LTE-U's impact is not clear, but it is unlikely to reduce Wi-Fi offload in the short-to-medium term

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Janette Stewart

Increasing demands for access to radio spectrum are driving regulators to consider sharing as a way of making more spectrum available. The 5GHz shared band is attracting attention in the market because of proposals to use a version of LTE-A technology called LTE Unlicensed (LTE-U) in that band. Separately, expansion of existing 5GHz unlicensed sub-bands to form a contiguous 5150–5925MHz band has been under study, ahead of this year's ITU World Radio Conference (WRC-15).

Operators have increased their use of unlicensed spectrum bands in recent years

The market for unlicensed, or licence-exempt, radio products has grown significantly in recent years and Wi-Fi has become nearly ubiquitous using 2.4GHz and 5GHz licence-exempt bands worldwide. Mobile operators have invested in deploying LTE and LTE-A (in licensed spectrum), but offloading data to Wi-Fi has also developed as a solution that mobile consumers have chosen to use and many mobile operators have actively embraced this.

Various technologies have been developed to improve the link between Wi-Fi and LTE and provide more seamless connection, such as link aggregation and emerging proposals for 5GHz LTE-U), which could ultimately produce an LTE unlicensed solution that competes with Wi-Fi.

LTE-U needs to prove that it is compatible with the 5GHz usage rules before it can be allowed into the band

To use the 5GHz band, LTE-U must be able to co-exist with Wi-Fi use and LTE-U standards must reflect this. This is required because, in unlicensed spectrum, individual rights of use are not required (unlike in conventional LTE licensed spectrum) and all systems accessing the band do so on an unco-ordinated, shared basis. Hence, specific interference management protocols are needed to ensure that new technologies can co-exist with established ones, and vice versa.

LTE-U solutions must be designed to co-exist with potentially competing IEEE802.11a-based Wi-Fi systems (which will result in the market being faced with the choice of using LTE or Wi-Fi for small cells), and must also be designed to conform to 5GHz regulations in different countries.

The LTE-U solutions that are emerging in the market-place do not meet the needs of all countries – particularly in Europe, where specific interference mitigation solutions are required in the 5GHz band. As a result, an alternative LTE-Licensed Assisted Access (LTE-LAA) protocol is being designed to meet the stringent regulatory requirements in Europe. LTE LAA must incorporate more complex listen before transmit (LBT) and dynamic frequency selection (DFS) protocols to be compatible with European requirements. Implementing these within LTE is still under study within 3GPP. However, the earlier implementation of LTE-U (minus LBT and DFS) might be suitable in some countries – notably China, South Korea and possibly the USA.

Wi-Fi will continue to dominate in the short term and operators will continue to rely on licensed spectrum for mobile broadband

If LTE-U can offer better performance than Wi-Fi, it may be a valuable addition to LTE-A networks for mobile operators. Whether this signals a decline in mobile operators offering solutions integrated with Wi-Fi will ultimately depend on how key metrics for each technology compare (see Figure 1).

Figure 1: Comparison of 5GHz Wi-Fi and LTE-U

Metric	Wi-Fi	LTE U
Distance/range	Short-range, limited by the propagation characteristics of the 5GHz band and the low-power licence exemption limits of the 5GHz band.[1]	In the 5GHz band, LTE-U will have the same range limitations as Wi-Fi, but when integrated with other LTE carriers in licensed spectrum, this range limitation is avoided (for example, via inter-cell carrier aggregation).[2]
Throughput	Up to 500Mbps or more is theoretically possible depending on the generation of technology used and the bandwidth deployed. Typical speeds are more likely to be around 100–150Mbps.	Undetermined at present, although in practice throughput will probably be measured across LTE small-cell licensed spectrum combined with the unlicensed 5GHz carriers and hence could exceed Wi-Fi depending on spectrum used.
Robustness	Less subject to interference than 2.4GHz Wi-Fi, but can be prone to lower throughput due to channel noise.	Channel performance is continuously monitored by the LTE network, so transmission can be switched to better channels (for example, in licensed spectrum) if channel noise is present.
Cost	Consumer-driven; low-cost.	Unclear – but the range of solutions being proposed (that is, LTE-U, LTE-LAA and LTE/Wi-Fi) and the need to integrate with varying bands of licensed spectrum suggest that divergence is possible, affecting economies of scale.
Offload performance with LTE	Not seamless.	Likely to be seamless.

1 A portion of the 5GHz band, around 5.8GHz, can be used with higher operating powers in some countries.

2 A key difference between Wi-Fi and LTE-U is that the former is a standalone solution, whereas LTE-U carriers are proposed to be deployed under the control of a 'primary LTE cell' in licensed spectrum.

Source: Analysys Mason

One compelling factor in favour of Wi-Fi in the short-to-medium term is that chipset and access point cost has been driven down by the widespread use of Wi-Fi systems in homes, businesses and public places. LTE-U costs will depend on how the 5GHz carriers are deployed and integrated with an operator's LTE carriers in licensed spectrum. LTE-U could also offer better overall performance (that is, range, throughput and robustness) because of its integration with LTE carriers in licensed spectrum.

However, the fact that traffic will be steered in LTE-U from unlicensed to licensed spectrum suggests that operators will continue to rely on licensed spectrum for meeting the demand for high-speed data for the foreseeable future. Nevertheless, we expect the development of LTE-U to continue because of its various potential benefits.

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conditions, value spectrum and prepare for spectrum awards. For more information, please contact Janette Stewart, Principal, at janette.stewart@analysysmason.com.