Technical Article

Getting to Know LTE Unlicensed

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While the small cell market has undergone considerable growing pains, we believe it is on the verge of a significant expansion over the next two years. At the same time, the growing demand for increased data rates and bandwidth are prompting the need for heterogeneous network (HetNet) architectures, making the economics of the network a tougher problem to solve.

Starting with the definition of the right specs for access points, to finalizing efficient deployment strategies to finding the right model for monetizing the investment, it has been a tremendous learning journey. However, one thing is clear–everyone from operators to network providers wants their small cell access point designs to be as low power and low cost as possible while still providing the highest performance and flexibility. This “ideal” scenario not only enables them to get the full-entitlement from their investment, but also future-proofs the access point by providing the ability to differentiate, upgrade and recalibrate through software as the industry evolves. The ability to upgrade current small cell access points to support LTE in unlicensed bands (LTE-U) and License Assisted Access (LAA) is just one way Texas Instruments (TI) is enabling the evolution and growth of the small cell industry.

Shared spectrum is appropriate now since the wireless industry has reached that point where the current ISM bands cannot meet the public’s voracious demand for more data and increased mobility. The ITU has defined 12 worldwide frequency bands for ISM use, providing a theoretical total of 4.0GHz of bandwidth. Wi-Fi® (802.11xx), which suffers from the greatest congestion, is only using three bands (0.9 GHz, 2.4 GHz and 5.7 GHz) and is limited to 276 MHz of bandwidth.

Table 1. Federal and shared bands under investigation for shared use

Federal and shared spectrum bands under investigation

Frequency Band (MHz)	Amount (Megahertz)	Current allocation/usage (Federal, Non-Federal, Shared)
406.1–420**	13.9	Federal
1300–1390**	90	Federal
1675–1710*	35	Federal/Non-Federal shared
1755–1780*	25	Federal
1780–1850	70	Federal
2200–2290	90	Federal
2700–2900**	200	Federal
2900–3100	200	Federal/Non-Federal shared
3100–3500	400	Federal/Non-Federal shared
3500–3650*	150	Federal
4200–4400** (4200–4220 & 4380–4400)*	200	Federal/Non-Federal shared Federal/Non-Federal shared
Total	**1,473.9**	

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A significant and often overlooked application that consumes ISM bandwidth is the wireless cellular service providers offloading significant amounts of their traffic to Wi-Fi® access points whenever possible. A study compiled by Cisco found that 45 percent of the global smartphone traffic is offloaded to the ISM bands of unlicensed spectrum. Moreover, the data needs of global mobile phones are expected to exceed 15 exabytes per month (that's 10 with 17 zeros behind it!) by 2018. Add to this another 50 billion Internet of Things (IoT) devices, which will likely pop into the ISM bands in the next few years and the additional congestion could threaten data throughput significantly. Consequently, the groundswell of demand from ISM users and service providers to expand the available unlicensed spectrum bandwidth comes as no surprise. Nor is it startling that with each passing year the chorus gets louder.

TI has now released three generations of small cell processors (TCI6630K2L, TCI6636K2H, and TCI6614). These system-on-chips (SoCs) are in mass deployment with both Tier 1 base station original equipment manufacturers (OEMs) and Tier 2 and 3 small cell manufacturers all over the world. Constant hardware changes that require small cell access points to be redesigned, re-trialed and re-deployed, are not what operators are looking for. The industry needs vendors to project the future requirements of small cells, provide silicon devices with the ability to support these future requirements and also provide the software building blocks to enable the latest evolutions of the market. This is why TI has become the first small cell base station SoC vendor to release LTE-U and LAA solutions to the market. Multiple customers have publicly demonstrated their access points and are moving forward with field trials and deployments.

TI is providing customers with enabling software solutions that achieve LTE Release 10, carrier aggregation, and unlicensed band support in one package, with which they can upgrade their current TI SoC based small cell access points to this generation of technology. These solutions can support dual 20-MHz carriers with one or both carriers being in either the licensed or unlicensed bands.

In conclusion, the growth of small cell deployments will require vendors and manufacturers to continually adapt to changing operator requirements and that adaption cannot mean a continuous stream of new capex spend and hardware changes. TI offers proven high-performance processors that enable small cell OEMs to differentiate themselves. The market demand for LTE-U and LAA support will continue to grow with the ever increasing need for higher data throughputs. TI is excited to enable the growth of the small cell industry through this advanced technology and the growth of our small cell OEM customers through market leading high-performance solutions. For more information, please visit www.ti.com/smallcells.

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