FIVE WAYS TO CUT COMPLEXITY, TIME AND COST IN NEW SITE INSTALLATIONS

Dealing with crowded tower tops, tight schedules and limited budgets

Like most technologies, the advantages of remote radio architecture come with a cost. Several costs, in fact, as crowded tower tops limit the amount of capacity you can add and force installations to take longer to perform—and congested environments increase the chances of installer error and PIM problems. All of this adds up to hard costs in CapEx and OpEx as well; tower lease costs are rising, PIM can cripple capacity—and the longer time to market limits how quickly you realize ROI from your installations.

For operators facing these challenges, there exist several key opportunities that can help reduce the costly impact of tower-top complexity, aggressive rollout schedules and limited CapEx and OpEx budgets. These opportunities exist at virtually every level of a typical site—from the ground to the antenna.

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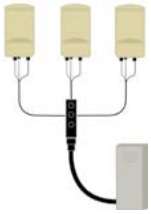
1. HYBRID FIBER AND FTTA ARCHITECTURE

A smart way to reduce tower weight and wind load is using a single run of cable for both fiber connectivity and power to remote radio units. Modern hybrid cable is lightweight and flexible, making it easier to install, in a single run, what used to require two. This not only streamlines the tower-top architecture; it streamlines installation practices, too, reducing CapEx.

Bringing connectivity and power to the tower top is only half the story. It needs to be broken out to the radios once it's up there—and that's where FTTA solutions can help simplify the process significantly. Far more efficient than running individual connections to ground level, FTTA breakout systems make it easy to distribute power to the radios with minimal cable lengths and easy installation. Some examples of FTTA breakouts are shown below.

Pendant Hybrid fiber/power breakout terminal	**Direct** Hybrid fiber/power breakout assembly	**Standard** Standard hybrid fiber/power	**Discrete** Separate fiber/power
			
The breakout terminal features an advanced hybrid plug-and-play interface that saves space, installation time and labor costs.	The breakout assembly with hybrid terminated cable legs give plug-and-play capability and saves space in high RRU-count environments.	The hybrid junction box offers exceptional agility for replacing cabling to add another sector or set of radios.	This architecture follows a traditional distribution system with separate fiber and power cabling, which offers an economical solution to upgrades or replacements.

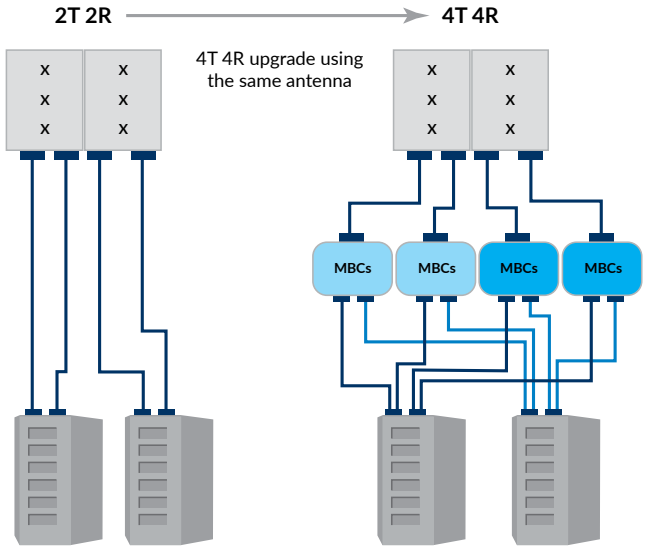
2. MULTIBAND COMBINERS (MBCs)

Today, operators typically own a complex arrangement of spectrum with singleband radios operating at each of the various frequency bands, so it's not unusual for a cell site to have four or more different radios operating at different frequencies. Operators have also now migrated toward four-transmit/four-receive architectures for each singleband radio. However, at a given site, it may not be possible or practical to add the required antennas and additional RF transmission lines to support all radios and RF paths due to zoning, tower space, or tower load restrictions.

