MOBILE DEV&DESIGN

Antennas Are The Answer

Dec 9, 2008 11:48 AM, By **Kent Heath**, Vice President of Marketing and Business Development, Ubidyne Inc.

An essential part of any design, today’s antennas can meet the “cost per bit” challenge of next-generation wireless networks.

With the introduction of HSxPA 3G service, cellular network operators have begun to introduce broadband wireless service models that are increasingly competitive with traditional fixed-line DSL or cable access plans. In some markets, like Australia, operators are now competing aggressively both with each other and with the fixed-line networks.

These operators are offering flat-rate data plans that let consumers purchase broadband services at rates that are similar to or lower than fixed-line, but with the added benefit of “anytime/anywhere” mobility. This is driving an explosion in wireless data consumption, resulting in dramatic data traffic growth but with a much lower increase in revenue improvement for the operators.

Because of the popularity of the new fixed-price data plans, network capacity limitations are quickly becoming a concern in dense urban areas, driving operators to spend heavily on “infill” solutions. At the same time, consumers are expecting the same service in rural areas that they experience in the city, requiring increasing capital expenditure (CAPEX) spending for coverage even where density is low.

To compete successfully and profitably, network operators need to adopt next-generation broadband wireless technologies like WiMAX and Long Term Evolution (LTE) that can offer cost per second or cost per bit that scales down faster than ever before (Fig. 1). Yet this demands advanced RF and antenna techniques, and some significant challenges lie ahead when it comes to deploying these new techniques in a real network environment.

More Antennas are Better

Next-generation wireless systems require advanced antenna systems to deliver higher data rates at increasingly lower cost points. In fact, at recent industry conferences, “the more antennas, the better” has become a common theme within some groups focused on “3.9G” network development and standardization. Proposed techniques include beam control, diversity solutions, multiple-input multiple-output (MIMO), and other active antenna schemes.

Currently shipping in volume today, remote electrical tilt (RET) systems are electromechanical systems that enable the network operator to adjust the passive antenna’s vertical orientation in response to changes in the surrounding environment and local call traffic patterns. They’re good tools for network optimization compared to former fixed-tilt or older mechanical tilt systems

However, the transmit (Tx) and receive (Rx) tilt angles must always be aligned, so there is a suboptimal tradeoff between Tx and Rx performance in the network even when these systems are utilized correctly. Further tradeoffs will have to be made with new multistandard (GSM/UMTS/LTE) RF platforms if a single passive antenna is used for all carriers, forming a significant challenge for network planners.

Designers have considered advanced adaptive tilt systems—systems with discrete, complex electromechanical systems providing differentiated tilt by carrier, standard, or frequency—to overcome the need to trade off Tx versus Rx tilt optimization and to support dedicated tilt-by-standard in multistandard/equipment sharing applications with specialized antennas.

These systems may provide significant RF performance benefits by providing capability for a much more flexible vertical tilt angle solution for each cell within the operator’s network. But this comes at the cost of complex added hardware and software that need to be integrated by the OEM basestation supplier and placed on the rooftop or at the cell site, increasing operational expenses (OPEX) as well as CAPEX costs.

Beam forming/steering systems are routinely used in other applications. In fact, azimuth control for changing the direction of the beam within the cell site is now common in TD-SCDMA and WiMAX applications. Multicolumn antenna systems with multiple RF Tx and Rx signal paths and complex control systems to monitor and optimize the beam shape on either a subsector or per-user basis are commonly proposed. These systems have been well accepted in networks where the added cost and complexity are compensated by added capacity and throughput required by the operator’s service model.

Diversity schemes can be implemented in many domains, e.g., space, time, or frequency. The basic idea for all approaches is to transmit the same information over at least two independently fading channels. At the receiver, the independence in fading significantly reduces the risk that all channels are degraded concurrently.

Today, in most cellular network deployments, receive path diversity is already common with an independent receiver connected to each of the antenna’s two orthogonal polarizations. Yet due to the added cost of increasing the number of expensive amplifiers, Tx path diversity has rarely been employed.

Already commonly deployed in Wi-Fi applications for in-building signal enhancement, MIMO systems are now being seriously considered for commercial cellular network deployments, as well as with new “3.9G” WiMAX and LTE systems where high data rates are a key market driver.

Although considered too expensive for commercial application in the past, the throughput advantages of MIMO systems are now generally accepted based on the work of the LTE/System Architecture Evolution Trial Initiative (LTSI), which has shown downlink peak rates of up to 326 Mbits/s with 4x4 MIMO systems (Fig. 2).

Find this article at:
http://www.mobiledevdesign.com/tutorials/antennas_improve_broadband_wireless_service-1209

Click to Print

SAVE THIS | EMAIL THIS | Close

☐ Check the box to include the list of links referenced in the article.