JULY/AUGUST 2021
EvaluationEngineering.com

EVALUATION ENGINEERING
For Electronic Test & Measurement

SPECIAL REPORTS

MEDICAL ELECTRONICS

Migrating Toward Public Places

POWER SEMICONDUCTOR TEST

Semiconductor Test Addresses the Latest Solutions

ALSO

MCU DESIGNS EMPOWER EMBEDDED SYSTEMS DEVELOPMENT

LEVERAGING THE CLOUD TO CONNECT THE ELECTRONICS INDUSTRY ECOSYSTEM

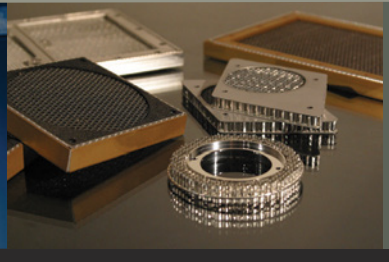
SPIRA

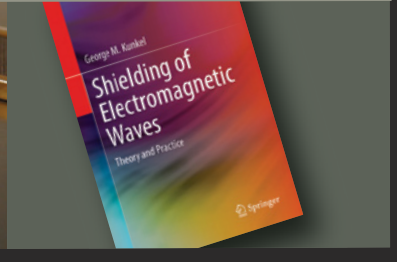
40 YEARS ANNIVERSARY

THE LEADER IN EMI GASKETS

Excellence by Design: Exceptional, Durable Shielding

When EMI protection is important, top manufacturers choose Spira EMI gaskets. Spira gaskets are well known for solving EMI shielding problems that no other gasket can solve, and are perfect for military, commercial and medical applications. Gaskets are designed to be highly reliable, and built to last the life of the system. Salt fog, high humidity and RoHS versions are available. Choose Spira gaskets to pass your shielding tests the first time.





EMI & Environmental Connector-Seal Gaskets. Superior EMI and environmental protection for flange-mounted connectors in front or back mount options.

Spira-Shield. All Spira gaskets utilize our unique patented spiral design which yields EMI shielding quality up to 165 dB with exceptionally long life.

Shielded Honeycomb Air-Vent and Fan Filters. High and reliable shielded filters at competitive prices providing over 80dB of shielding at 1GHz.

Groundbreaking new book on EMI Shielding Theory. A new, more accurate and efficient way for engineers to understand electromagnetic shielding theory and practice.

LEARN MORE & ORDER FREE SAMPLES – CONTACT US TODAY!

www.spira-emi.com • (818) 764-8222 • info@spira-emi.com

EVALUATION ENGINEERING
For Electronic Test & Measurement

SUBSCRIPTIONS/BACK ISSUES
e-mail: EvaluationEngineering@Omeda.com

EE-EVALUATION ENGINEERING is available by free subscription to qualified managers, supervisors and engineers in the electronics and related industries.

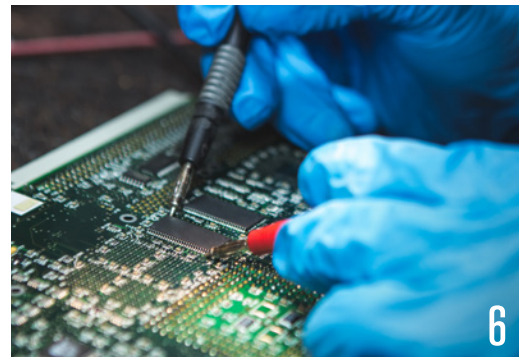
For subscription and other inquiries, please contact:

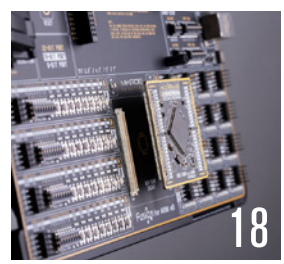
Evaluation Engineering
PO Box 3257
Northbrook, IL 60065–3257

Toll Free: (877) 382–9187 | Local: (847) 559–7598
Email: EvaluationEngineering@Omeda.com

CONTENTS

JULY/AUGUST 2021 | VOL. 60, NO. 4





DEPARTMENTS

Cover: vgajic/E+/Getty Images

INSTRUMENTATION

APPLICATIONS

TECHNOLOGY INSIGHTS

FOLLOW US EvaluationEngineering.com

FACEBOOK facebook.com/EvaluationEngineering
TWITTER @EE_Engineers
LINKEDIN linkedin.com/groups/2192877

EE-EVALUATION ENGINEERING (ISSN 0149-0370 Print; ISSN 2694-4618 Online) is published bi-monthly by Endeavor Business Media, LLC., 3918 Montclair Road, Suite 210, Birmingham, AL 35213. Postage paid at Birmingham, AL and additional mailing offices. **SUBSCRIPTIONS** are free to qualified subscribers as defined by Publisher. Rates for non-qualified subscriptions are: U.S. one year—$179.52; Canada/Mexico one year—$193.86; all others one year—$228.89. Single copies—$15.30 each (US) and $20.20 (all others). Subscription inquiries: EvaluationEngineering@Omeda.com. **CHANGE OF ADDRESS** request should be sent to Evaluation Engineering, PO Box 3257, Northbrook, IL 60065-3257. Please provide old and new mailing addresses and allow 4-6 weeks for processing. **POSTMASTER** should send address changes to Evaluation Engineering, PO Box 3257, Northbrook, IL 60065-3257. Printed in the U.S.A.

@TWITTER.COM/EE_ENGINEERS
APAULTRE@ENDEAVORB2B.COM

EDITOR'S NOTE

ADDRESSING THE TEST AND EVALUATION DEMANDS OF ADVANCED ELECTRONIC DEVICES

Convergence and integration are powerful forces that have been driving a great deal of innovation and development in our modern society. Today, an average consumer expects their personal devices to be multipurpose and multifunctional, employing the latest technologies and software utility. In addition, users expect their devices to be connected to the Internet and each another at all times.

These developments, while welcome from a user and societal standpoint, make things very difficult for the design, development, and manufacturing community. Combining multiple systems in a product not only involves a significant integration effort, the resulting devices require a comprehensive, far-reaching, and resilient infrastructure to function properly.

At the product level, this integration pressure demands a comprehensive understanding of every possible parameter of every conceivable action by the user and any environment the device is used in. This, in turn, requires testing and evaluation of a myriad of parameters, from RF performance to thermal management, in order to create a product that can function optimally in the field.

The test and evaluation industry has risen to the task in an exemplary manner, creating benchtop, rackmount, and handheld solutions for the design engineering community. The latest electronic development tools are fast, accurate, and connected, enabling teams of developers to collaborate and share information in their creation efforts.

The evolution of advanced simulation and design software, combined with collaborative tools, and reinforced by six-sigma manufacturing, has enabled the creation of the latest generation of powerful and connected products. This combination of powerful tools and the ability to share them will be a major force fomenting development going forward.

Collaborative development tools are far from new, but before COVID-19 they were mostly used by large organizations and contractors living abroad. Once people were forced to use remote collaboration and telepresence tools to work, not only did the design community become comfortable with it, the tools themselves were forced to evolve to more powerful and useful versions.

The adoption of collaborative design simulation software, benchtop tools, and processes are a powerful force multiplier in the marketplace, enabling companies and organizations that use them to perform faster and more efficiently. Any company developing a mainstream consumer electronics product without the use of these powerful tools is at a significant disadvantage to those who do.

The integration of six-sigma Industry 4.0 processes provides additional test and evaluation capabilities throughout the supply and manufacturing chain, adding to the oversight and awareness of the product, from concept to deployment into the field. In addition, the monitoring and over-the-air update capability in the latest products enables that management to continue until the product is no longer in use (or is out of warranty).

This expanded reach into a product, even as it passes into the hands of its intended users, is an opportunity and a risk. The opportunity is to create a new generation of always-connected, highly efficient, and multifunctional devices that can be monitored and managed throughout their entire operational lifetimes. The risk is that the ownership and responsibility for maintenance and repair in such situations can become an issue, but that is a societal concern.

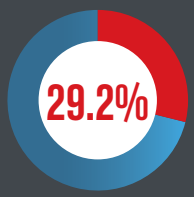
This new ecosystem of integrated products and infrastructure, leveraged by the latest design, development, and manufacturing, will usher in a new generation of enabled devices, products, and solutions. EE

Alix Paultre,
Editor

BY THE NUMBERS

133.6 BILLION

Global Semiconductor sales in 2Q 2021

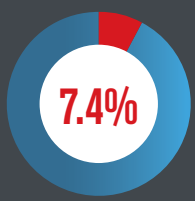


Revenue increase over 2Q 2020

Source: SIA

42.48 BILLION

Predicted market for global flexible electronics by 2027

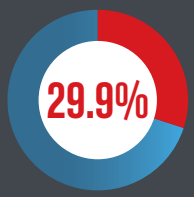


Predicted CAGR 2020-2027

Source: Allied Market Research

100 BILLION

Forecast for global sales of semiconductor manufacturing equipment in 2022



Sales increase over 2020

Source: SEMI

IDEA!

Industrial Design
Engineering & Automation

A HYBRID EVENT TAKING PLACE LIVE AT THE HUNTINGTON CONVENTION CENTER IN CLEVELAND ON NOVEMBER 9-11, 2021 & VIRTUALLY ON DECEMBER 7-8, 2021

CONFERENCE SESSIONS & TOPICS

- Automation & IoT IDEAs
- Advanced Manufacturing IDEAs
- Power & Motion IDEAs
- Laser Assisted Processing IDEAs
- Machine Vision IDEAs

Featured During

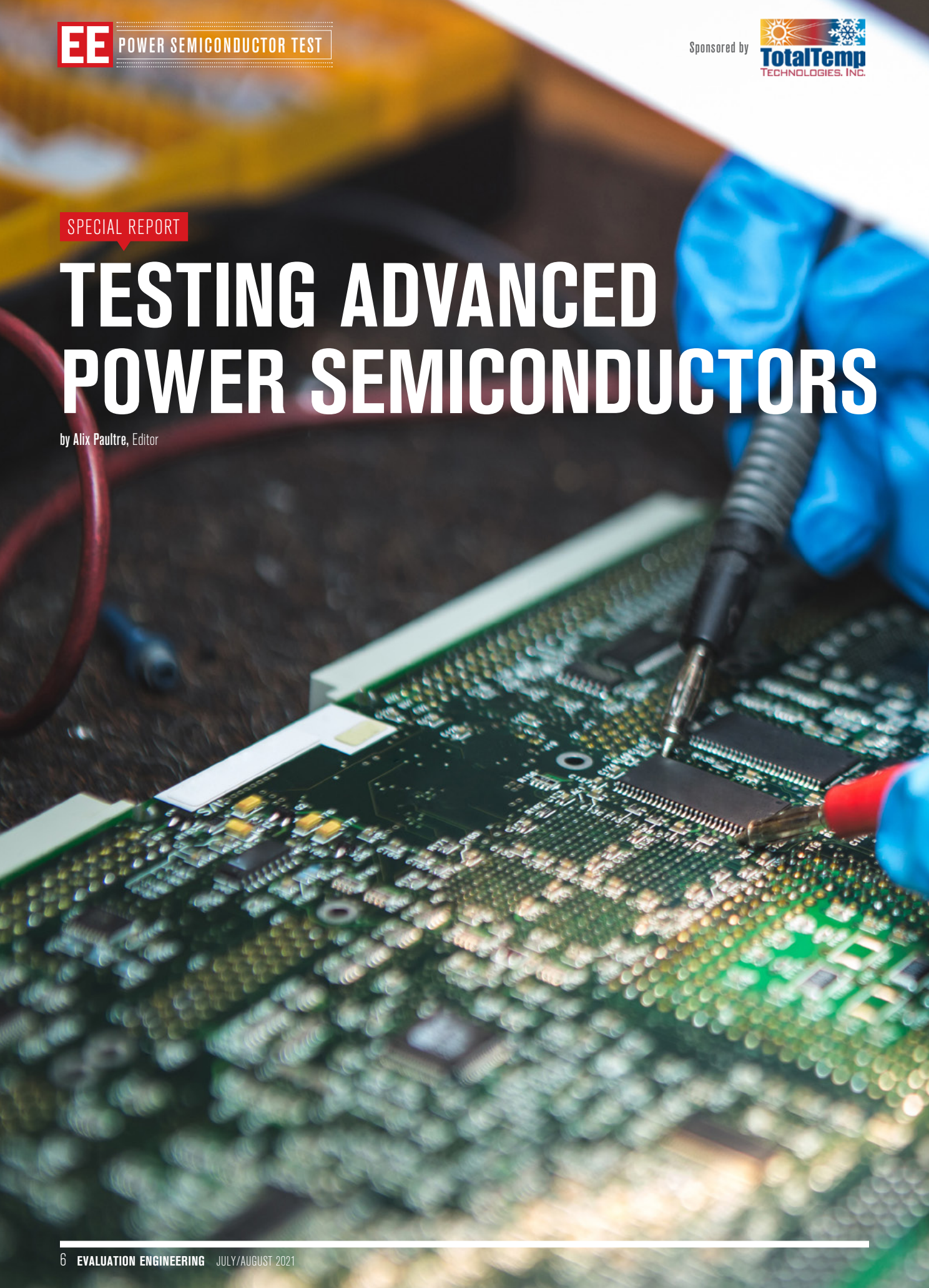
M&T THE MANUFACTURING & TECHNOLOGY SHOW

STRATEGIES FOR EXCELLENCE
FROM DESIGN TO DELIVERY

REGISTER NOW & SAVE $200!

WWW.MFGTECHSHOW.COM

WWW.MFGTECHSHOW.COM



SPECIAL REPORT

TESTING ADVANCED POWER SEMICONDUCTORS

by **Alix Paultre,** Editor

inakiantonana / iStock / Getty Images Plus

The expansion of intelligent devices and semiconductor-based solutions has transformed both legacy applications and new ones developed from the new capabilities provided by the latest components. However, the newest tech always impacts the testing of systems based on them.

In this Special Report, we'll take a look at some of the challenges being faced in testing wide-bandgap semiconductors and other next-generation devices in advanced power designs. We'll also examine some of the advanced functionalities in test systems needed to address those next-generation power applications.

