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White paper

Technical keys to successful network modernization: ultra-wideband antennas

Ensure you achieve your modernization goals by focusing on key areas

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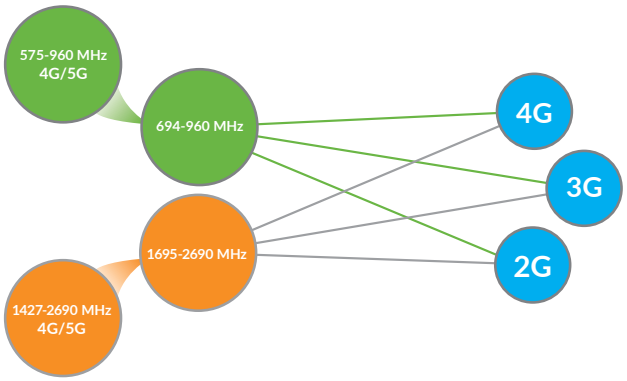
One challenge every operator must face when modernizing a network is the uncertainty of future frequency band availability. There are ten commercially launched frequency band combinations in use today (figure 1). Another overarching challenge is that of complexity—increasing antenna counts, antenna swap-out or additions, tower loading and many more considerations and variables.



What's needed is a versatile and adaptable base station antenna solution that simplifies deployment and supports all four major air-interface standards—GSM, CDMA, W-CDMA and LTE—in almost any wireless frequency range. One such innovative technology is ultra-wideband antennas.

Ultra-wideband antennas can help operators manage space restrictions on crowded cell towers by enabling multiband implementations. This versatile capability enables operators to deploy one antenna, for example, instead of two or three, saving on site approvals, installation time, and tower leasing costs. Operators can activate almost any new spectrum holdings in the future as long as they fall within the supported frequency ranges.

But how do you know if ultra-wideband is the right solution to help you modernize your network? What are the variables—known and unknown—you should consider when making the decision to migrate to ultra-wideband antennas? What are the technical considerations and advantages? And, most importantly, does the value warrant the investment?

Source of data: GSA's Evolution to LTE report — March 31, 2014
Global mobile Suppliers Association www.gsacom.com

