

Operators are well-placed to address the fragmented spectrum landscape for private LTE/5G networks

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Enterprises are expressing interest in [building private LTE/5G networks](#) and the opportunity for suppliers is growing. Enterprises can build these networks using operators and their licensed spectrum, or work with other suppliers and use other sources of spectrum (for example, shared spectrum or even spectrum that they have acquired themselves). This [range of spectrum options](#) may threaten the development of the market, and limit the opportunity for operators. However, operators should be well-placed to mitigate the risk of spectrum fragmentation and provide enterprises with private network options that scale and are cost competitive.

The fragmentation of the spectrum is a significant risk to the economics of enterprise private LTE/5G networks

Governments are introducing new spectrum regimes in an effort to drive industrial transformation but these initiatives, combined with the introduction of shared and unlicensed spectrum options for 5G, are increasing spectrum fragmentation. We have identified four spectrum options that are available for private LTE/5G networks (see Figure 1).

Figure 1: Options for private LTE/5G networks by type of spectrum

Type of spectrum	Description	Cost	Ecosystem
Private	Owned by enterprise or specialist service providers	Low	3GPP bands. Some may not achieve global scale.
Semi-private	A dedicated slice of MNO spectrum leased by enterprise	Medium	3GPP band. Full ecosystem support.
Public	Public spectrum owned by MNO	High	3GPP band. Full ecosystem support.
Shared or unlicensed	Shared on a licensed basis or non-exclusive, open to all users	Low/free	3GPP and non-3GPP bands. Large ecosystem for some bands. Some may not achieve global scale.

Source: Analysys Mason

The availability of private, shared and unlicensed spectrum can vary by country as follows.

- Private spectrum.** The importance of spectrum for industrial applications is growing, and national regulatory authorities (NRAs) in several countries have assigned spectrum for this purpose. For example, the NRA in Germany made 100MHz of spectrum available in the 3.7GHz–3.8GHz frequency bands.

- **Semi-private and public.** Operators make their spectrum available for some private network projects. For example, Deutsche Telekom provides a dedicated slice of its public network to its customer Osram (lighting manufacturer).
- **Shared or unlicensed.** NRAs allocate spectrum for shared use and may deploy a mix of licensed (priority access) spectrum and unlicensed spectrum. The FCC made 150MHz of spectrum in the 3.5GHz band available for shared use in the USA.

The risk of having so many different options is that none manages to get large enough to provide economies of scale, or that the process of gaining enough scale takes many years, limiting the benefits in the meantime. An analogy would be the development of the GSM standard. The industry agreed a technology standard and spectrum bands that gave suppliers the confidence to invest. For private cellular networks, the technologies are agreed (LTE and 5G) but there is less consensus about spectrum bands.

As more private networks are deployed, fragmentation is a significant risk to the economics of enterprise private LTE/5G networks. In a band that is allocated only to a few industries or countries, the availability of components to support it may be limited, resulting in a cost base that is closer to that of proprietary networks. An example is the USA's 4.9GHz public safety band – only 2% of licences were used, and a shortage of components was widely blamed. Many of the designated 3GPP bands for 5G¹ are expected to be fully supported by the ecosystem (for example, 3.5GHz–3.7GHz) but if some bands are not widely deployed in different geographical regions, the risk is that they will not benefit from broader ecosystem investment. The 3GPP has identified 26 bands below 6GHz but not all are likely to gain ecosystem support.

Operators can use their multinational scale to mitigate the effects of fragmented spectrum regimes

Operators are well-placed to protect enterprises from the risk of spectrum fragmentation and in doing so maximise their role in the value chain. They have a global view of spectrum allocation and can help to mitigate the effect of fragmented spectrum regimes in the following ways.

- **Drive scale.** Operators can use their market power and multinational procurement to build confidence among modem and device vendors to support specific bands. This is likely to reduce the price of devices for enterprises, and put operators in a stronger position in the value chain. Collective purchasing has precedents. For example, the Conexus Mobile Alliance, a group of MNOs, buys devices collectively.
- **Use standardisation to simplify adoption of private LTE/5G networks.** If particular spectrum bands are supported worldwide then large multinationals will be more likely to adopt them. For example, standardisation would enable an automotive manufacturer to have very similar (if not identical) private networks in different countries, something that they would find beneficial in terms of lower costs and availability of devices.

Operators could be instrumental in building confidence in private LTE/5G networks because operators:

- can help to build the economies of scale that could help to reduce the total cost of ownership of these networks for enterprises

¹ For more information, see www.3gpp.org and www.rtt.lt/wp-content/uploads/2019/05/Beyond-5G-final-final-1-1.pdf.

- can help enterprises to reduce the complexity of managing many different bands by operating cloud-based multi-connectivity platforms and their radio resource and spectrum management capabilities are superior to those of many enterprise providers (such as systems integrators)
- can provide a consistent network strategy in different countries, particularly if they are present in multiple countries.

Operators will need to co-ordinate their efforts, which is challenging if they are competing for business. However, operators already co-operate and work collectively to drive harmonisation of spectrum bands and collaborate to increase their bargaining power.

Operators can maximise their role in the value chain

Operators may see their role in the value chain diminished by the availability of industrial and shared spectrum for private network use cases. They should focus on the advantages they offer customers, particularly their ability to mitigate the effects of fragmented or niche spectrum allocations on enterprises, in particular in reducing device costs and network complexity. They have the necessary scale to influence the ecosystem as well as the spectrum management capabilities to manage the impact of multiple bands.