



allowing others to transmit in the interregnums. For Wi-Fi, this means the potential for less time in transmitting data which would decrease its effectiveness, but the reduction highly contingent on how it is deployed.<sup>3</sup> LAA would follow the LBT standard but some worry that its deployment would have a greater footprint than Wi-Fi access points and could decrease Wi-Fi download speeds.<sup>4</sup>

All participants have been actively engaged in discussion to ensure that everyone can use the unlicensed spaces effectively.<sup>5</sup> As was first pointed out in 1959, interference affects both parties, and thus there is a natural inclination for interested parties to come to a mutually beneficial agreement.<sup>6</sup> The coevolution of Bluetooth and Wi-Fi, and the efforts to minimize interference between the protocols, evince this penchant for agreement.<sup>7</sup>

While “fairness” gets bandied about in this discussion, no one is guaranteed exclusivity in the space. Legally, the point of unlicensed spectrum is stated clearly in Part 15.5 of the FCC Rules, which gives no one a “vested or recognizable right to continued use of any given frequency,” and “that interference must be accepted.”<sup>8</sup> Unlicensed is not solely for the purpose of Wi-Fi and Bluetooth, it is open to all technologies. To think otherwise means that government is in the business of picking winners and losers in this space, and that the bands where Wi-Fi has been deployed should only be used for Wi-Fi.

Since the FCC put a cap on the power of unlicensed transmitters, the distance that a signal can travel is effectively limited. Because LTE over unlicensed technologies have to conform to these standards, they will likely to be used in the near term for short range purposes to fill in gaps and provide capacity for constrained networks. The technology will have to work in areas where there is high demand for all kinds of network connections, which means that the carriers would have to accept interference from others using the same spectrum within the same geographic region.

Here the connection between spectrum pricing and interference becomes a little clearer. Interference is generally illegal in licensed spectrum. Additionally, these swaths of space are able to work at higher power levels than unlicensed allowing more geographically extensive networks to be created. As evidenced by the recent auction, which topped \$41 billion for 65 Mhz, licensed spectrum has become highly valued to carriers.<sup>9</sup> Spectrum is a highly sought after asset, especially when there are guarantees for non-interference.

---

<sup>3</sup> Joey Padden, *Wi-Fi vs. Duty Cycled LTE: A Balancing Act*, <http://www.cablelabs.com/wi-fi-vs-duty-cycled-lte/>

<sup>4</sup> The backoff time has been in contention for the development of LAA.

<sup>5</sup> Keith Dyer, *Hostilities break out over LTE-U at WiFi Global Congress*, <http://the-mobile-network.com/2015/05/hostilities-break-out-over-lte-u-at-wifi-global-congress/>

<sup>6</sup> R. H. Coase, *The Federal Communications Commission*, <http://old.ccer.edu.cn/download/7874-1.pdf>

<sup>7</sup> Sue White, *Wi-Fi and Bluetooth coexistence*, <http://www.ecnmag.com/articles/2012/03/wi-fi-and-bluetooth-coexistence>

<sup>8</sup> U.S. Government Publishing Office, *Electronic Code of Federal Regulation Title 47 Chapter 1 Subchapter A Part 15 Subpart A §15.5*, [http://www.ecfr.gov/cgi-bin/text-idx?SID=a17157960c63165990ed0feac5864453&node=se47.1.15\\_15&rgn=div8](http://www.ecfr.gov/cgi-bin/text-idx?SID=a17157960c63165990ed0feac5864453&node=se47.1.15_15&rgn=div8)

<sup>9</sup> Federal Communications Commissions, *Auction of Advanced Wireless Services (AWS-3) Closes Winning Bidders Announced for Auction 97*, [https://apps.fcc.gov/edocs\\_public/attachmatch/DA-15-131A1.pdf](https://apps.fcc.gov/edocs_public/attachmatch/DA-15-131A1.pdf)

On the other hand, unlicensed spectrum is effectively priced at zero. Economic theory suggests that unlicensed should eventually fall prey to overuse.<sup>10</sup> As the thinking goes, because there is no price mechanism, there is nothing to limit individuals from using the asset, leading to overuse, which in this case means interference. However, the technologies deployed in unlicensed spectrum have had power restrictions, limiting the range of networks and the potential for interference, but also curtailing the kinds of products and business models that can be deployed in the space.

Along with a number of other notable computer scientists, Pierre De Vries, a noted technologist and policy expert in this area, conducted one of the few studies exploring interference in the unlicensed 2.4 GHz space and found that,

Based on our assessment of public reports and experimental data, we conclude that there is currently no evidence for pervasive Wi-Fi congestion. We do not claim that the absence of evidence of congestion amounts to evidence for the absence of congestion. However, we do question the argument that congestion occurring somewhere, sometimes is a justification for regulatory intervention.<sup>11</sup>

Naturally, this leads to a question: if unlicensed spectrum is valuable, but is unpriced, then why isn't there more widespread interference? Interference is the direct result of extensive use, the best "market indicator" that we have in this space, but there is little concrete evidence to suggest this is widespread. While the LBT standard helps to mitigate interference, there is evidence to suggest it is an inefficient standard.<sup>12</sup> Power limits established in the unlicensed space effectively limit the ranges of Wi-Fi hotspots, which in turn minimizes interference. But the power and technical restrictions are one method to manage unlicensed spectrum, even though there are other possible configurations that could make the use of the band more efficient. Entrepreneurs should be actively searching for alternative arrangements to manage this commons. The FCC should thus be open to different technical protocols within the unlicensed space in order to approximate the market and ensure efficiency since licensed spectrum, the alternative, is so costly. Especially at this early stage, agnosticism in the protocols should be official policy.<sup>13</sup>

---

<sup>10</sup> Jerry Brito, *The Spectrum Commons in Theory and Practice*, <https://journals.law.stanford.edu/sites/default/files/stanford-technology-law-review-stlr/online/brito-commons.pdf>

<sup>11</sup> Jean Pierre De Vries, Ljiljana Simic, Andreas Achtzehn, Marina Petrova, and Petri Mähönen, *The Emperor has No Problem: Is Wi-Fi Spectrum Really Congested?*, [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2241609](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2241609)

<sup>12</sup> Mikael Ricknäs and Tim Hornyak, *LTE in Wi-Fi spectrum shows great potential, says NTT DoCoMo*, <http://www.pcworld.com/article/2597400/lte-in-wifi-spectrum-shows-great-potential-says-ntt-docomo.html>

<sup>13</sup> The opinions expressed in this comment reflect the views of the author and do not necessarily reflect the views of AAF.