October
2016

# New-Tech Magazine Europe

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**Run All Simulations from a Single Environment**

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**Aerospace and Defense Mobilize Insatiable Bandwidth Applications**

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**Radar echoes from a generator innovative testing solution for the lab and service**

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**IoT promises smarter health**



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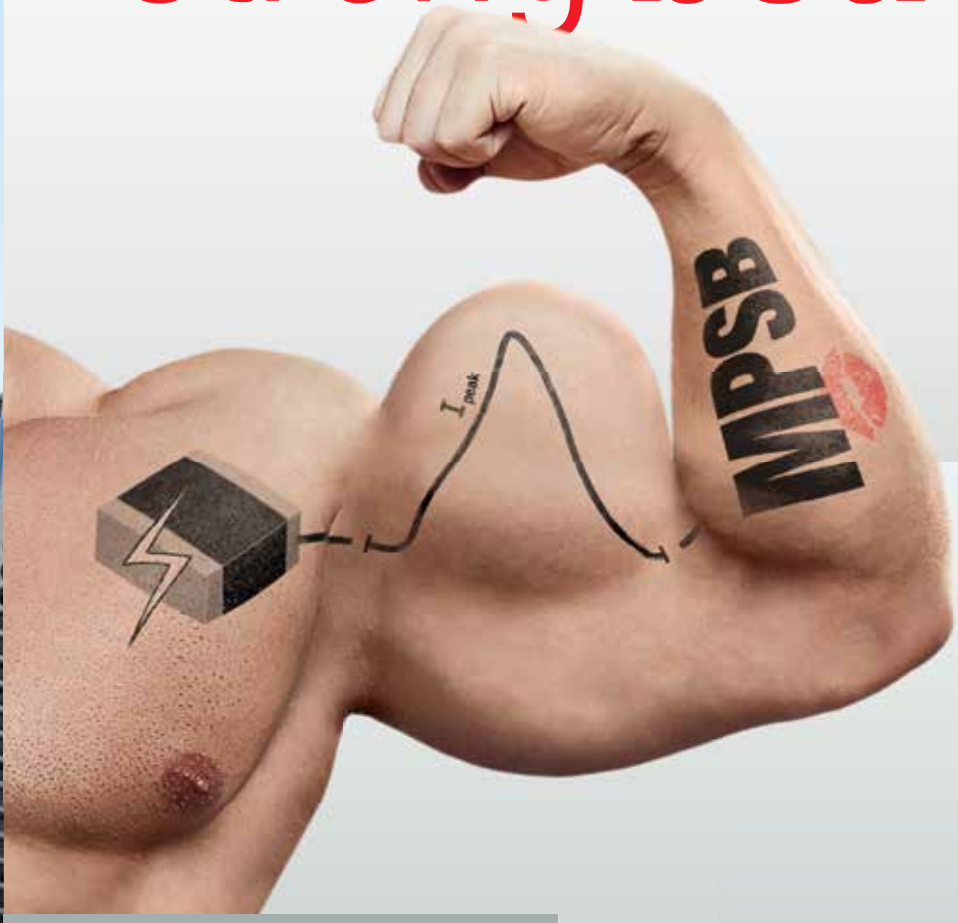


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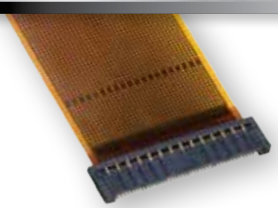

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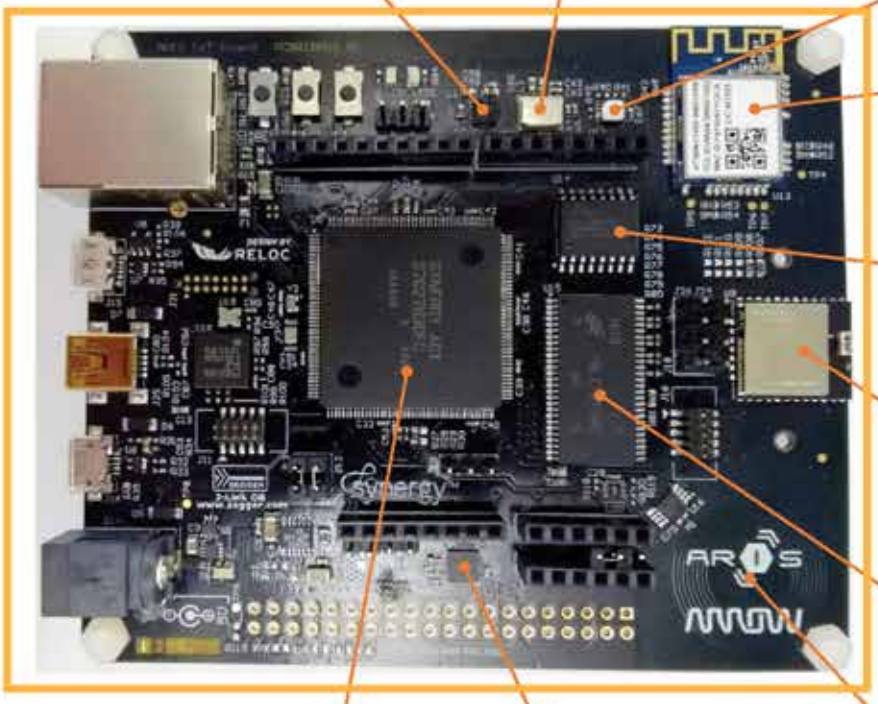

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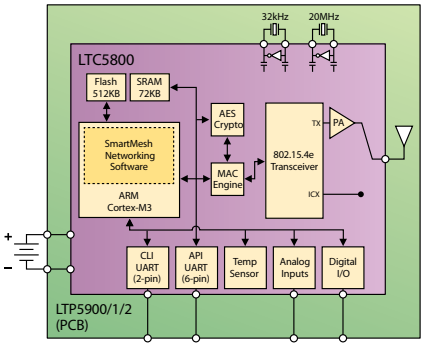


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Read To Lead

October 2016



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Our specialized target audiences prefer New-Tech Europe because they know that our publications are a reliable source of the latest information in their respective fields. Our multidimensional editorials, news items, interviews and feature articles provide them with a full, well-rounded picture of the markets in which they operate - an essential asset for every technological leader striving to stay ahead, make the right decisions, and generate the next global innovation.

Moreover, as an attractive platform for advertisers from around the world, New-Tech Europe has become a hub for bustling international commercial activity. Here, through ads and other promotional materials, Israeli readers obtain crucial information about developers and manufacturers worldwide, finding the tools, instruments, systems and components they need to facilitate their innovative endeavors.

Targeting the needs of both the global and european industries and global advertisers, New-Tech Magazines Group constantly expands and upgrades its services. Over the years, the company has been able to formulate a remarkably effective, multi-medium mix of offerings, combining magazine publications with useful online activities, newsletters and special events and exhibitions.

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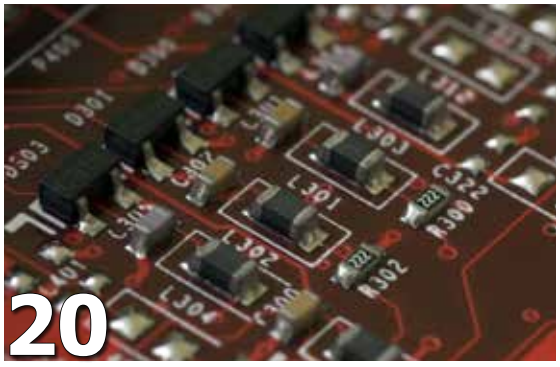





# Arrow receives Micron Distribution awards

Arrow EMEA received Micron Distributor of the Year award and Micron Design Distributor of the year award. The awards were presented in Munich during the Micron VIP distribution event on September 7th.

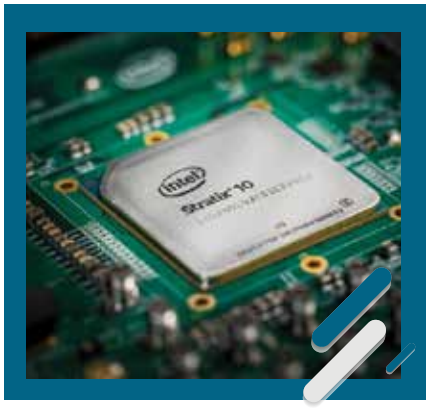
Arrow and Micron continue to support customers across a range of memory technologies from mature SDRAM,DDR2/3,parallel flash, to leading edge, DRR4 LPPDR4, eMMC, SSD and Quad SPI flash.

Joint collaboration has seen an increase in customer markets such a IOT, Automotive, Standard industrial sectors and digital markets.

Left to right: Hans Georg Steiger (Arrow EMEA Asset director) Amir Sherman (Arrow EMEA Director of embedded marketing) Lorenzo Ponzanelli (Micron Senior Director WW Distribution) Paul Mason (Arrow EMEA Technology Development Manager-Memory) Jeff Bader (Micron VP EBU (embedded business unit)

# Intel's Stratix 10 FPGA: Supporting the Smart and Connected Revolution

**Stratix 10's Features and Functionality Will Revolutionize the Data Center and Networking Infrastructure Performance as the Internet of Things Brings More Devices Online**



I'm happy to announce Intel has started sampling to customers Stratix® 10 field programmable arrays, the industry's first 14nm FPGA.

Stratix 10 combines the benefits of Intel's 14nm tri-gate process technology with a revolutionary new architecture called HyperFlex™ to uniquely meet the performance demands of high-end compute and data-intensive applications ranging from data centers, network infrastructure, cloud computing, and radar and imaging systems.

The features and functionality of Stratix 10 will revolutionize the performance of data centers and networking infrastructures, which must be able to support the rapidly growing number of devices coming online as the Internet of Things explodes by the end of the decade.

We live in a smart and connected world where billions of devices are creating massive amounts of data that must be collected, rapidly processed and analyzed, and available from anywhere. With Stratix 10 FPGAs, Intel is enabling service providers, data centers, cloud computing and storage systems to satisfy their insatiable demand for higher computational capabilities, lower latency, greater system flexibility and increased power efficiencies.

FPGAs are a critical part of Intel's growth strategy, which is being fueled by the virtuous cycle of growth. When speaking about Stratix 10 at IDF16, Intel CEO Brian Krzanich stated, "This thing is a beast," referring to the incredible performance and density of Stratix 10.

With Stratix 10, we have transformed the FPGA market and delivered the most significant FPGA innovations in over a decade1. These innovations and capabilities include:

- 2X the core performance and over 5X the density compared to the previous generation.
- Up to 70 percent lower power than Stratix V FPGAs for equivalent performance.
- Up to 10 TFLOPS of single-precision floating point DSP performance.
- Up to 1 TBps memory bandwidth with integrated High-Bandwidth Memory (HBM2) in-package.
- Embedded quad-core 64-bit ARM* Cortex*-A53 processor.

The Burgeoning Need for More Efficient Data Centers

Within the data center, FPGAs are used to accelerate the

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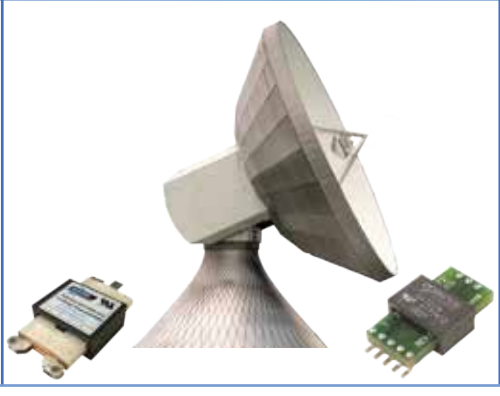
|  |  |  |



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performance of large-scale data systems. Stratix 10 FPGAs provide the optimal flexibility and performance-per-watt acceleration to address the data center needs of the future.

When used as a high-performance, multifunction accelerator in the data center, Stratix 10 FPGAs are capable of performing both the acceleration and high-performance networking capabilities.

And as a user's system demands or hardware requirements change, the FPGA can be reconfigured in milliseconds to accelerate individual tasks, which translates into significant improvements in system-level performance and power efficiency.

The need for more bandwidth and lower latency in our networks, the need for flexibility of our data centers to react to new and changing workloads, and the need to manage performance per watt are all key value drivers for the Stratix 10 FPGA.

The Explosive Need for Faster, Higher Bandwidth Networks

The growing number of bandwidth-intensive applications is creating a massive increase in customer demand and straining current network infrastructure.

Cisco* forecasts that by 2020, nearly a million minutes of video content will cross the network each second2, and that by 2020, the number of devices connected to IP networks will be three times the global population2.

A smart and connected world requires a highly connected, flexible, efficient, bandwidth-rich infrastructure that enables a seamless connection from the data center to the edge.

Stratix 10 FPGAs enable network innovations across the access, transmission and networking equipment arenas to aggregate, transport and deliver the triple-play traffic over converged multiservice networks.

Intel FPGA Innovation at its Finest

The Stratix 10 is an excellent example of the FPGA innovation that Intel is delivering to customers. We are delivering samples of the Stratix 10 FPGAs to customers today, and I personally look forward to seeing the innovations our customers will be able to deliver to market with this game-changing technology.

Dan McNamara is a corporate vice president and general manager of the Programmable Solutions Group at Intel Corporation.

