



SPECIAL REPORT

CISPR COMPLIANCE, REAL-TIME ANALYSIS DRIVING INNOVATION IN EMI/EMC INSTRUMENTS

By Mike Hockett, Editor-in-Chief

▶ The fields of electromagnetic interference (EMI) test and electromagnetic compatibility (EMC) test go hand-in-hand, providing measurements, debugging, pre-compliance, and full compliance testing for a wide variety of electronics. EMI/EMC testing is a vital stage in a product's life-cycle, ensuring that products function as intended, and that testing is done on instrumentation ranging from benchtop oscilloscopes, to modest sized chambers, to large test chambers for aircraft.

To learn what factors are driving innovation in EMI and EMC testing, we at *Evaluation Engineering* asked a pool of electronic test & measurement vendors and partners about the trends, challenges, and customer demands they're seeing, as well as what newer EMI/EMC test solutions they've put on the market. Here's what they told us.

What's trending?

What new or ongoing trends are vendors seeing among EMI/EMC receivers and amplifiers?

Dylan Stinson, RF products manager, and Alex Krauska, RF products system engineer at Tektronix: "While CISPR 16 compliant receivers are necessary for complying with EMI compliance standards, customers can get away with using non-CISPR 16 compliant real-time spectrum analyzers (RTSA) when performing their own in-house pre-compliance EMI testing. This allows product developers to rest assured knowing that their product is going to pass compliance in its first attempt through the compliance lab—reducing the chances of costly late-stage redesigns and trips to the test house.

◀ Rohde & Schwarz EMC testing equipment in an EMC testing chamber.

"The advantages of an RTSA is the ability to capture RF pulses as short as 15 us, digital modulations, and other pulsing or fast-changing signals. In addition, they can capture and process data much faster than traditional swept EMI receivers or spectrum analyzers—there's no need to wait seconds or minutes to capture a spectrum, even when using detectors at narrow resolution bandwidths (RBW). This allows for very fast troubleshooting, since you can see the result of fixes immediately. Tektronix RTSAs also feature EMI precompliance and troubleshooting software that walks the user through the process of performing FCC, CISPR, or MIL-STD radiated or conducted emissions tests.

"Most of the high-risk EMI tests are easily performed with low-cost RTSAs. The cost savings by performing troubleshooting and precompliance at your own facility can amount to hundreds of thousands of dollars and weeks or months of product delays. RTSAs have already proven to be invaluable for EMI debug and troubleshooting. Advanced spectral analysis will be especially important as mobile devices continue to shrink and more products incorporate wireless and other advanced digital modes."

Jeremy Cline, product manager at Rohde & Schwarz North America: "The need for more insight into the source of potential interferer continues to grow, and simple pass/fail results are no longer sufficient. EMI receivers today also need to provide capabilities that help the developer to diagnose the signals and their origins. Real-time spectrum analysis allows for detailed investigation of disturbances. Persistence mode also allows identifying signals within signals, where narrowband interferers can be seen despite an overlaying broadband interferer. FFT-based time domain scan enables ultrafast measurements, which now allows designers to run their tests many times over and optimizing their design between tests. EMI receivers also continue to improve their RF performance and measurement accuracy.

Exceptionally wide dynamic range, low DANL, high 1 dB compression point and high third-order intercept are required and expected.

“Standards in A&D (MIL-STD-461G) and automotive (CISPR 12/25) are gaining relevance, and for amplifier designs, device validation test (DVT) and product validation test (PVT) continue to be strong. Frequency bands BC, D, and E continue to be popular bands where a lot of validation is happening. Coexistence testing is also becoming increasingly relevant for both designers and test labs. With more potential interference around any given device, it has become clear that one not only needs to look at the operability and compliance of a single device, but also at coexistence to other emitters. Test labs are increasingly asked to also test for coexistence. A fairly new trend for broadband amplifiers is the ability to adjust the operating class during operation so that one can optimally tune the output signal to a specific application. During operation, one can adjust the operating class for transistors between Class A and Class AB as well as choose between maximum output power or higher mismatch tolerance at the output. Instruments with such capabilities from Rohde & Schwarz are the R&S ESR and R&S ESW for receivers, and the BBA130 for amplifiers.