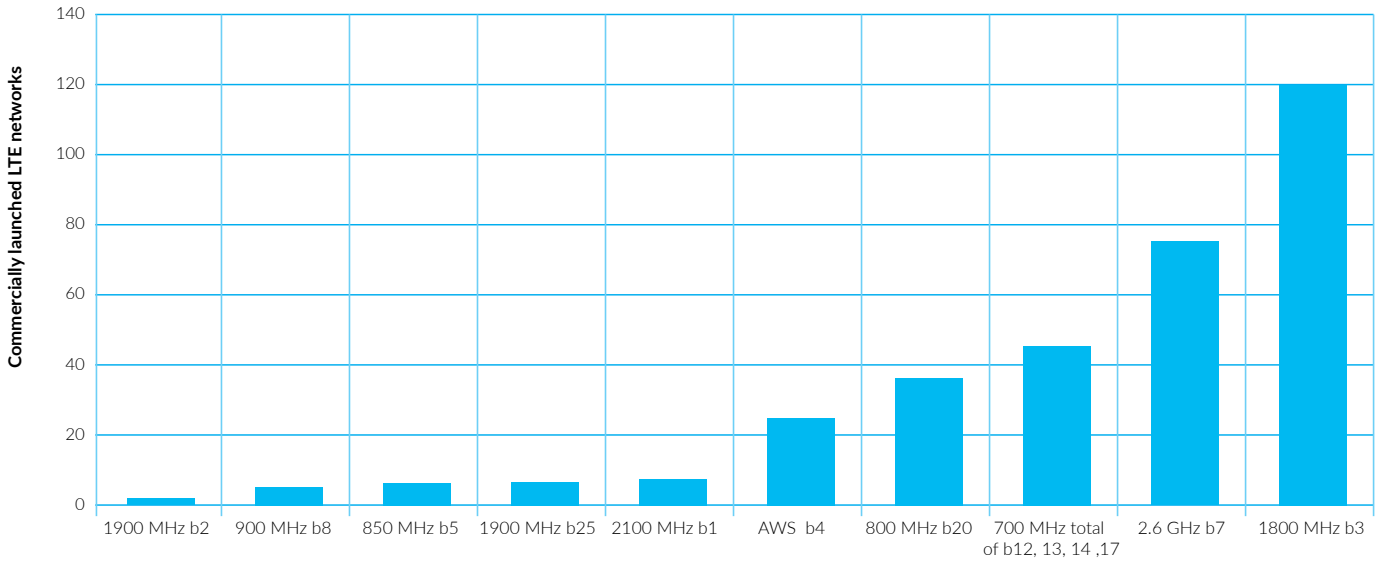


Figure 1: Commercially launched LTE networks

Four technical keys

All these questions give you a lot to think about. But, first, as you look to modernize your network, it's important to look at the "big picture." Upgrading your network is like solving a big puzzle with several key pieces. As discussed in the first *Technical keys to successful modernization* white paper on fiber to the antenna (FTTA), the four rather large pieces of the puzzle include:

- Fiber technology in FTTA solutions
- Ultra-wideband antennas
- Weight and wind load tradeoffs
- Passive intermodulation (PIM)

Each of these topics is a complex discussion, so there are four separate white papers, each focusing on a single area in the *Technical keys to successful modernization* series. This document is the second in this series, where we'll explore ultra-wideband antennas in greater detail.

Ultra-wideband antennas

Every operator today is faced with the dilemma of how to address network capacity. Without additional investment in frequency and air interface technology, it's impossible to effectively solve this issue. At its core is the area of spectrum availability in the industry, which creates a need for investment in new equipment. Adding to the complexity is the lack of clarity and certainty about spectrum wins, or even when regulatory agencies will release a given spectrum for use.

These unknown variables introduce a huge potential risk as you look at modernizing your network. Will your equipment be flexible in application to support current and future services? That's the question that needs to be asked before going the conventional route of simply adding new antennas. Installing new antennas and supporting RF path equipment to deploy new frequencies and technologies in your network, or even using different tower locations for antenna height, doesn't solve the problem.

Besides the inherent performance challenges of multiple antennas on heavily loaded towers (read our *Technical keys to successful modernization: weight and wind load* white paper), this approach can add to leasing costs; plus, installation complexities can put a drain on resources. When a lot of antennas are in close physical proximity, signal performance is prone to pattern distortion and service is susceptible to interference between bands. Using multiple, individual pieces of equipment also opens the door for more opportunities to experience failure in a wireless system. Performance issues can significantly impact a carrier's image as a service provider, as well as revenues as subscribers flock to other carriers to seek the fastest and most reliable service.

In addition, zoning restrictions on how much tower load is allowed—and visual or aesthetic compliance to local ordinances—make it slow and difficult to add more equipment to the tower. Bottom line, operators have fewer and fewer choices using the conventional approach of adding more antennas.

Why ultra-wideband antennas are the right approach

Ultra-wideband antennas provide operators with a solution to network capacity and a clearer path to the future without the problems associated with adding more antennas. Ultra-wideband technology also results in a cleaner, more visually attractive site due to reduced equipment on the tower. Ultra-widebandbase station antennas support the four major air interface technologies in almost every band used globally. Essentially, one antenna can do the work of six.

There are other technical advantages of CommScope's ultra-wideband antennas. While every product will vary in technical specifications, the ultra-wideband family of base station antennas includes the following features:

- Supports GSM, CDMA, W-CDMA, and LTE air interface technologies in 698–960 MHz and 1710–2690 MHz bands.
- Integrated smart bias tee eliminates the need for RET jumpers and RET home run cable by injecting the AISG signal onto the RF transmission line
- Elevation pattern upper sidelobe suppression of typically better than 18 dB across the frequency band and downtilts help reduce adjacent cell interference and increase data throughput
- Null fill included in the elevation pattern helps maintain signal levels in the coverage area, therefore reducing interference and increasing data throughput
- Azimuth beamwidth stability across the frequency band provides better coverage and uniformity of coverage across the band
- Horizontally spaced high-band array configurations for optimum MIMO performance