Additional Materials:

- Stratix 10 Overview Video
- Stratix 10 Architecture Video
- Stratix 10 FPGA White Paper
- Stratix 10 SiP DRAM White Paper

# F-Cell technology from Nokia Bell Labs revolutionizes small cell deployment by cutting wires, costs and time

F-Cell re-imagines architecture to support truly "wireless wireless" networking, removing the power and backhaul wires required by current small cell deployments

Massive capacity is deployed on demand with no pre-planning or civil works required, allowing for drone-based delivery of self-building wireless networks

Technology breakthrough wins CTIA Emerging Technology 2016 Award for transforming Wide Area Networks (5G, 4G and LTE 4.5)

Murray Hill, NJ – Nokia Bell Labs announces a breakthrough in small cell technology that offers greater flexibility, efficiency and optimized deployment economics to expedite the creation of the high capacity and low latency network that will form the digital fabric of the future for humans and machines. "F-Cell" technology eliminates the costly power and backhaul wires and fibers currently required for small cell installation to enable "drop and forget" small cell deployments anywhere.

Bell Labs recently demonstrated the world's first drone-based delivery of an F-Cell to a Nokia office rooftop in Sunnyvale, CA. (captured in photo). The F-Cell wirelessly self-powered, self-configured and auto-connected to the network and instantly began to stream high-definition video.

Underlying the F-Cell breakthrough is a re-imagining of the network architecture to place key functional elements in optimum locations. The F-cell architecture is comprised of a closed loop, 64-antenna massive MIMO system placed in a centralized location that is used to form 8 beams to 8 energy autonomous (solar powered) F-Cells, each of which has been redesigned to require minimum processing power so that the solar panel is no larger than the cell itself. In this way, F-Cell technology sustainably solves today's small cell and backhaul cabling, deployment and expense challenges for service providers and enterprises.

The architecture supports non-line-of-sight wireless networking in frequency division duplex (FDD) or time division duplex (TDD) mode, and the parallel operation of up to 8 individual 20 MHz channels allowing for a system throughput rate of ~1Gbit/s over existing LTE networks. In future, this architecture will scale to enable up to tens of Gbit/s using higher spectral bandwidth, new spectral bands and a larger number antenna arrays.

"F-Cell is a key breakthrough in massively scalable and massively deployable technology that will allow networks to deliver seemingly infinite capacity, imperceptible latency and connectivity to trillions of things," said Marcus Weldon, president of Nokia Bell Labs and Nokia CTO. "Nokia Bell Labs is again excited to re-invent the future and help drive what we believe will be a technological revolution, underpinned by the creation of a new digital network fabric that will transform human existence."

F-Cell advances Nokia's Future X Network vision of 100x capacity growth and 100x reduction in latency, with optimized, facile deployment economics to explore the human possibility of technology at speed and with the creation of new value.

In recognition of the breakthrough nature of the architecture and constituent technologies, F-Cell won the CTIA Emerging Technology (E-Tech) 2016 Award for cutting-edge mobile products and services transforming Wide Area Networks (5G, 4G and LTE 4.5).

# UK Government commits 1.3 billion funding for Successor Submarine programme

BAE Systems welcomed the announcement by the Right Honourable Sir Michael Fallon MP, Secretary of State for Defence, of nearly £1.3 billion of funding for the Successor programme.

The programme will deliver four new submarines for the Royal Navy and will replace the current Vanguard class, with the first submarine entering service in the early 2030s. The UK Ministry of Defence (MOD) funding announced today will cover initial manufacturing work, which will start next week, on the first of the Trident ballistic-missile-carrying submarines. It will also enable further procurement of long lead items in addition to ongoing redevelopment of the facilities and infrastructure required to build the submarines at BAE Systems' site in Barrow-in-Furness, Cumbria.

Comparable in size to the Vanguard class submarines, the next generation of nuclear deterrent submarine is widely considered to be one of the world's most complex engineering challenges. Technological advances, threat changes, new methods of design and production mean the new submarines will be a completely new design.

Defence Secretary Michael Fallon said: "Britain's ballistic missile submarines are the ultimate guarantee of our nation's safety – we use them every day to deter the most extreme threats. We cannot know what new dangers we might face in the 2030s, 2040s and 2050s so we are acting now to replace them."

Tony Johns, Managing Director of BAE Systems Submarines, added: "This additional financial investment by the MOD is an expression of confidence in our ability to build these sophisticated vessels. We have been designing the new class of submarine for more than five years and thanks to the maturity of our design, we're now in a position to start production on the date we set back in 2011. This is a terrific achievement and I pay tribute to all those who have

made this possible."

The Company and the MOD have also made significant investments in the Barrow site's operating systems, facilities and skills to prepare for the manufacturing phase of the Successor programme. The continued redevelopment of the site will transform the way submarines are built and will include new facilities and the refurbishment of existing infrastructure to ensure it has the capacity needed to deliver the Successor programme.

The Successor programme already employs more than 2,600 people across MOD and industry, including 1,800 at BAE Systems. Thousands more will be employed in the supply chain with an average of 7,800 people expected to be working on Successor each year throughout the duration of the programme. At peak, in the early 2020s, BAE Systems anticipates employing more than 5,000 people on the Successor programme.

To date, BAE Systems has worked with more than 100 suppliers, 85% of whom are based in the UK. The total spend in the supply chain is anticipated to reach between £8-9bn, with in excess of 350 suppliers in the submarines' build programme.

# Cypress Semiconductor extends Future Electronics franchise to include IoT product line acquired from Broadcom

Future Electronics, founded in 1968 by company president Robert Miller and now a world-class leader and innovator in the distribution and marketing of electronics components, today announced its worldwide distribution agreement with Cypress Semiconductor has been extended to include the IoT product lines which Cypress recently acquired from Broadcom.


The acquisition of Broadcom's IoT product lines by Cypress in July combined Broadcom's wireless products and its WICED developer ecosystem (Wireless Internet Connectivity for Embedded Devices – pronounced "wik-id") with Cypress' high-performance microcontroller, analog, memory and USB connectivity solutions, consolidating Future Electronics' already-strong offering in IoT devices.

The former Broadcom products offer wireless technologies like Wi-Fi for wireless local area networks (WLAN), Bluetooth for content streaming, and Bluetooth Low Energy (BLE) for ultra-low-power connectivity, which are the foundation of the Internet of Things (IoT), providing easy-to-use wireless connectivity solutions for consumer, industrial, medical, automotive and other applications.

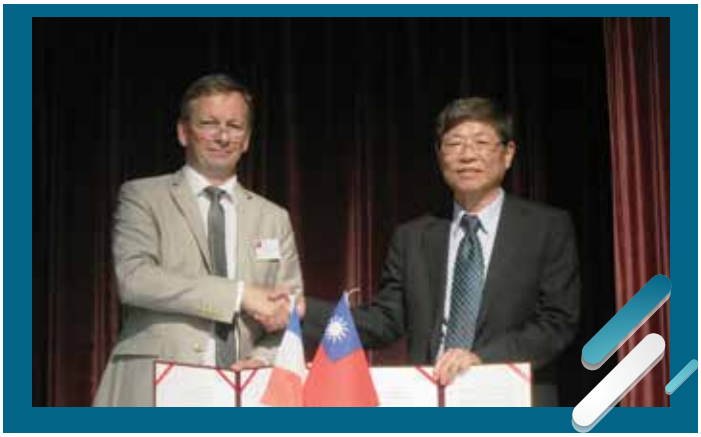
Under the distribution agreement Future Electronics will stock Cypress's broad wireless portfolio, which includes fully-certified, production-ready modules or silicon together with easy-to-use software for Wi-Fi + Bluetooth combo solutions that integrate IEEE 802.11a/b/g/n/ac WLAN and Bluetooth with Basic Rate (BR), Enhanced Data Rate (EDR) & Bluetooth Low Energy (BLE); Wi-Fi solutions with IEEE 802.11a/b/g/n WLAN and integrated ARM®Cortex® R4/M3 host MCUs; Bluetooth solutions with Basic Rate (BR) + Enhanced Data Rate (EDR) + BLE ; and Automotive Wi-Fi and Bluetooth.

"Future Electronics is proud to carry such a dynamic range of IoT products which, doubled with our engineering expertise, makes Future Electronics unrivalled for providing both high-quality products and support for our consumers to take their products from start to finish." – Jill Thomas, Future Electronics Technical Marketing Director, EMEA.

"As a long-time partner with Cypress, we are thrilled by this acquisition," said Kelly Murphy, Director of Product Marketing from Future Connectivity Solutions. "The addition of more industry-leading solutions in Wi-Fi and Bluetooth protocols greatly expands our offering to customers and further strengthens our position in serving our customers' IoT needs as this market continues to grow at a rapid pace."

# Leti and the Institute for Information of Taiwan

Leti, an institute of CEA Tech, and the Institute for Information Industry of Taiwan (III), a non-profit non-governmental technology development organization, today announced an agreement for mutual exploration of a wide range of information and communications technology (ICT) related to the Internet of Things (IoT) and 5G wireless connectivity.



Laurent Herault, VP Foreign Affairs at Leti and Dr. Pao-Chung Ho, Executive Vice President at III

The five-year collaboration will include, but is not limited to, joint development and implementation of IoT and 5G based Smart ICT solutions for the EU and Taiwan, and scientific information exchanges. Also envisioned are cross-invitations to scientific events, joint implementation of international collaborative projects and partnerships, and work on experimental platforms and test beds that can be used to provide real-world validation of solutions.

Leti's background in IoT and 5G systems, including spectrum management, radio access technologies and protocols, as well as IoT open platforms for large-scale systems, will be a primary contribution, along with its technological roadmaps. In addition to its expertise in IoT systems, III will provide access to Taiwanese technology platforms, as well as industry-driven requirements and use cases.

"Our two organizations have very complementary skills and ecosystems, and it's a pleasure to launch our collaboration. Together we have an excellent opportunity to pilot and demonstrate innovative 5G and IoT-related solutions that will be useful for industries and individuals in Taiwan and the EU," said Leti CEO Marie Semeria at the official signing ceremony in Taipei, held during a Leti workshop event there.

"Taiwan is currently supporting and promoting IoT and smart city. The service and platform that based on IoT technology will be the key factor for industrial development. III and Leti's collaboration will significantly enhance our ability to pursue our mission of promoting industrial applications, R&D technologies, and IoT infrastructures," commented III Executive Vice President Pao-Chung Ho. "We look forward to our information exchange and collaboration, and to building a creative and effective long-term research partnership between our teams."

# 3-D-printed robots with shock-absorbing skins

By "programming" customized soft materials, CSAIL team can 3-D print safer, nimbler, more durable robots.

Anyone who's watched drone videos or an episode of "BattleBots" knows that robots can break — and often it's because they don't have the proper padding to protect themselves.But this week researchers at MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) will present a new method for 3-D printing soft materials that make robots safer and more precise in their movements — and that could be used to improve the durability of drones, phones, shoes, helmets, and more.

The team's "programmable viscoelastic material" (PVM) technique allows users to program every single part of a 3D-printed object to the exact levels of stiffness and elasticity they want, depending on the task they need for it.

For example, after 3-D printing a cube robot that moves by bouncing, the researchers outfitted it with shock-

absorbing "skins" that use only 1/250 the amount of energy it transfers to the ground.

"That reduction makes all the difference for preventing a rotor from breaking off of a drone or a sensor from cracking when it hits the floor," says CSAIL Director Daniela Rus, who oversaw the project and co-wrote a related paper. "These materials allow us to 3-D print robots with visco-elastic properties that can be inputted by the user at print-time as part of the fabrication process."

The skins also allow the robot to land nearly four times more precisely, suggesting that similar shock absorbers could be used to help extend the lifespan of delivery drones like the ones being developed by Amazon and Google.

The new paper will be presented at next week's IEEE/RSJ International Conference on Intelligent Robots and Systems in Korea. It was written by Rus alongside three postdocs: lead authors Robert MacCurdy and Jeffrey Lipton, as well as third author Shuguang Li.

Putting a damper on things

There are many reasons for dampers, from controlling the notes of a piano, to keeping car tires on the ground, to protecting structures like radio towers from storms.

The most common damper materials are "viscoelastics" like rubber and plastic that have both solid and liquid qualities. Viscoelastics are cheap, compact, and easy to find, but are generally only commercially available in specific sizes and at specific damping levels because of how time-consuming it is to customize them.

The solution, the team realized, was 3-D printing. By being able to deposit materials with different mechanical properties into a design, 3-D printing allows users to "program" material to their exact needs for every single part of an object.

"It's hard to customize soft objects using existing fabrication methods, since you need to do injection moulding or some other industrial process," says Lipton. "3-D printing opens up more possibilities and lets us ask the question, 'can we make things we couldn't make before?"

Using a standard 3-D printer, the team used a solid, a liquid, and a flexible rubber-like material called TangoBlack+ to print both the cube and its skins. The PVM process is related to Rus' previous 3-D printed robotics work, with an inkjet depositing droplets of different material layer-by-layer and then using UV light to solidify the non-liquids.

The cube robot includes a rigid body, two motors, a microcontroller, battery, and inertial measurement unit sensors. Four layers of looped metal strip serve as the springs that propel the cube.

"By combining multiple materials to achieve properties that are outside the range of the base material, this work pushes the envelope of what's possible to print," says Hod Lipson, a professor of engineering at Columbia University and co-author of "Fabricated: The New World of 3-D Printing." "On top of that, being able to do this in a single print-job raises the bar for additive manufacturing."

Rus says that PVMs could have many other protective uses, including shock-absorbing running shoes and headgear. By damping the motion brought about by robots' motors, for example, PVMs are not only able to protect sensitive parts like cameras and sensors, but can also actually make the robots easier to control.

This work was supported by a grant from the National Science Foundation.

# Samsung to Acquire Viv, the Next Generation Artificial Intelligence Platform

Samsung Electronics announced that it has agreed to acquire Viv Labs, the intelligent interface to everything. Viv has developed a unique, open artificial intelligence (AI) platform that gives third-party developers the power to use and build conversational assistants and integrate a natural language-based interface into renowned applications and services. The transaction is subject to customary closing conditions.

