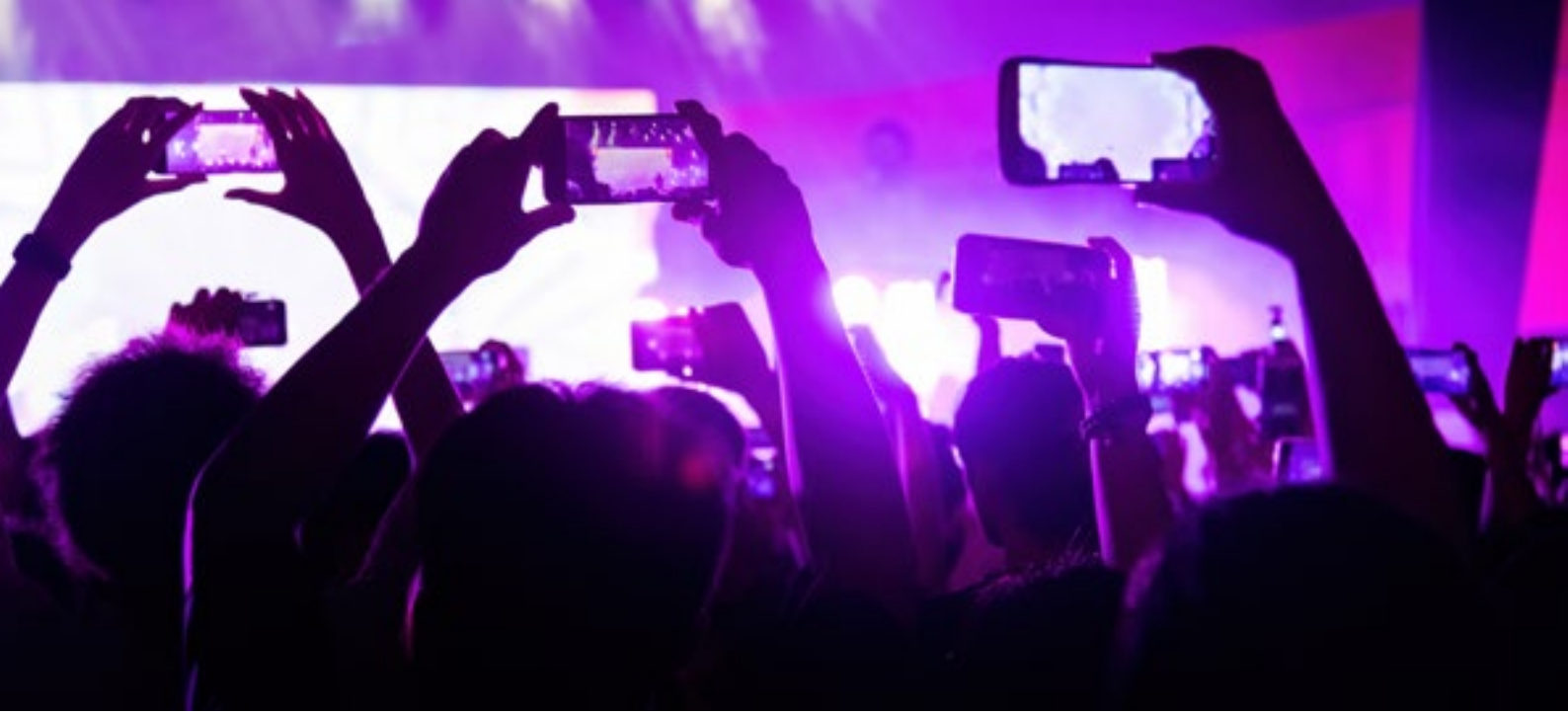


Executive summary

Background

5G, was launched commercially in 2018, is the current mobile technology, and is expected to continue developing into the 2030s. It is defined in a set of standardised specifications that are agreed on by international bodies, namely 3GPP and the ITU. 5G technologies support the use cases below.

1. **Enhanced mobile broadband (eMBB):** a reliable 100 Mbps download and 50 Mbps upload user experience data rate in dense urban areas.
2. **Ultra-reliable and low latency communications (URLLC):** 1ms latency and very high availability, reliability and security to support services such as VR and connected vehicles.
3. **Massive machine-type communications (MMTC):** the ability to support at least one million IoT connections per square km with long battery life and extensive wide-area coverage.
4. **Fixed Wireless Access (FWA):** the ability to offer fibre type speeds to homes and businesses in rural and urban areas in developed and developing markets.

5G is delivered over wide areas through the public, macro-cell, mobile network. This can be densified with small cells in high-use areas if there is a business case for doing so. The capabilities of 5G services are highly dependent on the type and amount of the spectrum used.

5G offers enhanced capabilities when compared to previous mobile technologies such as 4G. It provides connectivity for consumers, governments and businesses, delivering mobile broadband alongside smart city and enterprise connectivity. 5G enables industrial digitalisation through MMTC, allowing Internet of Things (IoT) applications, cloud computing and AI through high-capacity networks, cell-edge processing and other network functions. From automated industrial manufacturing and autonomous cars, to a vast array of connected machines and sensors, 5G enables smart and efficient business solutions in sectors including utilities, manufacturing and transport.

5G features such as network slicing and mobile edge computing support enterprise connectivity. Network slicing allows services to be precisely tailored to the needs of an organisation in terms of required quality of service, speed, security and latency. Edge computing brings compute capabilities closer to consumer and enterprise end users, enabling lower latencies.