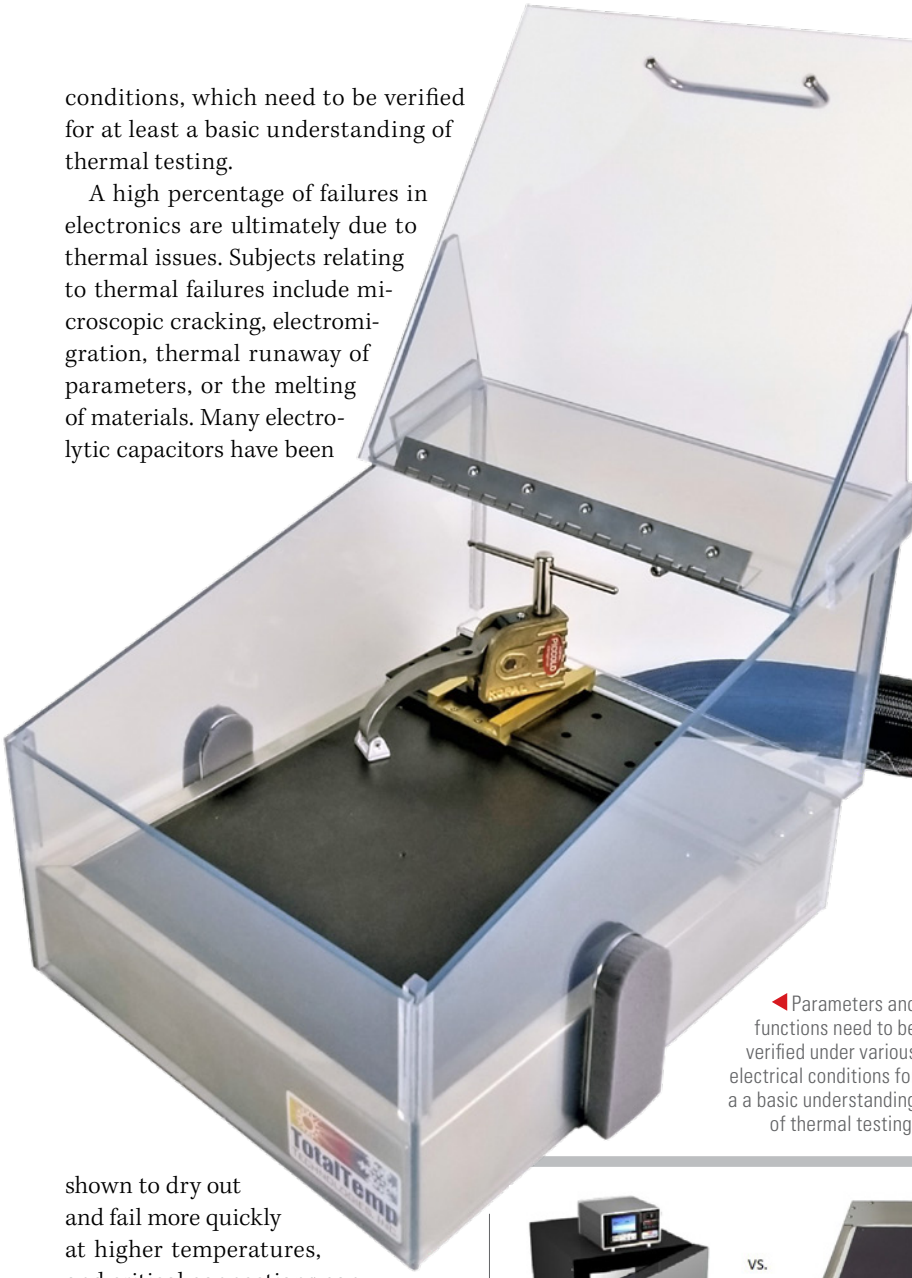
Keeping your cool

When we spoke to John Booher at TotalTemp Technologies, he emphasized the importance of proper test and evaluation of production items as a critical part of producing quality products. The consequences of a lack of quality are unfortunately well known, but the appropriate testing processes can be quite time-consuming and expensive, and easily run into the weeds of undertesting, overtesting, or just testing the wrong condition.

The tendency to err on the side of safety is generally accepted, but the flip side of thorough testing can involve spending too much time and money testing, or literally testing a product to death. When it comes to power, it's equally important to understand the electronic parameters and functions under various electrical

conditions, which need to be verified for at least a basic understanding of thermal testing.

A high percentage of failures in electronics are ultimately due to thermal issues. Subjects relating to thermal failures include microscopic cracking, electromigration, thermal runaway of parameters, or the melting of materials. Many electrolytic capacitors have been shown to dry out and fail more quickly at higher temperatures, and critical connections can corrode or otherwise deteriorate enough to cause failure. General thermal expansion and contraction, along with the associated moisture cycling, are often at the root of many failures.



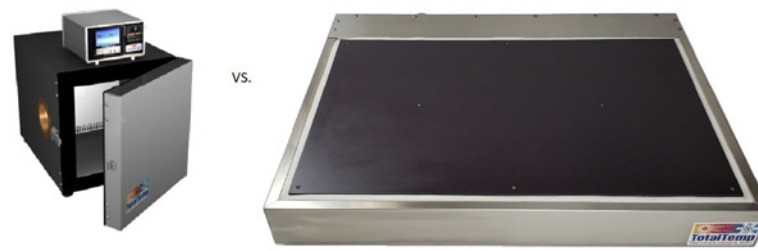
◀ Parameters and functions need to be verified under various electrical conditions for a a basic understanding of thermal testing.

The three ways temperature can be changed is by conduction, convection, and radiation. They are generally most effective in use for thermal testing in that order. Without a big dive into the math and logic behind the statement, conduction is the most effective heat transfer method. Surprisingly, convection, such as employed in a temperature chamber, is far more widely used.

Some of the main reasons for that disparity include heat transfer by conduction, which requires intimate contact between the heating and cooling equipment, also known at the thermal platform, and the device. Fortunately, many device packages for microwave and other power equipment come in a package with a flat thermally conductive surface. Additionally, many other parts can readily have a machined fixture to provide the needed surface contact.

It's important to recognize and cope with the fact there is always some thermal gradient between the system driving the equipment and the furthest part from the driving point that needs to be conditioned. Thinking "that's just the way it is done, or one size fits all" is also a mistake. Truly, not all items are compatible with a thermal platform, however, with a little prior planning, many parts can be effectively tested on a thermal platform, or in some cases, using two or more thermal platforms can get the job done.

Convection heat transfer can, in cases, rival conductive heat transfer effectiveness. High airflow is important for convection heat transfer, just as clamping force is important to conductive heat transfer. While good airflow is needed for heat transfer, it also comes at a cost. Air friction from high-volume blowers is a surprisingly large source of unintended heating and other losses. It is often seen that temperature chambers designed to maximize heat transfer and minimize test time produce a surprising amount of heat from air friction. For example, a high-performance chamber with strong airflow to maximize heat transfer can be seen to cause the chamber temperature to climb from ambient to over 100°C without any other heat added to the system.



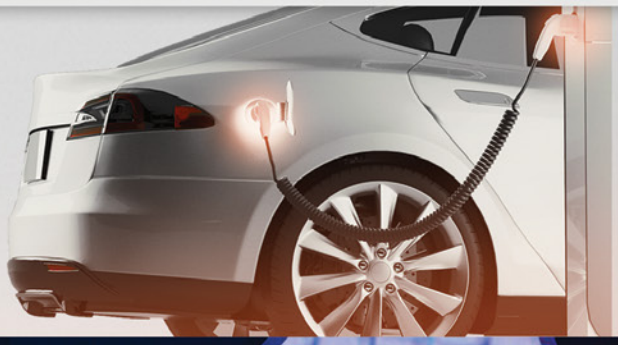
▲ The best test choice may be a convection chamber, thermal platform, or a hybrid system.

Of course, if you want it that hot, the additional heat from air friction can actually be a benefit. Fighting that heating with a refrigeration compressor system definitely requires a careful recalculation of this heating contribution, to achieve expected cooling results. Not to mention that this also adds more heat to the room, eventually adding to the air conditioning load of the lab room itself. For many

FULL WAFER CONTACT, MULTI-WAFER STRESS TESTING AND BURN-IN SOLUTIONS

SiC POWER
FOR ELECTRIC VEHICLES

Provide the reliability needed for quality Silicon Carbide devices in electric vehicles



LIGHT

Stabilization of Silicon Photonics and Lasers to ensure optimal performance from delivery through life

3D
SENSORS

Enabling the next generation of user security and health monitoring

LEADERSHIP

40+ years expertise in Semiconductor Test and Burn-in

Email us today at info@aehr.com
"Setting the Test Standards of Tomorrow"
CORPORATE HEADQUARTERS
400 Kato Terrace
Fremont, Ca 94539
Phone: (510) 623-9400
Visit us at: www.aehr.com

DNV-GL

AEHR TEST SYSTEMS

applications, a temperature chamber with mechanical refrigeration is a very good choice, but before purchasing, we suggest you take time to consider understanding the choices before you buy.

WBG devices can raise the bar for higher temperature testing, as well as higher power dissipation. Thermal platforms are a very effective way to test these high-power devices. Whether the best choice ends up being a convection chamber, thermal platform, or a hybrid system, they will all work more effectively with advanced controller functionality.

You can now combine the forces of convection plus conduction along with advanced temperature control algorithms and automated PDF delivery of printed results. This will result in superior speed, accuracy, gradient control, and easy data automation. While future-proofing might not be possible, you can definitely make your thermal equipment choices to test devices more effective and substantially more future-resistant.

Transportation evolution

Aehr Test Systems provides test systems for burning-in and testing logic, optical, and memory ICs, and offers solutions for package, wafer level, and singulated die/module level test. When we reached out to Vernon Rogers, Executive Vice President, Sales, he pointed out how transportation is a rapidly developing disruptive space. The transformation of human transportation was underway prior to the pandemic, and during the pandemic, a kind of domino-effect transportation revolution occurred as automobile manufacturers committed to electric vehicle (EV) development while abandoning the internal combustion engine (ICE).

Core technologies, like wide-bandgap (WBG) semiconductors such as silicon carbide (SiC), enabled this revolution by providing substantial improvements in conversion efficiency of static energy to dynamic energy, reducing the cost of EVs and/or extending the driving range, providing incentives to make the switch. Transformations bring challenges, and for SiC, a compound semiconductor that was first used in an electronic application in the early 20th century, is not immune.

Issues include defects from the manufacturing process, or in the crystalline structure that require different stress tests than the traditional silicon semiconductor. Among the challenges in semi test is that WBG semiconductors enable capabilities and efficiencies that silicon is unable to achieve, and this is driving a change across the semiconductor industry due to the unique manufacturing requirements of wide-bandgap technologies.

▼ SiC and GaN devices have lower leakage than silicon components.

Every high-quality SiC device requires an elevated temperature while applying voltage, to confirm that the parts per billion (PPB) quality requirement is achieved. SiC device technology adoption is pervasive, and the increasing number of applications is challenging the manufacturing supply chain, with the new requirement that every die has to be stress-tested at elevated temperature and voltage.

Traditional wafer stress test solutions do not meet the Cost of Test (COT) requirements and package part stress test and burn-in solutions create additional yield issues and struggle to deliver the COT required. Power devices such as SiC are migrating from single die per package to heterogenous packages and this is driving the requirement for full wafer-level qualification, stress test, and other testing, which is changing from the existing focus on package and part testing.

The ability to test and monitor all of the die on a wafer at the same time is required to meet stringent power-device Cost of Test (COT) parameters, while delivering the guaranteed test coverage and quality required. Advanced wafer probe technology integrates the probe card and wafer prober into a compact and lightweight wafer probe contactor. The compact wafer probe contactor, in conjunction with a highly integrated test system that uses a thermal liquid to control the wafer environment within one degree Celsius, ensures that a uniform high-quality stress test and burn-in procedure has been performed on each die.

A highly integrated test system, combined with the compact wafer probe contactor, can reduce the manufacturing footprint of nine to 18 tester and prober cells into the space of one unit. An analogy would be like compacting 18 parking spaces into one parking space, over an order of magnitude in saving precious manufacturing-floor space.

Expanding application spaces

Tom Tran, Teradyne Product Manager, explained to us how end markets are moving beyond mobile, and semiconductor

▲ Power devices such as SiC are driving the requirement for full wafer-level qualification, stress test, and other advanced testing.

applications are diversifying into spaces like autonomous driving, vehicle electrification, XR, AI & machine learning, data centers, etc. All of this creates a need for test solutions to address a wider range of devices. As semiconductor solutions expand into legacy applications, the company expects first to see an expansion in testing, as customers find new and inventive ways to test existing products against new requirements using our testers.

The next stage they expect to see is a drive for improvement that touches on design and process, as we've seen with automotive traction inverters and the adoption of wide-bandgap semiconductors. Hard-switching Dynamic RDS(ON) continues to be a challenge, in that there is an ongoing drive to start sampling the on-state resistance as close as possible to when the device is switched.

When it comes to speed, the solutions are down to a single µs or less, leveraging knowledge of AC switching transistors to control the response, and ensure that good measurements start as soon as possible after switching. SiC also adds an extra layer to existing test requirements, if only from raw power. IGBTs already require a significant power source for AC testing, but to test the short-circuit and saturation in silicon carbide requires higher voltages and more current. At the upper end of those measures, the challenges become focused on trade-offs in material physics.

The major system improvements that will be necessary for next-generation power devices, particularly with the adoption of WBG products, include high-voltage force and measurement capability, shorter pulse-width at higher currents, higher speed digitizers with increased precision, higher bandwidth-high voltage dividers, and higher bandwidth sensors.

Precise power

Talking to Maureen Lipps, Product Manager at Newark Electronics, when we talked about some of the challenges they are facing in testing WBG semiconductors in advanced power designs, she said compared to traditional silicon devices, wide-bandgap semiconductors offer higher power density, smaller size, better high temperature performance, higher frequency response, and lower ON resistance than silicon. In turn, SiC and GaN have lower leakage than silicon.

Therefore, some of the challenges with testing wide-bandgap devices include the need for sourcing higher test voltages, as well as appropriate current measurement sensitivity. For SiC, leakages are more than two orders of magnitude lower than similarly rated silicon devices, so current measurements in the single micro-amps and pico-amps are required.

The key parameters in measuring power semiconductor devices are high voltages, plus both high and low currents while also providing current measurement sensitivity. Advanced functionalities in test instruments must be capable of measuring significantly high rated voltages, typically 1K to 3K volts, but also up to 10K volts. Test instruments must also be capable of measuring high peak currents in the 10-A range while measuring leakage currents in the micro to pico-amp range. In addition, wide bandgap devices require unique test fixtures optimized for high-speed and high-power switching. EE

SPECIAL REPORT

MEDICAL ELECTRONICS MIGRATE TO PUBLIC PLACES

By Alix Paultre, Editor

Medical electronics have gained a significant amount of functionality and capability in recent years.
Chaikom/ Shutterstock

From addressing COVID-19 to improving your track times, advanced medical technology is finding itself in all kinds of places.

