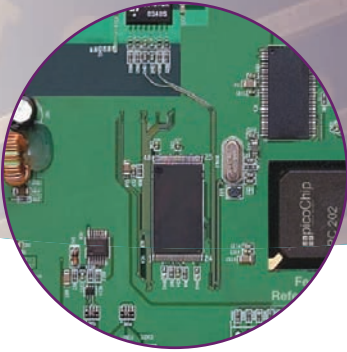


Solutions for

Femtocell Manufacturing

**Accelerating delivery of quality,
low-cost femtocells to market**

Application Note



Overview

Femtocells (3GPP Home Node B for W-CDMA/HSPA and enhanced Home Node B for LTE) are low-power wireless access points that connect standard mobile devices to a mobile operator's network via residential DSL or cable broadband. While a compelling entrant into the broadband CPE (Consumer Premises Equipment) market dominated by Wireless LANs, femtocells are forcing manufacturers to confront a number of test considerations; namely cost, quality and volume. Early femtocells are costly (roughly \$100-\$300), multiformat (e.g., may require GPS, support for W-CDMA, LTE or WiMAX™, etc...), operate in the licensed spectrum, and face stringent conformance requirements. Achieving high volumes and driving down cost requires every aspect of the manufacturer's design through production to be streamlined. The ultimate goal is to reduce test times while maintaining quality, a difficult task since some designs will be unstable at first launch and require rigorous conformance testing and verification of complex functionality (e.g., network sniffer mode, Rx sensitivity) and new formats. Addressing these constraints demands fast test equipment with just enough performance to enable rigorous verification early in production and less testing as volumes increase.

Problem

As service providers stand ready for mass deployment of femtocells, manufacturers now face unprecedented challenges to quickly deliver quality, low-cost devices to market. Limiting test is one way to improve production throughput. Since femtocells are subject to stringent requirements on interference, compatibility tests between the device and the network (e.g., self-organizing network, handovers), and adherence to the 3GPP's rigorous verification and conformance document, limited testing is not an option—at least not during early production. As femtocell volumes rise, manufacturers may continue to run a large number of tests to get the quality they need, with long test times, opposing the manufacturers desire to streamline production and drive down cost. Manufacturers may also want to produce multiple femtocell products (e.g., a WiMAX and a W-CDMA femtocell), demanding separate test equipment and further driving up cost.



Agilent Technologies

Solution

Achieving comparable test times with Wireless LANs under these conditions will be challenging, especially given their 1 to 2 minute test time benchmarks. Femtocell test times may be 5 to 10 times greater. Manufacturers can successfully navigate this challenge by employing low-cost test equipment that easily scales to meet their throughput and test requirements without compromising performance and quality. Support for multiple formats is also important as it enables manufacturers to leverage the same test equipment to produce multiple femtocell products on the same line.

The Agilent MXG vector signal generator and Agilent EXA signal analyzer provide a general-purpose RF test solution designed to help manufacturers quickly deliver quality, low-cost femtocells to market. Fast measurement times and switching speeds, and “just enough performance” significantly reduce test times and enable manufacturers to achieve the quality they demand. Scalability allows the tools to be tailored to meet the manufacturer’s changing test needs. They can be used to perform rigorous validation early in production and scaled down as volumes increase and the manufacturer’s confidence in the design grows. Flexible, multiformat measurement capabilities ensure that both current and future formats will be supported.

Key features of the Agilent MXG signal generator and EXA signal analyzer in support of these capabilities include:

Fast Measurement Times/Switching Speeds

- MXG’s fast switching option provides fast frequency, amplitude and waveform switching in either SCPI ($\leq 1.2 \mu\text{s}$) or list sweep ($\leq 900 \mu\text{s}$) mode (Figure 1).
- EXA’s fast measurement speed features <75 ms mode/measurement switch and <14 ms ACLR with fast method.