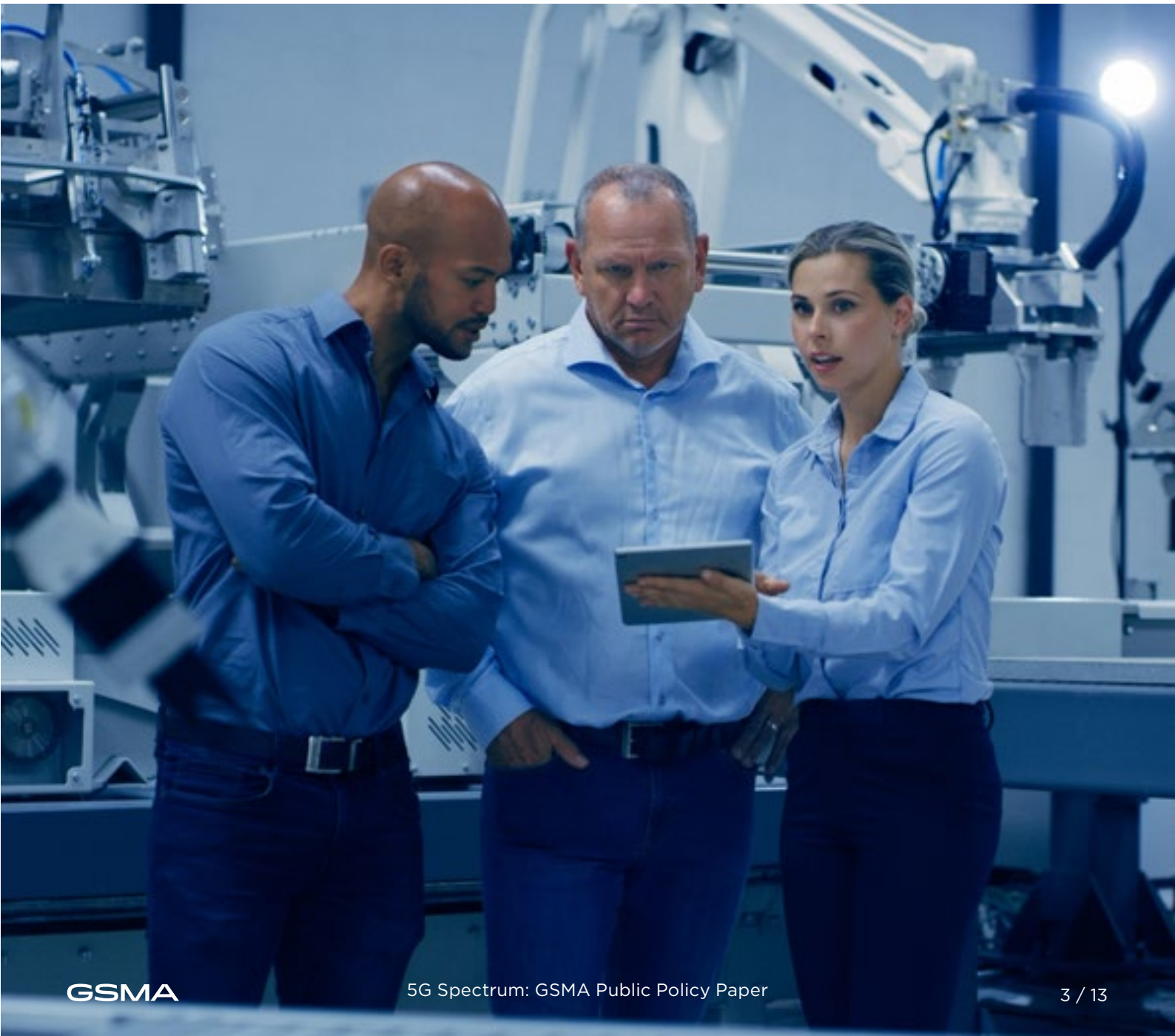
5G has grown faster than any other mobile technology, having surpassed 2 billion connections at the end of 2024. Growth will continue in the second half of this decade, and 5G connections are expected to surpass 4G for by 2028.

The GSMA's 5G spectrum positions highlight the areas where governments, regulators, and the mobile industry need to cooperate to expand 5G and 5G-Advanced success.

5G helps realise the vision of smart cities, enables high-capacity enhanced mobile broadband, and powers the full potential of enterprise digitalisation. Ensuring 5G capacity delivers connectivity in all the areas where we live, learn, work and play will enable secure public networks, and provide economic growth for society.

New funcationality will continue to develop through 5G-Advanced and 5G will remain a platform for innovation that will drive mobile into the 2030s.

However, the speed, reach and quality of 5G services continues to depend on governments and regulators supporting sufficient, affordable spectrum access. There is significant variation between countries in the amount of spectrum assigned, and the prices paid at auctions, which means the potential of 5G services varies. This, in turn, directly impacts the socio-economic benefits of 5G and the competitiveness of national economies.



Policy positions

1. **Full-power, licensed spectrum is vital to the success of 5G.**
   Full-power, licensed spectrum enables wide coverage areas and high quality of service. It has been central to the global success of mobile and is essential to guarantee network investment.

2. **5G needs spectrum across low, mid- and high bands to deliver capacity in all areas and support the full range of use cases.**
   - Low-band spectrum (below 1 GHz) is needed to drive digital equality, provide capacity in wider and rural areas, and for deep indoor coverage. Increased low-band capacity creates greater equality between urban and rural broadband connectivity and supports addressing the digital divide.
   - Mid-bands (1–8.4 GHz) provide city-wide 5G capacity. They play a core role in delivering enhanced mobile broadband and applications which impact how we manufacture goods, deliver education, and build smart cities. To date, mid-band spectrum has been the most used to launch 5G networks around the globe.
   - High-bands or mmWave (above 24 GHz), with their wide channel bandwidth, deliver the fastest broadband speeds and lowest latencies. They deliver the highest performance for 5G but only cover shorter distances so are used for high-capacity hotspots.

