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## *Wi-Fi*

### **3GPP Set to Study ‘LTE Over Unlicensed’ Technology, Sowing New Spectrum Battles**

In this Internet age, technology is constantly finding new and interesting ways to solve the problems it creates. Here’s one that needs addressing.

In 2013, the world’s mobile data networks carried nearly 18 exabytes of traffic according to Cisco Systems Inc.’s Visual Networking Index. To put that into perspective, in 2000, a mere one exabyte of traffic traversed the entire global Internet.

For the nation’s wireless carriers, the problem boils down to this: How do you reduce the effect of network congestion and guarantee customers a certain quality of service, all while keeping costs down?

Until now, the simple answer has been more spectrum, over which all our television and radio are broadcast and all those communications signals are sent. But so far efforts by the Federal Communications Commission and the Commerce Department’s National Telecommunications and Information Administration to reclaim spectrum from others—TV broadcasters, the military—have proven politically tangled, costly, and time-consuming.

What if, instead, the winning solution to the problem were a *technological* solution? What if the carriers were able to take greater advantage of *unlicensed* spectrum, just as Google Inc., Microsoft Inc., Comcast Corp., and others have?

**‘LTE Over Unlicensed’ Offers Solution—and Brings Controversy.** At a plenary meeting set to begin Sept. 9 in Edinburgh, Scotland, the Third Generation Partnership Project (3GPP) will consider a proposal to study the feasibility of deploying LTE (Long Term Evolution) technology in unlicensed spectrum in the 5-gigahertz band.

Qualcomm Inc. and Ericsson first proposed the idea to the industry standards-setting body in November 2013, laying out a vision for a supplementary 20-megahertz channel in the 5-GHz band that could be combined with channels in licensed spectrum from 700 MHz to 2.6 GHz using LTE Advanced’s carrier-aggregation mechanism. The companies’ decision to target 5 GHz, out of all other spectrum bands, was an easy one: There already is more than 500 MHz available in the band on a shared basis, with hundreds of megahertz more slated to be freed up by regulators in the United States, Europe, and Asia in the coming years.

The 5-GHz band is also where Wi-Fi is making its future home.

Thus the solution that the wireless carriers have been eagerly waiting for—what has been termed “LTE Over Unlicensed,” or LTE-U—also sets up a potential new battle with Silicon Valley, cable operators, and maybe even the world’s communications regulators, none of whom want to see a new technology annex unlicensed spectrum for the sole benefit of one industry segment—and limit the future development of Wi-Fi in the process.

**‘LTE Can Coexist With Wi-Fi.’** “To overcome spectrum scarcity, operators need as much spectrum as possible,” Dino Flore, director of technical standards at Qualcomm and chairman of 3GPP TSG RAN (3GPP’s Radio Access Network technical specification group), which is considering the proposal, told Bloomberg BNA in an interview. “Of course, you can improve spectral efficiency, but only up to a certain point. After that, you need more spectrum to deploy technologies.”

Broadly, Flore sees unlicensed spectrum in 5 GHz becoming a “perfect complement” to the carriers’ licensed spectrum from 700 MHz to 2.6 GHz. On the issue of whether LTE-U will ultimately have the effect of crowding out Wi-Fi in the 5-GHz band, Flore was quick to note that “the initial test results tell us that, when augmented with the appropriate coexistence mechanisms to operate in unlicensed spectrum, LTE *can* coexist with Wi-Fi and even do better in terms of spectral efficiency. But co-existence is a very important issue to all involved.”

“We want to make sure that those operators that will choose to offload to unlicensed via Wi-Fi have the best possible interworking mechanism, and mobility between the systems,” Flore added.

**Carriers Need Wi-Fi, Too.** For many wireless carriers, Wi-Fi has become an important tool for maintaining quality service during times of skyrocketing data usage.

In 2013, according to Cisco, carriers offloaded 45 percent of all mobile data traffic onto a fixed network using Wi-Fi or femtocell technology. By 2018, Cisco predicts that more data traffic will be offloaded from cellular networks via Wi-Fi than will remain on those networks.

