

Software-Defined Multi-Device Parallel Testing of Small Cells

Small-cell device testing can be optimized by utilizing PXI architecture with advanced software.

GROWTH IN THE DEPLOYMENT of small cells continues to intensify the test challenges faced by original equipment manufacturers (OEMs): They need to carry out manufacturing test at higher volumes and within tighter budgets. This article describes how automated multi-DUT testing combined with intelligent sequencing enables efficient testing of small-cell devices. Specifically, it will show how small-cell manufacturers can align and verify up to four devices in parallel on a single RF channel, achieving substantial time and cost savings.

The choice of a standard tester with customizable test software also offers significant benefits compared with either the development of an in-house automated-test-equipment (ATE) system or outsourcing development to a third-party system integrator. Not only does it lower integration time, cost, complexity, and technical risk, but it reduces resources required for ongoing support and maintenance.

Recognizing the combined challenges faced by OEMs of ever-increasing product complexity, acute commercial pressures, and the need to maintain test engineering competen-

cies, Cobham Wireless developed a family of configurable hardware and software tools based on an industry-standard PXI modular architecture. The most recent addition is the 3041 Small Cell RF Tester, which allows small-cell OEMs to run fast multi-device RF alignment and RF performance verification measurements. Advanced test software makes this possible—it manages the utilization of the equipment to ensure the shortest possible test times.

SOFTWARE

The small-cell tester uses the PXI Maestro test-sequencing software suite. The software is designed to accelerate test system development and reduce test time, which in turn lowers test costs. A schematic of its architecture is shown in the figure.

Testing up to four devices in parallel can achieve productivity gains approaching 400%, and test engineering costs are just about eliminated since customer integration effort is virtually nonexistent.

REDUCING TEST TIME

PXI Maestro reduces test time and, therefore, helps maximize production throughput thanks to highly efficient test flow management. It includes a multi-threaded intelligent sequencer that's designed to take advantage of modern multicore computers. This helps ensure that different tasks within a measurement sequence or measurement step are overlapped or executed concurrently, rather than sequentially, as is the case with conventional instrumentation.

Where multiple RF measurements are required for a single test condition, intelligent data capture is used to perform the tests in parallel on the same captured data. Acquiring a signal for measurement and processing results are decoupled, which means signal captures can be queued for processing, leading to faster test times.

It has been demonstrated that a single-channel 3041 Small Cell RF Tester can run a full calibration and test plan for LTE, WLAN, and GPS—including custom diagnostic tests—on two devices in only eight minutes. Comparatively, an existing ATE installation with two RF channels takes 12 minutes to perform the same function. Thus, the 3041 solution running PXI Maestro reduces test time by 33% while requiring 50% less test hardware.

TESTING DEVICES IN PARALLEL

No reconfiguration or additional hardware or software elements are needed when testing multiple devices in parallel with a single tester. The tester can be configured to synchronously test between one and four devices connected in parallel. Synchronous testing is able to provide higher throughputs than sequential testing, and can be particularly beneficial for time-consuming receiver sensitivity test cases, or where device initialization times are long in comparison to validation times.

Production process flow can be further improved by testing devices in two groups of two, with the first group undergoing test while the operator loads the second group into the test fixtures. Such an approach can prove particularly efficient in cases where device handling times represent a significant portion of the overall test cycle, since it can maintain an even flow rate into and out of the test station.

INTEGRATION COMPLEXITY

Developing, adapting, and optimizing RF test systems to cope with the constant evolution in wireless device complexity is a challenge to production-test system engineers. It is time-consuming, and requires highly skilled staff with a detailed knowledge of their test tools and the communications control interface to third-party chipset suppliers. An optimized ATE solution that is ready for testing multi-standard devices, and

is software-upgradable, simplifies the process of test system integration, ultimately helping to accelerate new product introduction and saving on cost of ownership.

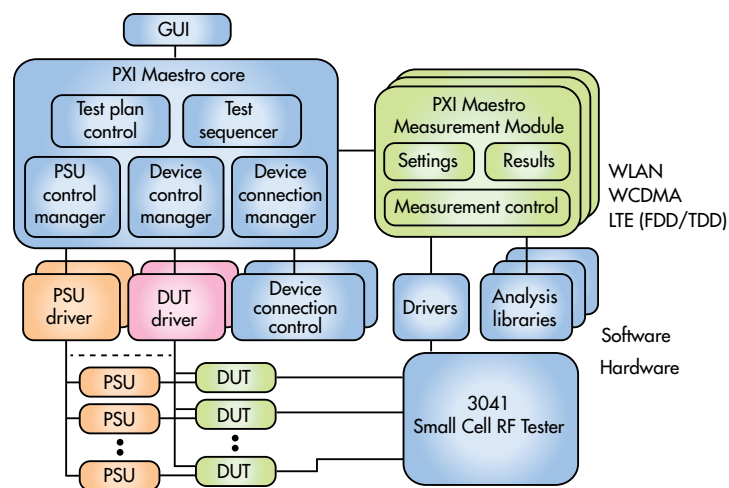
The simple graphical user interface (GUI) of PXI Maestro allows the test engineer to generate and execute test plans, and make application changes without any knowledge of how to control instrumentation or the device under test. Consequently, it eliminates the need to develop and maintain test-system code. All tester and device control commands are executed as an uninterrupted measurement sequence with no further user input. Measurement results are displayed as they are executed, with a final test report available in a user-friendly format.

STANDARDS

The tester can perform accurate calibration and standards-compliant RF performance verification of LTE, UMTS, or WLAN transceivers, as well as other RF broadcast receivers such as GPS or Network Listening. It comes with a test sequencer fully integrated with device control for the Qualcomm FSM99xx family of devices, and can be easily expanded to support devices from other silicon vendors. The test system achieves all of this while retaining the inherent flexibility of its PXI modular architecture, which allows it to expand test coverage beyond RF functionality.

CONCLUSION

The 3401 Small Cell RF Tester eliminates the need for costly and risky in-house test-system development. The cost-effective, production-ready solution easily adapts to OEMs' specific test needs and reduces the time required to ramp up to high-volume production. Moreover, it substantially shrinks test times by employing parallel testing and intelligent sequencing. **MW**



PXI Maestro software is a high-level architecture that helps reduce test times.

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