3. **5G needs significant harmonised spectrum and clearing prime bands should be prioritised to meet market demand. Regulators should aim to:**
   - Award 100 MHz of contiguous mid-band spectrum per operator for 5G launch
   - Increase low-band spectrum capacity by assigning all available bands (including 600 MHz)
   - Make 2 GHz of mid-band spectrum available per market by 2030 (e.g. through 3.5 GHz and 6 GHz assignments)
   - Consult with industry over the need for mmWave to cover busy hotspots, allowing for an initial assignment of 800 MHz per operator and potentially making 5 GHz available per market as demand grows.

4. **High 5G spectrum prices should be avoided as this is linked to slower broadband speeds and lower coverage.**
   Excessive reserve prices and poor auction design, high annual fees, or limited spectrum supply (including through set-asides) can all lead to high spectrum costs. Increased network investment can be supported through coverage and QoS commitments in exchange for cash payments.

5. **5G spectrum licence commitments and conditions must be related to achievable targets, deducted from reserve prices, and used to benefit broadband connectivity.**
   Arbitrary targets can create unnecessary high costs and impact network investments.

6. **Spectrum policy measures should be adopted to encourage long-term investment and evolution in networks.**
   Indefinite or long-term licences, with a presumption of renewal, should be used for spectrum assignment. Further certainty can be provided through a long-term, technology-neutral spectrum roadmap and flexible use licencing.

7. **Spectrum for private and local networks can be made available through public mobile networks, through network slicing, or sub-leasing of national licences.**
   Setting spectrum aside for private networks in priority 5G bands could jeopardise the success of public 5G services and has no positive impact on enterprise digitalisation.

8. **Voluntary spectrum sharing and sub-leasing between operators does not reduce the overall amount of spectrum required in any market.**
   However, allowing spectrum sharing between operators may support efficient spectrum use, lower network costs, and optimise connectivity.

9. **Regulators should carefully consider 5G backhaul needs, including making additional bands available and supporting wider bandwidths in existing bands.**
   Measures should also be taken to ensure mobile backhaul licences are affordable and designed effectively.

10. **WRC harmonisation helps the evolution of mobile.**
    Governments and regulators should adopt internationally harmonised bands in their national plans to support affordability through economies of scale. Further harmonisation of mobile spectrum at future WRCs should be sought.

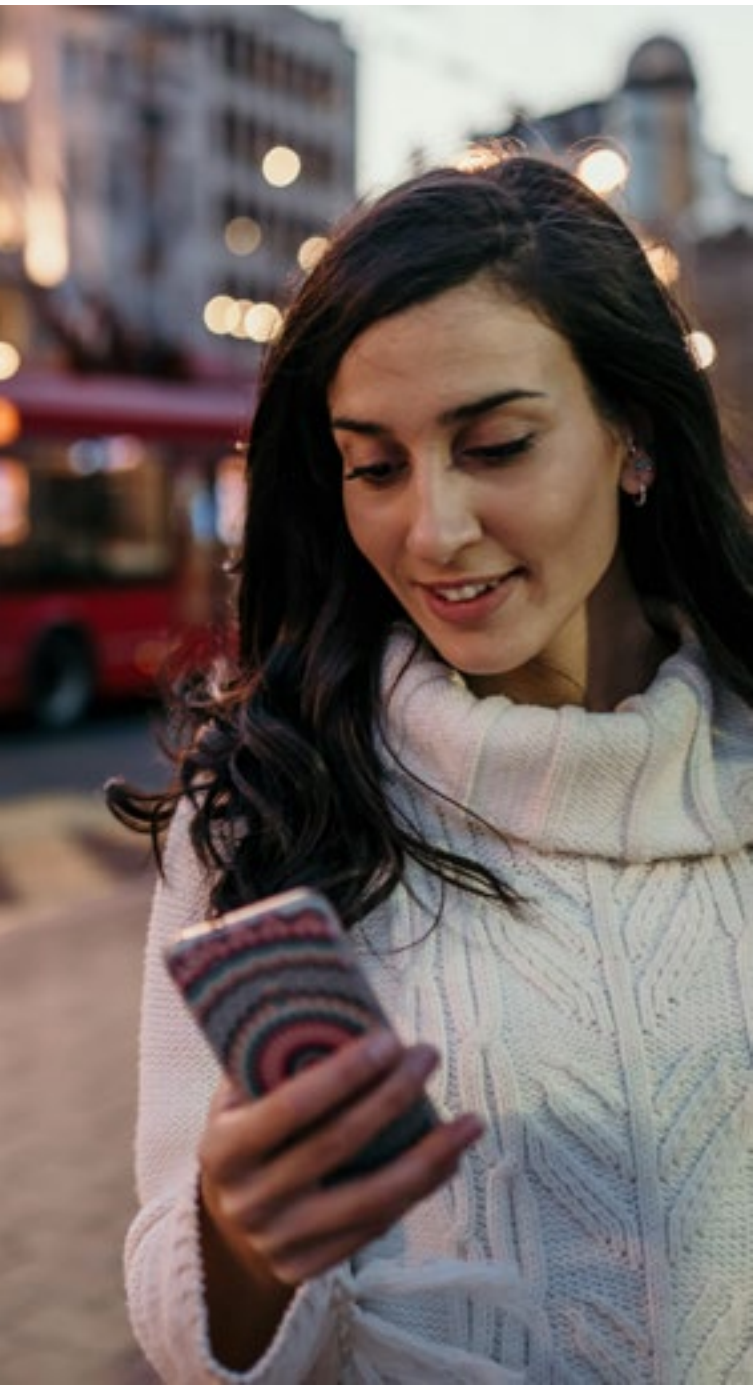
Harmonised bands widely used for 5G

Low-bands: 600 MHz, 700 MHz, 800 MHz, 900 MHz

Mid-bands: 1500 MHz, 1700 MHz, 1800 MHz, 2.1 GHz, 2.3 GHz, 2.6 GHz, 3.5 GHz (3.3–4.2 GHz), 4.8 GHz and 6 GHz

High-bands: 26 GHz, 28 GHz

Specific frequency arrangements and operating bands are standardised mainly by ITU and 3GPP.[1, 2]



How much spectrum does 5G need?