Among the four major U.S. wireless carriers, AT&T Inc. has activated the most Wi-Fi hotspots in the United States—more than 30,000—mainly to bolster its 3G and 4G networks’ capacity in large metropolitan markets. It was therefore not surprising when the company raised the concern in filings with the 3GPP that if licensed networks—AT&T’s own, even—were allowed to borrow capacity from unlicensed spectrum, then there would be less capacity left for unlicensed users—including AT&T. For that reason, even though AT&T lags behind

only Verizon Wireless in rolling out 4G LTE services nationwide (and would arguably stand to benefit from an industrywide implementation of LTE Over Unlicensed technology), the company has been urging 3GPP standard setters to proceed cautiously.

3GPP must “determine enhancements which enable LTE to coexist with legacy technologies in unlicensed bands,” AT&T said in a formal presentation made at a workshop on the issue in June in Sophia Antipolis, France. In short, the 3GPP should develop a “good neighbor” policy. “Do not make legacy systems unusable,” AT&T said.

For cable operators, this concern is a much more acute one.

**Is LTE-U a Real Threat to CableWiFi?** Over the past several years, Comcast, Time Warner, Cox Communications, Bright House Networks, and Cablevision Systems Corp. have collectively invested hundreds of millions of dollars in creating a truly ubiquitous nationwide Wi-Fi access network—both as an enticement for their home broadband and cable TV customers not to cancel their services, and as a hedge. The company’s CableWiFi initiative—and the recent development of voice-over-Wi-Fi and Wi-Fi-to-cellular “handoff” technologies—have comfortably positioned Big Cable to compete with Verizon Communications Inc. and AT&T Inc. in the market for both wireless and *wired* services, at least for the foreseeable future.

To be sure, these same five companies aggressively lobbied the FCC to open up 100 MHz of spectrum in the 5-GHz band for higher-powered, outdoor Wi-Fi use—and now they are simply trying to protect that investment.

“It is entirely possible for Wi-Fi and LTE Over Unlicensed to co-exist in shared, unlicensed spectrum,” Rob Alderfer, principal strategic analyst for CableLabs, the cable industry’s research consortium, told Bloomberg BNA. “But we certainly have concerns because that outcome is entirely dependent upon the way that LTE Over Unlicensed is developed and implemented, all of which is being settled right now.”

One of CableLabs’ main points of contention is that what 3GPP will be looking to study is “Licensed-Assisted Access using LTE,” which essentially means that LTE Over Unlicensed technology would be available *only* to spectrum license holders. All of the network operations would still be “controlled” from within carriers’ licensed channels from 700 MHz to 2.6 GHz. In sharp contrast, Wi-Fi technology is available to everyone. (If LTE-U proves successful, the cable operators may want to adopt the technology for themselves, either by installing LTE-U nodes throughout their existing cable networks for use by their own subscribers or offering both operator-neutral LTE-U cellular offload and backhaul services to the wireless carriers.)

But perhaps CableLabs’ biggest issue is the inherent difference between the way LTE and Wi-Fi technologies operate.

As Alderfer explained, “LTE is a scheduled and managed technology, whereas Wi-Fi is a decentralized, listen-before-talk technology. You can imagine a Wi-Fi access point next to a LTE unlicensed base station both trying to transmit at the same time. The LTE base station will transmit and the Wi-Fi access point will shut down because it hears noise. Wi-Fi is polite and built to

share spectrum, but that means a centrally managed technology like LTE can control its access.”

Indeed, according to a study by Nokia Oyj, the operation of LTE in unlicensed spectrum—without any modification—would degrade Wi-Fi performance by as much as 90 percent.

When reached for comment, a spokesman for the National Cable and Telecommunications Association told Bloomberg BNA that the trade group has not yet taken a formal position on LTE Over Unlicensed, and has opted to deferred to CableLabs’ technical expertise at this time.

**Will FCC Be Wi-Fi’s Protector?** It goes without saying that Wi-Fi would not have been possible if not for the FCC’s decision to open up spectrum for unlicensed use—first in the 2.4 GHz band and then in the 5 GHz band. According to Informa, a research firm, the number of Wi-Fi hot spots worldwide will reach 5.8 million by the end of 2015, up from 800,000 in 2010.

Despite such growth, however, Wi-Fi continues to operate in the most chaotic regulatory environment for spectrum. In the United States, any person or entity can use the unlicensed spectrum bands for either private or public purposes so long as the user’s equipment is certified by the FCC and operated in conformity with the agency’s Part 15 rules. What’s more, users enjoy no regulatory protection against signal interference. Congestion? Just deal with it.

