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# LTE moves into unlicensed spectrum as SpiderCloud and Verizon plan tests

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LTE in unlicensed spectrum is not without controversy. SpiderCloud Wireless is now ready to trial an LTE-U offer with Verizon. Will that put an end to the battle?



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SpiderCloud Wireless has announced that Verizon is planning trials of the SpiderCloud Wireless LTE-U (LTE in unlicensed spectrum) implementation in Q3 2016. The capability delivers LTE signals over unlicensed spectrum in the 5GHz band. With this addition, SpiderCloud enables Verizon's enterprise customers to gain supplemental downlink carrier aggregation above and beyond Verizon's spectrum holdings.

## THE 451 TAKE

SpiderCloud's announcement of its pending trial with Verizon is significant because it reflects both the advanced state of LTE-U evolution and the strength of SpiderCloud's relationship with Verizon. Progress on LTE-U has been relatively quick, with Qualcomm bringing it to a larger group of collaborators in 2013. While concerns lurk in the cable industry and with other Wi-Fi-centric organizations, the technology promises rapid relief of spectrum congestion for mobile operators. In countries such as India, the extra spectrum available as a supplemental downlink can mean the difference between competitive and uncompetitive service in congested hotspots. Qualcomm's efforts to assure fair coexistence appear to be sufficient. If issues remain, particularly with time-sensitive voice applications over Wi-Fi, it is vital that opponents deliver solid research documenting the issue. LTE-U, however, is an interim solution; the real answer is LTE Licensed Assisted Access (LAA). But as long as SpiderCloud and others can deliver early LTE-U systems capable of software upgrades, these early engagements should help operators solve hotspot congestion issues while gaining vital experience with a compelling new technology.

## CONTEXT

SpiderCloud holds a unique position in the small cell mobile-equipment market. At a time when an increasing share of the market is owned by a small set of large-scale systems integrators – Ericsson, Huawei and Nokia – SpiderCloud operates as a privately held, independent supplier of enterprise-class small cell systems. The company works with mobile operators and business partners to deliver reliable in-building mobile cellular coverage and capacity with its scalable 3G/4G or dual-band 4G systems with SON (self-organizing network).

Founded in early 2008, the company is based in San Jose and headed by CEO Mike Gallagher, an executive with experience at prior startups including Flarion Technologies and Shasta Networks. SpiderCloud also maintains key offices in New Jersey, London and Mexico City. It has about 120 employees. The company has raised $125m in venture funding over five rounds. Included in that amount are two recent infusions that added $20m to its coffers.

To date, SpiderCloud claims seven operator deals for its portfolio, with an additional 10 trials in progress. Reference customers include Vodafone (UK and the Netherlands), Verizon Wireless, America Movil/Telcel, EE, Avea and Warid Telecom.

## TECHNOLOGY

With its embrace of LTE-U, SpiderCloud Wireless joins other suppliers working to help operators extend spectral capacity by tapping unlicensed spectrum. To be sure, all major small cell suppliers plan to incorporate this functionality, but SpiderCloud's announcement marks one of the first public trials in the space.

LTE-U is one of three approaches proposed as mechanisms for supplementing costly – sometimes scarce – licensed spectrum resources. Ushered in by Qualcomm in 2013, LTE-U is a pre-standard approach that comingles LTE signals with Wi-Fi signals in unlicensed spectrum for operation in nations with flexible regulatory environments. A standardized follow-on to LTE-U is LTE LAA, a similar capability that replaces a coarse duty cycle for regulating transmit and idle times with a fine-grained 'listen before talk' (LBT) mechanism. LTE LAA is required for operation in nations with strict LBT regulations attached to use of unlicensed spectrum, including Japan and Europe. The third approach, LTE Wi-Fi Link Aggregation, provides for dual connectivity higher in the protocol stack – at the PDCP layer – with a packet-aggregation mechanism operating below the IP layer.

Of the three approaches, LTE-U stands out as controversial. With its coarse duty cycle, LTE-U is feared as a potentially destructive source of RF energy that will strip available capacity from widely available Wi-Fi devices attempting to operate in the 5GHz band. The fear of Wi-Fi ecosystem players is that reliance on simpler Carrier Sensing Adaptive Transmission (CSAT) channel-utilization detection and longer transmission time blocks will have negative consequences for Wi-Fi signal delivery.