Medical electronics have gained a significant amount of functionality and capability in recent years, and through technology convergence has been manifested in a variety of personal medical solutions that have impacted the way we address medical issues in people. From Cloud-enabled tech to advanced wearable devices, medical technology is also moving from the hospital to the home, and other places as well.

Along with the recent experience with COVID-19 mitigation, activities such as public monitoring and environmental awareness in public places have also expanded the use of next-generation medical technology to office spaces and public venues. The blurring of the lines between medical, public health, sports, fitness, wellness, and other aspects of life-quality management has also created challenges for those who design, test, and evaluate them.

Serving the community and home

When we asked Steve Hayes, Technical Director of Connected Technologies at Element, he explained that there is a general trend in the medical industry to do as much as possible in the community and home, rather than in a professional healthcare facility (hospital). The reason for this is that these large facilities are under pressure, mainly due to the rising age of the population, and if this pressure can be reduced by performing lower risk, routine type work remotely, it will free up critical space and resources to focus on lifesaving and complex issues.

There are secondary benefits such as reduced traffic on the roads, improving the air quality and less fossil fuel usage if these minor medical tasks can be performed at home. There is another problem with unwell people mixing with other unwell and vulnerable people: it increases the chances of them catching something completely unrelated to the main purpose of the visit to hospital.

Whilst moving more of the clinical work into the community frees up space, it does mean introducing new risks, as there is little or no control of the environment. For example, you can't restrict someone's cellphone use on their property just because the person in the next house is using an ECG machine. There are other issues such as giving some medical electronics to a person for them to operate themselves, to take heart rhythm measurements etc.—what happens if the person is elderly or infirm? Do they have the dexterity to use the equipment as intended or should the equipment be modified with bigger buttons, displays etc? Are they more likely to drop the device onto the floor and hence it needs to be designed to be more robust?

The examples above help to solve one problem but create new ones as a result.

▼ Performing critical tests demonstrates that the product remains safe and fit for its purpose.

These newly introduced risks become the responsibility of the manufacturer, who must carefully consider a wide variety of issues covering the product's fundamental functions (known as essential performance) as well as all the potential external influences on the product that could change its essential performance and basic safety characteristics.

Element works with a wide range of manufacturers to help them work through the wide-ranging hazards of their products and risks associated with them as well as performing critical tests that demonstrate that the product remains safe and fit for purpose. As the products themselves become more complex, the tests, or rather the monitoring of the product, becomes more complex. Imagine using the latest 5G technology to perform surgery remotely—how will a manufacturer confirm that the movement of the cutting instrument is as precise as physically holding the instrument and being in the same room. These are just some of the daily challenges Element is presented with and how they help manufacturers get their product to market safely.

▲ The HPX-DR 2329 GK is a cutting-edge detector enabling superb resolution and defect detection.

Seeing is believing

Carestream's Non-Destructive Testing (NDT) group recently launched the HPX-DR 2329 GK, a cutting-edge detector enabling superb resolution and defect detection (CARESTREAM IMAGE). The HPX-DR 2329 GK's 75 µm resolution offers powerful image capture for miniscule defect detection, and is an ideal option for the inspection of critical parts and assemblies to identify defects, including small cracks, porosity and flaws other detectors may miss.

Designed for industries that require the highest resolution possible to meet stringent industry standards, including medical and aerospace, the detector aims to improve confidence in accurate image analysis and reporting, increase productivity, and lower costs. In addition, it expands the variety of parts that can be examined and improves the accuracy of each inspection. Lightweight with a compact size of 230 x 290 mm and thin profile at 17 mm, the HPX-DR 2329 GK detector can fit in tight spaces, allowing for imaging and positioning in confined areas.

According to Marty Graen, Global General Manager for Carestream NDT, the launch of the HPX-DR 2329 GK underscores the company's commitment to offer innovative solutions that are cost-effective and improve productivity. The HPX-DR 2329 GK detector works with Carestream's INDUSTREX Digital Viewing Software, which operates seamlessly across all Carestream NDT computed radiography (CR) and digital radiography (DR) modalities.

Environmental monitoring

Working with Honeywell to establish new standards related to indoor air quality, safety and regulatory compliance, ASM Global is promoting its VenueShield LIVE proprietary program for venue reopenings and operations. Honeywell will consult with ASM on guidelines related to deploying healthy-building technology including indoor air quality, safety and security, and personal protective equipment (PPE). Honeywell will also create a custom, real-time Healthy Buildings dashboard for the VenueShield LIVE program to help ASM's facilities staff quickly identify and correct critical building control issues.

Additionally, Honeywell will work with the ASM Global venue network to deploy a variety of technologies that support smarter, safer, and more sustainable venues to improve the overall guest experience, including solutions to enhance overall building operations; mobile computing and data capture technologies to expedite ticketing, concessions and retail experiences; and more environmentally preferable products to help the venues' efforts to reduce their carbon footprint. ASM Global President and CEO Ron Bension pointed out how aligning with Honeywell will help ASM create the world's finest audience experiences at a variety of venues.

Jeff Kimbell, Honeywell Senior VP and CCO, explained that as vaccine programs progress around the world, the desire for normalcy continues to increase. Live events such as concerts, sports and conventions contribute greatly to the vigor and excitement of daily life. Honeywell is working with the ASM Global team to not only help audiences feel more confident about coming to live events, but also in supporting venue modernization and digitization by providing greater automation and insight into the portfolio performance and a more seamless audience experience.

VenueShield LIVE is deployed at more than 325 ASM Global facilities around

the world, already providing high levels of cleanliness and safety, while inspiring consumer confidence, all in coordination with leading medical professionals, industry experts and public health officials. Honeywell's Healthy Buildings solutions integrate air quality, safety, and security technologies, along with advanced analytics to improve indoor air quality while meeting energy-efficiency goals to create a more productive and better occupant experience.

Surgical navigation

When we reached out to TT Electronics EVP, Michael Leahan, he brought up the company's collaboration with Radwave to bring an accurate, reliable, and customizable electromagnetic (EM) tracking platform to the surgical navigation market. This advanced technology offers solutions for medical device innovators who are seeking to add new or improved EM capabilities to their medical devices. The complete navigation system can be customized to accurately track a broad spectrum of minimally invasive diagnostic and therapeutic devices during surgical procedures with no clear line of sight.

The Radwave electromagnetic tracking platform is a new option for tracking surgical instruments designed from the ground up for seamless integration into medical devices and the clinical environment. The modular platform can be rapidly customized to meet specifications and is highly accurate with a fast sampling rate using state-of-the-art algorithms and components. The thin and lightweight field-generating antenna is translucent during fluoroscopy and can be easily customized to accommodate different sensing volumes.

The platform also features a fully encrypted API that is easy to integrate and comes with an open-source SDK. TT Electronics will support Radwave's platform by providing complete manufacturing capabilities spanning a range of critical sensor technologies. TT's sensor technologies enable the platform to deliver the highest degree of accuracy and precision, even in challenging settings where other EM systems have been limited by interference or sensing volume constraints.

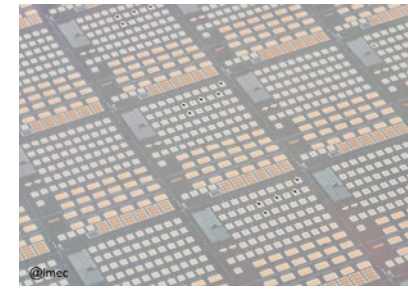
▼ TT Electronics and Radwave are bringing an accurate, reliable, and customizable electromagnetic (EM) tracking platform to the surgical navigation market.

Biomedical sensing

Joris van Campenhout, Optical I/O Program Director at imec, talked about the need to accelerate the adoption of silicon photonics in advanced applications such as biomedical sensing. A collaborative effort for the hybrid integration of InP lasers and amplifiers with Silicon photonics is going on with Sivers Photonics and ASM AMICRA Microtechnologies. The group recently announced the successful wafer-scale integration of indium-phosphide (InP) distributed feedback (DFB) lasers from Sivers' InP100 platform onto imec's silicon photonics platform (iSiPP).

Using ASM AMICRA's latest NANO flip-chip bonder tool, the InP DFB laser diodes were bonded onto a 300 mm silicon photonics wafer with an alignment precision within 500 nm, enabling reproducible coupling of more than 10 mW of laser power into the silicon nitride waveguides on the silicon photonics wafer. Many legacy silicon photonic systems have issues such as off-chip laser coupling losses, a large physical footprint, and a high packaging cost.

Together with its partners Sivers and ASM AMICRA, imec is extending its silicon photonics prototyping services to include high-precision flip-chip integration capability of InP lasers and amplifiers. In the recently completed development phase, C-band InP DFB lasers have been passively aligned and flip-chip bonded onto 300 mm silicon photonics wafers with ultra-high alignment precision within 500 nm (three-sigma value), resulting in reproducible on-chip waveguide-coupled laser power beyond 10 mW.



The InP DFB laser diodes are bonded onto a 300 mm silicon photonics wafer with an alignment precision within 500 nm.

Going forward, the hybrid integration portfolio will be extended with reflective semiconductor optical amplifiers (RSOA), leveraging the etched-facet capability of Sivers' InP100 technology, and ASM AMICRA NANO's superior bonding alignment precision. This capability will enable advanced, external cavity laser source types, as required for emerging optical interconnect and sensing applications, and should become available in early 2022.

A precise fit

LeNoir "Len" E. Zaiser III and his son, Len E. Zaiser IV, are entrepreneurs who have empowered medical manufacturing with advanced CNC machines. Putting their production process first, Len Zaiser IV said building skilled CNC machinists and programmers, investing in world-class technology, and refining manufacturing procedures creates the best product, a "Field of Dreams" philosophy," Len Zaiser IV said. "If you build it, they will come."

One such industrial force multiplier is the RoboDrill. When Len Zaiser III founded Structure Medical in 2005, the Zaisers used the machine to manufacture

▲ RoboDrills became known for their precise, accurate, and reliable components.

a titanium pedicle screw assembly—a mechanically complex orthopedic screw inserted after spinal surgeries. According to Len Zaiser IV, they determined it was the most profitable job in the whole factory in less than a year.

Structure Medical continued to grow, as did the number of RoboDrills in the shop. Operators became accustomed to the usability of FANUC controls, Zaiser said, and the machines themselves produced precise, accurate, and reliable components. He said they became known for their titanium and polyetheretherketone (PEEK) implants and other complex components, things that other people couldn't make. Although now under new ownership, Structure Medical continues to grow.

Conformity assessment

Dr Andreas Purde, Global Director Active Medical Devices at TÜV SÜD, brought up their cooperation with Johner Institute for the qualitative expansion of its innovative services in the medtech sector. The testing and certification company plans to offer medical device manufacturers a digital solution for conformity assessment procedures as early as this year. Using the standardized digital solution developed by the Johner Institute, TÜV SÜD plans to significantly reduce the efforts involved in the submission and review of documentation, and thus boost the efficiency and predictability of conformity assessment procedures.

Professor Christian Johner, Head of Johner Institute, explained the digitization solution is a standardized platform with open interfaces, eliminating legacy document processing. Freedom from the paperwork of the past enables people to embrace the possibility of improving productivity and their international competitive strength.

In the future, Dr Andreas Purde, Global Director Active Medical Devices at TÜV SÜD added, manufacturers can use the new tool to record their technical documentation and provide it directly to TÜV SÜD assessors without first having to convert the content into hard copies. The new platform supports closer interaction between manufacturers and TÜV SÜD. The open interfaces on the platform are the grounds for an ecosystem for a new generation of software tools, giving manufacturers free choice of their Notified Body.

A reference architecture for hospitals

Hans Bartmann, Managing Director of SparxSystems Central Europe, talked about how the current Corona pandemic shows us how important modern and crisis-proof hospital management is. Nictiz is the Dutch competence center for e-health. Based on Enterprise Architect, the hospital reference architecture ZiRA was created. The framework is used to

facilitate the inventory, development and innovation of hospital IT.

ZiRA (Ziekenhuis Reference Architecture) was born out of the realization that Dutch hospitals were dealing with similar problems, but there was no framework for cooperation in the field of IT. So 10 IT specialists from different hospitals in the Netherlands joined forces and developed ZiRA, using Enterprise Architect, based on information needs and best practice examples. ZiRA is part of the iZiekenhuis community, in which hospitals share their knowledge and experiences in terms of information provision.

ZiRA also provides a digital platform for sharing knowledge, information and best practices. In addition, workshops with and for information architects are organized on a regular basis. The ZiRA reference architecture is the replacement for the Domain Reference Model for Hospitals (RDZ), which has been used for many years to develop various applications in Dutch hospitals.

A separate practice manual explains the general principles of ZiRA and gives practical examples. It states that ZiRA provides a reference framework and helps in the development of the organization and information provision in hospitals. The reference architecture is intended to support daily work but does not claim to be complete or absolutely correct. By means of concrete examples, the practitioner's handbook is intended to encourage people to join the growing ZiRA community and to have their work made easier by modelling.

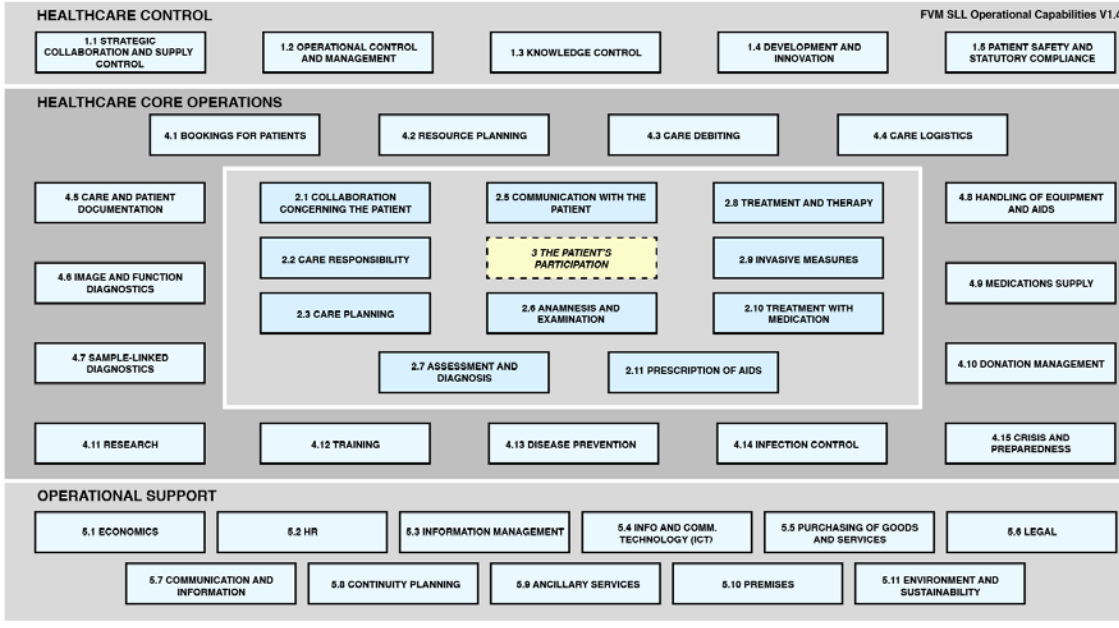
As in many companies, models are often used in hospitals to map the existing IT. This gives an overview of hardware and software and their interdependencies, which helps in replacing obsolete things as well as in further developing the system. The Erasmus University Medical Center in Rotterdam is considered one of the most important university hospitals in Europe and has used ZiRA as the basis for its own Enterprise Architecture Repository (EAR).