“For power amplifiers, there is the continuous trend toward higher frequency coverage with same output power and level of VSWR handling. Solid-state technology has become the de-facto standard for broadband amplifiers and will eventually

replace TWT tube technology that has poor reliability and production yields.”

Bill Stumpf, technical & laboratory manager at D.L.S. Electronic Systems: “Since FFT receivers have been accepted by CISPR standards, we see a push toward that capability in a continuing effort to increase measurement speed. Software and hardware functions are being added to try to keep pace with advancing wireless technologies.”

Challenges

As EMI/EMC technology continuously evolves, so do its challenges thrust upon vendors of such instruments. What key challenges are vendors of EMI/EMC receiver & amplifier facing today?

Stinson and Krauska, Tektronix: “Increasing clock speeds and the proliferation of wireless connectivity in IoT devices means that emissions are becoming higher in frequency and in some cases intermittent or with a time varying behavior. This presents several changes in terms of detection—with a lot of receivers having a traditional maximum range of 1 GHz and sweep speeds that will miss many intermittent or time-varying events.”

Cline, Rohde & Schwarz: “For receivers, providing wider bandwidths and higher frequency coverage continue to be major drivers. In addition to the hardware performance as described above, it has become crucial for vendors to also support their customers with tools and capabilities that give

more insight into possible interferers. This also puts additional focus on usability aspects of EMI receivers. Today’s instruments not only need to meet

and exceed the required hardware specifications, but they also need to come equipped with a variety of capabilities and an intuitive user interface that helps customers to go beyond pass/fail results to really understand where potential interferers are coming from.

“Complete EMC solutions are also becoming more complex; it is no longer sufficient to design a system for just one standard. Customers need the ability to test against multiple standards including ANSI, ETSI, and FCC. Coexistence tests are also becoming more relevant and a requirement for many customers. As a supplier, it is important to be able to offer a complete system of instrumentation including receivers, amplifiers, generators and other accessories designed for the use case of that customer.”

Stumpf, D.L.S.: “Keeping pace with advancing wireless technologies and associated test standards is a constant and difficult challenge for EMC test equipment manufacturers and test labs. As wireless and other product operating frequencies go higher so will the requirements of EMC measurements.”

What are customers asking for?

Here are the features and other innovations today’s EMI/EMC receiver & amplifier customers are asking vendors to provide.

Stinson and Krauska, Tektronix: “As mentioned earlier, real-time capability over traditional swept significantly increases the likelihood of observing and recording short-duration events. In addition to near-field E- and H-field probes, customers are asking for support of calibrated current probes—for measuring transient common-mode currents along cables and I/O ports. Customers are also asking for support of near-field TEM cells (TEM/GTEM/Crawford Cells) for desktop-size EMC testing. Low cost RF-shielded tents have also become very popular for precompliance.”

Cline, Rohde & Schwarz: “Receivers: Generally, customers are always faced with wider measurement bandwidth and



◀ An engineer performing EMI debug troubleshooting a Tektronix real-time spectrum analyzer.

the need to speed up their design—thus test time—and the need to identify potential interferers. Therefore, they need the ability to perform EMI debugging. This requires real-time spectrum analysis, persistence, and the ability to perform measurements quickly (FFT time domain scan). Amplifiers: Beyond output power and frequency range, customers we see are trending toward the more efficient use of broadband amplifiers. With ‘smart amplifiers,’ amplifiers that can be tuned, customers can choose between maximum output power and high mismatch tolerance. For EMS applications, this allows the flexibility to increase the power of a given BBA130 amplifier up to 50%.”

Stumpf, D.L.S.: “Increased sensitivity, frequency range, function, and automation for specific compliance standards.”

Now on the market

Here’s what EMI/EMC receiver and amplifier solutions or features vendors told us they’ve recently made available.

