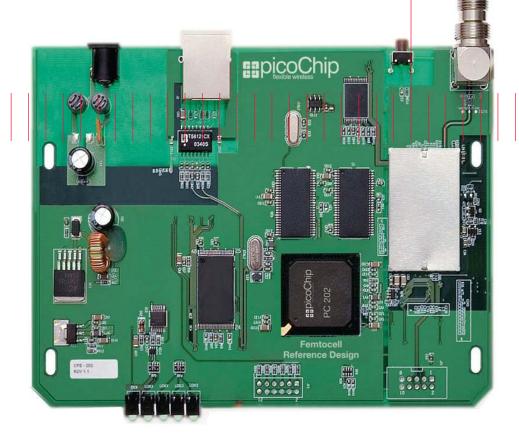# Keysight Technologies
Solutions for Femtocell Manufacturing

Accelerating delivery of quality,

low-cost femtocells to market

Application Note

KEYSIGHT
TECHNOLOGIES

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.

Solution

Achieving comparable test times with Wireless LANs under these conditions will be challenging, especially given their 1 to 2 minute test time bench marks. 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 Keysight Technologies, Inc. MXG vector signal generator and Keysight 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 Keysight 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 (≤1.2 µs) or list sweep (≤900 µs) mode (Figure 1)
– EXA's fast measurement speed features <75 ms mode/measurement switch and <14 ms ACLR with fast method.
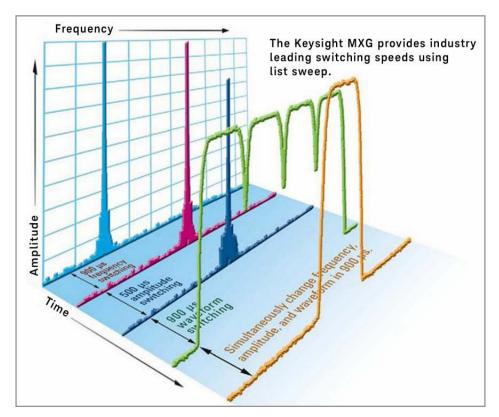

Figure 1. MXG switching speed

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).
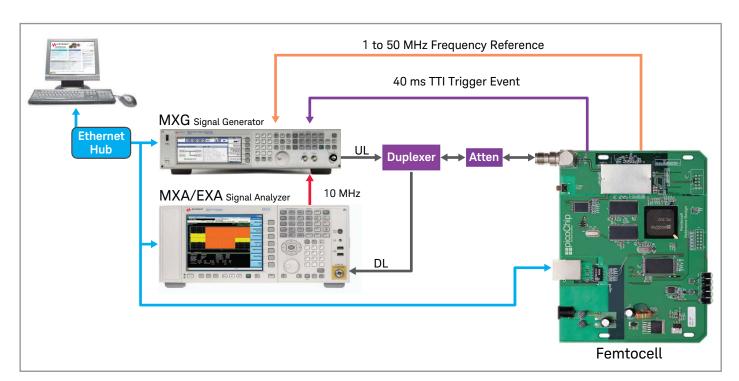

Figure 2. Femtocell Tx/Rx test setup

Fast Femtocell Measurements

A typical femtocell Tx/Rx test setup with the Keysight 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 Keysight for more information on GPS testing with the Keysight 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 Keysight'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.

The Power of X

The Keysight MXG Signal Generator and MXA Signal Analyzer are key products in Keysight'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, Keysight's X products are helping engineers bring innovative, higher-performing products to emerging markets around the globe.

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

Related Applications

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

Related Keysight 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)

Signal Studio Software

MXG N5182A Vector Signal Generator

myKeysight

www.keysight.com/find/mykeysight

A personalized view into the information most relevant to you.

www.axiestandard.org

AdvancedTCA® Extensions for Instrumentation and Test (AXIe) is an open standard that extends the AdvancedTCA for general purpose and semiconductor test. Keysight is a founding member of the AXIe consortium.

www.lxistandard.org

LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.

www.pxisa.org

PCI eXtensions for Instrumentation (PXI) modular instrumentation delivers a rugged, PC-based high-performance measurement and automation system.

Three-Year Warranty

www.keysight.com/find/ThreeYearWarranty

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.

Keysight Assurance Plans

www.keysight.com/find/AssurancePlans

Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.

www.keysight.com/quality

Keysight Technologies, Inc.
DEKRA Certified ISO 9001:2008
Quality Management System

Keysight Channel Partners

www.keysight.com/find/channelpartners

Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

WiMAX, Mobile WiMAX, WiMAX Forum, the WiMAX Forum logo, WiMAX Forum Certified, and the WiMAX Forum Certified logo are US trademarks of the WiMAX Forum, cdma2000 is a US registered certification mark of the Telecommunications Industry Association.
ATCA®, AdvancedTCA®, and the ATCA logo are registered US trademarks of the PCI Industrial Computer Manufacturers Group.

www.keysight.com/find/powerofx

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at:
www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	0800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
(BP-06-23-14)

KEYSIGHT
TECHNOLOGIES