The deal showcases Samsung's commitment to virtual personal assistants and is part of the company's broader vision to deliver an AI-based open ecosystem across all of its devices and services. With Viv, Samsung will be able to unlock and offer new service experiences for its customers, including one that simplifies user interfaces, understands the context of the user and offers the user the most appropriate and convenient suggestions and recommendations.

Viv was founded by AI visionaries Dag Kittlaus, Adam Cheyer and Chris Brigham. As part of the acquisition, the founding team will work closely with Samsung's

Mobile Communications business, but continue to operate independently under its existing leadership.

"Unlike other existing AI-based services, Viv has a sophisticated natural language understanding, machine learning capabilities and strategic partnerships that will enrich a broader service ecosystem," said Injong Rhee, CTO of the Mobile Communications business at Samsung Electronics. "Viv was built with both consumers and developers in mind. This dual focus is also what attracted us to Viv as an ideal candidate to integrate with Samsung home appliances, wearables and more, as the paradigm of how we interact with technology shifts to intelligent interfaces and voice control."

With the rise of AI, consumers now desire an interaction with technology that is conversational, personalized and contextual—an experience that fits seamlessly within their everyday lives. To achieve this, Viv has developed a new and proprietary platform that allows this interaction to scale. Viv's platform also allows developers to teach the system how to create new applications or to use existing applications, building an open ecosystem of intelligence that is greater than the sum of its parts and gets smarter every day. Viv's superior platform combined with Samsung's leading devices, services and global resources will help drive the next generation of AI solutions.

"At Viv, we're building the simplest way for anyone to talk to devices and services everywhere. We see a future that is decidedly beyond apps—where you can get what you need quickly and easily no matter where you are, or what device you are near," said Viv co-founder and CEO, Dag Kittlaus. "Samsung offers us a unique opportunity to deliver a single conversational interface to the world's apps and services across a diverse range of products, at global scale."

Samsung's Global Innovation Center spearheaded the acquisition for Samsung's Mobile Communications business. "At GIC we're always looking for startups with a compelling vision and breakthrough experiences we can help build, grow and scale," said Jacopo Lenzi, SVP of Business Development and Strategic Acquisitions. "We see great potential in the Viv AI software and platform, and we're excited for Viv to reach our millions of users through Samsung's global presence and distribution."

## Faurecia Invests in Canatu and Deepens Ties by Choosing Canatu as Innovation Partner

Canatu, the leading manufacturer of 3D formable and flexible transparent conductive films and touch sensors, and Faurecia, a global automotive interior system manufacturer, have deepened ties. The two companies have signed a Joint Development Agreement. Faurecia was also the latest significant investor for Canatu in its recent funding round which totaled 22 million euros.

The collaboration is being announced at The Paris Motor Show 2016 where Canatu is exhibiting alongside Faurecia at their Open Innovation Corner. By joining forces, Canatu and Faurecia aspire to enhance automotive interior systems by providing the industry with innovative automotive user interfaces and novel functional automotive interior parts with tactile functionality. Canatu's enabler material along with Faurecia's visionary modular systems provide automotive interior designers total design freedom to use free form shapes for tactile functions that are in strong demand for the center console and dashboard. The companies will develop, integrate, and verify the necessary technologies to be able to adapt them into automotive programs.

Canatu's films and touch sensors are based on its enabler material CNB™ (Carbon NanoBud®) which offer unique stretch properties. CNB products provide designers total design freedom by providing a clear path to the replacement of mechanical controls with 3D shaped touch sensors and seamless touch displays.

Faurecia is one of the world leaders in automotive interior systems including complete modules for car cockpits, instrument panels, door panels and center consoles. Faurecia works with all leading automotive manufacturers and is developing technologies for the cockpit of the future.

"Touch is a very natural and intuitive way of interacting and will become ubiquitous in the car interior. Our products enable interactive solutions and finishes for automobiles never seen before. The design freedom now possible will without doubt thrill designers. The breadth and depth of experience Faurecia has acquired has impressed us, and we are proud to have our CNB Film to be a key enabler in bringing Faurecia's visions of Smart Surfaces and Intuitive Connectivity into life", says CEO Juha Kokkonen from Canatu.

"This is an important step in the evolution of our interior systems offering towards the move to smart surfaces, driven by the fusion between Electronics and surface decorations. It also confirms our strategy to work with an open network of various technology partners with leading-edge solutions. Coupling Faurecia's position as Lead Architect of a new Customer Experience and Canatu's unique CNB films, we are convinced that the combination will rapidly offer automotive-level solutions tailored to end-consumers' advanced needs" explains Mr. David Weill, VP Marketing and Business Development at Faurecia Interior Systems.

Specifically designed for automobile center consoles and dashboards, consumer electronics, wearable devices and specific user interfaces, CNB™ In-Mold Films can be easily formed into shape. The film is first patterned to the required touch functionality, then formed, then back-molded by injection molding, resulting in a unique 3D shape with multitouch functionality. With a bending radius of 1mm, CNB™ In-Mold Films can bring touch to almost any surface imaginable.

Bryan, Garnier & Co, the independent investment bank focused on European growth companies, advised Canatu for the latest investment transaction made by Faurecia.

## New automotive lighting revolutionizes road safety

A German research alliance with well-known members from industry and research has developed the basis for smart, high resolution LED headlights, which takes adaptive forward lighting to a new dimension. The demonstration model was developed by overall project manager Osram in collaboration with the project partners Daimler, Fraunhofer, Hella and Infineon. Both headlights contain three LED light sources, each with 1,024 individually controllable light points (pixels). This means that the headlight can be adapted very precisely to suit the respective traffic situation to ensure optimum light conditions at all times without dazzling other drivers. The light can be adapted to take account of every conceivable bend in the road so that there are no dark peripheral areas. In addition, with the aid of sensors in the vehicle, the surroundings can be analyzed in order to illuminate oncoming traffic. This allows the driver to see these vehicles more clearly. At the same time, the beam of light does not shine on the heads of oncoming drivers, which means they're not dazzled. As a result, such shifting headlights no longer have to be dimmed on country roads.

The project, which was funded by the German Federal Ministry of Education and Research (BMBF), has now been successfully completed after three and a half years with the production and field test of headlight demonstrators. For the implementation, Osram Opto Semiconductors, Infineon, and the Fraunhofer Institute for Reliability and Microintegration (IZM) developed an innovative LED chip with 1,024 individually controllable pixels. In the current generation of adaptive headlights on the market, several LED components are installed in the headlights side by side and on top of each other. Additional electronic components are required to switch light segments on and off. The number of segments is limited due to the restricted space in the headlight. In the new approach, electronic activation of the LED is integrated in the chip, resulting in a much higher resolution, while still meeting limited space requirements. For the innovative, high resolution, smart automotive lighting, in a second step, the Osram Specialty Lighting unit developed an LED module. It features an electrical and thermal interface that enables direct connection to the vehicle's electronics.

The feasibility of the system has now been demonstrated successfully in the project; when a smart, high resolution headlight is used, driving and weather conditions are continuously analyzed: What is the course of the road, how fast is the car driving, is there oncoming traffic, and what is the distance between the car and other vehicles? Based on these conditions, the variable, adaptive light distribution ensures tailor-made lighting in every situation. For example, at high speeds, the range of the light beam is increased automatically. In city traffic, on the other hand, wider light distribution improves safety as, in addition to the road, also the sidewalk and peripheral areas are illuminated better. These functions are implemented fully electronically with no mechanical actuators. With glare-free full beam the driver always has the best possible light at night – with no adverse effects for other drivers. For motorists this is a clear benefit in terms of awareness – an important contribution towards reducing the risk of accidents when driving at night.

"We now want to develop this new type of high-resolution LED light sources so that it's ready for serial production and we see enormous potential for its use in headlights," said Stefan Kampmann, Chief Technology Officer at Osram Licht AG.

# Dassault Systèmes Completes CST Acquisition

Dassault Systèmes, the 3DEXPERIENCE Company, world leader in 3D design software, 3D Digital Mock Up and Product Lifecycle Management (PLM) solutions, announced the completion of the acquisition of CST – Computer Simulation Technology AG, the technology leader in electromagnetic (EM) and electronics simulation based in Germany, for 220 million euros. Dassault Systèmes will integrate CST solutions into its portfolio of industry solution experiences based on the 3DEXPERIENCE platform to offer a new standard in multiphysics and multiscale simulation.

CST STUDIO SUITE software is used by designers and engineers at more than 2,000 leading companies in the high-tech, transportation and mobility, aerospace and defense, and energy industries to evaluate all types of EM effects during every stage of electronic system design processes. CST's customers include Airbus Defence and Space, Bosch Group, Frauscher Sensor Technology and Sirona.

EM simulation is an essential part of the development of connected products to ensure the performance, reliability and safety of their interactions with their surrounding environment. With the integration of CST, Dassault Systèmes will offer full spectrum EM simulation of autonomous cars, connected homes, medical equipment, wearable electronics and other smart objects. Customers can quickly create and analyze high fidelity electromagnetic behavioral models that simulate electronic, antenna, electrical device and electromechanical product function across all frequencies and length scales, as well as access design synthesis and simulation tools needed for intricate electronic systems design.

# Micronas presents a new entry-level sensor solution with advanced diagnostic capabilities

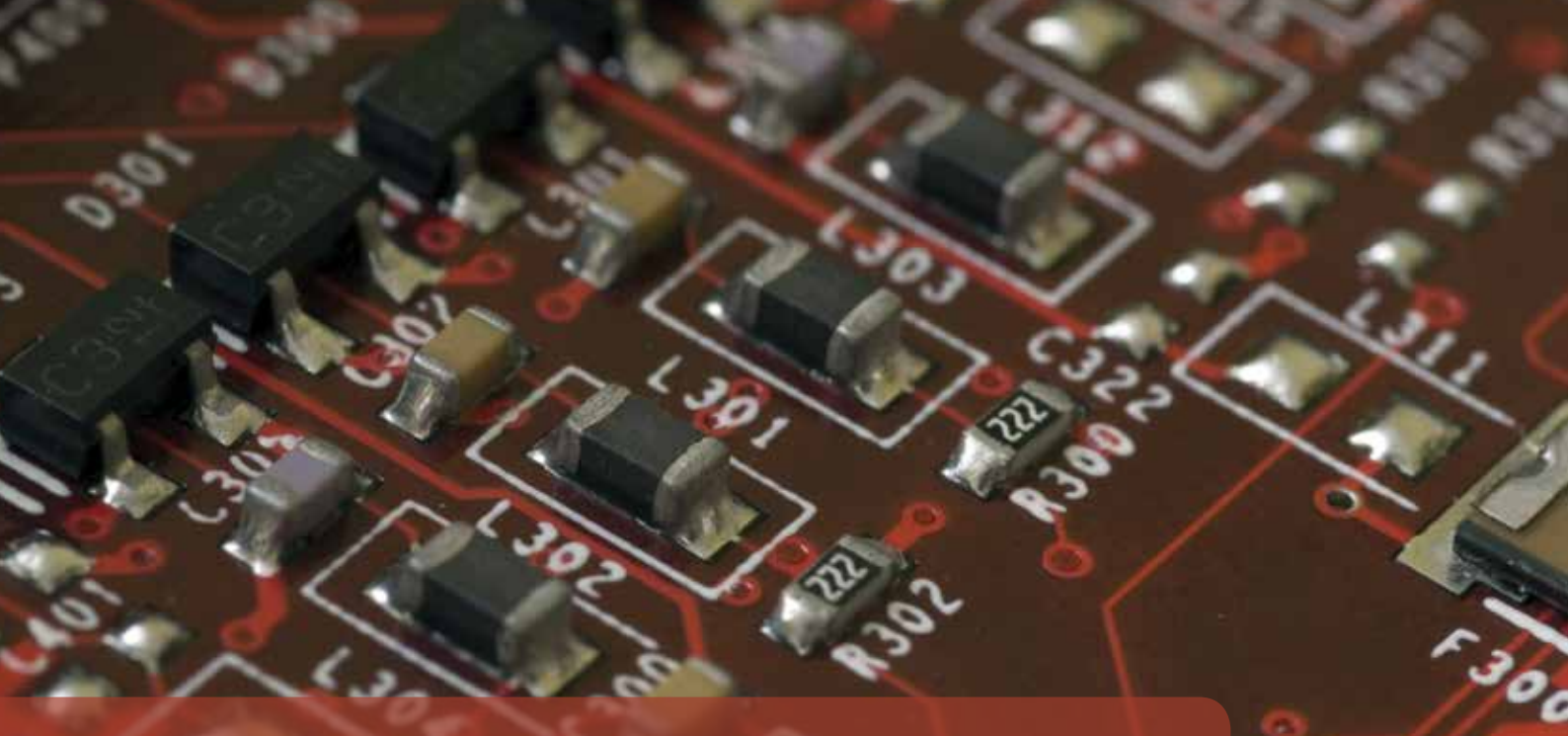
Micronas, a TDK group company, expands its Hall-effect sensor HAL 18xy family with the HAL 1860, a small, robust and cost-effective solution with output signal supervision capabilities. Several programmable output signal clamping levels extend error signaling capabilities to indicate various fault conditions like under/overvoltage, under/overflow of the signal path, or overcurrent. A one-pin programming interface enables simultaneous programming of several devices through the output pins. Other major sensor characteristics like magnetic field range, sensitivity, offset and temperature coefficients are programmable in a non-volatile memory.

"The small package and the protection functions of our new HAL 1860 sensor are perfectly suited for space constrained and harsh environments. The type of diagnostic and clamping used to enhance the signal integrity are usually found on higher-end devices. Furthermore, our customers will improve productivity thanks to our programming interface enabling the sensor performances to be optimized at the end of their production line. You clearly get more for less!", says Matthieu Rezé, Product Marketing Manager at Micronas.