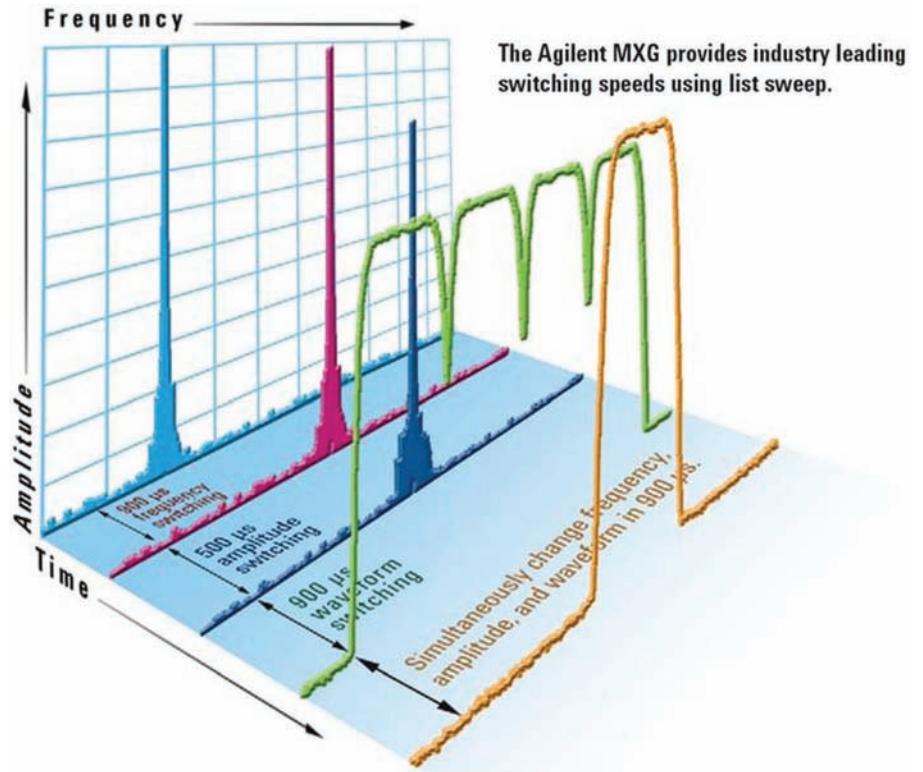


FIGURE 1: MXG switching speed.

Just Enough Performance

- MXG features high performance (output power to 23 dBm, ACLR up to -73 dBc with W-CDMA TM1 64 DPCH and EVM of 0.8% with W-CDMA 1 DPCH).
- MXG offers a full suite of optional performance features including, frequency range, dynamic range, and internal baseband generator rates.
- EXA provides -73 dB (adjacent) and -76 dB (alternate) as W-CDMA ACLR dynamic range with noise correction turned on.
- EXA provides support for multiple frequency ranges (9 kHz to 3.6, 7.0, 13.6, and 26.5 GHz), an internal fully calibrated pre-amplifier option up to 3.6 GHz, standard analysis bandwidths of 10 or 25 MHz, and an optional 1-dB electronic attenuator to 3.6 GHz.

Scalability and Flexibility

- MXG’s Signal Studio offers a suite of flexible, easy-to-use, standards-based signal creation software including W-CDMA, HSPA+, LTE, WiMAX, and more.
- MXG’s waveform licensing allows manufacturers to license individual waveforms when full applications are not required.
- EXA offers a wide range of standards-based measurement applications running inside the instrument.
- EXA features a set of standard one-button power measurements for characterizing signal quality (e.g., ACLR, channel power, occupied bandwidth, spectrum emissions mask, CCDF, burst power, and spurious emission).

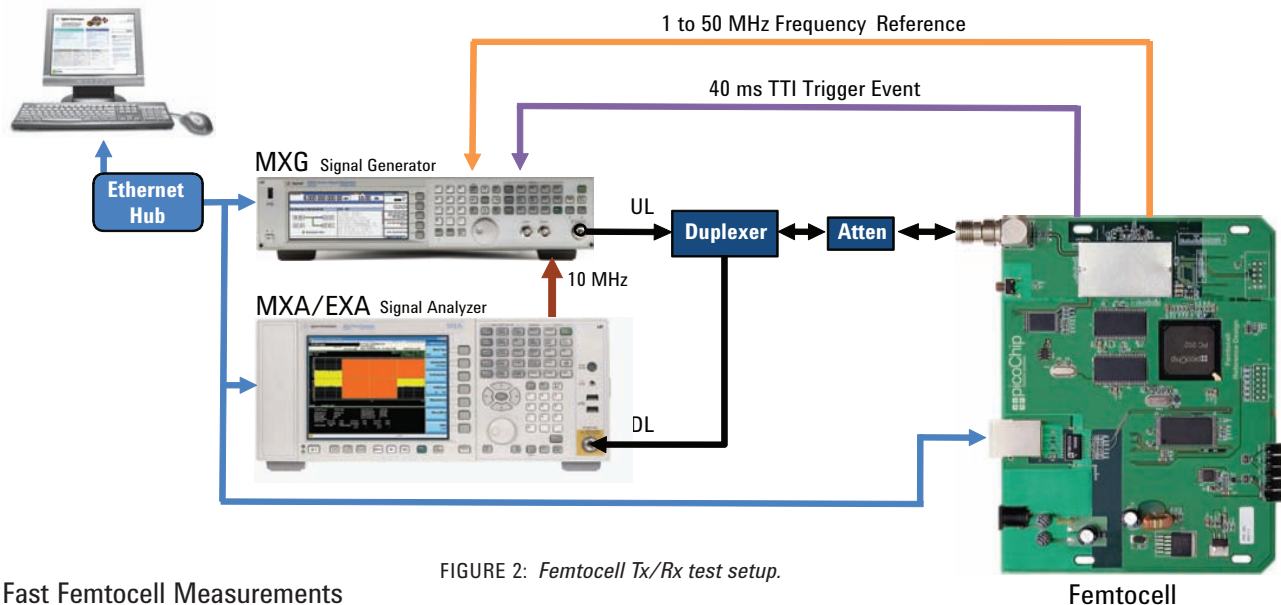


FIGURE 2: Femtocell Tx/Rx test setup.