5G uses spectrum in three broad ranges:

- Low-bands (below 1 GHz) which help provide wide area and in-building coverage
- Mid-bands (1–8.4 GHz) which provide city-wide capacity
- High-bands or mmWave (above 24 GHz) which support the highest capacity over short distances

Mid-bands, including the priority 5G launch range at 3.5 GHz, have been used for the majority of 5G launches. Low-bands provide a coverage layer augmenting the city-wide coverage of mid-bands in rural areas and deep indoors. mmWave can be used for busy hotspots where applicable.

The ITU's technical requirements to meet the IMT-2020 criteria support 100 MHz mid-band channels per operator. They also specify support for up to 1 GHz per operator in mmWave bands.

2 GHz of **mid-band spectrum** per country will be needed for 5G, on average, by 2030. Mid-band spectrum has been the main driver of 5G launches so far and is expected to help realise the largest portion of 5G's socio-economic benefits in the next decade. Meeting spectrum needs in this range is vital to 5G's future and requires a clear spectrum roadmap from policymakers.

Expanding **low-band spectrum** (below 1 GHz) as much as possible is vital to giving rural communities equitable access to the services available in urban areas and pushing towards digital inclusion goals. Current band arrangements in the 600 MHz band allow for 2x35 and 2x40 MHz of additional low-band capacity beyond the 7/8/900 MHz bands. Expanding low-band spectrum by this amount can improve rural download speeds by 30–50%.

High-band, mmWave spectrum may be used to cover busy hotspots. Initial assignments of 800 MHz per operator should be considered, potentially rising to 5 GHz per market where demand requires. High bands can complement low and mid-band spectrum implementations in dense urban areas, where required, and can provide fibre-like connectivity through FWA. They can also be used for high-capacity installations for industry and enterprise. mmWave also helps ensure reliable networks in high-density locations, such as sports and music venues and transport hubs.

1 ITU, Recommendation M.1036, Frequency arrangements for implementation of IMT
2 3GPP, Technical Specification TS 38.104 (Release 19), 2025

How have regulators made 5G spectrum available?

Auctions remain a fair way to assign spectrum where demand is high but are not the only way to assign spectrum. Most regulators have made spectrum available for 5G by auctioning nationwide, full power 5G licences. Properly designed auctions or administrative processes, tied with long-term licences and a presumption of renewal, are used to encourage network investment.

At the outset of 5G, some regulators set-aside a portion of spectrum in priority 5G bands (e.g. the 3.5 GHz range) for private or local networks to deliver tailored solutions for enterprises.[3] However, 5G set-asides have been controversial. Their take-up has been low, while the reduction in capacity available to public networks impacts national download speeds and decreases economic growth.

Private and local networks have been successfully provided by mobile network operators, either through network slicing on public network equipment, through dedicated equipment on national spectrum licences or a hybrid of these systems.

Regulators have also been looking closely into reducing spectrum prices to support 5G development. The cost of spectrum affects access to connectivity for businesses and consumers. High spectrum prices are linked to lower network coverage and lower download speeds, impacting political and social goals such as digital inclusion. Increasingly, assignments are being designed to support network investment through making use of coverage and QoS commitments rather than straight cash bids.

There has been a variation in the amount of spectrum assigned to mobile operators for 5G around the world and this is linked to the quality and impact of their 5G networks. Initial 5G mid-band awards have varied from 20–150 MHz per operator. Reduced spectrum availability is also associated with higher spectrum fees.