But herein lies one surpassing benefit: low cost. Licensed spectrum is auctioned and sold for billions; unlicensed spectrum is free. Innovate away, says the FCC.

“If [LTE-U] is deployed significantly and it does have the potential to negatively impact Wi-Fi or prevent Wi-Fi from accessing channels at congested times, it essentially becomes the *key* to the unlicensed spectrum—and the only holders of that *key* are companies that have licensed spectrum,” CableLabs’ Alderfer said. “It’s really the opposite of the FCC’s goal for the unlicensed bands—free and open and rapid innovation.”

Will the FCC act?

Richard Bennett, a visiting fellow at the American Enterprise Institute who contributed engineering expertise to create the world’s first Wi-Fi wireless networking standard, 802.11-1997, nearly 20 years ago, said the FCC may be pressured to act if LTE-U engineers were to devise systems that require higher-power emissions levels, which could drown out Wi-Fi signals.

“More people use Wi-Fi than any other communications protocol that’s ever been devised; you don’t just push those people out of the way,” Bennett told Bloomberg BNA in an interview. “If the Wi-Fi Alliance and the Wi-Fi community don’t get behind this plan, then it doesn’t go anywhere. Without their support, LTE-U is nothing more than a lab toy.”

In some countries, like the United States, regulations allow LTE operators to preempt Wi-Fi users on any channels that the LTE operator chooses to occupy. In other countries, rules for unlicensed spectrum require LTE operators to “listen before talk”—that is to say, check the frequencies first to see if anyone is using them.

**Push for ‘Global Solution.’** Initially, two types of LTE-U solutions had emerged—one for countries with “listen before talk” regulations and one for countries without. But the 3GPP TSG RAN decided to work toward producing one “global solution,” Qualcomm’s Flore said.

Now, according to the proposed “Study on Licensed-Assisted Access using LTE,” the 3GPP will look to “identify and define design targets for co-existence with other unlicensed spectrum deployments, e.g. fairness with respect to Wi-Fi . . .”

“The fast uptake of LTE in different regions of the world shows both that demand for wireless broadband data is increasing, and that LTE is an extremely successful platform to meet that demand. At the same time, unlicensed spectrum is more and more considered by cellular operators as a complementary tool to augment their service offering,” the document states. “Unlicensed spectrum can never match the qualities of the licensed regime. However, those solutions that allow an efficient use of it as a complement to licensed deployments have the potential to bring great value to 3GPP operators and, ultimately, to the 3GPP industry as a whole. Given the widespread deployment and usage of other technologies in unlicensed spectrum for wireless communications in our society, it is envisioned that LTE would have to coexist with existing and future uses of unlicensed spectrum.”

So far, supporters of the proposal include Ericsson, Qualcomm, Huawei Technologies Co., Nokia Networks, Verizon Wireless, SoftBank Corp., Alcatel-Lucent, T-Mobile US Inc., China Unicom, Panasonic Corp., Sony Corp., KDDI, Deutsche Telekom AG, Vodafone Group plc, and NTT Docomo.

Of these companies, Huawei and NTT Docomo have recently completed tests of Licensed-Assistance Access using LTE in 5 GHz spectrum, showing that LTE can work in the band at speeds of up to 100 megabits per second.

These early results notwithstanding, LTE-U is being considered for 3GPP standards “Release 13,” which is not likely to be completed until 2016, allowing ample time for debate to mature. If LTE-U is included in Release 13, the earliest equipment would be available would be late 2017 or early 2018.

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*For the proposal up for consideration at 3GPP TSG RAN during the group’s Sept. 9-14 plenary meeting in Edinburgh, Scotland, visit <http://op.bna.com/der.nsf/r?Open=sbay-9nrptm> and <http://op.bna.com/der.nsf/r?Open=sbay-9nrpv6>*

*For the full text of industry stakeholder submissions to a 3GPP workshop in France in June, visit [http://www.3gpp.org/news-events/3gpp-news/1603-lte\\_in\\_unlicensed](http://www.3gpp.org/news-events/3gpp-news/1603-lte_in_unlicensed)*