An EAR is ideally suited to describe the ACTUAL and TARGET states of IT mentioned above. Regardless of the architecture framework chosen, Enterprise Architect is a fully-fledged EAR that can store and manage all architecture content. In Erasmus MC, they added their own organization-specific concepts: organizations, subsidiaries, themes, pillars, departments, etc. The applications were read from the CMDB (Configuration Management Database) and linked to the application functions. In addition, the own architecture principles and the data centers, servers, networks and nodes from the infrastructure layer were added.

This process is illustrated using the example of the business activity "Taking anamnesis." Erasmus MC thus used the meta-model, structure and concepts of ZiRA as a basis for setting up the repository, but enriched it with its own organization-specific elements.

The Antoni van Leeuwenhoek (AVL) Hospital in Amsterdam is a leader in cancer research and treatment. With the help of the consulting company Logiqol, AVL launched the "Integrated Capacity Management" program in 2017 to optimize logistics processes in the healthcare sector and is thus able to better manage throughput and access times. With ZiRA, it was possible to provide the required control information.

At Gelre Hospitals in the Netherlands, the ZiRA information model was used to develop a business information model. For example, the distinction between activity and outcome information objects proposed in ZiRA was found to be very useful and was adopted. The business model should provide an overview of which business information objects exist in the primary care process and how they relate to each other. In a functional and technical design, it is now easy to determine whether information objects already exist and can be reused or whether a new object needs to be created. EE



◀ Models map the existing IT, giving an overview of hardware, software, and their interdependencies.

ADVANCED MCU DESIGNS EMPOWER EMBEDDED SYSTEMS DEVELOPMENT

by Alix Paultre, Editor

Addressing embedded development from a microcontroller (MCU) selection perspective, MikroElektronika (MikroE), recently released SiBRAIN, presented as a standard for a modular plug-and-play development board system to enable easy swapping of various MCUs on a SiBRAIN-socket-enabled development board. This enables embedded designers to try out multiple devices in their development phase without a massive hardware investment.

Each SiBRAIN board is self-contained, addressing the specific requirements of different MCUs, regardless of pin count or pin compatibility. Each card has male and female high-speed 168-pin mezzanine connectors with the SiBRAIN socket pin-out, and the design prevents incorrect orientation and placement. We spoke to Nebojsa Matic, CEO of MikroE, about the SiBRAIN system and what it can mean to the embedded systems designer.

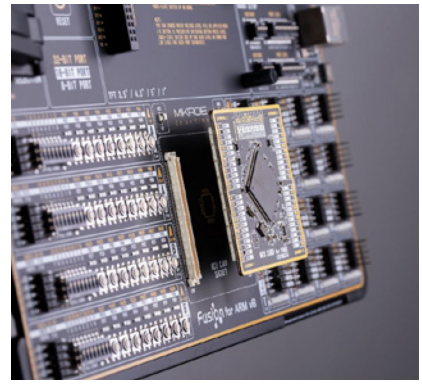
EE: **Glad to have you with us, Nebojsa.**

Neb Matic: Glad to be here. By the way, everybody calls me Neb, it's much easier. So, I'm an engineer who has been forced to run the company for 20 years. In setting the standard in MikroE, we were really encouraged by the mikroBUS standard. Based on that logic, we go further and standardize the socket and add-on board for all the microcontrollers in the world.


Matic

For example, a given legacy MCU card has a connector, it could be a pretty big one, it may be clumsy or delicate. You may not be able to put the MCU card back on the board when you remove it. So, we came up with this standard, we call it SiBRAIN. Why SiBRAIN? Because Silicon Brain, SiBRAIN, can do more than hold a microcontroller, you could also have Linux, or other OS, on such a board.

I'm looking forward to seeing an SiBRAIN card with Microsoft Azure Sphere, we already made an agreement with them to place media tech chips on


▲ SiBRAIN is a standard for a modular plug-and-play development board system.

that card. We already have an agreement and permission to do that with BeagleBoard. We don't have an agreement and permission yet from Raspberry Pi, but we are looking forward to having it.

For the last 20 years we have been doing only dev tools and compilers. So, let me tell you something about MikroE. We are a 20-year-old company, with 80-plus employees, and we do only five things: development tools, compilers, peripheral boards, programmers, debuggers and smart displays. Basically, we make a complete ecosystem for the development of any electronic device.

What is important for us is for you to know we are a highly organized group of people, with 2,000 of our own products. Most importantly, we release one new product per day. So, every day, at 10 o'clock in the morning, we introduce a new product, which never existed. It's not 10 o'clock yet. So, I don't know ...

We set up an organization, with distribution, bookkeeping, an IT sector for our ERP system, production, marketing, and of course, sales, etc. We are like a small corporation, but we are so efficient, thanks to our ERP system, that we don't need to have 500 people for what we are doing. The new card, by the way, it's an SiBRAIN microcontroller card for PIC24, with a whole string of numbers afterward. It's a 100-pin card with 256K of flash memory.

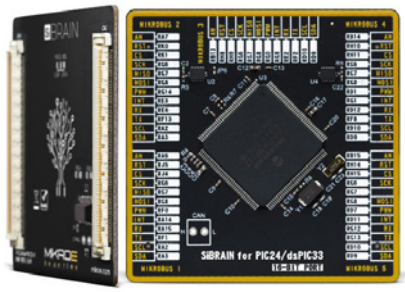
We release one new product per day, how many products do you think we should have in the pipeline to be able to release one new per day? Every day in this company there are 250 projects in one of 12 stages. The first stage is an idea, the last stage is the web page, which means it's finished.

EE: **What are your thoughts on helping the design engineering efforts of your clients?**

Matic: We are focused on one word—time. When we think about ourselves, we think that we sell time—and the products we produce are just a vehicle for how we are selling the time. We like to really free up as much of the time of our fellow engineers as we possibly could. With the tools we produce, you will do the most with the time you have. So, that's how we see ourselves. For example, I like to go fishing,

so when you say time, I almost calculate immediately in fishing time.

We provide fully featured development



▲ SiBRAIN microcontroller card for PIC24

boards, small development boards, programmer debuggers, smart display, compilers, and peripheral boards. We have the biggest number of compilers available. The reason we have so many is because we make compilers from scratch. We have 1000 peripheral boards with unique functionality. So, if you took a board with five sockets, and you have five sockets and 1000 click boards, it gives you trillions of unique combinations. So just imagine how we make engineering easier.

EE: **The nice thing about engineers is that you don't sell them something by saying, "Now in purple," you know, if you have a direct benefit for an engineer, you're going to get people who are going to use the solution. If you build it, they will come. Of course, you have to let them know it's there, but if you have a good solution and you could present how it's a good solution, then you'll get at least the smart clients.**

Matic: We want to make it so engineers could easily switch microcontrollers in their project. It keeps you from having to rely on only one microcontroller line, when there is another one maybe which fits better in your project. Or, just imagine if you are a design service company, and the guy who made the project left the company, and of course, he knew the best microcontroller to use. In this case, what you do is to just switch to another card, another microcontroller.

Another example could be, if you want to show your boss something on how your idea is working, you can use the biggest microcontroller with the most resources just to show him. Then when he says, "Yes, let's go to make that project" you can downsize to the right microcontroller, at the right price and everything. So there are a lot of reasons to switch the MCU easily. It's all about scalability. You can either downsize for cost optimization, or if marketing comes along with a great idea, but it adds a bunch more memory, then you can go for the next MCU up in the series.

It's an open standard, so you don't need to pay anything to us. If you want to place a socket on your board, if you want to make a SiBRAIN card, it's up to you. We want to have a more universal tool because we like to cut down on MCU switching time, because that switching time is actually what engineers hate. EE

LEVERAGING THE CLOUD TO CONNECT THE ELECTRONICS INDUSTRY ECOSYSTEM

by Alix Paultre, Editor

The Cloud is enabling a connected ecosystem of design, supply chain, and manufacturing stakeholders, enhancing the engineering of smart & connected products.

It has often been the case in our current state of disruptive development that the core technologies transforming the devices we use is also revolutionizing the way we make them. A growing aspect of the Cloud and IoT are solutions like logistics and supply-chain management like Telematics, and the explosion of collaborative software tools that are changing the way the electronics industry works together, evolving processes and tasks into an integrated environment of collaborative workflows.

One of the companies offering a solution is Altium, who recently introduced Nexar, a Cloud-based partner platform that connects the rapidly growing Altium 365 PCB design community with the tools and partners needed to create smart & connected products. To get a better understanding of how collaborative Cloud-based platforms can accelerate the industry's ability to introduce new products, and what it means to the electronic design community, we spoke with Ted Pawela, Chief Ecosystem Officer at Altium, about the design and development challenges involved.

EE: **One thing about electronic design, is the more sophisticated the solutions, the more challenging the development environment, right? Between technology convergence, new technology, and other advancements, it's almost like a Red Queen's race. We're constantly moving faster and faster as we progress into the future. What are your thoughts on that?**

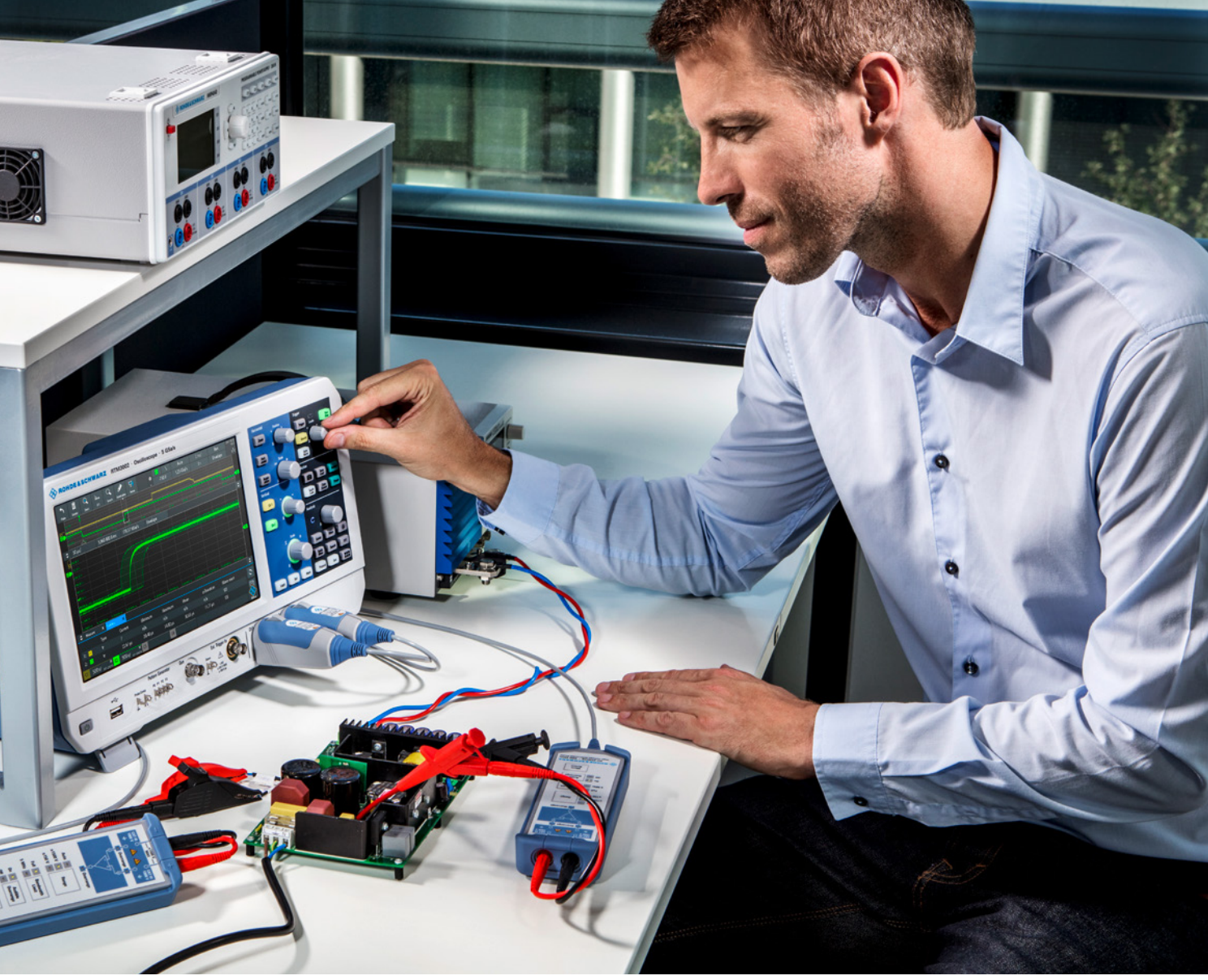
Ted Pawela: I think ultimately what we see in design from a software perspective, is that simplicity represents more sophistication than does complexity. I think the same thing is true in terms of product development, and more and more we see, whether it's the organizations or the processes that they use, that people are striving for that simplicity without giving up sophistication.

EE: **Once upon a time, for example, if I manufactured a mechanical part with an electric motor in it, like a church organ, I didn't have to worry about software. Today, a church organ design may have to be a web system specialist, because that organ's probably tied into the church's LAN with a link to the priest. Everything is now more complex.**

Pawela: I think there's a combination of things that have kind of contributed to this; one is that, same in many industries, everyone has moved away from kind of vertically integrated development and supply chains to where there's more specialization. That means that you need to be able to work with and collaborate with and co-design with many more people.

Then you have more stakeholders in the process. Then you kind of layer on top of that, the fact that we're much more geographically distributed than we used to be. Something that's very temporal as well is that we find that even when we're co-located in a city or a country, we still layer on top of that yet again, things like the COVID situation, and the fact that we've all kind of adapted to working remotely, which makes us more distributed by nature.

