Turning Ideas Into Validated Products—Faster

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Due to the integration of RF, microwave and digital technologies in many high-performance systems, solutions that support standards-based technologies are needed.

For test equipment manufacturers and their customers, one trend is unavoidable: the deepening integration of the RF, microwave and high-speed digital technologies used inside today's electronic systems, especially mobile devices. To satisfy end-user demand for always-on access and fast data rates, mobile devices need powerful processing capabilities, dependable wireless connectivity and long battery life. These needs are driving new developments in four major areas: faster chipsets, buses and memory; multiple radios that use multiple standards; new antenna techniques; and low-power operation.

Dealing with these trends and developments—now and in the future—has implications for the organizations that design and manufacture modern systems as well as those that install and maintain such systems.

Equipping Development Teams for Success

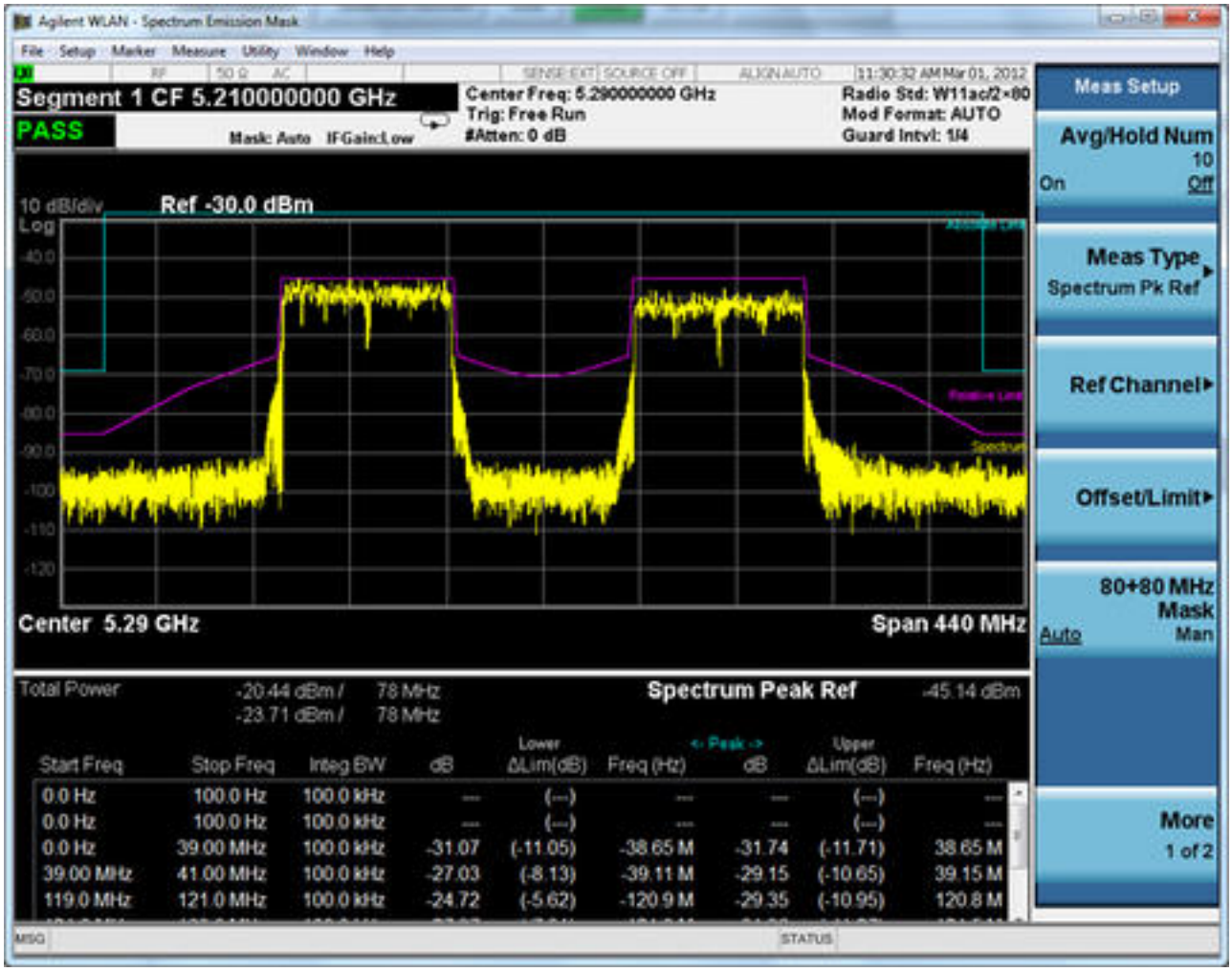
Depending on the industry, time-to-market or time-to-deployment is a key metric. For developers, isolated design and test tools are necessary but insufficient. The ability to rapidly transform a product concept or idea into a validated product requires solutions that support specific needs—and the foundation is software and instrumentation working together in harmony. To meet present and future needs, software must go beyond design and simulation to address areas such as signal generation, signal analysis and EMI behavior.