Thanks to the aforementioned benefits, the HAL 1860 is the optimal system solution to measure small angle (<90°) or linear displacement (few mm) in stringent applications. For example, it can be used as gear position detection sensor in dual clutch automatic transmission or steering torque sensor for industrial/recreational vehicles.

The HAL 1860 is qualified according to AEC-Q100 and is packaged in an industry standard 3-pin TO92-UA, lead (Pb) free, with matte tin leadframe plating. It comes with two lead forming configurations: an inline version with 1.27 mm pin-to-pin spacing or alternatively a spread version with 2.54 mm pin-to-pin spacing, better suited for welding process.

Samples are available now. Start of production is planned for early 2017.




# Run All Simulations from a Single Environment

› Steve Kaufer, Mentor Graphics Corp.

High-speed PCBs vary greatly in size, layer count, routing density, signaling speed, types of silicon used, power-delivery challenges, and other factors. Some designers resort to multiple analysis tools, for example trying a batch-mode SI simulator for slower signals and a 3D-EM solver for very-high-speed SERDES channels. But even a set of tools offered by a single EDA vendor typically require changing applications and user interfaces for different types of analysis (e.g., signal versus power versus 3D).

In contrast, HyperLynx now offers all types of analysis in a single application, with one GUI. A user can literally be simulating a critical SERDES channel one minute, and by selecting a single new menu item, switch to analysis of a large power net's decoupling.

Many designers perform analysis using a variety of tools, often with disparate user interfaces, and not all share data in a friendly way. Now, HyperLynx from Mentor Graphics has merged an entire set of simulation tools into a single application, and of course, with one unified GUI. Switching between, say, a power integrity analysis to looking at a SERDES channel is just a click of a button.

But such convenience is valuable only if underlying simulation engines and algorithms are strong. Mentor has invested heavily in HyperLynx analysis technology in recent years. Much research and development has gone into interconnect modeling: HyperLynx now combines a super-fast computational geometry engine and advanced materials modeling (for wideband dielectrics, copper roughness, etc.) to produce highly accurate simulation netlists.

Crosstalk can be modeled in great detail; aggressor nets can be identified quickly in even the largest layout databases, based on geometric or electrical thresholds. For higher signaling speeds, the HyperLynx simulators have been upgraded to efficiently handle S-parameter models of virtually any size, and S-parameter extractions are now handled by a unique, dedicated engine.

## Faster and Faster

The frequencies at which SERDES circuitry operates can generate a substantial amount of unwanted electromagnetic radiation. The result of this could be failing EMC requirements. But 3D EM simulation can be complex to understand and set up. To simplify, HyperLynx deeply

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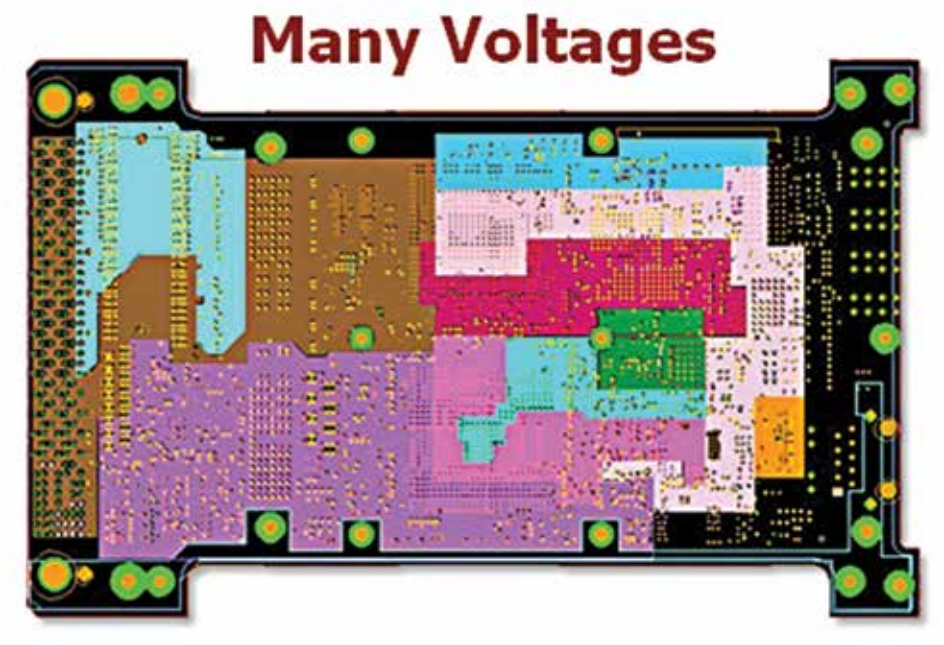


**Figure 1.**

integrates the 3D engine so that the user never has to learn the intricacies of a full-wave-solver environment. Structure geometries are passed, EM ports are formed, simulations are run, and S-parameter results are returned and incorporated into time-domain simulations, automatically.

Recently, PCB power-delivery systems have come under stress. What formerly were "power planes" are now collections of highly compromised power "areas," (Figure 1) whose integrity must be simulated. HyperLynx has added multiple engines - two 2.5D solvers, the industry's fastest DC/IR-drop simulator, and a fast quasi-static 3D solver - to enable a full set of power-integrity features, all of which are available side-by-side in the same application as HyperLynx signal-integrity capabilities. This version adds a second, more-advanced 2.5D solver, capable of not only pure power but also mixed signal-and-power modeling, which can be used to add accuracy to SI simulations when simultaneous-switching-noise (SSN) complications are suspected.

## Analysis from Beginning to ENd

Simulating every detail of signal routing and power delivery on a PCB is powerful, but possibly overwhelming. The HyperLynx DDRx batch-simulation wizard pioneered easy setup, automated whole-bus simulation, and consolidated results reporting for memory interfaces. Now, HyperLynx extends this popular capability to DDR4 and LPDDR4 interfaces. HTML-based reporting creates design documentation and allows internal Web-based "publication" of results (Figure 2).

A new analysis tool has become popular for SERDES busses. This tool, called Channel Operating Margin (COM) allows checking the "goodness" of links based on a specific, complex set of simulation steps that in the end produces a single pass/fail number per-channel (Figure 3). The new version of HyperLynx offers the first robust commercial implementation of COM for 100GbE signaling, with all simulation details fully automated.

Another way to streamline the daunting task of simulating all signal and power effects on a large PCB is to proactively identify portions of a design that most need detailed analysis, and to reduce the time required for simulation by promoting aggressive re-use of expensive-to-create models (like 3D-based S parameters).

This is accomplished by integrating the powerful HyperLynx DRC engine directly inside the HyperLynx SI/PI environment. Now the super-fast DRC engine (capable of scanning board-wide for routing and other geometric anomalies in seconds) can provide "simulation triage," by accurately finding layout structures that violate design intent or best practice. For example, HyperLynx SI/PI deploys this engine to automatically find all differential via pairs that do not conform to pre-designed known-good "patterns"; and to group all such vias into sets for which only one 3D-EM S-parameter extraction (automatically run) is needed per set, saving potentially many hours of simulation time per board.

Continuing with ease-of-use and fast interactive analysis, the new release puts dual emphasis on a very different type of usage: in a pure batch-mode environment, driven by scripts, run on entire layouts at least once-per-day, with little/no user intervention and a completely suppressed GUI. Much investment has gone into robusting HyperLynx for such use: the ability to efficiently handle very large layouts (including extra-deep stackups, huge net counts, and entire multi-

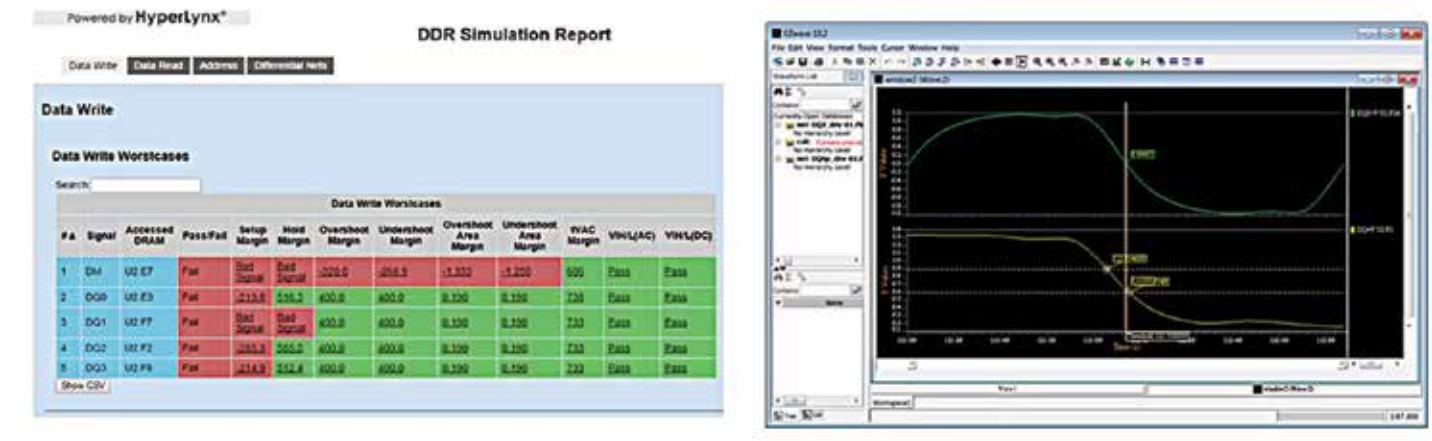


**Figure 2.**

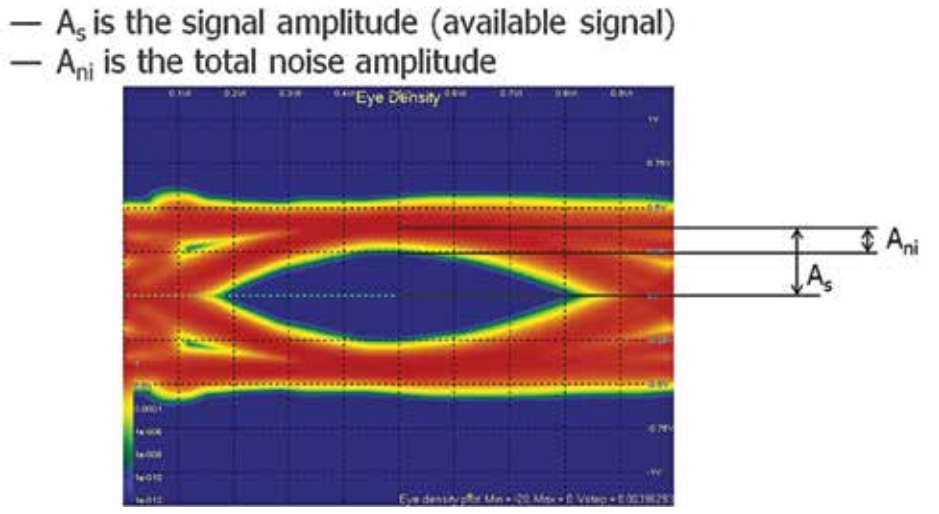


**Figure 3.**

board systems); multi-processor and other simulation-engine performance enhancements; and caching and re-use of extracted models. The latest version of HyperLynx offers two scripting interfaces, a simplified one requiring no programming expertise and a richer, language-based environment; the latter makes customized access to the powerful HyperLynx engines possible.

## Summary

This version of HyperLynx incorporates the results of many years of Mentor Graphics R&D investment and technology acquisition, offering in a single unified environment a rich set of robust, high-performance, high-accuracy simulation capabilities. HyperLynx now addresses all aspects of signal-integrity, power-integrity, SERDES, and 3D-electromagnetic analysis, and adds fast DRC/geometry scanning for simulation triage...all integrated into one user interface. The result is a toolset capable of a full range of capabilities from fast/interactive analysis, through complex mixed mode (signal/power/3D) simulation, through high-capacity script-driven daily batch analysis.

# Aerospace and Defense Mobilize Insatiable Bandwidth Applications

› Ian Beavers, Analog Devices, Inc.

Aerospace and defense applications such as electronic warfare and active phased array radar often require the use of a higher order Nyquist rate band to ferret out wider frequency communications. Not only is a larger observed bandwidth needed from a system ADC, but systems are also pushing the need for a higher full power bandwidth. If an ADC's input frequency bandwidth is high enough, it is possible to downconvert directly within the ADC by undersampling the IF signal band of interest.

Higher bandwidth input signals and sample rates allow direct RF sampling of wider band signals. This permits the possible reduction of an entire stage in a signal chain for lower system power and simplicity. Next-generation GSPS ADCs allow GHz sampling well into the 3rd and 4th Nyquist band, with the capability to also get the dynamic range needed for small signal detection. A wideband ADC that also offers a higher dynamic range allows a system to move the noise floor lower to decipher weaker power signals that would have otherwise been buried in the noise.

For a system to reconstruct the original signal perfectly from the sampled data, the Nyquist-Shannon sampling theorem indicates that the sample rate must be twice the signal bandwidth of interest; distinctly different than a sample rate that is twice the maximum IF frequency component. ADC undersampling is the technique of using a sampling frequency, which is less than twice the maximum frequency component in the signal band. The signal bandwidth of interest must still be within a single Nyquist rate or half of the ADC sample rate. This technique can also be referred to as harmonic sampling, band-pass sampling, or super Nyquist sampling.

In order to maintain the Nyquist-Shannon sampling theorem, using a BW as the signal bandwidth of interest, then a sample frequency of Fs > 2 BW is required. The signal bandwidth of interest can be between dc to BW or from x to y, where BW is y – x. So long as the bandwidth of interest does not overlap an ADC's Nyquist band, which is half of the sample rate (Fs), undersampling can work for higher signal bands with ADCs that have a high full power bandwidth (FPBW) relative to their respective sample rate as seen in Figure 1.