All of those things, plus what we see in virtually any product that you look at today, there's the whole notion of electrification, or trends of IOT, and things like that. But everything's getting smarter, which means from a product perspective, it's not a simple device anymore, it's a smart and connected product, which means that, in many cases, moved from pure mechanical design to now electromechanical design.



You've got to connect to an infrastructure of information. I think the level of complexity as you suggest is vastly increased from what it was even five years ago, let alone a decade ago or two decades ago. Our approach to addressing that has been that people need to interact in the design process, and that need is sort of more acute than it ever has been.

We feel that the only way in today's world that is really possible and practical and effective is through the cloud. What we've been trying to do is not change our software from desktop applications to cloud, but to cloud-enable them so that collaborative mechanism is ever present and to do it in a way that people don't have to think about it, and don't have to do anything beyond what they've already been doing, but it's just there. It just works for them.

For the last two years, we've been focused on the introduction of a cloud platform called Altium 365. It was intended all along to be a two-sided platform in that it was intended to support our users and their collaborative workflow, but also for partners and other stakeholders in this product development ecosystem. They can participate in it in a collaborative way, they can contribute to it. That was really for us, the genesis of this idea of Nexar that we're launching now, and Nexar is really that same cloud platform, but is the face of it to our partners where we expose APIs and we expose solution development kits. We likewise expose things like feeds of data that we have available to us through our various product lines and businesses.

So you can easily connect into that ecosystem, and provide value to the people who are doing design today. What our team is trying to achieve with that is the thing that we've been talking about now for certainly as long as I've been a part of Altium, which is five years now, and that's to help to transform the industry. What we mean by that, is to move the electronics design industry from something that was designed and architected to work 20 or 30 years ago. It's largely stayed the same, and we're trying to move it into 2021 and beyond into again, a more connected collaborative style of product development.

EE: **Right. We had interviewed a company that had been working with Altium and one of the questions that I had was how this has been almost a perfect storm for collaborative technologies, because it's not like they haven't been around, but they were in their evangelical growth process when COVID hit. And all of a sudden everyone started demanding these products that the industry had been trying to convince them they needed for such a long time.**

Pawela: The way that I look at it is that everything with the COVID pandemic wasn't so much changing what was already set in motion, I think what it's done is accelerated it. People had talked about transitioning from the office environment for a long time and the products that are needed to support them. The transition was happening, but with a slow, gradual approach, and what we've just seen is this massive acceleration of having to do it by necessity. Necessity ultimately is the mother of all invention, and I think this is one of those situations, and we have absolutely seen it from our customer base.

You would potentially expect that everything stopped when the pandemic hit, but it actually didn't at all. In fact, it pushed down the accelerator because the demand for the products that our customers create, and the demand for those to become even more innovative, has just increased in the past year.

EE: **To put it in context and perspective in the process, why don't you walk us through it. I'm a designer, and I've got an idea for a smart device with interoperability and connectivity. I approach you to say, "Hey, improve my development process." Where do you insert your value in my process to add that value?**

Pawela: We do that at various levels. For many years, Altium has been doing this at the design tool level and helping people to streamline the way that they go from concept to a completed design that's ready and manufactured. But now, we're focused on a couple of other issues. The first is recognizing that the design process is not generally done in isolation. Sure, in a startup occasionally, somebody's got a product idea and as an entrepreneur, they handle design themselves but there are typically other stakeholders involved in the process; you have to add different elements for a full product design, not just a printed circuit board design. That collaboration element is one place that we help them today in ways that we didn't a few years ago.

Moreover, when you go about that design process, you never go into it with the idea that the job is done when the design is complete. The job is done when the product is manufactured, when the product goes to market and the product is out in the field being used by end customers. That's an extremely complex and multifaceted process. So, imagine you complete a design and want to move onto the manufacturing stage, and you have to find the parts that are going to be used to create a printed circuit board. Suddenly you find that a capacitor, a simple passive capacitor that you designed into this printed circuit board and device a month ago, suddenly the entire stock all over the world has evaporated. As crazy as that sounds, that's a real life scenario that happens today.

We see that in many industries; they're struggling to keep up with consumer demand because of that supply chain shortage. Having access to real-time supply chain information while you're designing is vital, so you can avoid using parts that are suddenly unavailable, or that are maybe facing end-of-life. That's another area where we're helping them. We do that through our Octopart part and data-feed information. That tells us everything about the pricing, about the availability, about the stock at various distributors as you're designing. Making that available during the design process is another way that we're helping transform the electronics industry.

EE: **It is cool that you're working with Octopart. I remember when those kids launched, it's very cool to see that they got where they wanted to with that service.**

Pawela: Octopart has been great. It's been a fantastic business for us, and it's been a big contributor to the industry. They have over six million queries every single month; people looking for different parts on Octopart, so it's widely used and adopted in the industry. But it's not the end of the road for us with Octopart either because there's a whole lot more that we can do in terms of making that information available to actual OEMs and manufacturers so that they have access to that as well—not just people in the design process.

What's interesting to many of the actual component manufacturers is to get an understanding of what people are designing today. What are the trends? Is it Wi-Fi? Is it 5G? Is it high-speed design, high-density interconnect? What are the things that they should be thinking about as we're introducing new products? And they're thinking about what stock and inventories we should create. That kind of intelligence is something that is really needed and desired by the manufacturers, and having access to both the design tools and that supply-chain information is incredibly valuable.

We have a unique opportunity to be able to give insight into that from a trends perspective, not an individual customer perspective. If we look at Europe, we have to also ask what are the design trends in the US? What are the design trends in Asia? Are they the same? Are they different? And you know, what sorts of chips are people needing? What passive components, what other parts? Octopart's been a very interesting business and we've got still a long way to go with it.

EE: **As advanced as what you're doing is, you probably see room for growth. Is there anything you see that is something that you would want around the corner?**

Pawela: For us, the big thing that we've been trying to do from a high level is to connect the design community with the supply chain community and the manufacturing community. We see right now a really great opportunity where we've done a lot with Octopart and the supply chain, and making that information available, but manufacturing is still sort of largely isolated and it sort of manifests itself. You see this very easily when, if you were to go to a board fabricator and just ask them, "How many board designs do you receive that you can immediately put onto your assembly equipment, put it down the line and actually produce that board?" Largely, they'll tell you it's almost always zero.

That's because designers don't like the fact that we have design rules that largely guide us away from things that are hard to

manufacture, and we call this design for manufacturing, right? Those rules are not consistent from manufacturer to manufacturer because they all have different equipment and different capabilities. Your design has to conform to a specific manufacturer's requirements. On top of that, if manufacturers get something like design or Gerber files or something, they don't know what the design intent was. Did those traces have to be that close together? Did this one have to run so close to a connection that you've designed into the board? Those things can affect everything in a dramatic way; the cost of the board, the speed to produce that board, all of those sorts of things.

So, what we want to do is bring manufacturing closer with design. What I like to say is it transitions from design for manufacturing to design with manufacturing. That's a big part of why we're introducing this other side of our cloud platform, the partner side—the Nexar side—so that we can bring manufacturing onto that platform. The process of communicating about the design, even while it's happening, can be taking place between designer and fabricator, or between designer and assembly house or contract manufacturer.

So, we can short-circuit the questions that come at the end of the process, and bring them forward. Not "design-in" problems, but "design-out" challenges that we might not be able to catch downstream in the timeline of product development.

EE: **Very cool. It's an inevitable direction. You were saying before how the task doesn't end until it leaves the factory. Nowadays, it doesn't even end there, with some products you've got in the field getting software updates, and you're monitoring the product until the warranty runs out half the time now with an advanced product out there in the field. I think we're actually progressing to an almost meta awareness of a product, from the simulation and design all the way out to maintaining it and keeping in contact with it in the field.**

Pawela: I couldn't actually agree more. We used to think about having all kinds of statistical information for quality and throughput on the manufacturing line, and it kind of stopped there, but now, as you suggest, we're seeing that, that extending out into the field where we're actually being able to collect data. We can see more how people are using them and when things go wrong.

There's a full lifecycle of information that's available now that was never available before. And the big transition is that we're moving to a place where we're actually starting to use it where it becomes not just information or data, but it becomes intelligence and that's highly valuable, because that informs all kinds of decisions that we never would have been able to make in the past.

EE: **Well, it could even cascade backwards if you think about it, Ted, right? I could create a product; discover a product problem in the field and have that change cascade all the way back to the design process.**

Pawela: Yes, absolutely. And it goes even further because sometimes you find that something that you see in the field that you might change on that given product, that might be a component that isn't functioning properly, and you want to know, where else did I use that in all of the products that I have available? We can really blossom into something very extremely valuable.

EE: **That is an excellent point to bring up, because that level I would call a meta-awareness, that kind of awareness through your design processing and manufacturing procedures. It's the kind of thing that you point to and say, "That's what Big Data does well. That's why we do this thing."**

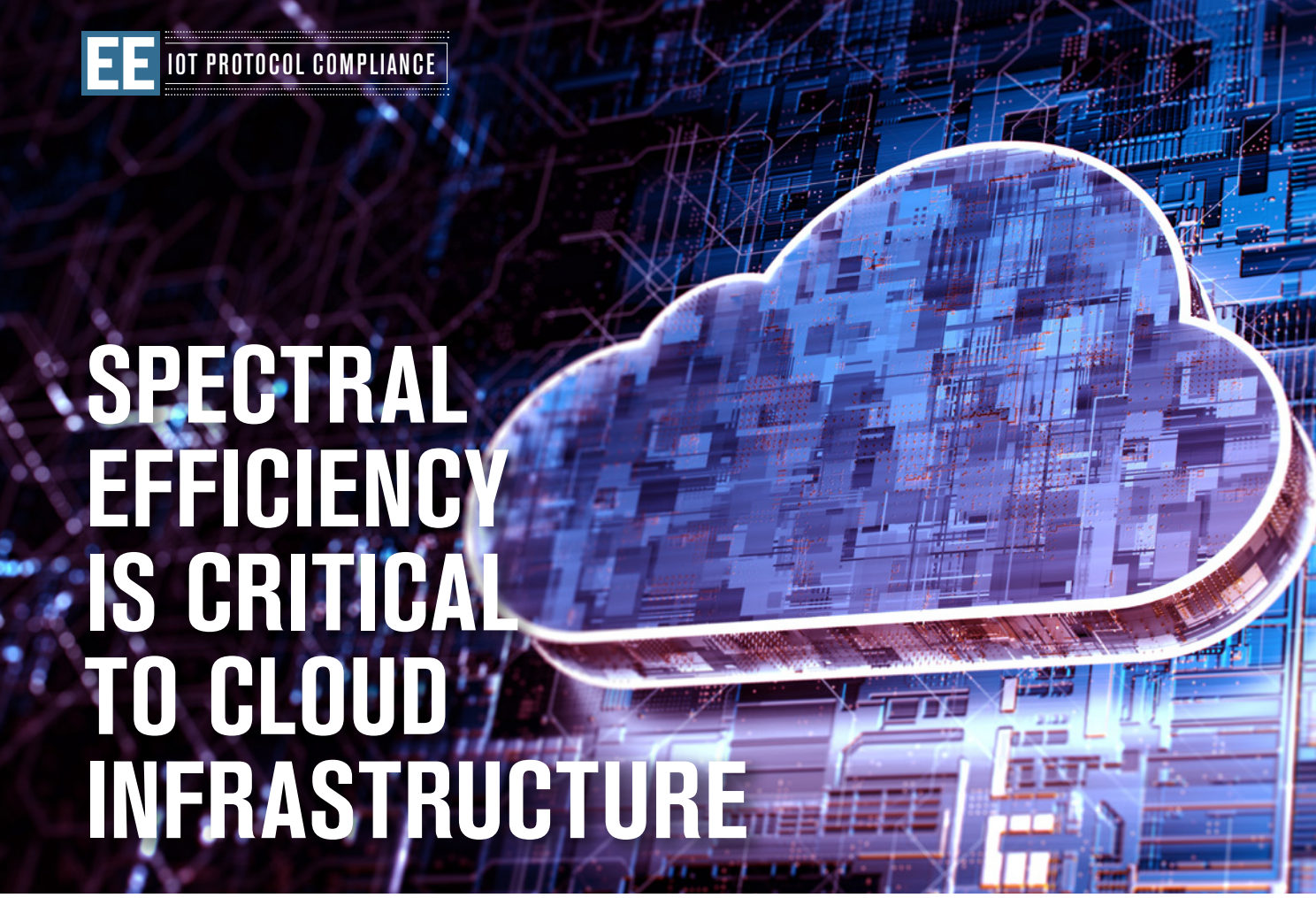
Pawela: Absolutely. I think what we're seeing is also a trend in general for the industry to start thinking about now: how do I also apply artificial intelligence algorithms to that? So that I cannot only sort of be reactive to it, but I can be predictive.

Let's just say the product development industry in general and particularly now that electronics are in everything. We think that our sort of relevance is extremely broad, but in the electronics industry, relevance is now applicable to almost everything we see in everyday life. Everything we do over the course of your day, if you look around, you see electronics built into that, and yet we have an electronics sort of value chain that is still largely disconnected. It operates in the same way that it largely did 20 years ago. The opportunity for this industry to bring itself forward and modernize itself is really incredible right now. It's going to result in massive time and cost savings and massive amounts of innovation if we can, as an industry, come together to solve that and attack that problem.

This is exactly what Altium is doing with the Nexar platform right now. We're trying to attract any stakeholder or partner in the electronics design ecosystem, even our competitors, to participate in modernization of our industry. We're not asking for anyone to pay for that; it's sort of zero friction, zero costs for partners to come and do that. We know that we will win ultimately through our design tools and our design platform, and the better we do this, and the more value we can add to our platform, both organically and through partnerships, the more people will come and use our design tools.

That's what we're trying to achieve—getting more and more people to use the platform…people, companies, technologies, all coming together to participate, and use the platform for their own benefit. They get to take advantage of the fact that we've got a vast user community who need their products. And, in exchange, we're giving value back to all of the people who do the design work today. Everyone wins; customers financially benefit by having better solutions and faster time to market. Our partners benefit by virtue of being able to do business with this community of designers. And our designer customers benefit because they are once again receiving the benefit of better, more connected processes, tools and so forth.

That's what Nexar is all about and we're genuinely excited about having this opportunity. And we're hoping that the rest of our peer companies in the industry, likewise, will feel the same way. EE



SPECTRAL EFFICIENCY IS CRITICAL TO CLOUD INFRASTRUCTURE

by **Alix Paultre**, Editor

Olemedia/E+/Getty Images

To get a deeper look at one of the aspects of the Cloud and managing the RF spectrum, we reached out to Michael Eddy, VP of Corporate Development at Resonant. The company has been working on solutions to address spectrum deficit, which can mean reduced data speeds and a reduction in usable bandwidth. RF filters are one of the ways to enhance spectral efficiency by protecting from degradation due to interference.