Enabling these capabilities requires connections between software and a variety of instrument types. For example, signal creation benefits from links to arbitrary waveform generators (AWGs) capable of producing wide bandwidths and high resolution simultaneously, and links to vector signal generators (VSGs) with I/Q modulation capabilities. Signal characterization requires spectrum or signal analyzers that offer analysis bandwidths of up to 160 MHz today and even wider in the future.

To meet evolving requirements, connected hardware should provide scalable performance and essential capabilities for stimulus, response and analysis: signal generation, waveform characterization, signal analysis, component characterization (i.e., vector network analysis), and logic and protocol analysis. All these must be capable of addressing a wide range of communication or digital formats.

As an example, consider a solution for IEEE 802.11ac. The standard supports RF bandwidths up to 160 MHz, MIMO antenna techniques and high-density 256QAM

modulation. Software tools must enable engineers to view and troubleshoot all 802.11ac modulation formats, from BPSK to 256QAM, as implemented in mobile and stationary devices (Figure 1). To thoroughly test receivers and transceivers with realistic signals, VSGs and AWGs need to support these same bandwidths, formats and techniques (e.g., MIMO). For real-world testing of transmitters, tools such as signal analyzers and vector signal analysis (VSA) software must provide the necessary demodulation capabilities plus essential measurements of signal quality—such as EVM—for the same bandwidths and formats.



Supporting Cost-Effective Manufacturing

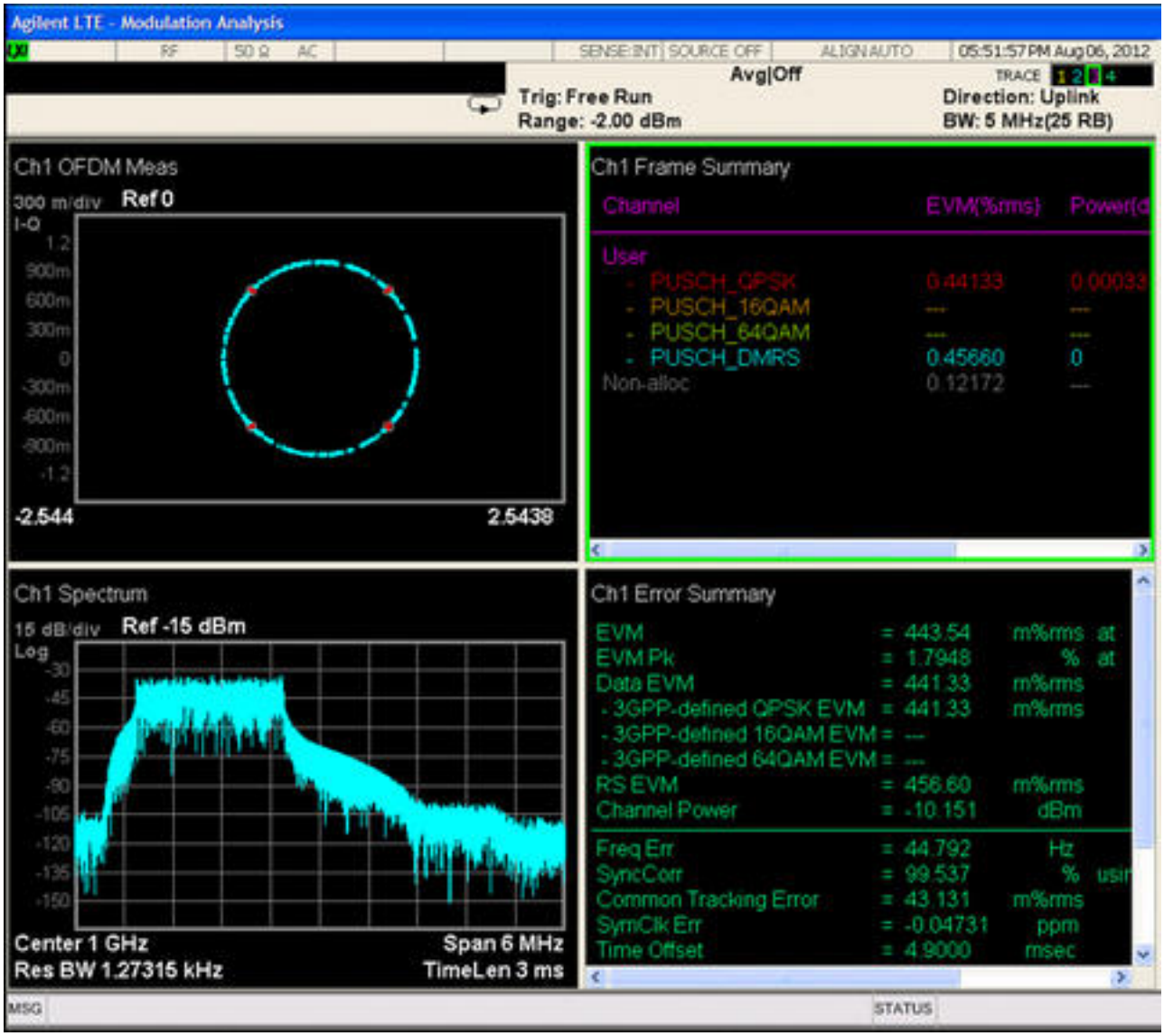
In the production of mobile devices, one of the key issues is reducing capital expenses and the cost of test while satisfying three key needs: support multiple radio formats (new and existing), enable fast test development and reduce overall test time. Instruments such as wireless communication test sets or “one-box testers” (OBTs) are designed to help manufacturing organizations meet these needs.