Stinson and Krauska, Tektronix: “Tektronix has recently introduced EMCVu, a full-featured EMI precompliance software and hardware solution that enables customers to take advantage of RTSAs as EMI receivers, greatly simplifying the process of performing precompliance radiated or conducted emissions testing. Tektronix is a one-stop shop for getting setup to perform EMI/EMC precompliance including instruments, accessories, and software. With Tektronix RTSAs combined with EMCVu precompliance software, engineers now have a fast, easy, accurate, and affordable way to determine if their new product designs are ready to submit to the test house. Unlike other spectrum analyzer-based solutions, Tektronix offers a complete solution, including precompliance software, instruments, and accessories, greatly reducing the cost and simplifying the process of getting up and running with your own in-house EMI precompliance solution.

“In addition to offering a powerful suite of real-time analysis tools that include advanced measurement displays such as density, spectrogram (waterfall),

and others, Tektronix RTSAs are unique in that they provide Digital Phosphor Technology (DPX) swept display. This allows them to sweep wide (up to the instruments frequency range) and display density/persistence of interfering, intermittent, or signals under noise. Other real-time spectrum analyzers can only display persistence up to the real-time capture bandwidth of the instrument, a much narrower view. Swept DPX provides significantly enhanced measurement insight compared to traditional swept spectrum analyzers.

“Tektronix RTSAs are also unique in the fact that they are not mode-based analyzers, which require users to switch into different modes to operate in real-time or signal analysis mode. Instead, Tektronix RTSAs can acquire, measure, record, and display all at the same time, without leaving a gap in RF signal data.”

Cline, Rohde & Schwarz: “Receivers: The R&S ESR and R&S ESW EMI receivers have both the best RF performance on the market and all features for EMI testing helping customers to get beyond pass/fail results and analyze the true nature of possible interferers. Amplifiers: The new BBA130 can be biased to be a Class A or Class AB amplifier. This ‘smart amplifier’ can be tuned during operation and thus deliver up to 50% more output power. Customers have the flexibility to choose between maximum output power or high mismatch tolerance. Automatic Visual Inspection: R&S AdvISE visual inspection system allows visual monitoring of EUT for gauges, lights, colors changers, intensity changes or character recognition. Visual inspection software automates the process of visually monitoring an equipment-under-test during a test sequence. This eliminates human inattention, ensures reproducible results and simplifies the test documentation. A typical application is EMS testing with R&S EMC32 and R&S ELEKTRA test software.

“Our focus on instruments with the RF performance and usability tools help

identify possible interferers quickly and accurately. Our EMI receivers with fast scanning (FFT), real-time spectrum analysis, and persistence mode are ideal tools to help identify and solve potential EMI and EMC challenges. Additional instruments such as our vector network analyzers, real-time-oscilloscopes, and signal generators are broadly used to solve signal integrity and power integrity challenges.”

Cadence: “The Cadence Sigrity technology product line is designed to help customers solve their most challenging signal integrity, power integrity, and EMI/EMC problems in IC packages, PCBs, and electronic systems. For example, our Sigrity Advanced SI package provides a complete power-aware system SI simulation environment for high-speed serial interfaces, such as PCI Express, HDMI, SAS, USB, etc. and high-speed parallel bus interfaces, such as those used in DDRx memory. The power-aware technology allows customers to simulate the impact of the power delivery network (PDN) on signal integrity, which is necessary in today’s high-speed interfaces.”

▼ Keysight’s N9048B PXE EMI Receiver.



Keysight Technologies: “In April of this year, Keysight announced the addition of time domain scan (TDS) and real-time scan capabilities to the Keysight N9048B PXE EMI Receiver, which enables real-time measurements and diagnostics for faster EMC certification. Keysight’s new TDS and RTS capabilities in the N9048B PXE EMI receiver enable independent compliance test laboratories, as well as in-house self-certification labs, to shorten overall test time and easily perform gapless signal capture and analysis, certifying that a product meets regulatory compliance standards. 