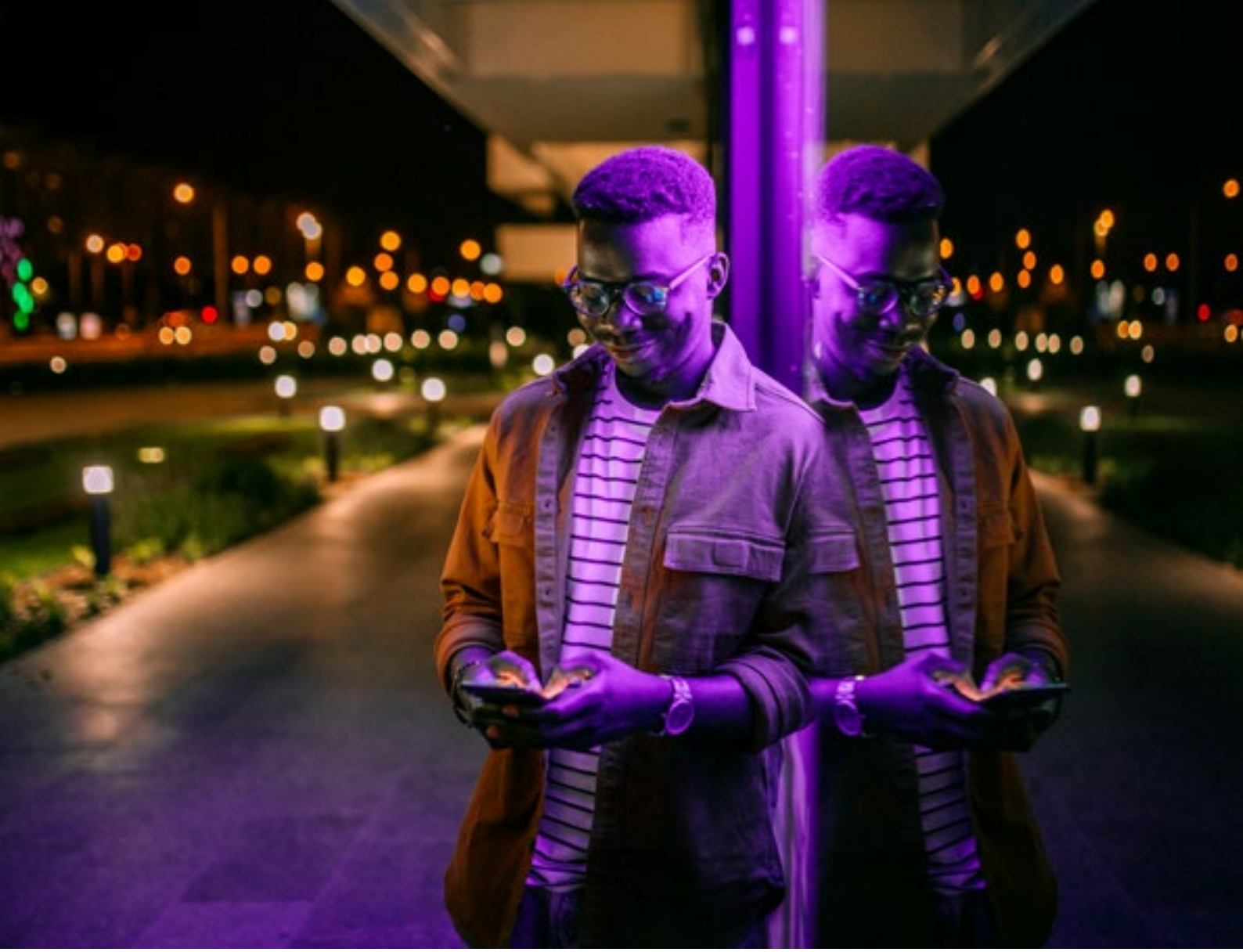
TDD synchronisation

5G often uses TDD (Time Division Duplex) as well as FDD (Frequency Division Duplex). All 5G bands above 3 GHz use TDD and there are some instances of bands lower than this (e.g. some TDD use of 2.6 GHz or 1500 MHz). This means 5G base stations and end-user devices transmit using the same channel at different times.

Synchronisation between mobile networks can help maximise the efficiency of TDD bands and ensure optimal spectrum use. Base stations using the same TDD band will need to transmit at the same fixed time periods, and all 4G and 5G devices need to transmit at different fixed time periods. Synchronisation of TDD networks is the best way to avoid interference and efficient spectrum usage can be maximised through synchronisation procedures. Additional guard bands are not required and therefore network equipment cost can be reduced.

Synchronisation between operators in the same country and region will help avoid interference while cross-border interference is more likely if networks are not synchronised. It is thus an important tool in maximising the efficiency of 5G spectrum.

3 GSMA, The Impact of Spectrum Set-Asides on 5G, 2023



01. Full-power, licensed spectrum is vital to the success of 5G

Full-power, licensed spectrum enables wide coverage areas and high quality of service. It has been central to the global success of mobile and is essential to guarantee network investment. Long-tenure, reliable and predictable spectrum licensing helps reduce investment risks and encourages network deployment.

Covering wider areas by using the full power of internationally harmonised standards helps keep costs down. When network power is reduced, denser networks will be required, which means higher costs and higher carbon emissions. Full-power networks are needed to address a diverse set of use cases, ranging from delivering high-capacity enterprise applications through network slices, mobile broadband to consumers or fixed wireless access in cities, suburban areas or rural towns.

For low and mid-bands, 5G services benefit from exclusively licensed spectrum that either covers entire countries or wide geographic areas in larger countries (e.g. Brazil, the US, and India have all used a regional approach).

mmWave spectrum will also benefit from exclusive licensing and the geographic scope of licences should be considered in consultation with local industry. Based on national circumstances, other licensing approaches could be explored such as exclusive wide-area licences in high demand areas (e.g. city centres) with local licensing used elsewhere, or even local licensing in all areas.

02. 5G needs spectrum across low, mid- and high bands to deliver capacity in all areas and support the full range of use cases

All three ranges have important roles to play.