Multiband combiners (MBCs) can solve these problems by providing the capability to easily and quickly upgrade existing site infrastructure to support higher-order MIMO architectures. MBCs combine several radio ports from different radios onto a common RF path, avoiding the need for additional antennas and simplifying cell site architectures. MBCs also play a critical role in upgrading existing sites to add more radios, making them an important element in a network's future-proofing strategy.

Another factor is that radios are capable of generating dc/AISG signals for powering and controlling tower-top devices and antennas. Smart MBCs automatically detect these signals and provide intelligent routing, further simplifying the site modifications and build.

The block diagram below shows a typical installation with various MBCs.



When combining multiple radios onto one RF path, there is an opportunity for unwanted passive intermodulation (PIM) interference. Therefore, operators should deploy only best-in-class, factory-tested, low-PIM MBCs.

3. ULTRA-WIDEBAND ANTENNAS

The release of additional spectrum for operator use is great news—if you have the antennas you need to support the new bands. Crowded tower tops offer few opportunities to add more antennas, so a better option is to upgrade existing antennas to ultra-wideband alternatives that are now available.

Quality ultra-wideband antennas have inputs for your current spectrum and newly available 1400 MHz (in Europe) and 600 MHz bands (coming in 2017), all without taking up more space on the tower. Support for these frequencies is a business imperative for operators; the FCC even suggests that the 600 MHz band will become the catalyst for 5G adoption, a critical initiative.

Frequency support is only the beginning, however. To get the most efficiency from a new antenna, it must be designed with precise RPE and low sidelobes. RET is another critical feature required to get the most from the investment in new antennas.

Ultra-wideband antennas are smart, forward-thinking network modernization solutions that enable sharing of tower-top equipment while maximizing capacity and performance.

4. 4.3–10 CONNECTOR ECOSYSTEM AND ADAPTERS

The additional inputs on modern antennas lead to a related challenge: the increasing density of connections at the tower top. Traditional DIN connectors are adequate when properly torqued, but installation errors are not uncommon and they can become a performance bottleneck. The likelihood of installation error only rises as more connections are packed into small spaces, which is why the new 4.3-10 connector standard is gaining such wide adoption.

Not only do 4.3-10 connectors provide a smaller form factor; they're also easier to work with and less prone to installation errors. 4.3-10 connectors also support all current and soon-to-be-released bands, providing a degree of future-proofing in their design.

There now exists an entire ecosystem of 4.3-10 solutions as well as adapters that allow for partial or phased deployment. In any event, the new standard offers the promise of better connectivity at the tower top without increasing the amount of space or weight required to do so. It also reduces the potentially costly consequences of installation errors.

5. PIM CONTROL AND INTERFERENCE MITIGATION

Poor connections can be a source of PIM, but there are many others, such as moisture infiltration, corrosion, cable damage and so forth. To keep PIM under control and limit its effect on network capacity, it's important to employ solutions from a single manufacturer whenever it's practical to do so. Quality manufacturers offer PIM-tested components and superior compatibility, which helps obviate PIM sources in the hardware design.

To help reduce the chances of PIM introduction elsewhere, it makes sense to use installers who are familiar with the manufacturer's solutions and are experienced with deploying them. Many top manufacturers offer training and certification programs to installers, which helps ensure that error-induced PIM doesn't arise. As a side benefit, using such certified installers can also mean improved warranty coverage from the manufacturer.

Then there are sources of external interference, such as crowded co-siting arrangements and adjacent sectors. Towers aren't the only things growing more crowded—the landscape itself is becoming more densely covered. Inclusion of interference mitigation filters (IMFs) in the RF path can help ensure that no interfering signals get past the antenna. By keeping intended bands clear, IMFs improve capacity (and therefore revenue) without the need for increased signal power, reducing OpEx.

Combined, these five strategies can help simplify tower complexity, accelerate time to market, and reduce both CapEx and OpEx for operators. While these measures make good business sense today, in a couple of years they will become absolutely essential as new spectrum is introduced and 5G standards are finally published.

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