Mid-band spectrum is important for 5G networks

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The deployment of 5G will bring large benefits to users over the next few years. 5G supports much faster speeds and lower latencies than previous mobile generations and enables the full potential of industry digitalisation. 5G networks can support mobile broadband services together with fixed-wireless access (FWA) and the technology can be used to address use cases beyond traditional communications.

Spectrum in low-frequency bands, mid-bands (from around 2–8GHz) and high (millimetre-wave) frequency bands will be required for 5G in order to ensure the full International Mobile Telecommunications (IMT) vision. Additionally, a large amount of mid-band spectrum is required to support the effective operation of three or four national 5G mobile networks.

Mid-band spectrum is being used for the first wave of 5G deployments

Many 4G networks today provide download speeds of the order of 40–50Mbit/s, but end users will expect more from 5G networks. Indeed, international speed tests show that average speeds of 100–250Mbit/s are common in 5G networks. Over time, more spectrum will be needed to sustain these speeds as the number of users grows.

There tends to be three or four mobile network operators in the mobile market in most countries. 5G spectrum must be therefore distributed in packages that can support the effective operation of three or four autonomous mobile networks with a good quality of service and customer experience. At least 80–100MHz of contiguous spectrum per operator is required to achieve this.

Mid-band spectrum offers a good compromise between coverage and capacity for 5G networks. The C-band (3300–3800MHz) is the most commonly used band for 5G so far, and is sufficiently wide that four operators can be awarded spectrum packages of up to 100MHz.

However, there may be legacy issues that delay the refarming of the C-band for 5G use in some countries. In these cases, TDD bands at 2300MHz (up to 100MHz) and 2600MHz (190MHz) could be used for 5G networks instead. TDD bands at 3300–3400MHz, 3800–4200MHz and 4800–4990MHz are also available in certain countries.

Spectrum in other bands may become available in the next 5–10 years

Resolution 245 was one of the key outcomes of the 2019 World Radio Conference.[1] However, there is a long lead time between studies, frequency allocations to mobile services and the actual deployment of equipment in these bands. The 6GHz band is the widest band included in Resolution 245, and it has the potential of being an important band for citywide 5G services from 2025 onwards.

Mid-band spectrum is especially valuable for use with 5G because it offers higher capacity than low-frequency bands and greater coverage (even indoors) than high-frequency bands. The 6GHz band is an attractive solution to complement the mid-band spectrum that is currently available for 5G. The band will be needed in countries that require additional capacity and coverage to meet future data demand. The 6GHz band will also provide an alternative for those countries that are facing challenges in making large and contiguous frequency blocks available in the bands that are already harmonised for 5G.

New studies are being performed to explore the coexistence between 5G and other services using the 6GHz band ahead of the 2023 World Radio Conference. Mobile broadband, citywide video consumption, mobile networks for safe and smart cities, Industry 4.0 and FWA are the most important considerations when defining future spectrum requirements.

The uplink power of mobile devices is the limiting factor when it comes to cell range. However, by adopting the supplementary uplink (SUL) scheme, lower frequencies can be used in combination with the C-band to extend base stations' range. The SUL mode is already included in the 3GPP standards for the 700, 800, 900, 1800 and 2100MHz frequency bands, and is being considered by mobile operators to enable them to extend coverage while avoiding network densification costs. Use cases such as live broadcasts and vertical industry applications are likely to require even more uplink spectrum in the mid-to-long term. Further work on SUL spectrum choices and larger bandwidths is expected from the 3GPP in order to address this issue.

The amount of spectrum required is heavily influenced by the amount of data used. The take-up of tariffs with unlimited data allowances is likely to lead to data traffic growth, and will therefore necessitate more spectrum. Governments in many countries and regions also have ambitious broadband goals that realistically can only be met by using wireless networks as part of the solution. This too will call for increased amounts of spectrum.

Governments can support 5G deployments by following spectrum management best practice

The reduction of spectrum scarcity is a simple and effective way for a government to contribute to the introduction of 5G networks.

Governments that follow spectrum management best practice will support industries (other than the telecoms industry) that rely on 5G services. The spectrum management principles of objectivity, transparency and non-discrimination can be met by running public consultations and providing spectrum release plans for 5G. The investment climate for 5G can be strengthened by having spectrum licences with long durations and predictable renewal procedures.

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1 Resolution 245 mandates studies on frequency-related matters for the terrestrial component of IMT identification in the 3300–3400MHz, 3600–3800MHz, 6425–7025MHz, 7025–7125MHz and 10.0–10.5GHz frequency bands.

Spectrum is a publicly owned resource and governments should be able to collect revenue from 5G auctions and include roll-out requirements in spectrum awards. However, the price and revenue expectations in 5G auctions need to be realistic. The move from 4G to 5G networks will require a significant increase in the size of mobile operators' spectrum portfolios, but future revenue is still uncertain. Creating artificial spectrum scarcity and having excessive reserve prices in auctions should therefore be avoided.