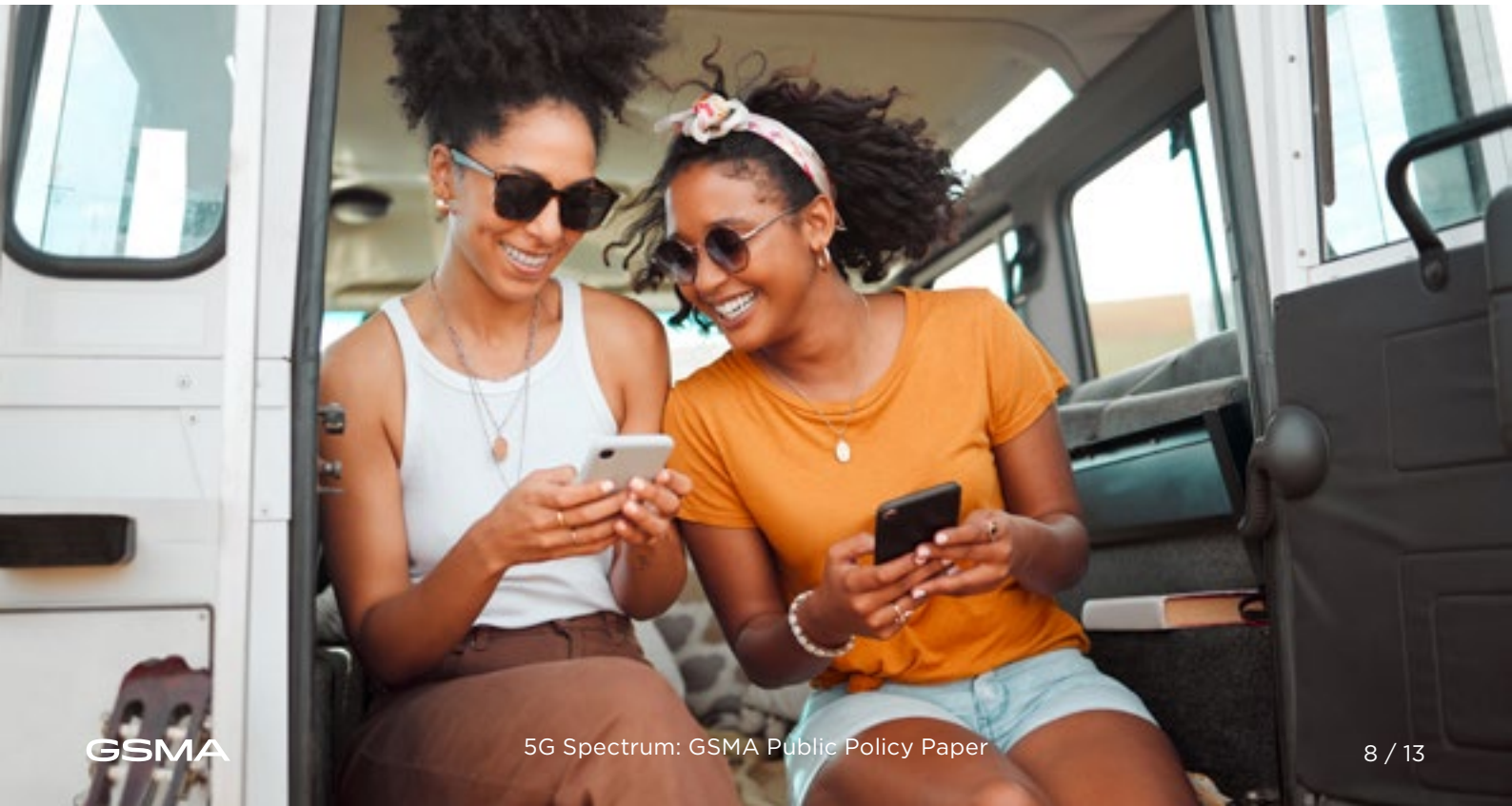
- Low-band spectrum (below 1 GHz) is needed to drive digital equality, provide capacity in wider and rural areas, and for deep indoor coverage. Increased low-band capacity creates greater equality between urban and rural broadband connectivity and supports addressing the digital divide.
- Mid-bands (1–8.4 GHz) provide city-wide 5G capacity. They play a core role in delivering enhanced mobile broadband and applications which impact how we manufacture goods, deliver education, and build smart cities. To date, mid-band spectrum has been the most used to launch 5G networks around the globe.
- High-bands or mmWave (above 24 GHz) deliver the fastest broadband speeds and lowest latencies. They deliver the highest performance for 5G but only cover shorter distances, so are used for high-capacity hotspots.

Increased low-band (sub 1 GHz) capacity is required to create greater equality between urban and rural broadband connectivity and reduce the digital divide. Lower frequencies propagate further, which is ideal for covering wider areas, but there is less bandwidth available meaning that low bands are always in short supply. Low-bands also improve in-building 5G services and helps support the growth of IoT.

Assigning all low bands (900 MHz, 850/800 MHz, 700 MHz and 600 MHz) identified for IMT to mobile will help digital inclusion. The growing support for additional lower frequency bands was reflected in the results of the World Radiocommunications Conference 2023 (WRC-23), where more countries in different regions identified this band for IMT. In Antigua and Barbuda, Canada, Puerto Rico, Saudi Arabia and the United States of America, the band is already assigned to mobile using the n71 operating band (UL 663 MHz–698 MHz, DL 617 MHz–652 MHz), while the n105 operating band (UL 663 MHz–703 MHz, DL 612 MHz–652 MHz), originally developed by APAC countries, offers 2 x 40 MHz of 600 MHz bandwidth.

Mid-bands offer city-wide capacity for 5G and have been used for around 70% of total 5G launches worldwide. Regulators should maximise mobile capacity in the 3.5 GHz, 4.8 GHz and 6 GHz ranges, depending on market demand. 1–3 GHz bands may also be migrated to 5G, requiring technology-neutral licences so that evolution to the latest mobile technologies can be achieved.

High band, mmWave spectrum, is needed to provide the highest capacity 5G services in the busiest hotspots such as city centres, transport hubs and sports stadia. Widely harmonised spectrum such as 26 GHz, 28 GHz and 40 GHz are the most important high bands.



03. 5G needs significant harmonised spectrum and clearing prime bands should be prioritised to meet market demand

Regulators should aim to:

- Award 100 MHz of contiguous mid-band spectrum per operator for 5G launch.
- Increase low-band spectrum capacity by assigning all available bands (including 600 MHz).
- Make 2 GHz of mid-band spectrum available per market by 2030 (e.g. through wide 3.5 GHz and 6 GHz assignments).
- Consult with industry over the need for mmWave to cover busy hotspots, allowing for an initial assignment of 800 MHz per operator and potentially making 5 GHz available per market as demand grows.

Harmonised spectrum helps deliver economies of scale, reduces equipment costs and thus helps narrow the usage gap.[4] Ensuring that standard equipment can be used on full-power networks, using internationally harmonised frequencies, delivers increased digital inclusion, supports digital security and with these helps deliver economic growth.

