Brainstorm: Test & Measurement

Edited by Jason Lomberg, Technical Editor

How are trends in wireless electronics effecting test and measurement?

Pamela Aparo, Analog Devices, Inc., www.analog.com **[1]**

The proliferation of RF/wireless communications in everything from video games to patient monitors and automobile collision avoidance systems is fueling the need for a new breed of RF test equipment. This trend is being driven by several factors, each of which has its roots in the sheer number and diversity of end applications.

• Wireless systems must pass a series of functional tests, but because so many new RF designs are for relatively low-cost devices, manufacturers must find ways to quickly verify performance without increasing end-system cost.
• The growing number of wireless applications demands that engineers with little or no prior RF design experience have access to easy-to-use and relatively foolproof test equipment. Field repair engineers are in the same position, which means that the user interface of today's test and measurement equipment is becoming even more important.
• Equipment must be flexible. Test Engineers do not have the luxury of buying different test platforms for every test they run. The flip side is that the very features that make a test platform more flexible can render it more complicated to use.
• The popularity of wireless electronics is creating demand for higher data rates. This is driving new communications protocols that require higher-performance equipment in the RF lab.

As RF design and test considerations are being pushed into the hands of technicians and repair engineers the industry needs to rethink its approach to system design by rebalancing the features and functionality they offer.

Janine R. Whitacre, Agilent Technologies, www.agilent.com **[2]**

The biggest trend in wireless communications technology is the push for speed. Today's most popular applications such as social networking, video streaming, and Internet searching all require fast data downloads—the faster, the better. To get this speed, wireless networks require more spectrum to implement high data throughput, new technologies such as OFDMA and advances in antenna technology with techniques such as MIMO and beamforming.

Getting all these new technologies to work correctly is where testing comes in. Test equipment has to cover the higher bandwidths at which wireless devices work. Test equipment also has to cover many different pieces of the spectrum, because the industry is maximizing every bit of space. And because RF interference can severely impact the performance of high-speed wireless devices, test equipment must be able to look beyond the channel frequencies specified for the devices under test. To measure data throughput, test equipment has to operate at the same speeds as the wireless devices. Test equipment suppliers such as Agilent provide engineers working on wireless product design and manufacturing with flexible solutions such as up-to-the-moment, standards-based software that can be downloaded to hardware instrumentation and modular platforms.

Todd Hanson, Honeywell Sensing & Control, http://sensing.honeywell.com **[3]**

Testing and validation are essential to ensure that industrial wireless systems can offer the necessary robustness and reliability expected by customers. In extremely harsh industrial environments, the applications do not provide any latitude for failure by the switches and sensors used to control and monitor heavy equipment and machinery. Add the wireless component, and the potential for things going wrong increases. That is why ongoing wireless testing and validation are so

important and need to be comprehensive.

To ensure reliability, wireless switches and sensors are tested for communication range, power levels and resistance to interference from other devices in the 2.4 GHz radio range. In addition, these devices are tested to work without failure in harsh environments - in rain, snow and extreme heat or cold. Such wireless devices often operate in corrosive environments and are also tested to resist the effects of smoke, fumes and paint.

To ensure security, wireless devices are tested to make sure they provide a high degree of immunity from radio hacking. Power supply and battery life are tested for reliability, including monitoring of the battery power levels under various environmental conditions. Users want to know well in advance when it is time to change a battery, so they can schedule such replacement to coincide with other maintenance tasks.

For wireless devices to be sold or utilized in machines that could be shipped globally, the necessary communication agency compliance approvals need to be obtained, even if the wireless devices operate in the so-called unlicensed band. Compliance testing is necessary to ensure the wireless devices have the necessary U.S. and international wireless certifications. If you sell to a global market, your wireless products have to be tested and certified for all these markets. The E.U., Australia, and Asia Pacific countries all have their own agencies and compliance procedures.