Fast Femtocell Measurements

A typical femtocell Tx/Rx test setup with the Agilent MXG and EXA is shown in Figure 2. With this setup, manufacturers can perform rigorous femtocell measurements to ensure conformance to the 3GPP 25.104 ver 8.5.0 2008-12 standard. Example measurements include maximum output power, power dynamic range, code domain power, EVM, peak code domain error, frequency error, spectrum emission mask, receiver sensitivity, and more. Femtocells with integrated GPS receivers may drive additional go/no go production testing to confirm proper integration of the GPS receiver into the femtocell. Contact Agilent for more information on GPS testing with the Agilent MXG signal generator.

Figure 3 provides an example of a key measurement performed using the setup in Figure 2. This same setup is used to perform static referenced sensitivity testing to verify conformance to the receiver sensitivity level (-107 dBm) and BER (not to exceed 0.001) specified in 3GPP 25.104 ver 8.5.0 2008-12. Here the femtocell provides the external reference input to the MXG or EXA directly. Synchronization with the femtocell must be obtained prior to making the measurement. Information on this procedure is available in Agilent's N7600B online documentation.

Summary of Results

Testing femtocells during production is a challenging task—one that can be greatly simplified using the MXG signal generator and EXA signal analyzer. Their fast measurement speed, “just enough” performance and scalability deliver both the cost/time savings and quality that manufacturers demand. Using these tools manufacturers are now able to quickly deliver quality, low cost femtocells to market and compete more effectively in the broadband CPE market space.

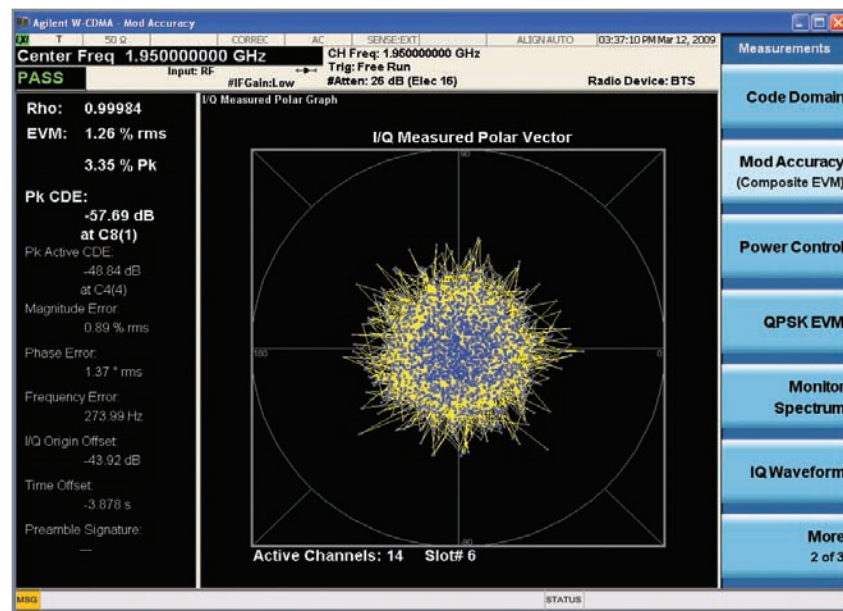


FIGURE 3: EVM analysis is used to check the distortion of the RF signal transmitter (e.g., multiple channels/modulation transmissions).

About the Power of X

The Agilent MXG Signal Generator and MXA Signal Analyzer are key products in Agilent's comprehensive Power of X suite of test products. These products grant engineers the power to gain greater design insight, speed manufacturing processes, solve tough measurement problems, and get to market ahead of the competition.

Offering the best combination of speed and scalability, and created and supported by renowned worldwide measurement experts, Agilent's X products are helping engineers bring innovative, higher-performing products to emerging markets around the globe.

To learn more about Agilent's suite of X products please visit: www.agilent.com/find/powerofx.

Related applications

- Designing and Testing 3GPP W-CDMA Base Transceiver Stations

Related products

- MXG N5182A Vector Signal Generator
- ESG E4438C Vector Signal Generator
- PXB MIMO Receiver Tester
- Signal Studio Software for signal creation (e.g., W-CDMA/HSPA, LTE, WiMAX, GSM/EDGE, cdma2000, 1xEV-DO, TD-SCDMA, WLAN and more)
- EXA Signal Analyzer
- MXA Signal Analyzer
- Advanced measurement applications for X-Series (e.g., W-CDMA/HSPA, LTE, WiMAX, GSM/EDGE, cdma2000, 1xEV-DO, TD-SCDMA, WLAN and more)



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