Wider frequency bands support higher speeds and larger amounts of traffic with lower network densification and implementation cost. For 5G, regulators should aim to assign at least 100 MHz per operator in mid-bands. 100 MHz channels have become international best practice and are implemented in most 5G-leading markets. Meanwhile, 800 MHz bandwidth per operator should be considered when implementing mmWave bands.

Regulators should start planning a clear roadmap for additional spectrum assignments that will deliver enough capacity for 5G services to scale following launch using harmonised spectrum.

04. High 5G spectrum prices should be avoided as this is linked to slower broadband speeds and lower coverage

Excessive reserve prices and poor auction design, high annual fees, or limited spectrum supply (including through set-asides) can all lead to high spectrum costs. Increased network investment can also be supported through coverage and QoS commitments in exchange for cash payments.

The cost of spectrum affects access to connectivity for businesses and consumers. High spectrum prices are linked to lower network coverage and lower download speeds, impacting political and social goals such as digital inclusion. Excessive spectrum prices can be caused by setting high annual fees or through poorly designed assignment processes. Governments and regulators should assign 5G spectrum to support their digital connectivity goals rather than as a means of maximising state revenues.

Auctions remain a fair way to assign spectrum where demand is high but are not the only way to assign spectrum. Increasingly, assignments are being designed to support network investment through making use of coverage and QoS commitments rather than straight cash bids. The causes of very high prices are typically policy decisions that prioritise maximising short-term state revenues over long-term socio-economic benefits. To avoid this, governments and regulators should consider the following options.

- Set modest reserve prices / annual fees and rely on the market to determine spectrum prices.
- Avoid limiting the supply of 5G spectrum as scarcity can lead to excessive prices. Making spectrum for private networks available through MNO licence conditions rather than set-asides will help avoid scarcity.
- Carefully consider the assignment design to avoid unnecessary risks for participants (e.g. avoid mismatched lot sizes, or first-price, sealed bid auctions).
- Develop and publish a technology-neutral spectrum roadmap with the input of stakeholders to help operators plan effectively around future availability.
- Consult stakeholders on the award rules / licence terms and conditions and take these into account when setting prices (see sections 5 and 6 below).

4 GSMA, The State of Mobile Internet Connectivity

05. 5G spectrum licence commitments and conditions must be related to achievable targets, deducted from reserve prices, and used to benefit broadband connectivity

Arbitrary targets can create unnecessary high costs and impact network investments.

The decisions regulators make around spectrum licensing – including geographic licence areas, terms and conditions, obligations, or QoS targets – will have a major impact on 5G services. Regulators will support connectivity goals by carefully considering these decisions and consulting industry to ensure the best possible 5G services can be delivered.

Licence terms, conditions and obligations should be used very carefully to augment investment in rollouts, minimise the cost of covering non-profitable areas, and avoid distorting the award of spectrum. All assignment conditions and obligations should be discounted from reserve prices / upfront fees to further incentivise investments.

Coverage obligations are not suitable where spectrum will be used for delivering high capacity rather than coverage. Insisting on blanket geographic coverage where there is no population or business case must be recognised as a high cost to operators and reflected in the overall licence cost.

06. Spectrum policy measures should be adopted to encourage long-term investment in networks

Indefinite or long-term licences, with a presumption of renewal, should be used for spectrum assignments. Further certainty can be provided through a long-term, technology-neutral spectrum roadmap.

5G network deployments require regulatory certainty. The speed of rollouts, quality of service and coverage levels will all be compromised without sufficient investment underpinned by transparent implementation of the right licensing policies from governments and regulators.

Indefinite licences, or long-term licences with a presumption of renewal, should be used for assignment processes. Further regulatory uncertainty should be removed by flexible-use rules allowing for a long-term and technology-neutral spectrum roadmap, to ensure a steady flow of network investment. Where licences are not indefinite, renewals should be on a technology-neutral and affordable basis and allow for migrating these spectrum resources for future connectivity requirements. This provides predictability for licensees to encourage ongoing network investment.

Governments and regulators can encourage high levels of investment by adopting important spectrum policies including the options below.

- Supporting exclusive, wide area mobile licences either indefinitely or with a presumption of renewal.
- Producing a national broadband plan which details activities and timeframes.
- Publishing a long-term and technology neutral spectrum roadmap.

07. Spectrum for private and local networks can be made available through public mobile networks, through network slicing, or sub-leasing of national licences

Setting spectrum aside for private networks in priority 5G bands could jeopardise the success of public 5G services and has no positive impact on enterprise digitalisation.

The digitalisation of industry is a priority for every country but approaches to providing connectivity for private and local networks have varied. The use of public spectrum resources for industrial and local connectivity must benefit business and consumers simultaneously.

Private and local networks are delivered today by regulation which varies from light-touch to interventionist. They are provided by mobile network operators, either through network slicing on public network equipment, through dedicated equipment on national spectrum licences or a hybrid of these systems. Bespoke private network solution providers may lease spectrum from mobile operators for their own network installations. At the other end of the scale, spectrum set-asides have been made by regulators for use on local and private networks, some of which exclude mobile operators from using the spectrum.

The regulatory practice of setting aside spectrum for private networks does not benefit digitalisation.[5] Private networks are growing equally in countries without spectrum set-asides, where more spectrum can be used for consumer or other connectivity requirements, as they are in countries which have put set-aside or low power sharing regimes in place and limited other users.

Set-asides are an interventionist regulatory tool, and their impact needs to be carefully understood. Making spectrum available solely for industry has to be balanced against demand from other users. Lighter-touch regulatory solutions exist, and are flourishing, which is why spectrum set-asides have no impact on digitalisation.

Offering set-aside spectrum at reduced or no cost can also lead to distorted incentives in the market for digital solutions and infrastructure. Pricing spectrum differently depending on whether it is used by public or private networks impacts the relative cost of each solution. As the cost saving is passed on to prospective users, the use of private networks with set-aside spectrum is effectively subsidised. This can put solutions based on public mobile networks at a disadvantage when they otherwise would have been the optimal choice, leading to economic inefficiency.