Not surprisingly, Qualcomm and its partners are working to deflect objections against LTE-U. Qualcomm has undertaken laboratory studies to demonstrate that LTE-U mechanisms operate 'as a better neighbor to Wi-Fi than Wi-Fi itself.' First, LTE-U dynamically searches available spectrum for clear channels unencumbered by signals from unlicensed traffic, including Wi-Fi. In the event there is no clear channel, LTE-U incorporates a channel-sharing mechanism with an adaptive duty cycle (LTE off/LTE on) based on CSAT. The 'on' portion of the duty cycle will vary, but it can range from 20ms to hundreds. During the 'on' time, an RF signal is transmitted using LTE's OFDM technology. The signal appears to the network and device as simply one more LTE carrier available for aggregation with an anchor carrier. It is important to note that LTE-U is positioned as a supplemental downlink, meaning that no traffic is transmitted from the UE to the network over the LTE-U carrier. To aid fairness, the LTE-U network node estimates the number of active Wi-Fi access points on the channel and allocates a proportional block of time for maximum utilization.

Beyond asserting that LTE-U can coexist fairly, Qualcomm provides studies that suggest that overall digital capacity in a covered area actually increases for Wi-Fi when traffic shifts away from inefficient Wi-Fi procedures dating back to the early days of Ethernet. By having traffic migrate from Wi-Fi to LTE, transmissions benefit from tight network-controlled scheduling functions that yield higher efficiency.

While Qualcomm and other members of the LTE-U Forum – a group that includes Verizon and its suppliers: Ericsson, Nokia (via Alcatel-Lucent) and Samsung – position LTE-U as a good citizen, Wi-Fi stalwarts such as Hewlett Packard Enterprise (via Aruba Networks), Boingo Wireless, Broadcom, CableLabs, Google and Ruckus Wireless continue to raise concerns about coexistence. CableLabs points to early tests showing that LTE-U Forum recommendations for fairness based on proportionate airtime have a disproportionately negative impact on Wi-Fi performance. As such, these players call for continued development of comprehensive tests across a broad set of realistic usage scenarios.

To be sure, the coming 3GPP Release 13 LTE LAA mechanism based on LBT is a less intrusive alternative to an unstandardized LTE-U. With LTE transmission bursts limited to 1-10ms – far short of the hundreds expected with LTE-U – the LTE LAA approach is favored by Wi-Fi ecosystem players. But operators in China, India, Korea and the US are eager to start getting experience delivering supplemental LTE bandwidth with unlicensed bands. Qualcomm and others claim that network equipment implementing LTE-U can be software upgraded to support LTE LAA in the future. If true, operators can proceed with investments aimed at early experience without fear of a future equipment swap. In the absence of evidence that LTE-U delivers illegal interference with nearby Wi-Fi devices, the operators will move forward with early LTE-U trials followed by upgrade to LTE LAA.

## PRODUCTS

SpiderCloud's announcement that it is working with Verizon to trial LTE-U in Q3 2016 is an important reminder of the company's strong position as a supplier of small cell systems for enterprises and venues. With its Enterprise Radio Access Network (E-RAN) architecture that incorporates a centralized self-organizing network (SON) capability, SpiderCloud enables simplified small cell installation. The company's SpiderCloud Services Node (SCSN) provides an on-premises controller to facilitate installation and integration with both mobile network operator and enterprise networks. In a recent development, SpiderCloud has made the SCSN available for hosting in a mobile network operator's datacenter. With the hosted approach, SpiderCloud and its partners can expand the addressable market by supporting deployment in smaller properties that do not justify a dedicated on-site SCSN.

## COMPETITION

SpiderCloud's competition comes from large network equipment providers (NEPs) such as Ericsson, Huawei, Nokia, Samsung and ZTE. The NEP offers are small-form-factor extensions to macrocellular network offers. A key competitive point cited by the NEPs is code compatibility across all nodes supplied by the NEP, regardless of form-factor size.

In the enterprise and small-venue segment, SpiderCloud also faces competition from CommScope, following its acquisition of Airvana in October 2015. Airvana brings CommScope a small cell system aimed at enterprises and small venues, effectively matching SpiderCloud's ambitions. In the run-up to Mobile World Congress 2016, UK small cell specialist ip.access is launching Viper, its answer to enterprises seeking a small cell platform.

## SWOT ANALYSIS

### STRENGTHS

SpiderCloud brings a proven systems approach to small cell deployment in enterprise environments and small venues. Its Services Node provides a foundation for value-added services to boost the value proposition.

### WEAKNESSES

SpiderCloud is not a supplier of macrocellular radio access networks, and must overcome barriers poised by the large NEPs.

### OPPORTUNITIES

By incorporating LTE-U and eventually LTE LAA into its capacities, SpiderCloud can erode the value proposition of distributed antenna systems. Joint LTE-U and standard LTE scheduling operations on a single node are difficult to achieve with DAS architectures.

### THREATS

SpiderCloud faces marginalization from macrocellular network suppliers driving fear, uncertainty and doubt around small cell and macrocellular network coexistence.