How efficiently a given frequency carries a data packet is critical to maximizing a system's RF performance. Filters with wide bandwidth are needed to realize the full potential of 5G and Wi-Fi. Resonant's XBAR resonator can create filters that deliver performance and maximize efficiency at up to 1,200 MHz, with support for frequencies higher than 3GHz, with very high power handling and low loss.

EE: **Thinking about how far RF has come as an application space, I mean, 50 years ago, you could count direct RF applications on one hand. After you get past consumer, there were a few military applications, a handful of industrial applications. What would you say is the big defining line in the RF space, where RF stopped being a niche application space as it were, and really started becoming a commodity for society?**

Michael Eddy: I think the driver and the inflection point happened because of the phone, the wireless phone. At the very beginning, and I remember, if you see on the TV, these very early Motorola phones,


Eddy

which looked more like a brick than what you see in a modern smartphone, the key was the RF. But no one really knew how that was going to take off, as you started to really engineer that RF component in the phone, so that you could make it both mobile and have distinct functionality, and allow you to become wireless, as opposed to wired.

EE: **You could make the argument then, Mike, it's almost like an iPod, iTunes thing, that the smartphone is now ubiquitous, a mainstream RF device, but that it also required the connectivity aspect to be realized to make it a thing. It's one thing to say, "Okay, everybody can get a walkie-talkie," but then to say, "everybody can now get a walkie-talkie that is indistinguishable from a telephone in your mind."**

Eddy: Initially it was just the voice and putting that code on the phone, but once you started integrating it with the internet, it really took off as a device that was essential for everybody, both to make calls and also to interface with the internet and become more and more sophisticated as each generation of wireless technologies evolves and becomes more and more sophisticated and more and more functionality.

EE: **We see multiple issues when we start doing what we call the Cloud, right? You've got multiple devices, using multiple bandwidth, with multiple protocols. I mean, there are a lot of moving parts, no pun intended, out there.**

What are some of the issues you see?

Eddy: Really, the issues we see are more of a function of the complexity and the amount of signals being transported from your phone to the network, and from all the different devices to the network and then the internet, and being able to define and maintain the lanes of the different signals, to make sure that they reached the place they need to go to, with high integrity.

EE: **What about the people who would say, "Well, I've got software defined radio now, I've got digital devices, I can just define in the software how exact I want my signal to be."**

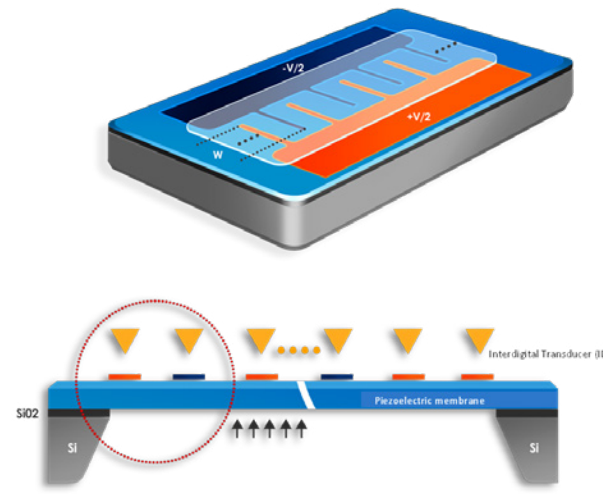
Eddy: You can do that to an extent, but the size and the amount of these signals now are such that you're still required to deal with that integrity and maintaining the lanes, the frequencies of these signals, using RF. It's only though, by very sophisticated filtering, allowing the signals that you want to listen to and to deal with in the phone and vice versa, that you can maintain the integrity of those signals. That's why high-performance filters in the phone have become an essential piece of maintaining and making sure that the performance of the phone is maximized.

EE: **What kind of performance on these filters are we talking about? Are these straight up brick wall filters or is there an attenuation roll off? How precise are the current filters and how precise do they need to become?**

Eddy: Just as a stake in the ground, take a modern smartphone. A high-end smartphone has somewhere between 60 to 100 filters in there. That's because these phones need to operate on multiple frequency bands, anywhere from 600 MHz, and now in 5G and Wi-Fi, up to 7 gigahertz. Each particular band that you want to use in that phone needs a filter, so that the different signals do not interfere with the signal that you're interested in.

The key to these filters are they have to have very low loss, so that you can maintain low power so that your battery is not drained. That also gets the maximum signal strength, so you can get the highest data rates possible out of your phone. Then, it must be rejecting any of the out-of-band signals that are potential interference. So, as you said, the roll-off needs to be very steep. The closer you can get to a brick-wall filter the better, and that involves what we call acoustic-wave filters. These filters are based around the piezoelectric effect and the roll off you can get in this very, very small size is incredible. So, you're typically attenuating a potential interfering signal by somewhere in the order of 50 DB.

▶ Resonant's XBAR resonator tech creates filters performing at up to 1,200 MHz, supporting frequencies higher than 3GHz.

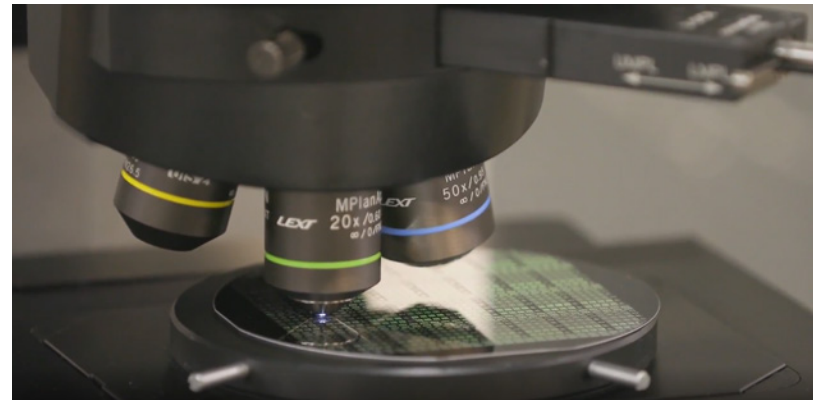


EE: **That's very interesting Mike, because the power space is being disrupted right now by GaN, which is a piezo semiconductor. It's interesting that piezo materials, which used to be a novelty, are now becoming critical parts of our infrastructure.**

Eddy: Using piezoelectric filters was a critical turning point in the phone, because there are so many filters and they need to be so small, that the only kind of filter technology that you can really utilize with this kind of performance and this kind of size, are piezoelectric filters. They're basically using the piezoelectric effect to generate resonances that can be built up as a filter. As you say, it's a very interesting time right now because 4G is transitioning to 5G, and obviously when that happens, there are some key disruptions going on because of the change in requirements.

You mentioned GaN, which is a very, very good power semiconductor for high power and high frequency. That's why you're seeing GaN now being used for infrastructure for 5G, because 5G is now moving to higher frequencies and a much larger bandwidth. That's exactly what's happening, so you'll see the replacement with GaN on the power side. Also, what you're seeing now in the phone is a move to different kinds of filters, still based on the piezoelectric effect, that can optimize

▼ These piezoelectric filters are very, very small in size.



the performance because they work best at high frequencies and wide bandwidth.

EE: Some of our audience knows that my background is Army electronic warfare, which was in my day was nothing but old-school RF and we were almost out there in the woods with coat hangers. To see the migration now to such high levels of precision, it's really something. For example, if you wanted to look at another application space that's completely removed from ours, but is actually getting a weird renaissance because of accuracy of precision is ancient archaeology. We now have the tools to appreciate how precise that stuff was. 18th- and 19th-century man didn't have the tools to know how precise that stuff was.

Eddy: That's a really great analogy and perhaps I can just build a little bit on that, about what Resonant does and our technology for 5G, which we call XBAR. In cellular wireless technologies, we go by different generations. So, in 3G technology, the frequency bands were about 2 GHz with a bandwidth of about 35 MHz, and a certain kind of acoustic-wave filter technology is optimized for that particular set of requirements. And that's what's called SAW, surface acoustic wave, acoustic technology. When 3G went to 4G, you're now looking at about 2 GHz frequency bands, with a wider bandwidth of somewhere in the order of 65 MHz. So, the bandwidth increased, and the frequency increased, and the old technology for 3G SAW was really not optimized for this new set of requirements, and a new acoustic wave resonator technology was developed for that particular new set of requirements, which was called FBAR.

It was actually invented by Broadcom, then Avago, and that is a bulk acoustic-wave technology that was optimized for these new requirements. 5G is again, very different. You're now talking above 3 GHz with bandwidths of 600 MHz, 900 MHz. The new Wi-Fi bands at 1,200 MHz wide at 6 GHz. These new requirements, the old 4G technology, there is a huge amount of fab infrastructure, engineering infrastructure around that 4G technology.

Those companies are trying to extend the performance to meet these new requirements. But Resonant is an IP licensing company with some very sophisticated software, so what we did is we took a blank sheet and said, "What is the best technology for these new requirements?" So, we invented this new resonator technology for filters, optimized for these new requirements and we call it XBAR. Our XBAR technology is designed for these 600 MHz, 900 MHz, 1,200 MHz bandwidth, at frequencies of 3-7 or higher GHz. Does that make sense?

EE: **It makes a lot of sense, and actually, I wanted to comment on what you said and follow up, because it is so fascinating to hear the development path for Resonant's solutions. You could tell that it's an example of technology convergence in that you're a material scientist, a professional, and you've come up through these spaces because you've touched the spaces by adding value with material science, and it's almost a chemical engineer's approach. "Okay, what's the shape of the molecule? What molecules can I find that'll have that shape and let me make this new drug." It's interesting to see the different approaches refreshingly creating these enabling solutions.**

Eddy: Actually, it is a tremendous convergence of some really critical technology. One of which, as you said, is the material science, and the material science that has been critical is what's called engineered substrates. The ability to put different layers of single-crystal substrates on silicon. So, we can now put things like lithium niobate and lithium tantalate, these piezoelectrics on silicon. This is a very recent establishment of what we call engineered substrates.

Then the other convergence within Resonant, is we have this very sophisticated software platform, it's called a full finite element modeling tool, where when we have the materials, properties, and physical dimensions, we can accurately predict the kind of RF performance we will get out of a fabricated structure. I think we're the only ones who have that level of predictability and accuracy around our software tool. So, the convergence of the materials and the sophisticated software allowed us to invent the right kind of structure for these new requirements.

▼ Filter type comparison

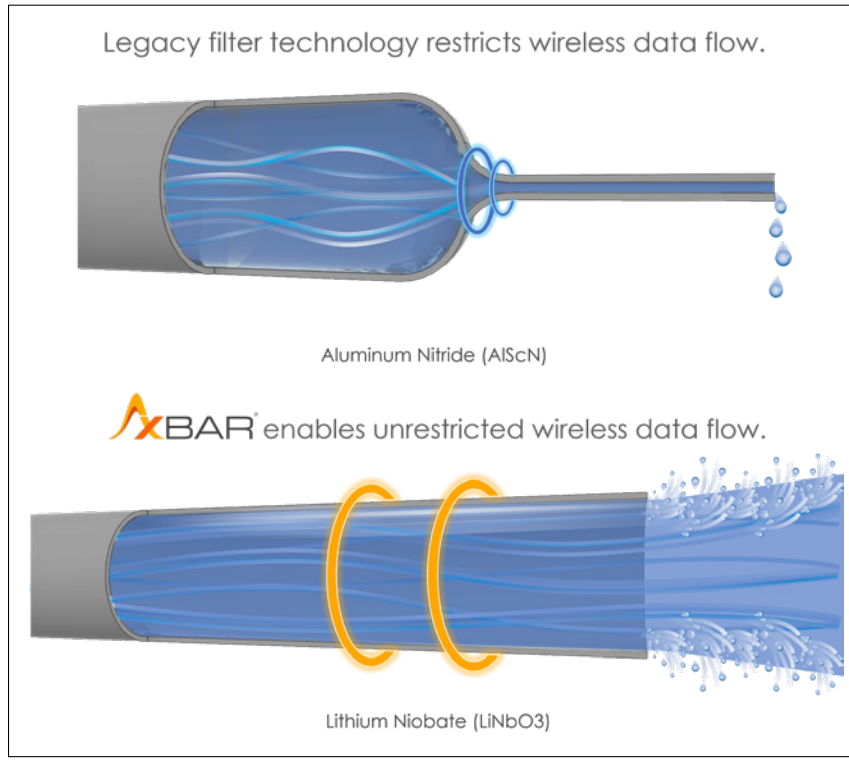
EE: **Well, kudos. One of the ways to determine a technology's sophistication, is how precisely can they apply force. From military weaponry to RF signaling, the thinner your scalpel blade is and the more precisely you can place it, the better a doctor you are, as it were.**

Eddy: Absolutely. We're firm believers in that, that we're continually improving our software tool for accuracy because that's what really allows us to invent and really make sure that we are at the forefront of the kind of technology for this next generation wireless. And it's not just 5G, all of the frequency bands below 3 GHz are full, so all of the new wireless technologies are above 3 GHz. That's why 5G is in the 3.3-5 GHz range. The new Wi-Fi bands are five to 7.1 GHz, and ultra wideband is being used now in the iPhone 11 and 12, for very precise location. That's in the 6.5-9 GHz range. You'll see even Satcom looking in the 12 GHz range, that's where the bandwidths are available. We believe our technology will be able to utilize and take advantage of all of these new applications.

EE: **You touched on one of them, when you said location, smartphones and personal electronic devices tied to the Cloud are going to become a critical part of sensor fusion in a smart city environment, intelligent traffic and the like. Because the car may see you, but then if the car also sees the phone as it were, you're doubly safe.**

Eddy: Yep. If you look at a modern automobile and you look at the shark fin, that is a very sophisticated. It's called a telematics control unit, a TCU, and it's building on the kind of modules you see in the phone, because it needs to interface to the network. Then, it needs to interface within the car and interface with all of the sophisticated sensors that are within the car. And so already, you're seeing a very sophisticated wireless module that is being used in the car, as we move toward more and more autonomy and more and more need for infotainment within that car. And that's why you see rumors of people like Apple looking at autonomous vehicles, because everybody is fighting for that, what they call a full screen, the screen within the car.