Secrecy is an important aspect of military operations. To reduce the probability of intercept or detection, the form and magnitude of a radar transmission is designed (in many cases) to spread energy over the widest possible frequency range.

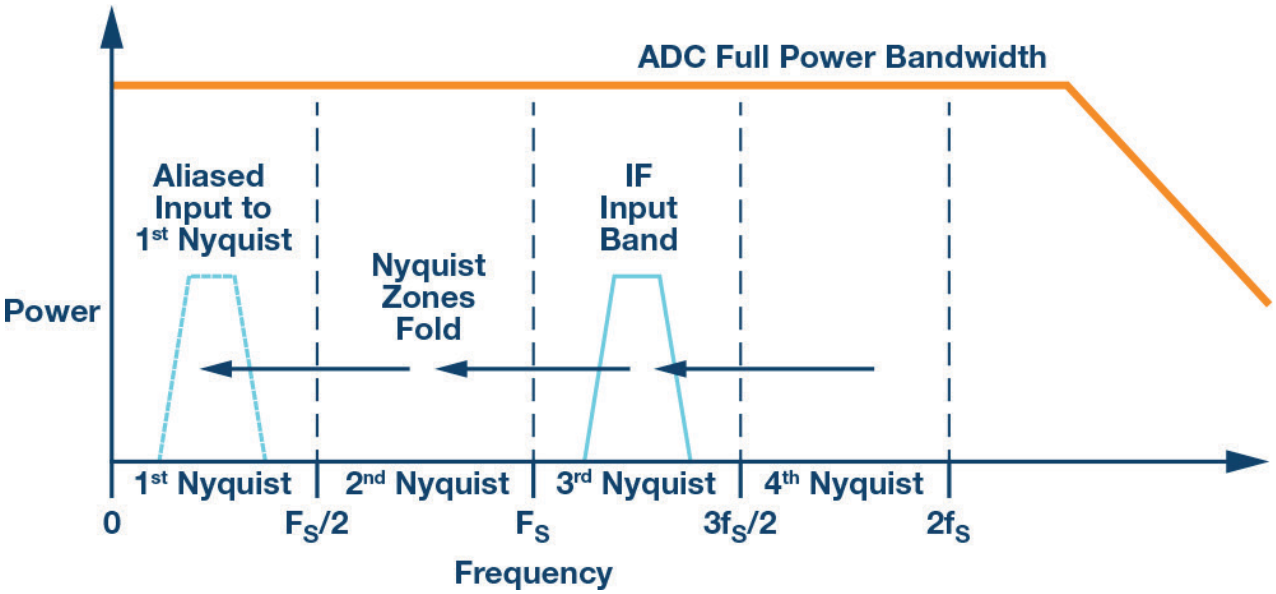


**Figure 1. Wide ADC full power bandwidth allows the use of higher order Nyquist bands. Band-pass filtering of the unused Nyquist zones is mandatory to remove unwanted signal energy that could potentially fold back into the 1st Nyquist and impact the dynamic range**

Low probability of intercept (LPI) and low probability of detection (LPD) are classes of radar systems that possess certain performance characteristics that make them nearly undetectable by today's modern intercept receivers. LPI features prevent the radar from tripping off alarm systems or passive radar detection equipment.

To provide resistance to jamming, systems can be architected by intelligently randomizing and spreading the radar pulses over a wide band so there will only be a very small signal on any one band, which is known as direct sequence spread spectrum (DSSS), as seen in Figure 2. Frequency hop spread spectrum (FHSS) also provides some protection against full-band jamming. In these cases, the wide transmission signal consumes bandwidth that is in excess of what is actually needed for the raw signal of interest. Therefore, a wider receiver bandwidth and higher dynamic range are needed to continue to advance system capability.

One of the most important factors for success in an LPI system is to use as wide of a signal transmission bandwidth as possible to disguise complex waveforms as noise. This conversely provides a higher order challenge for intercept receiver systems that seek to detect and decipher these wideband signals. Therefore, while this creates improvements toward LPI and LPD, it also increases radar transceiver complexity by mandating a system that can capture the entire transmission bandwidth at once. The ability of an ADC to simultaneously digitize 500 MHz and 1000 MHz, as well as larger chunks of spectrum bandwidth in a single Nyquist band, with high dynamic range helps provide a means to tackle this system challenge. Moving these bands higher in frequency beyond the first Nyquist of the ADC can be even more valuable. Today's wideband ADCs offer systems potential for multiple wide Nyquist bands within an undersampling mode of operation. However, using a high order ADC Nyquist band to sample requires strict front-end antialias filtering and frequency planning to prevent spectral energy from leaking into other Nyquist zones. It also ensures that unwanted harmonics and other lower frequency signals do not fall into the band of interest after it is folded down to the 1st Nyquist. The band-pass filter (BPF) upstream of the ADC must be designed to filter out unwanted signals and noise that are not near the nominal bandwidth of interest. New GSPS ADCs such as AD9234, AD9680, and AD9625 offer multiple Nyquist band sampling with high dynamic range across wide input bandwidths.

Since a direct sampling technique folds the signal energy from each zone back into the 1st Nyquist, there is no way to accurately discriminate the source of the content frequency. As a result, rogue energy can appear in the 1st Nyquist zone, which will degrade the signal-to-noise ratio

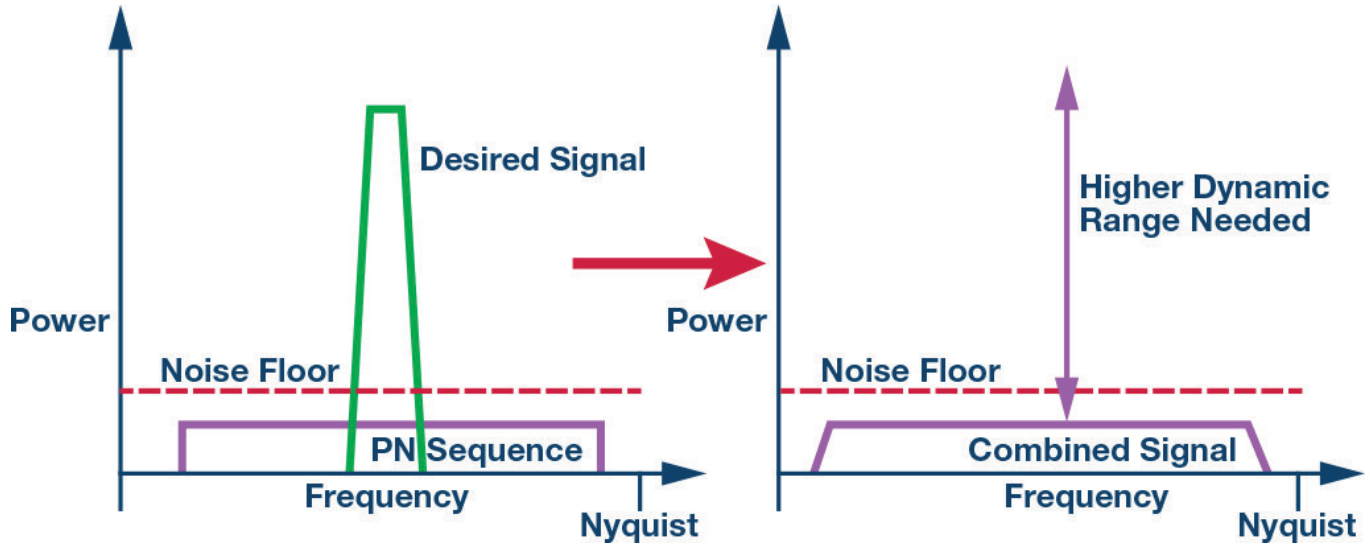


**Figure 2. Direct sequence spread spectrum systems require a wide receiver bandwidth and high dynamic range as the signal band of interest is modulated with pseuorandom noise (PN) to push the communication into the noise floor**

(SNR) and spurious-free dynamic range (SFDR). Spectral issues have the potential to plague government and military applications, both for communications and sensing. Digital radio transceivers for military communications are another example of the use of high speed ADCs and DACs that can potentially replace a traditional baseband mixer stage. The architecture has several advantages because tight filtering and adjacent channel rejection can be done in the digital domain for the baseband conversion.

Several advantages are offered by direct RF sampling for radar RF front-end designs. First and foremost, it can allow component count reduction, as can be seen in Figure 3, when an entire downconversion stage can be eliminated. It also removes the need to design a mixing chip to fit a uniquely tailored frequency plan. Second, it can simplify the design of next-generation receivers for future signal bandwidths that become available as radar systems are modernized and updated. All that may be needed to work with a new carrier frequency is to select an appropriate sampling rate and incorporate an appropriate band-pass filter. Third, it is possible to make a single RF front end suitable for multiple frequency bands, given different sample rates. This approach to multifrequency radar receiver front-end design eliminates the need for multiple front ends.

Current generation ADCs now offer a plurality of internal digital downconversion (DDC) processing blocks for narrow-band inspection of a communication. Each DDC can apply its own decimation rate and numerically controlled oscillator for tuning placement within a Nyquist band. Processing gain can be achieved within a narrower bandwidth that digitally filters out-of-band noise. This reduces the required ADC output data and minimizes processing complexity in FPGAs and DSPs. However, additional channelizer signal processing can also be done downstream of the ADC.

Wideband communications and sensing systems require extremely high speed data converters. State-of-the-art GSPS ADCs such as AD9234, AD9680, and AD9625 not only offer high sample rates for a wider instantaneous bandwidth, but also the ability to sample high frequency inputs with high dynamic range above the 1st Nyquist. A single direct RF sampling ADC used at a high bandwidth can potentially replace an entire IF sampling or zero IF sampling subsystem of mixers, LO synthesizers, amplifiers, and filters while achieving greater flexibility. This can significantly reduce the system bill of materials (BOM) cost, design time, board size, weight, and power consumption.

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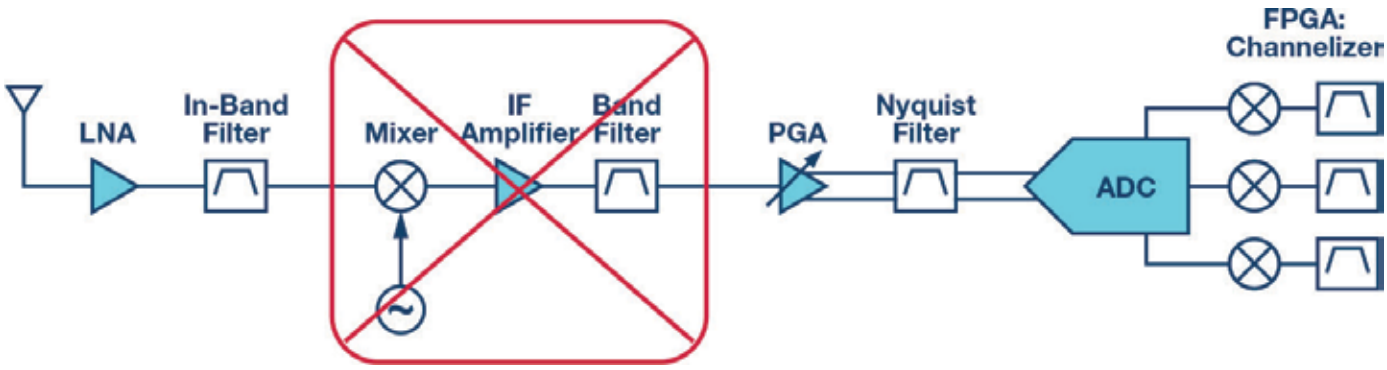


**Figure 3. The undersampling technique can potentially remove a downconversion stage as the higher input frequency band is given directly to the RF sampling ADC**

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## About the Author

Ian Beavers is an applications engineer for the high speed ADCs team at Analog Devices in Greensboro, NC. He has worked for the company since 1999. Ian has over 20 years of experience in the semiconductor industry. Ian earned a bachelor's degree in electrical engineering from North Carolina State University and an MBA from the University of North Carolina in Greensboro. Ian is a member of EngineerZone's High Speed ADC Support Community. Feel free to send your questions to IanB on Analog Devices EngineerZone Online Technical Support Community.

# Radar echoes from a generator innovative testing solution for the lab and service

› Dr. Rainer Lenz, R&S

A new software option simulates realistic radar echoes that can be used to comprehensively test radar systems. All that is needed is a signal generator and a spectrum analyzer.

## Radars: proven reliability a must

Radars, similar to optical systems, provide images of the surroundings. They use electromagnetic signals to illuminate their surroundings and then generate an image of the environment from the echoes returned by reflecting objects. Unlike optical systems, radars can also produce a situational image in the dark or where visibility is poor. Radars consist of several subsystems, including a transmitter, receiver and the radar processor, which calculates the situational image from the data received. The radar is set in the appropriate operating mode for the specific task and the radar processor sets the required parameters, such as the pulse duration and pulse repetition rate.

One of the typical requirements for navigation radars is to reliably detect the signal echo reflected by another ship from among the numerous disruptive echoes caused by waves, even in heavy seas. Since radar images are essential for navigation and reconnaissance, the systems must be extremely reliable. Ensuring reliability often requires extensive field tests in addition to standard laboratory tests (see box) - and these have to be repeated in every operating mode. Navigation radars, for example, have two separate modes for detecting close and faraway objects. All these tests take time and tie up resources, which is why manufacturers and operators always strive to minimize the effort involved.

## Simulation software reduces testing effort

The R&S®SMW-K78 radar echo generation software option for the R&S®SMW200A vector signal generator enables users to artificially generate radar echoes. The R&S®FSW signal and spectrum analyzer is also needed as a radar receiver. This solution makes field tests largely unnecessary. The option can generate radar signal echoes in a realistic manner and provides all the prerequisites for conducted and over-the-air (OTA) tests. The generator controls the spectrum analyzer and configures it so that both devices appear to the user as a single system that is operated via the generator.