This is becoming increasingly challenging. As an example, the list of formats supported by a single device is long and getting longer: LTE, LTE-Advanced, HSPA+, W-CDMA/HSPA, cdma2000/1xEV-DO, GSM/EDGE/EDGE-EVO; WiMAX; Wi-Fi; Bluetooth®; and GPS/GNSS. As the cellular infrastructure evolves, mobile devices will be expected to support a range of new and legacy formats.

The ability to accelerate test development depends on software that simplifies the creation of increasingly complex test plans. To support OBTs and other instruments that produce signals for multiple radio formats, software must also support efficient creation of the standards-based waveforms needed to test receivers and transceivers (Figure 2). As modulation formats continue to become more complex, the signal-creation software will need to enable a variety of possible signal impairments a receiver or transceiver may face during real-world operation.

Increasing device complexity can make it more difficult to achieve shorter test times. The ability to meet present and future throughput goals requires capabilities such as multiple measurements from a single data capture. As antenna methods evolve, it is becoming increasingly necessary to efficiently automate the testing of MIMO devices.

Finally, doing all of this while reducing capital investment depends on reliable measurement equipment that supports lower-cost non-signaling test. It also benefits from scalable hardware and software that supports the evolution of technologies and test modes.



Ensuring Efficiency and Productivity in I&M

During installation and maintenance (I&M) of RF and microwave infrastructure equipment, field personnel depend on handheld instruments that, in one unit, provide a wide range of essential capabilities that enhance readiness in unpredictable situations and ensure precise measurements in harsh conditions (Figure 3). Example use cases include inside a BTS during a snowstorm, aboard a ship sailing rough waters and at a satellite trailer in a sandstorm.

Handhelds that provide bench-caliber results help operators optimize their infrastructure and thereby ensure subscriber satisfaction and loyalty. In commercial applications, this includes activities such as checking the alignment of antennas in point-to-point microwave links and validating cables and antenna systems in aircraft.

To maximize the effectiveness for a range of user skill levels, new generation handheld instruments include operating modes that are flexible enough to meet the needs of novice and expert users. To increase efficiency, the latest handhelds can be configured with multiple capabilities in a single unit: cable and antenna test, spectrum analysis and vector network analysis. Additional built-in capabilities such as a tracking generator, power meter, DC source and even GPS reduce the number of items I&M personnel need to carry into the field.

Interestingly, these handheld instruments increasingly reflect the main theme of this discussion: the deeper integration of RF, microwave and high-speed digital technologies in a single device that must provide outstanding battery life. Thus, those instrument manufacturers that offer advanced handhelds are looking for software and hardware tools that will help them overcome the same issues their customers face.

Many of the solutions described above have applications that go beyond consumer devices: the integration of RF, microwave and digital technologies is also occurring in high-performance systems used in aerospace, defense and beyond. As a result, design and test solutions that are flexible enough to support standards-based technologies as well as customized or proprietary approaches will benefit any organization—development, manufacturing, installation or maintenance—that is seeking to accelerate device creation, production and deployment. The net result is a greater likelihood of ongoing success for users in day-to-day operation.

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