Looking at existing practice shows making spectrum available for private networks and industry does not require the heavy intervention of set-asides. Market-driven approaches that foster cooperative solutions can bring the best outcome for spectrum users and consumers alike.

5 GSMA, The Impact of Spectrum Set-Asides on Private and Public Mobile Networks, 2024

08. Voluntary spectrum sharing and sub-leasing between operators does not reduce the overall amount of spectrum required in any market

However, allowing spectrum sharing between operators may support efficient spectrum use, lower network costs and optimise connectivity.

Spectrum sharing frameworks can play a complementary role but must be carefully designed to avoid undermining the potential of 5G. Regulators should permit operators to voluntarily share spectrum with each other to help support quality of services, encourage more efficient spectrum usage, and extend the benefits of network sharing arrangements.

These benefits are also offered in club licensing, which is especially attractive when spectrum is scarce, as it allows operators to access wider channels that would otherwise be unavailable. Club licences allow licensees in a band to access another's spectrum where it is unused and/or pool spectrum in shared networks (e.g. in shopping centres). However, although club licensing approaches can mitigate spectrum scarcity issues, they cannot overcome them. If there is insufficient total spectrum available to meet demand in an area, then services will still be inadequate.

Sharing frameworks should include permitting operators to voluntarily sublease their spectrum to other types of operators, such as enterprises or local network providers. This approach helps maximise the benefits of exclusively licensed spectrum while also ensuring it is efficiently used and available to meet the needs of other potential users without requiring set-asides (see position 7. above).

Sharing might also be a solution when clearing a band is not feasible, enabling access to new spectrum in areas where it is under-used by current incumbents. Still, prospective bands for sharing must be harmonised and available to support 5G. To justify widespread heavy network investments, mobile operators need certainty of access to significant amounts of licensed spectrum for a sufficient duration.

Approaches which undermine mobile operators' certainty of access to spectrum, such as mandating existing licensed spectrum to be shared in ways that create an uncertain business environment, risk jeopardising network investment. Any sharing mechanism that does not allow full-power use of spectrum should be avoided. Complex, three-tier sharing regimes with set-aside spectrum for certain tiers may limit, or eliminate, the potential for 5G services in the band. For example, the CBRS band in the US had an economic cost of US$15-20bn compared to similar, exclusively licensed spectrum.[6]

6 GSMA, Spectrum set-asides, US Case Study, 2023

09. Regulators should carefully consider 5G backhaul needs including making additional bands available and supporting wider bandwidths in existing bands

Measures should also be taken to ensure mobile backhaul licences are affordable and designed effectively.

Data capacity has significantly increased in the 5G era, which also has a major impact on spectrum for mobile backhaul. While fibre backhaul is ideal, wireless terrestrial backhaul still plays a vital role as fibre is not accessible or affordable at all sites. Microwave backhaul is still heavily used, but 5G backhaul requires new, wider channels in higher spectrum bands (e.g. 70/80 GHz, 92–114 GHz and 130–175 GHz).

Traditional microwave bands (6–42 GHz) will continue to play an important role as they can support longer distance backhaul links, however they have relatively narrow channel sizes. They are still useful in many suburban and rural areas, where less capacity is typically needed, as well as to provide added resiliency for higher frequency backhaul bands. Regulators need to ensure they make significant amounts of spectrum available in these bands, and in sufficiently wide channel sizes (e.g. 56 MHz–250 MHz channels) to address various backhaul scenarios.

Regulators should also review their backhaul licensing approaches to ensure that pricing regimes are appropriate to today's channel bandwidths. For example, block licensing could play a greater role in new, higher frequency backhaul bands where historical, per MHz, pricing may no longer be an appropriate solution, due to the higher channel sizes required. The formulas used to calculate prices are often designed for legacy narrow backhaul channel sizes, which means costs quickly become unsustainable for newer wider channels. Regulators should ensure formulas mitigate such price jumps. Some pricing approaches also penalise operators for adopting newer and more spectrum efficient backhaul technologies. These too should be avoided, as they discourage network upgrades, and a technology-neutral approach pursued.

The price that operators pay for backhaul varies significantly around the world. The highest spectrum prices in some markets exceed the global median by 22 times are 59 times higher than the lowest priced markets.[7]

Supporting longer licence durations and encouraging spectrum trading can also encourage heavier backhaul network investment and more efficient spectrum use.

10. WRC harmonisation helps the evolution of mobile

Governments and regulators should adopt internationally harmonised bands in their national plans to support affordability through economies of scale. Further harmonisation of mobile spectrum at future WRCs should be sought.

Existing 5G bands are the result of multiple rounds of international coordination through the World Radiocommunication Conference (WRC) process. Most recently WRC-23, among its many results, harmonised 6 GHz, identified 600 MHz in some countries and finalised the work, which was begun in WRC-15, to harmonise the core 3.5 GHz range. WRC-19 was focussed on the identification of mmWave bands.

WRCs help further harmonisation and create economies of scale, lowering handset costs as their components are mass-produced across the world. Adherence to the principles of harmonisation to deliver affordability means that WRC Agenda Items are always relevant, no matter what stage of telecoms development a country is at. Even when a technology is not yet being used in a country, it is important that the spectrum bands underpinning it are possible options for future use.

Continuing mobile evolution means that WRCs will be needed to ensure future harmonised spectrum as mobile connectivity grows. WRC-27 will look at new spectrum including the 7-8 GHz band which may be used for mobile expansion beyond the 2030s.

7 GSMA, Spectrum for Wireless Backhaul, 2021

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