From a value proposition perspective, ultra-wideband antennas provide some substantial benefits:

- A cleaner solution that reduces the amount of equipment needed on the top of the tower
- The potential to bypass or shorten the time required for site approvals
- Greater speed to market means you can build revenues more quickly
- Faster deployment for new services now and in the future, which also boosts and protects your image as a service provider
- Flexibility not only helps save in operational leasing costs, but also in future capital expenses that would be spent on the next spectrum rollout
- In addition, dual-band tower mounted amplifiers (TMAs) and combining solutions help reduce equipment needed on the tower by combining multiple frequency bands and technology standards to allow antenna and feeder sharing

Since ultra-wideband antennas support the four major air-interface standards in almost any wireless frequency range, they are ideal for complex multi-technology, multi-layer, multi-operator networks. The low-band antenna operation covers the entire 698–960 MHz band. And the high-band antenna operation covers the entire 1710–2690 MHz band. With an ultra-wideband antenna, operators can have the infrastructure in place to support an extremely wide range of RF spectrum and standards.

When analyzing and comparing ultra-wideband antennas, it's important to look at all of the technical specifications to ensure the equipment is truly multiband. For example, some antenna manufacturers claim multiband capabilities but come equipped with narrowband ports. Such details are important to consider for truly extended frequency capabilities.

Another available technology for modernizing your antenna is independent service. This allows for multiple tilts in a single antenna. With this capability, operators of antenna-constrained sites can replace existing antennas with one antenna per sector and add LTE services to the new multiband, multiport ultra-wideband antennas.

That makes pattern management capabilities another important feature of ultra-wideband antenna technology. For example, consider this scenario:

- A low-band antenna with 13 dbi of gain and 65-degree horizontal beamwidth will have an elevation beamwidth of 15 degrees.
- A high-band antenna that physically matches it will have an elevation beamwidth of 7 degrees.
- If the antenna is mechanically tilted down for the low band without considering the impact on the performance of the high band, there's a good chance pattern distortion will result.
- Independent tilt capabilities for ultra-wideband antennas make it possible to achieve optimization of every frequency and every application.

Conclusion

Now that you have a better understanding of the technical considerations and advantages of ultra-wideband antenna technology, it may be clearer to you why network operators are embracing this innovation. And it may be a vital piece of the modernization puzzle for your network.

CommScope can help you migrate your network to ultra-wideband antennas. Our ultra-wideband solution uses innovative pattern-shaping technologies for a flexible, scalable and independently optimized antenna system. It can help simplify your network while providing the maximum degree of future-ready capacity. By migrating to ultra-wideband, you can:

- Prevent future antenna swap-outs or additions
- Reduce your network antenna count
- Implement MIMO for extra capacity
- Minimize your tower loading and leasing costs
- Accelerate operator's migration process

CommScope white paper series: Technical keys to successful modernization

In order to meet these challenging needs, each of the four technical areas identified in the introduction of this white paper must be addressed when updating your network. They are, in fact, the four pillars of successful network modernization. That's why CommScope has created a series of four white papers that address each of these keys individually. By addressing these technical areas, you'll not only create a strong foundation for today, but ensure your network is ready to deploy future technologies to meet tomorrow's demands.

We encourage you to read the three other white papers in our series to get a complete view of the four network modernization keys.

Everyone communicates. It's the essence of the human experience. *How* we communicate is evolving. Technology is reshaping the way we live, learn and thrive. The epicenter of this transformation is the network—our passion. Our experts are rethinking the purpose, role and usage of networks to help our customers increase bandwidth, expand capacity, enhance efficiency, speed deployment and simplify migration. From remote cell sites to massive sports arenas, from busy airports to state-of-the-art data centers—we provide the essential expertise and vital infrastructure your business needs to succeed. The world's most advanced networks rely on CommScope connectivity.

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