EE: **The car is literally the convergence of every technology currently being developed. Everything from wide-bandgap semiconductors to advanced RF filtering, it's going in the car.**



Eddy: And as you said, as you move to more and more autonomy, it becomes very, very critical. Part of 5G is very wide bandwidth. The other part is very, very short delay times. Latency getting less and less, and that's going to be critical in the car, and if you think of safety, moving at 60 miles an hour, if you have something that is going to have a long delay, that is going to be a problem. And so again, another key piece of 5G is to move the compute piece to the edge, closer to the user, so that the delay becomes minimal.

EE: **That's the whole impetus behind, for example, artificial intelligence at the edge. Everything that you can do to leverage computing at the edge is being looked at because latency is so critical.**

Eddy: Yep. No, I'm very excited about the transition from 4G to 5G because it is such a disruption and it's very different from 4G because it's going to enable new applications beyond just the wide bandwidth. Whether it's more autonomy in the car, whether it's more robotics in the manufacturing line, whether it's increasing use of AR and VR, because the latency's so short now. There's just a raft of new applications that can be generated because of these very different and improved requirements of 5G.

EE: **Excellent. If you had any final thoughts, now would be a perfect time for them.**

Eddy: I think basically, making sure that people understand that we're in the early stages of 5G. Each generation in wireless lasts about 30 years, and each generation of wireless starts at a clip of about every 10 years, and we get a new generation. Right now, we're at the early stages, and so you're not seeing the dramatic improvement over 4G yet, but in the next two, three, four, five years, you'll start to see some great improvements in the data rates for wireless and 5G.

You'll also start to see the need for these very high-performance filters, that we are at the front edge of, at Resonant, generating our XBAR filters. And the validation beyond, you're absolutely describing this correctly, is we have the very sharpest scalpel with our software tools, is that the largest filter manufacturer in the mobile space is partnering with Resonant to bring this technology to the marketplace. EE

SMALL-CELL DEVELOPMENT IS KEY TO A SUCCESSFUL 5G INFRASTRUCTURE

by **Alix Paultre**, Editor

The most important aspect of our modern Cloud-based IoT-oriented society is the infrastructure required to sustain it. For all the wireless wonders that abound today, they rely on a lot of wiring behind the wainscoting. Establishing, managing, and maintaining the wireless infrastructure is vital to the continued functioning of the Internet of Things as we know and expect it to be.

Development and deployment of that infrastructure is multi-tiered and -faceted. The modern RF airways are superhighways in the sky, relying on proper lane and traffic management to prevent complete chaos. Within the 5G infrastructure, small cells are crucial, providing increased coverage and uniform 5G user experiences, as well as maintaining high data rates and low latencies.

Addressing the emerging 5G small cell market and accelerating 5G deployments in outdoor metropolitan and indoor enterprise locations, LitePoint, a provider of 5G test solutions, announced it has signed an agreement with Qualcomm Technologies to support LitePoint's development of 5G test solutions for the Qualcomm 5G RAN Platform for Small Cells (FSM 100xx).

A comprehensive solution

LitePoint's IQgig-5G is a fully integrated, versatile multiband millimeter wave (mmWave) non-signaling test solution and the first of its kind to support all 5G FR2 frequencies within the 23-45GHz frequency range. All signal generation, analysis, processing, and RF front-end switching are self-contained inside a single chassis. The one-box design makes it simple to set up, use and maintain in order to achieve reliable measurements.

Enabling small-cell waveform generation and analysis for 5G radio technologies, provides an intuitive graphical user interface (GUI), and allows for real-time RF parametric analysis for small cell products. The Qualcomm 5G RAN Platform for Small Cells (FSM 100xx) is the industry's first 5G NR solution for small cells. The 10nm solution supports both sub-6GHz and mmWave spectrum bands.

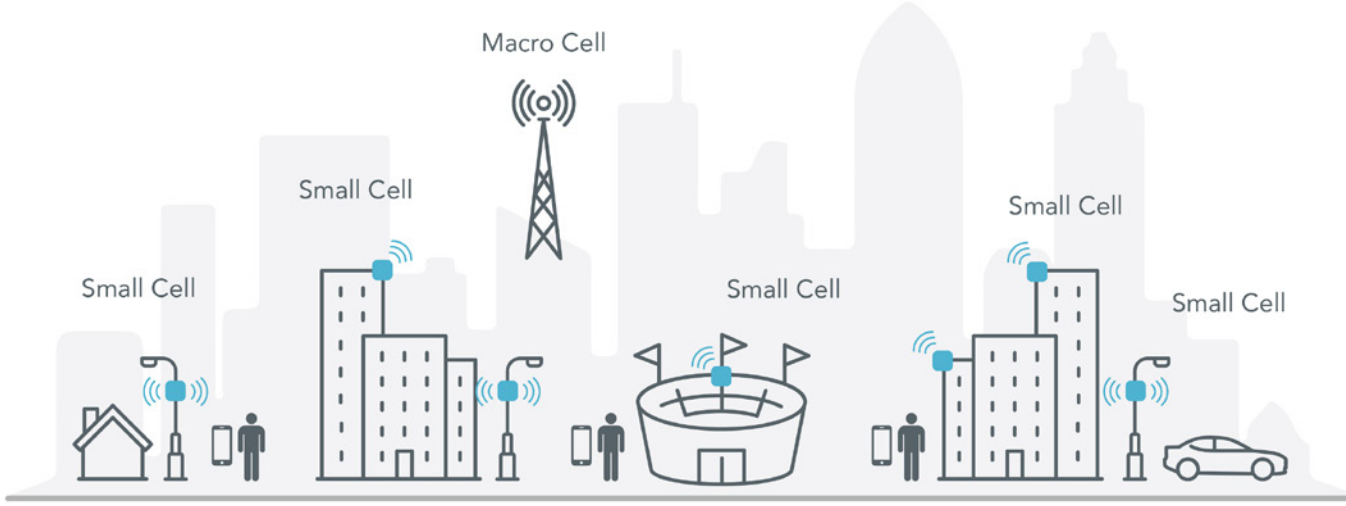

Chen

This platform is designed to support original equipment manufacturers (OEMs) to reuse both software and hardware designs across sub-6GHz and mmWave products. To take a deeper look at this development and the role of small cells in 5G development, we spoke with Rex Chen, Director of Strategic Business Development at LitePoint.

EE: **Radio has been a fundamental part of society since Tesla developed the core technologies and Galvani implemented them. But for a long time, radio was considered more of a public good and a niche asset. Now applications for wireless have become mainstream, and we're adding new applications every day. Where would you say, Rex, where the tipping point came, where wireless became a critical infrastructure commodity?**

Rex Chen: I think the tipping point where it became a commodity was when we transitioned from analog to digital. In particular, I would say it really got started around the 3G era, when you had clear voice communications and an actual device to carry with you to make a call anywhere, any time. I think that started the momentum of wireless and seeing how powerful it is and has become prevalent. It's become a part of society, and part of our everyday usage.

There are businesses that are developed on top of wireless systems that would



▲ LitePoint's IQgig-5G multiband mmWave non-signaling test solution uses the Qualcomm 5G RAN Platform for Small Cells.

not otherwise survive today without it. A good example would be something like Uber, right? It's an app, sits on your mobile device, and it entirely relies on the wireless communication to identify where a person is located at any point in time. Being able to communicate and request a service that they need and to get a ride to go somewhere. I think even though it's a crowded space, we're still in the early innings of how this can really transform industries with 5G.

EE: **Now there's a challenge to ensure that we can provide these services. Because it places demands on the equipment, the precision. Right? It's like having a soda fountain, each of the flavors better be in their own pipe.**

Chen: It's certainly crowded. I think the idea of where the wireless system used to be, I think you mentioned earlier, kind of a very tight-knit or closed-loop asset, is now kind of moving from that kind of central base concept into the edge or open-loop concept.

EE: **Excellent point. What are your observations on that? Now that it is becoming decentralized and digitized and almost like a part of the web?**

Chen: I think a variety of things can happen. Look at how the media is transforming itself today. You have YouTube influencers, you have documentaries or films that are not from the core mainstream. I think what you'll see in these wireless networks is also kind of the similar path. Where you still have your core network infrastructure, but as it kind of moves and decentralizes, you'll have these smaller, mini base stations, what we call small cells, that are going to be prevalent in places that are high density, metropolitan areas.

The emergence of O-RAN also known as open radio access network, is another good example of how a closed-loop system is now opening up and allowing white-box vendors to participate in different layers of the network stack and lower the cost for operators to deploy new wireless infrastructure in the market.

I think these new technologies moving from the core to the Edge and becoming more transparent are just some display of where we are going in the future.

EE: **Because this announcement with Qualcomm directly impacts development of small cells, why don't you put it into context of what you just explained? Considering the importance of small cells within the context of the Cloud, and the importance of precision performance to make sure that you stay "within your lanes." So how does this announcement with Qualcomm impact the development of small cells?**

Chen: This announcement with Qualcomm directly impacts the OEMs building these small cells, helping accelerate products getting out in the market faster. The reason it's able to do that is because a lot of the test metrics and methodologies are highly dependent on the chipset inside the product. So this license agreement between LitePoint and Qualcomm inherently speeds up OEMs that use Qualcomm small cells (FSM 100xx) to get the end device tested in production faster and it really helps the entire ecosystem moving forward.

EE: **Let's talk about the designers involved in the deployment. How much hand-holding are you willing to offer? What kind of engineering support can you provide people who want to maximize and optimize this?**

Chen: I think there are a couple of angles to look at. For some OEMs, they want to be able to have the ability to manage production, not just the actual device, but all the software and tools involved. For others, they are looking for already-existing optimized software solutions that are vetted by industry standards. What we do besides working with the chip makers here is also offer not just the test instrument hardware, but all the software involved and the ability to turn on certain knobs and optimize those test methodologies.

How do you actually optimize, for example, your test time? That requires understanding what is underneath the hood in the system software and what tradeoffs or compromise can be made between quality versus time. That tradeoff has a direct impact on the bottom line of how much it costs to get a product out in the market. The collaboration with Qualcomm has been going on for many years in our cellular technologies and connectivity product, but this is kind of the next step forward.

The area where small-cell plays, it's going to have a more and more important role in the future for these mobile operators to deliver higher data rates, lower latencies, and better performance. We are at the center stage of that enablement, in particular areas where there's high density, metropolitan cities, or enterprise environments, indoor corporate spaces, campuses, and facilities. The ability to get these small-cell base stations in a faster time with better cost structure is really enabling the industry and ecosystem at large for the 5G evolution. EE

For more information on LitePoint's 5G testing solutions, visit https://www.litepoint.com/products/iqgig-5g/.

EVALUATION ENGINEERING'S

FEATURED TECH

1

2

3

4

1. mmWave Semiconductor Device Test Systems

Marvin Test Solutions' TS-900e-5G Series mmWave semiconductor device test systems deliver proven performance to 44 GHz and beyond, while meeting the high throughput requirements demanded by OSAT production. The scalable multi-port architecture supports up to 20 independent VNA channels, dynamic digital with per-pin parametric measurement units (PMUs), and a wide range of instrumentation options. Claiming the fastest mmWave production test performance in the industry, they are ideal for both wafer probe and package test. Additionally, the flexible receivers provide support for most popular production automation and handling tools.

Marvin Test Solutions

2. RF Loads with 1.85mm, 2.4mm, 3.5mm, SMP and SMPM Connectors

Fairview Microwave has broadened its selection of RF loads to address a range of applications involving test, R&D, production, commercial and military RF communications systems. Fairview Microwave's RF loads provide a maximum power of 1 watt and connector options that include 1.85mm, 2.4mm, 2.92mm, 3.5mm, SMP and SMPM. They are suitable for terminating multicoupling devices, coax cables and test equipment across a variety of applications. These RF loads cover 18 GHz, 27 GHz, 34.5 GHz, 40 GHz, 50 GHz and 67 GHz frequencies and provide excellent VSWR performance as low as 1.15:1.

Fairview Microwave

3. IoT Mesh Evaluation Kit

Fujitsu has released its IoT Connectivity Solutions Mesh evaluation kit, which simplifies testing of all use cases for wireless IoT platforms driven by Wirepas mesh technology and Fujitsu hardware. The kit contains everything needed to get up and running, including five FWM8BLZ07Y sensor nodes, outfitted with temperature, humidity, barometric pressure, accelerometer, luminance, and sound level. It also features five FWM8BLZ07P mesh nodes (set as asset tags), 20 FWM8BLZ07P mesh nodes (set as Wirepas), and one FWM8GWZ01 Wi-Fi gateway with two Wirepas sink nodes.

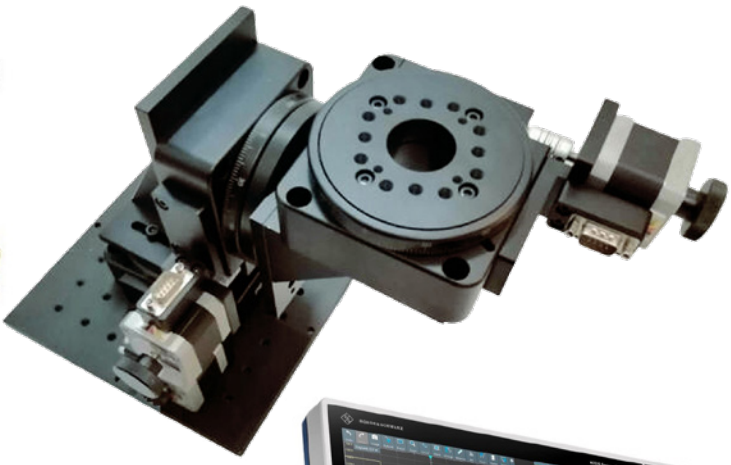
Fujitsu

4. Low-Profile XY Brushless Linear Motor Positioning Stage

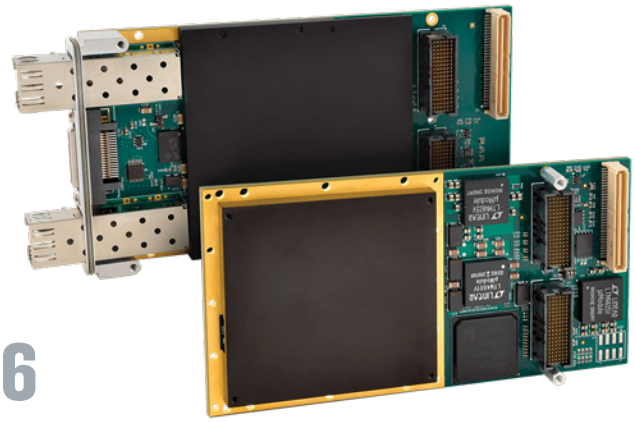
The SRS-004-006/004-003-01-XY is a low-profile XY single-rail positioning stage that uses brushless linear motors to generate a continuous/peak force of 6.2 lbs [27.8 N] and 18.7 lbs [83.3 N] (bottom axis), 3.1 lbs [13.8 N] and 9.4 lbs [41.8 N] (top axis), with a total stroke length of 4.3 in [109 mm] (bottom axis), 4.3 in [109 mm] (top axis). The top axis directly mounts to the moving bottom axis motor. A low-profile system able to make quick moves in both the X and Y axes provided the solution for an automated assembly application.