For pure receiver tests, the R&S®SMW200A can be used as an echo generator even without the spectrum analyzer. It generates

the transmit signals in the digital baseband, e. g. using the R&S®Pulse Sequencer software.

### Realistic simulation of radar echoes

The R&S®SMW200A generates radar echoes of static and moving objects at user-configurable ranges. It automatically sets the delay, the Doppler frequency and the RF output level for each object. For moving objects, the generator constantly updates the delay and the output level of the echo signal. This means, for instance, that the signal level of the echo of an object that is radially approaching the radar increases after each update. The algorithm is based on the radar equation and the propagation loss in free space. The generator can simultaneously produce up to a total of 24 static and moving objects.

The top section of Fig. 2 shows the menu for defining the objects used to create the echo signal. Static objects are assigned a specific range. Their size can be defined via the radar cross section (RCS). The R&S®SMW-K78 option models the point objects with a constant RCS, which is often called "Swerling 0" after the underlying RCS statistic.

For moving objects, the velocity and the start and end range to the radar can be specified (Fig. 2, bottom). The objects can be assigned a movement pattern, e. g. a one-way path from the start to the end location or continuous movement between the start and end location. Superposition of echoes can easily be simulated by mixing static and moving objects.

### Handles many different test cases

Radar engineers have to cope with numerous test cases and types. Typical system tests include confirming fixed target suppression performance for moving target indicator (MTI) radars and testing the minimum threshold for detecting an object. For a test system to be able to test whether a radar system can detect small objects near a large object, it must

## Typical test scenario at sea

For certification tests, maritime radars are mounted on a ship and put into operation. The ship operates in a defined sea area in which objects with defined backscatter properties and backscatter power (mainly buoys) are placed. These are arranged so that it is possible to determine the most important radar properties such as the range resolution and the azimuth resolution.

The range resolution of a radar is its ability to recognize that two objects positioned behind each other at the same azimuth angle to the radar are separate objects. The radar under test transmits a pulsed signal and receives the echo signals from the two test buoys (Fig. 1). The difference in the delay times of both echoes is a measure for the geometric spacing of the two objects. If the system can separate the two echo signals from each other, the two objects will be displayed on the radar screen. If the range resolution is too low, only one object will be seen on the screen.

Determination of the azimuth resolution is similar. In this case, a check is made to see if the system can distinguish between two objects that are positioned at the same range, but at different azimuth angles to the direction the ship is traveling. This ability is mainly determined by the antenna characteristic.

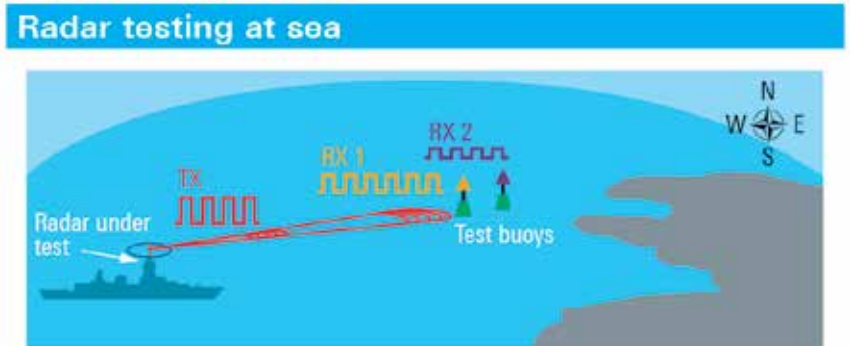


**Fig. 1: Test scenario for determining the range resolution of a radar.**

have a sufficiently large spurious-free dynamic range. By generating multiple echoes and several objects with different velocities, it can be demonstrated how well radars can simultaneously track, resolve and display these objects. Standard test approaches such as using optical delay lines only partially solve these issues. They are often not flexible, generally need intensive maintenance and also require other measuring equipment to perform all the tests. Thanks to its excellent RF characteristics and versatility, the R&S®SMW200A vector generator equipped with the R&S®SMW-K78 option can be used to perform a variety of tests – without a lot of equipment.

## Conducted tests and OTA tests

For conducted tests, the radar signal is fed to the R&S®FSW via a cable. It is then downconverted, digitized in realtime and fed to the R&S®SMW200A (Fig. 3, top). The generator uses this signal to generate echo signals that are indistinguishable from real echoes. For OTA tests, the signals are received and transmitted by antennas that are connected to the input port of the analyzer and to the output port of the generator (Fig. 3, bottom).

## Conducted tests

Conducted tests are ideal for development and final testing before radars are permanently installed on a platform. They significantly reduce the overall effort since tests that would only be possible fairly late, such as certification runs for navigation radar, can be carried out during development.

The software offers the option of

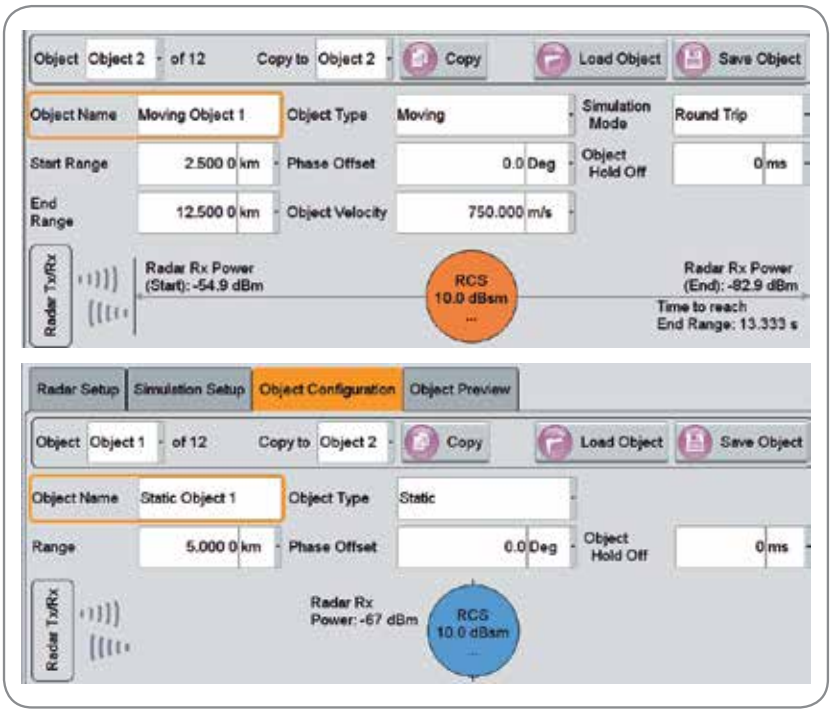


**Fig. 2: Configuration of a static (top) and a moving object (bottom) on the R&S®SMW200A vector signal generator.**

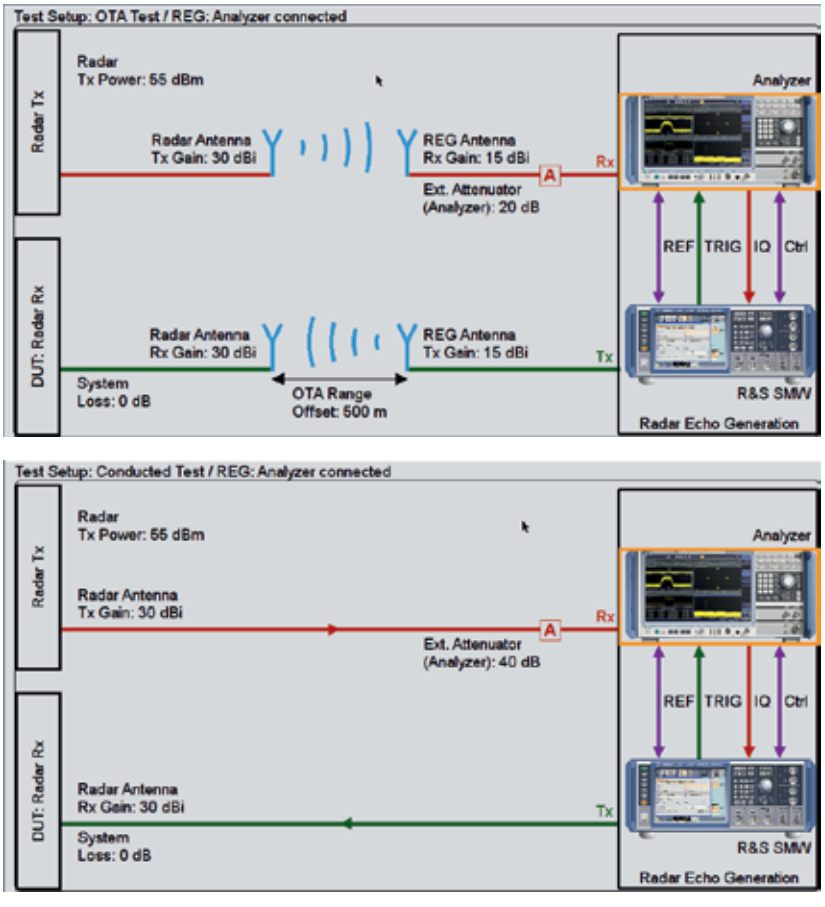


**Fig. 3: Conducted test (top) and OTA test (bottom).**

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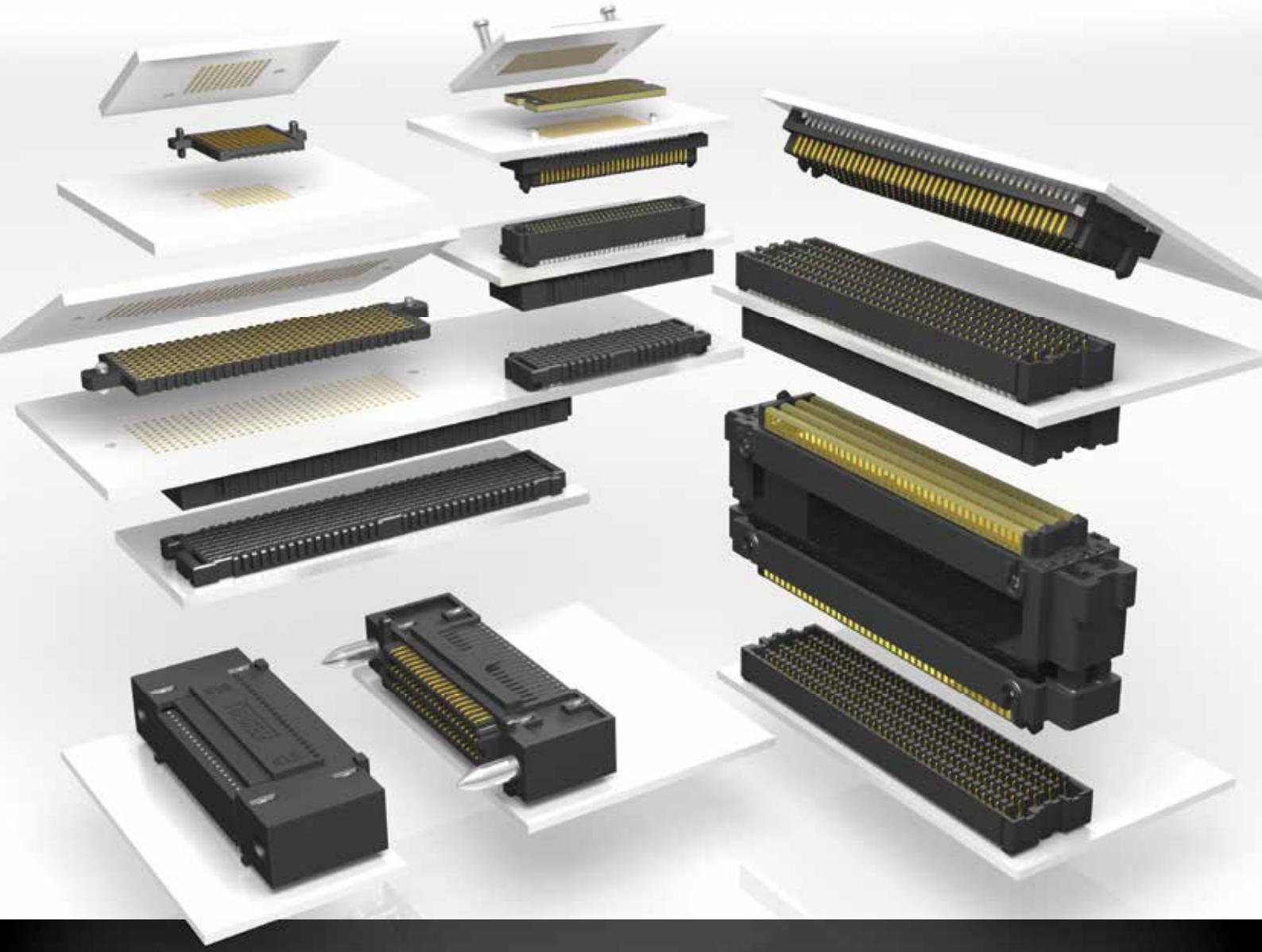

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manually configuring the radar receive level or using the radar equation to automatically calculate it based on the radar scenario. Fig. 4 shows all parameters (except the object properties and center frequency) that must be set in order to use the radar equation to automatically calculate the signal power level at the receiver.