Wireless is an enabler, but there is much more involved than simply embedding a wireless radio into a sensing or switching device. When looking for wireless devices, testing is important. Make sure you buy from a reputable company that has done all the necessary regulatory, environmental and reliability testing.

Bob Green, Keithley Instruments, www.keithley.com **[4]**

The growth in wireless electronics is leading to a similar surge in the need for systems capable of testing them. Interfacing these wireless components with test instrumentation demands RF/microwave switching systems that can adapt rapidly to address changing wireless standards.

The automotive industry is one business that’s obviously committed to wireless technology in a big way. Each model year brings new systems that employ RF/microwave signals to transfer information, ranging from tire pressure and oil

quality monitors to sophisticated telematics, such as emergency warning systems, GPS navigation, integrated hands-free cell phones, wireless safety communications, and intelligent parking assist systems. Some are even designed to communicate with the vehicle operator remotely via a smartphone app.

Tablet computers also present particular challenges for designing wireless switching for T&M. For example, the most basic model of the iPad 2 incorporates several wireless technologies, including Wi-Fi (802.11 a/b/g/n) and Bluetooth 2.1 + EDR. The Wi-Fi+3G version adds UMTS/HSDPA (Quad band–850, 900, 1900, 2100 MHz) and GSM/EDGE (Quad band–850, 900, 1800, 1900 MHz). The Wi-Fi+3G version for Verizon also adds CDMA EV-DO Rev. A (800, 1900 MHz).

What does this mean for T&M? That tomorrow’s test system designers will need to work in closer cooperation than ever with their switch system suppliers to coordinate testing of these multiple wireless technologies.

 **Manny Gutsche, RF Industries,** www.rfindustries.com **[5]**

One trend is the increased need to test for unwanted interference at wireless communications sites. The expansion in wireless infrastructure has lead to a proliferation of transmitters and receivers at a given communications site and the byproduct of signal mixing interference called intermodulation distortion (IMD). Most communication sites are shared by many users with collocation on the same tower common. In many instances, testing is required to certify that installation or modification of wireless communication sites will not contribute to an interference problem. Once thought to be primarily caused by active components in the communications systems, intermodulation interference from passive components also know at passive intermodulation (PIM) can be a contributing factor.

The design, manufacture and installation of Passive components such as connectors and antennas can be critical in the prevention of PIM. Simple factors like the plating of connectors can affect the performance of a communications system. RF Connectors plated with ferrous materials like nickel are conducive to PIM generation. Communication site installers and equipment providers are more educated on the causes of intermodulation and use testing at a component and system level to reduce and eliminate the causes of interference.

Alan J Lowne, Saelig, www.saelig.com **[6]**

The flexibility and cost savings of untethered technology are driving widespread wireless adoption in many applications, including test and measurement, mostly at modest data rates. Measuring data such as temperature, humidity, vibration, strain, fluid levels, acidity, and machine operation can now utilize wireless sensors where a wired infrastructure is not feasible, such as in remote, hostile or moving environments. Wireless sensors can be embedded within machinery, where wired sensors are not possible due to cost, limited mobility, or can cause maintenance issues.

But “wireless” is still not the same as “wired”. Dropped calls are a tolerable cell-phone trade-off, but not for data acquisition. Wireless sensors are gaining popularity in the 900 MHz and 2.4 GHz ISM bands using spread spectrum and frequency hopping technologies, with WiFi, Bluetooth, and Zigbee offering some data security; Bluetooth Low Energy and Low Power WiFi will become increasingly significant. Range is still a big issue unless great care is taken with system design. Datasheets usually quote unreal “open-field” range specs. Try a system in situ, and be aware of (or eliminate) interfering signals or path disturbances. Wireless sensor networks are invading building applications to conserve installation and operation costs. The cost of installing, testing, maintaining, trouble-shooting, and upgrading a wired network makes wireless systems potentially attractive for many situations, despite their initial increased outlay.

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