H2W Technologies

5



7



6

8

5. GaN PIN Diode Switches

Pasternack's RF and microwave PIN diode coaxial-packaged switches are designed for commercial and military radar, jamming systems, medical imaging, communications, and electronic warfare. The switches use GaN and chip and wire semiconductor technology. They offer robust thermal properties and higher breakdown voltages, allowing them to handle higher input power levels. Switch features include cold switching performance up to 100 W CW RF input power, broad frequency band coverage ranging from DC to 18 GHz with reflective SPDT and SP4T PIN diode designs. They also feature TTL compatible driver circuitry for accurate logic control and are EAR99-compliant, allowing them to meet environmental conditions for altitude, vibration, humidity and shock.

Pasternack

6. XMC FPGA Modules with Write-Protected Configuration

Designed for defense and aerospace systems, Acromag's XMC-7AWP and XMC-7KWP modules have a user-programmable Xilinx Artix-7 or Kintex-7 FPGA with write-protected flash memory to secure configuration files. These modules are well-suited for a broad range of applications such as hardware simulation, communications, signal intelligence, adaptive filtering, and image processing. High-speed interfaces are provided for PCIe, 10GbE, LVDS, serial and other I/O signals. The XMC-7KWP models offer a choice of Kintex-7 FPGAs for 325k or 410k logic cells. Dual SFP+ ports offer support for 10-gigabit Ethernet with fiber or copper transceivers.

Acromag

7. Tri-Axis Yaw-Pitch-Roll Stages

Optimal Engineering Systems introduced a series of Tri-axis Yaw, Pitch, and Roll Stages. The YPR-100-100-100-01 model is driven by two-phase stepper motors. The -02 version is driven by three-phase brushless servo motors, with quadrature incremental optical encoders mounted on the shafts of the motors. The -03 is driven by DC servomotors with quadrature incremental optical encoders, while the -04 is driven by stepper motors with quadrature optical encoders for position verification. They are suitable for the precise measurement of angles, the curvature of an object, laser machining and drilling, scanning, tracking, and for use with coordinate-measuring machines.

OES

8. Oscilloscope Delivers Speedy Insights

Rohde & Schwarz says its RTO6 oscilloscopes deliver fast insights with an updated user interface on a larger, 15.6-inch Full HD touchscreen and straightforward workflows. The R&S RTO6 delivers deep insights into designs on the engineer's workbench, with state-of-the-art specifications such as a 9.4 ENOB, an update rate of one million waveforms per second, and a comprehensive toolset of analysis functions. The digital oscilloscope offers six different bandwidth models from 600 MHz to 6 GHz and a sample rate of up to 20 Gsample/s.

Rohde & Schwarz

TECH FOCUS

SAFETY TEST

Test and evaluation systems for safety can be applied to a myriad of applications today, from cars to factory automation. Being able to operate a system safely also directly impacts how well it can serve its application.

Renesas Releases FSoE Software to Help Accelerate EtherCAT Safety

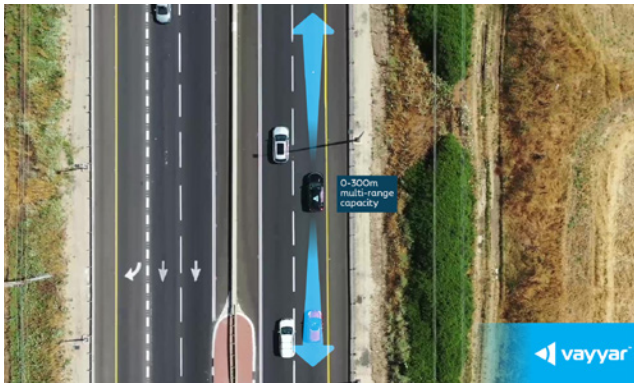
Renesas Electronics extended the RX Functional Safety solution with the release of its Functional Safety over EtherCAT (FSoE) Application Software Kit. The solution addresses industrial automation applications, reducing the complexity of IEC 61508 SIL3 certification. Based on the FSoE standard published by the EtherCAT Technology Group, developers can obtain an FSoE protocol stack in addition to an RX microcontroller (MCU) with functional safety support and the software in a single package. This allows quick implementation of functions supporting safety, such as alarms indicating danger or emergency stop signals using an RX MCU. RX Functional Safety support is now extended to all MCUs built around the RXv3 core (e.g., the RX72M, RX72N, RX72T, RX66N, and RX66T) in addition to the previously supported MCUs built around RXv1 and RXv2 cores. Using the certified software eliminates the need to develop MCU-specific functional safety software. RX MCU users can also use existing software assets when developing equipment with functional safety support. RX Functional Safety provides everything from self-diagnostics at the individual MCU level to comprehensive development support aimed at certification of user-developed equipment.

Renesas

Module Lets Vehicles Assist Drivers in Unsafe Situations

The u-blox VERA-P3 vehicle-to-everything (V2X) module allows automotive OEMs, Tier-1s, and manufacturers of traffic-management infrastructure to integrate V2X technology into their platforms and solutions for commercial deployment. VERA-P3 communicates via the IEEE 802.11p wireless standard, referred to as Dedicated Short-Range Communications (DSRC) in the U.S. (also known as ITS-G5 in Europe), to connect vehicles with each other and with roadside infrastructure. By effectively seeing beyond the line of sight, V2X lets vehicles assist drivers in potentially dangerous situations, in the event of slow traffic ahead and by negotiating complex intersections. Smart cities can also benefit from vehicle-to-infrastructure (V2I) applications to manage traffic, from providing green-light speed advisory, roadwork warnings, and hazardous location warnings. The VERA-P3 module could play a crucial role in enabling truck platooning, which will be supported by most new trucks by 2025. VERA-P3 is also suited for other applications, such as agriculture and mining, in which heavy machines must communicate with each other to synchronize their activities.

u-blox



Multirange XRR Chip

Vayyar Imaging launched its multi-range XRR chip, outfitted with a single RFIC with a range from 0 to 300m, for passenger cars, trucks and motorcycles. The chip is outfitted with a 48-antenna MIMO array and provides radar imaging with increased accuracy for various safety applications, without requiring external processors. The XRR chip offers an ultra-wide field of view with 4D point-cloud imaging. It provides multifunctionality on a single-chip, supporting dozens of Advanced Driver Assistance Systems (ADAS), Advanced Rider Assistance Systems (ARAS) and autonomy features.

Vayyar

ADVERTISER INDEX

This index is provided as a service. The publisher does not assume liability for errors or omissions.

AUTOMATED TEST MAKES COMPLEX TASKS MANAGEABLE

By Evaluation Engineering Staff

While many applications using automated test procedures involve high-speed manufacturing test processes, automated test is also a way to optimize complex test procedures. Here are some recent news items related to automated test:

Partnership Develops Solution for Evaluating 5G Video Quality

A solution for evaluating the video quality of 5G devices was recently developed by a partnership between Spirent Communications and TOYO using Anritsu's SmartStudio NR (SSNR) Network Simulator and Spirent's Attero and Umetrix Video software. Operating as a 5G Call Box, Anritsu's MT8000A simulates a 5G base station and core network with a state-machine-based GUI.

The solution can simulate a range of 5G network conditions, such as Standalone (SA) and Non-Standalone (NSA) topolo-

gies at FR1 or FR2 frequencies, without creating protocol scripts. Throughput, mobility, VoNR, EPS-Fallback, SMS, CMAS, CDRX, and other functional tests can be performed with the GUI. SSNR flexibility and ease in reproducing a 5G network situational environment to analyze video quality.

Changeable filters test the effect of impairments on specific packets or types of traffic, and the Umetrix Video evaluation system scores the QoE (Quality of Experience) using Video Mean Opinion Scoring (V-MOS) from the receive-side only, supporting video-streaming services and video-content analysis, allowing faster and lower-cost repeatable design, regression, and competitor benchmarking tests.[1]

Simulating a Vehicle for Wire Harness Optimization

Simulation can help optimize any design, including the cables and connectors in a vehicle's wire harness. In a recently released publication, Rosenberger, maker of connectors and cable assemblies, applies ZVEI TLF0101 guidelines and examines

optimization practices. Their work provides for a standardized format for exchanging parameters of electro-thermal component models to simulate a vehicle's electrical network for the purpose of thermal optimization.

Able to simulate an entire vehicle virtually, the system helps reduce cable cross-sections. For example, Rosenberger's HVS 240 connector is 50 mm² across, offering a volume and weight savings of up to 30% as well as up to 50% thinner than non-optimized solutions in a design. Rosenberger and Leoni developed a demonstrator, using cable, connectors, and power to demonstrate how the process can optimize cable requirements.[2]

Latest DewesoftX Version Upgrades Include Modal, Power, and Combustion Analysis Modules

Dewesoft released DewesoftX 2021.2, which includes upgrades to the Modal Analysis, Power Analysis, and Combustion Analysis modules, among others. The Modal Analysis Module allows engineers to perform assessments of structures. It now automatically detects

the measured frequency response functions and shows the curve fitted results in a new stabilization diagram. It calculates and displays an AutoMAC matrix with a table that shows natural frequencies with damping ratios.

The Power Analysis Module takes advantage of the processing capability of your computer's GPU (graphical processing unit). Leveraging the GPU enables real-time execution of all power module calculations at high sampling rates. Even a mid- to high-performance notebook computer with an Nvidia GPU will easily run 3 x three-phase power modules at 5 MS/s/channel. This is a huge technical step forward that dramatically increases processing speed while performing advanced real-time calculations.

The Combustion Analysis Module includes a brand new knocking detection algorithm that sharply increases the module's ability to handle gasoline power combustion analysis, ideal for detecting pre-ignition events. Diesel engines from small cars to the biggest two-stroke ship engines in the world are also well supported.

Additional new features and capabilities of DewesoftX 2021.2 include enhanced soft synchronization of GigE cameras, the ability to display amplifier status parameters on the screen in the measurement mode, and much more.[3] EE

REFERENCES

1. evaluationengineering.com, "Partnership Develops Solution for Evaluating 5G Video Quality," June 29, 2021
2. evaluationengineering.com, "Simulating a Vehicle for Wire Harness Optimization," June 3, 2021
3. evaluationengineering.com, "Latest DewesoftX Version Upgrades Include Modal, Power, and Combustion Analysis Modules," May 10, 2021

CHECK OUT THESE RESOURCES FROM

EVALUATION ENGINEERING
For Electronic Test & Measurement

Visit: www.evaluationengineering.com

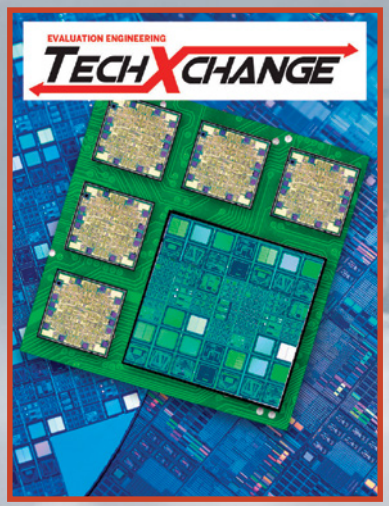
MORE FROM EVALUATION ENGINEERING

White Papers
Focus On: Addressing 5G Development with OTA Testing
Dec 3rd, 2020

Industry Events
Design Summit 2020, Day 1:
Nov 16th, 2020

Semiconductors
AMD to Buy Xilinx for $35 Billion in Drive to Diversify Business
Nov 2nd, 2020

Industry Events
Design Summit Focus is on the Future
Evaluation Engineering Oct 23rd, 2020



SPECIAL REPORTS

Special Reports
2021 Special Report: Mil/Aero Test
Evaluation Engineering Mar 24th, 2021

Special Reports
2021 Special Report: Portable Instruments
Evaluation Engineering Mar 23rd, 2021

Special Reports
Special Report: Vector Network Analyzers
Evaluation Engineering Feb 24th, 2021

Special Reports
Top Stories of the Week - Feb. 15, 2021
Evaluation Engineering Feb 22nd, 2021

Modular Sensor Simulation

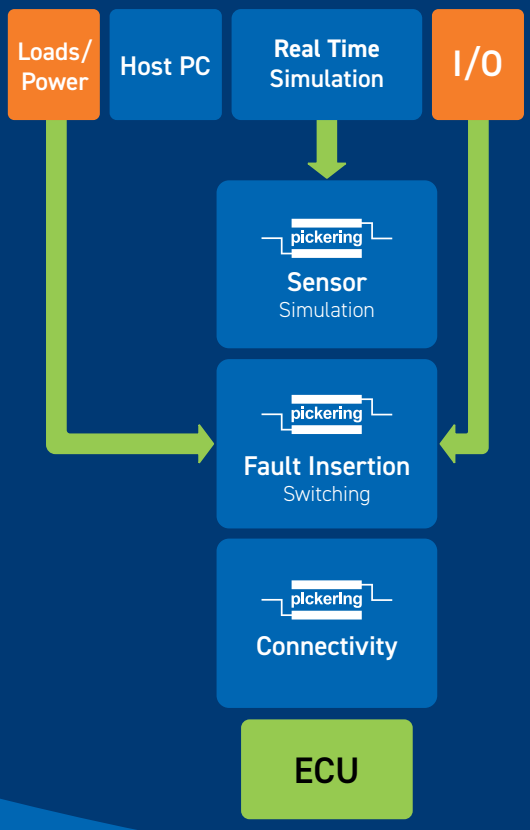
Validate ECU Operation & Software using **H**ardware-**I**n-the-**L**oop (**HIL**) Simulation

Simplify & Accelerate
your **testing** & **verification**

Does your test strategy require simulating environmental sensors—including pressure, temperature, altitude, and strain gauges?

By working with the creative, collaborative and agile culture of Pickering and our 30+ years in signal switching and simulation. We can help to streamline the development and deployment of your high-performance electronic test and verification systems.

pickeringtest.com/simulation



PXI, PCI, LXI & USB
Simulation & Fault Insertion Switching
400+ Modules Available

Application Software
& Software Drivers

Diagnostic Test Tools
& Expert-level Support

pickeringtest.com
781-897-1710 | ussales@pickeringtest.com

pickering