## OTA tests

If radars are already in operation and installed on a ship, for instance, then the effort to set up tests in the lab is excessively high. In such cases, functional tests have to be performed at sea. However, these take time and during this time the ship cannot be used. The Rohde & Schwarz solution makes it possible to perform comprehensive tests during normal port layovers. The setup consists of the R&S®FSW and R&S®SMW200A with antennas at the RF inputs and outputs (Fig. 5). The generator and the analyzer are installed in a stationary test system that receives the radar signals via a test antenna with known properties and returns the echoes to the radar under test. This test setup (Fig. 5) can be completely configured on the R&S®SMW200A if all relevant transmission path parameters are known (e. g. radar and test setup antenna gains and radar transmit power).

For this test case as well, it is possible to manually configure the radar receive level or use the radar equation to automatically calculate it based on the radar scenario. The required RF output power at the generator is automatically determined from the configured parameters so that the right echo level reaches the input of the radar receiver.

## Example of a test scenario

A typical test scenario consists of two objects. Such scenarios can be easily simulated in the lab with the R&S®SMW200A. The parameters can be changed for variants. The top section of Fig. 6 shows a preview in the range /velocity view displaying the overall result of all configured reflecting object parameters. Object 2 (orange) is stationary at a range of 3.75 km from the radar. Object 1 (blue) moves a few kilometers away from the radar at a velocity of 750 m/s and returns. Before the tests are carried out, the user can check whether the scenario is properly configured.

The bottom section of Fig. 6 shows the level of the echo signal versus time calculated by the R&S®SMW200A. Echo 2 (caused by object 2) has a constant level and a constant time

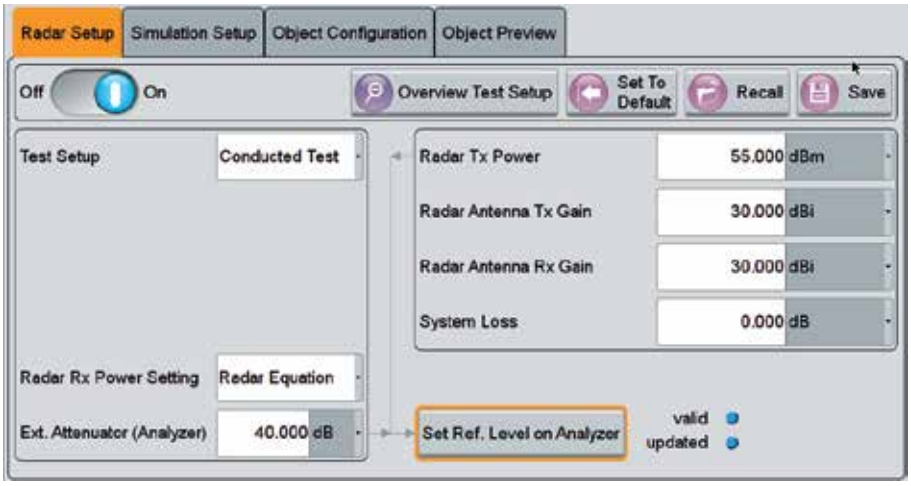
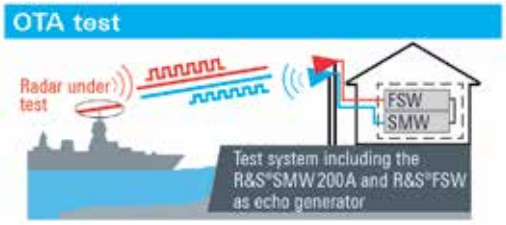
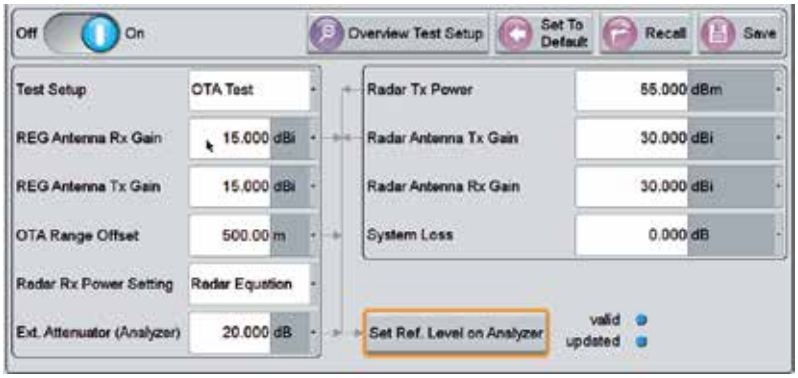



**Fig. 4: Required parameters for configuring conducted tests**

**Fig. 5: Basic test setup of an OTA test on a radar (right). Below is the menu for the required settings.**



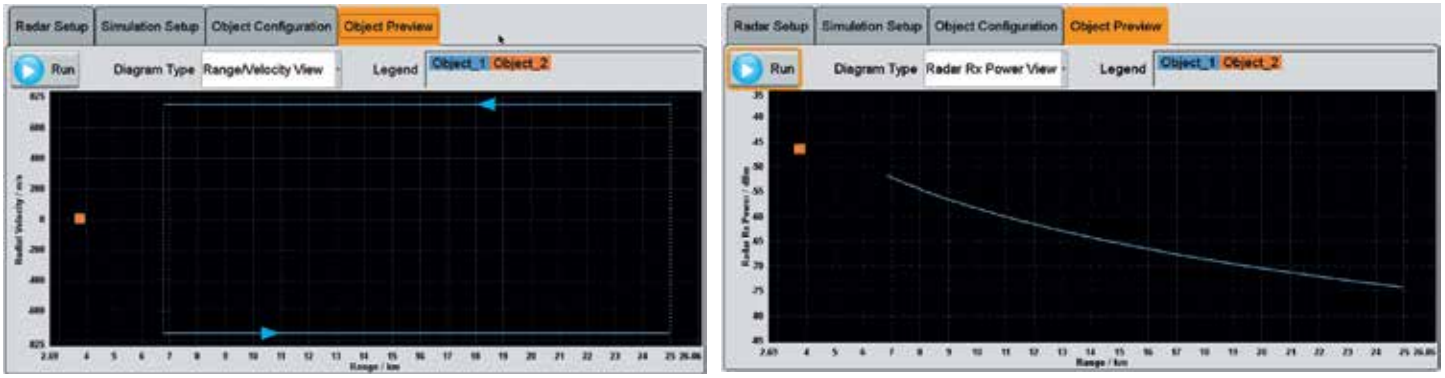



**Fig. 6: Live preview of the configured scenario containing a static and a moving object (top). Bottom: Calculated echo signal level versus time.**

delay to the transmission pulses. Both the level of echo 1 (caused by object 1) as well as the time delay to the transmission pulses vary based on the range.

## Summary

The new R&S®SMW-K78 option for radar echo generation saves time when testing prototypes in development as well as when servicing operational radar systems. The R&S®SMW200A signal generator together with the R&S®FSW signal and spectrum analyzer make it possible to perform conclusive radar tests that previously could only be made in time-consuming field tests after development was complete. The user does not have to invest in special solutions and the cost of lab equipment is reduced since the spectrum analyzer and vector signal generator are already on hand and can also be used for other measuring tasks.


# IoT promises smarter health

› Randall Restle, Digi-Key Electronics

Healthcare costs around the world are rising as the population ages. The proportion of the population of the world aged 65 and over is set to double over the next 25 years, from a little over 7 per cent today to 15 per cent. In the developed world, the rise will be even higher as average life expectancy is already higher. Although people will live longer, many will live with chronic medical conditions that require regular treatments and consultations. The result is likely to be a dramatic increase in the cost of healthcare, whether financed by state taxation or insurance costs.

A key issue is the amount of time that people need to stay in hospital after a treatment so that they can be observed before receiving more treatment or are considered healthy enough to discharge. Hospital treatment costs are much higher than if the patient can stay at their home and receive instead a series of brief consultations from a nurse or doctor. However, appropriate medical staff is not always close enough to allow travel to a surgery by a patient. Specialist medical staff work in city hospitals but in a developed nation a quarter of the population will live in rural areas and do not find it easy to travel for consultations.

The stress of travelling to a surgery to have measurements of heart rate, blood pressure and other physical attributes is stressful in itself and can lead to situations where the patent receives the wrong level of treatment for their actual conditions. If doctors had access to measurements taken over a longer period during real-world activities they would have a much better idea of the patient's progress.

Governments around the world have also come to the realization that if some chronic conditions, such as type-two diabetes or cancer can be prevented instead of needing acute treatment, this will slow the relentless rise in healthcare costs.

In both of these cases, information technology in the form of the Internet of Things (IoT) provides the core of the solution. Wearable sensors and portable monitoring systems have the potential to extend the reach of medical staff out to the home and provide them with the ability to react much more quickly to changes in the patient's condition and provide more appropriate healthcare. At the same time, because IT can be used to only signal important changes received over the IoT, overall costs are reduced by not having doctors and nurses perform consultations when they are not necessary.

Using the IoT, sensors are deployed around the patient's body to the points where they are needed. These

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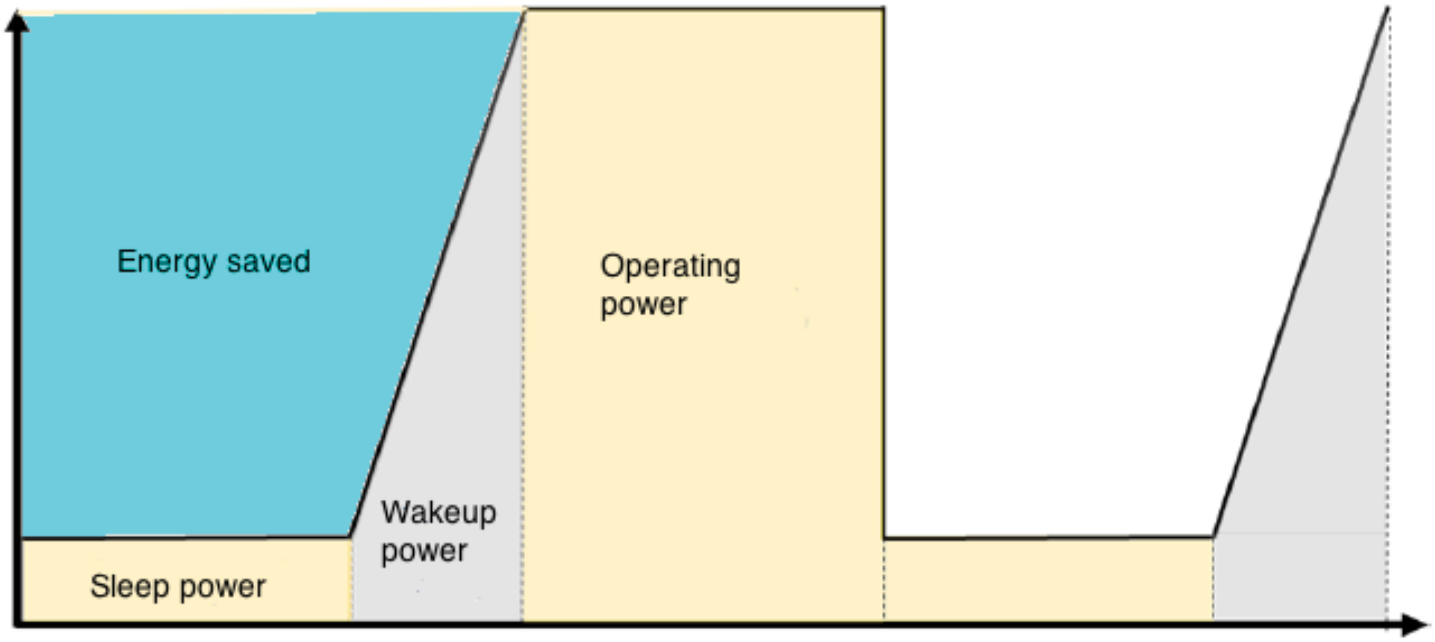



**Figure 1. low power siliconlabs**

sensors would be used to monitor vital signs such as heart rate, blood pressure and respiratory rate, in the case of patients who have suffered congestive heart failure or are considered high risk for a heart attack. If a patient has had a stroke or is suffering from mobility issues either leading up to or post hip-replacement surgery, accelerometers and similar motion sensors can be deployed around the body to ensure they are moving well and also to alert emergency services if they suffer a fall. Researchers have also found that in the case of rehabilitation, they get a better sense of the effective mobility of a patient if they can determine how well a patient climbs and descends stairs and gets out of a chair rather than simply walking across a doctor's surgery.

Wearable IoT goes far beyond treatment of medical conditions. It can help reduce injury and boost wellness. People who wear simple exercise-monitoring wristbands find that working out how many steps they have taken that day changes their behaviour. GPS-enabled sports watches are already in widespread use by athletes, amateur and professional alike. The same IoT technology proposed for medical sensors can be used to prevent injury, such as damage to knees caused by bad running posture, through the use of accelerometers worn on the legs, perhaps sewn into a pair of leggings. Similar sensors incorporated in a vest could help prevent the poor posture that leads to back pain. In these cases, exercise programs in a smartphone or tablet would advise interactively on better ways to run or sit and warn the user that they are slipping into bad habits when they lose concentration.

The sensors used for wellness need not be entirely wearable. For people suffering from debilitating conditions such as dementia that threaten to remove their ability to live independently, sensors and displays placed around the home can help them. The sensors detect what kinds of activities the occupant is trying to perform and can present reminders and help on the displays as they move around their home.

The unifying theme behind these different applications is that of intelligent sensor fusion. Smart sensors wirelessly relay data about changes in circumstance to a monitoring unit which assimilates the incoming information and makes decisions on what to do next. For example, a sudden change in heart rate flagged by one sensor may simply be through additional exertion. But if accompanied by difficulty breathing picked up by another sensor may trigger the monitoring unit to send an alarm to a nearby medical specialist over the cellular connection of a mobile phone.

The key component technologies therefore are low-power microcontrollers and sensors that either have built-in wireless support or can communicate with low-power RF devices that are able to fit in a compact package. The key wireless technologies for wearable and smart-home applications are Bluetooth Low Energy (BLE) and ZigBee. Both are designed for low-energy

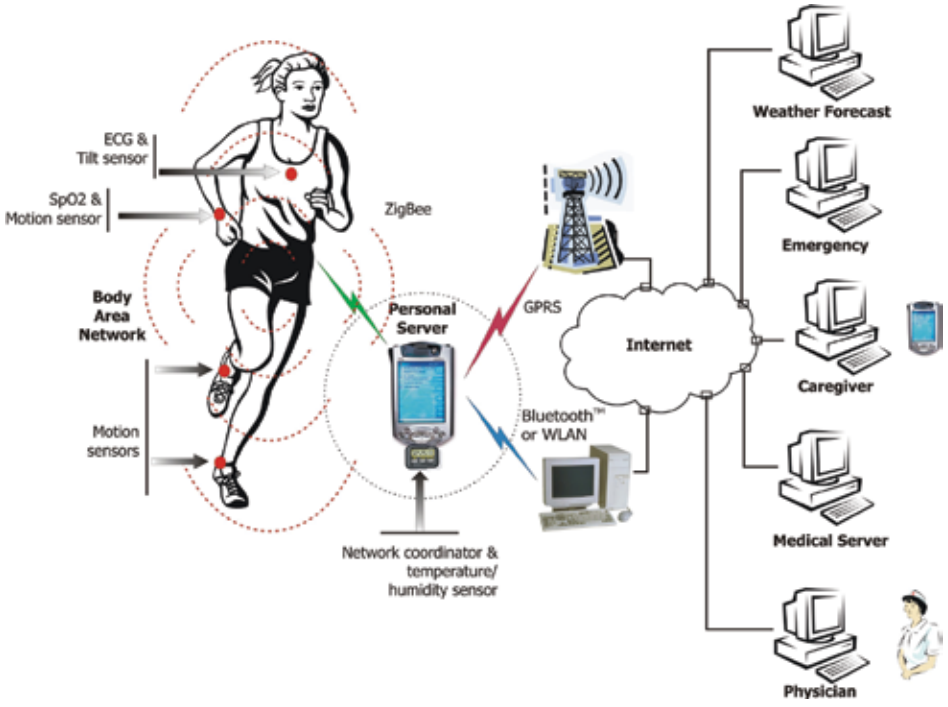



**Figure 2.**

consumption, a key requirement for devices that users do not want to have to recharge every day.

Given its compatibility with smartphones, BLE has important advantages for wellness devices that are sold to consumers over the counter as well as for more specialised medically oriented devices. BLE is well supported by component manufacturers such as CSR and STMicroelectronics for both sensor devices and monitoring hubs, where BLE is often coupled with WiFi, allowing easy transfer of data to the internet. However, ZigBee has longer range, suiting it to use where sensors need to be integrated in the home and are not just deployed around the body.

Microcontroller suppliers such as Atmel, Freescale Semiconductor and Texas Instruments have developed IoT-capable processors that can handle BLE and ZigBee protocol stacks. These offerings are scalable through support for 8-bit and 32-bit cores, depending on the complexity of the software needed by each particular sensor node.

IoT-oriented MCUs often incorporate specialised low-power support such as hardware state machines that offload much of the real-time sensor processing from the core processor itself. This allows the processor to spend much of its time in a low-energy sleep mode, only waking up when the peripheral hardware indicates that a sensor has picked up a sudden change in activity or condition. Because a high proportion of time is spent in sleep mode – often higher than 99 per cent – overall energy consumption is kept to a minimum and ensuring longer periods between recharge.

Through dedicated silicon support, the IoT is set to revolutionise the world of healthcare and promote a shift in thinking to ongoing wellness, and heading off the need to deal with the consequences of illness.

# Switching Aircraft Interior Systems to Fibre Optics

› Thomas Heller, Molex

With more airline passengers demanding in-flight Wi-Fi, system designers need to find a smart solution for migrating on-board systems to fibre optics. Here Thomas Heller is account manager, aerospace and defence, Molex, surveys the current state and major trends for aircraft OEMs.

One of the hottest technology trends relating to cabin electronics in civil aircraft is creating designs that accommodate all the passengers that now want to use their smartphones, tablets, and laptops on board. Passengers want, and will eventually demand, the ability to recharge their devices as well as gain Wi-Fi access to stream video, audio, and data files throughout the entire flight. Essentially, many flyers want aircraft to become flying Internet cafés.

This trend, of course, creates challenges when it comes to outfitting aircraft cabins with modern electronic and electrical solutions. Size, weight, available space, power, cost, and vibration — all of which come at a premium within aircraft system designs — must be considered.

To address the challenge, speeds and bandwidth over copper have increased dramatically over the last few years. But with copper, Wi-Fi access presents what amounts to an impossible obstacle, especially in cases where 300 passengers try to access Wi-Fi all at once.

In addition to ensuring there's no interference from the wide variety of systems on plane airframe systems, there's also the issue of sufficient bandwidth for that number of users, especially those accessing video and audio files. Aircraft on-board system designers are at the tipping point for switching to fibre optics.

Fibre vs. Copper

With device and connector manufacturers driving the push to make photon-to-electron conversion points as small and as light as possible, fibre optic interconnects generate interest for their ability to perform better than copper in the critical SWaP (size, weight, and power) areas. Size wise, fibre interconnects and cable assemblies

can typically be smaller compared to copper-based products that have equal or less information through-put. As boxes become smaller in size with increased bandwidth, output requirements become a key design factor. It goes without saying that weight impacts directly on payload capacity and related fuel usage – so the lighter the better, and fibre optics provide greater bandwidth for transmitting information. This is particularly helpful when trying to maintain high-level signal integrity during the uploading/downloading of video and audio files.

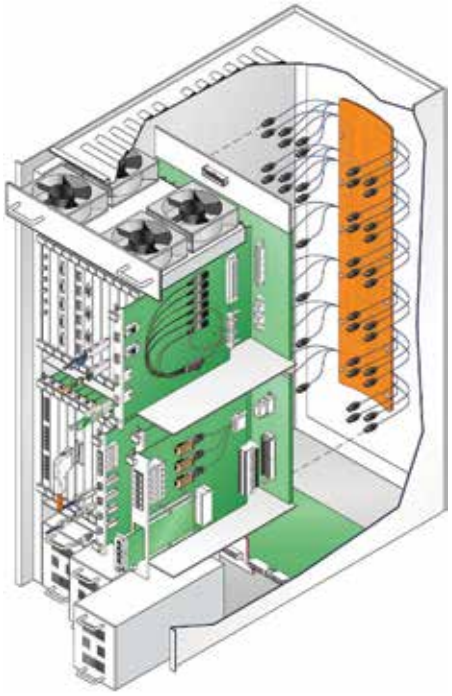
One option in development is fibre optic flex planes. Flex planes, with fibres embedded in an engineering plastic sheet, can greatly reduce weight and cross-sectional area of a data system. The conformability helps manufacturing and the weight savings enhances fuel efficiency for the life of the aircraft. Whereas copper cables (with their higher weight) require quite heavy fixtures, ribbon fibre can be easily attached without additional mechanical fixtures.

## Turning on to Light

Companies that provide cabling interconnects for printed circuit boards (PCBs) and PCB box units to in-flight entertainment system manufacturers are also designing new power supplies as well as wireless hardware and lighting systems. Some Aircraft manufacturers are also conducting flight simulation tests on fibre optic systems for future modifications and updates of cabin systems.

Another key area for design engineers to focus on in addition to the rapid growth in the number of fibre optic systems, the density of the PCBs will increase and the size of the boxes housing them will decrease. This has already occurred in laptops and other personal electronic devices, and the industry will soon see this within in-flight entertainment systems.

In the not-so-distant future, all phones in the backs of the seats will disappear while the big boxes under the seat, although growing smaller, will still contain seat power, hubs, and access points, along with more functionality. For on-board system designers to meet such needs, the use of fibre optic interconnects will become a mandatory requirement.



**Network Box**
**In addition to the rapid growth in the number of fibre optic systems, the density of the PCBs and size of the boxes housing them will decrease**

**Thomas Heller, account manager, aerospace and defence, Molex.**

# Measuring Heart Rate and Blood Oxygen Levels for Portable and Wearable Devices

› Zhang Feng & Marten Smith, Medical Products Group - Microchip Technology Inc.

The changes occurring in the medical and fitness fields, along with their associated electronic devices, can be called truly revolutionary. The demands of today's healthcare-device markets are many, varied and challenging. Devices that were once primarily found in hospitals are now used for home-medical applications, as well as fitness monitoring.

For example, the capability to measure heart rate and blood oxygen levels is showing up more often now in consumer products. These measurements can be taken using pulse oximeters that are now available as both home-medical devices as well as part of integrated wrist-worn fitness activity trackers.

This article will cover the basics of pulse oximetry for medical and fitness applications. It will also examine a pulse-oximeter design example that demonstrates the measurement of heart rate and blood oxygen levels.

## What is Oximetry?

Oximetry is the measurement of oxygen saturation in blood, and is usually expressed as a percentage. A pulse oximeter is a non-invasive device that measures the oxygen saturation of a person's blood, as well as their heart rate. Pulse oximeters are easily recognized by their associated clip-type probe, which is generally applied to a patient's finger.

A pulse oximeter can be a stand-alone device, part of a patient-monitoring system, or integrated into a wearable fitness tracker. Accordingly, pulse oximeters are used by nurses in hospitals, outpatients at home, fitness enthusiasts at the gym and even by pilots in unpressurized aircraft.

## What is Blood Oxygen Saturation?

Blood oxygen saturation is measured by examining hemoglobin, which is the oxygen-carrying pigment of red blood cells that gives them their red color and serves to convey oxygen to the tissues. Hemoglobin is found in two forms. The first is called oxidized hemoglobin, which is denoted as HbO2 (i.e., oxygen-loaded). The second is called reduced-oxygen hemoglobin, which is denoted as Hb (i.e., oxygen-depleted)

So, blood oxygen saturation (SpO2) is the ratio of Oxy-hemoglobin to Deoxy-hemoglobin. This can also be expressed as:

$$SpO2=HbO2/ (Hb + HbO2)$$

The value of blood oxygen saturation is expressed as a percentage. A normal reading is typically 97% or higher.

## How Does a Pulse Oximeter Measure Blood Oxygen Saturation (SpO2)?

One of the really interesting things

about hemoglobin is how it reflects and absorbs light. For example, Hb absorbs more (and reflects less) visible red light. HbO2 absorbs more (and reflects less) infrared light. Since blood oxygen saturation can be determined by comparing the values of Hb and HbO2, one method for doing this is shining both a red LED and an infrared LED through a body part (such as a finger or wrist), and then comparing their relative intensities. There are two common methods of doing this: (1) measuring the light transmitted through tissue is called transmissive oximetry, and (2) measuring the light reflected by tissue is called reflectance oximetry (See Figure 1).

Generally, most hospital patient-monitoring systems have an integrated transmissive pulse oximeter. On the other hand, many of the newer, high-end wearable fitness devices utilize the reflectance-pulse-oximetry method.

## How Does a Pulse Oximeter Measure Pulse Rate?

When your heart beats, it pumps blood through your body. During each heart beat, the blood gets squeezed into capillaries, whose volume increases very slightly. Between heart beats, the volume decreases. This change in volume affects the amount of light, such as the amount of red or infrared light, that will transmit through the tissue. Though this fluctuation is very small, it can be measured by a pulse oximeter using the same type of setup that is employed to measure blood oxygen saturation.

## Detailed Theory of Operation

Typical pulse oximeters monitor the oxygen saturation (SpO2) of a human's blood, based on the red light (using a 600-750 nm wavelength) and infrared light (using a 850-1000 nm wavelength) absorption characteristics of oxygenated hemoglobin (HbO2) and deoxygenated hemoglobin (Hb). This

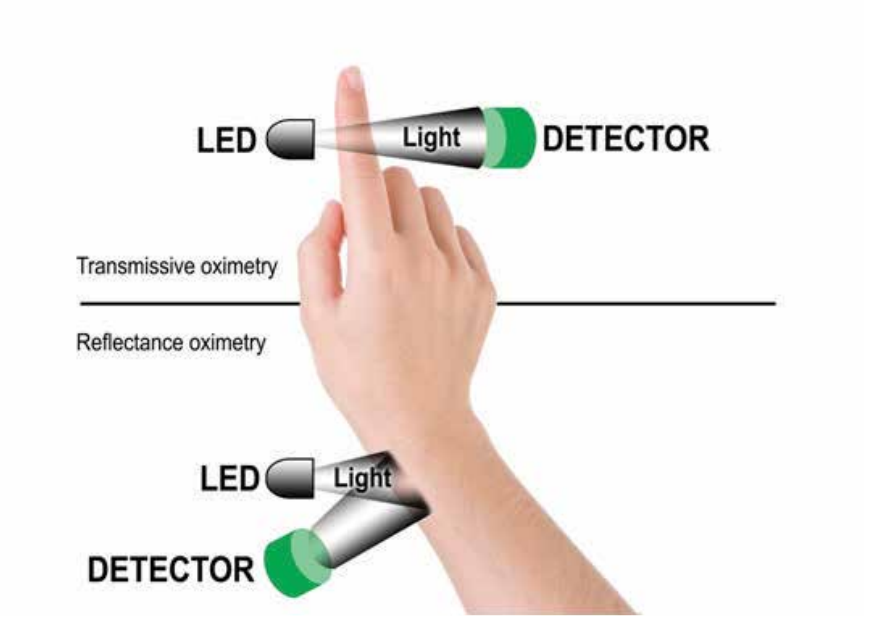



**Figure 1: Two Oximetry methods**

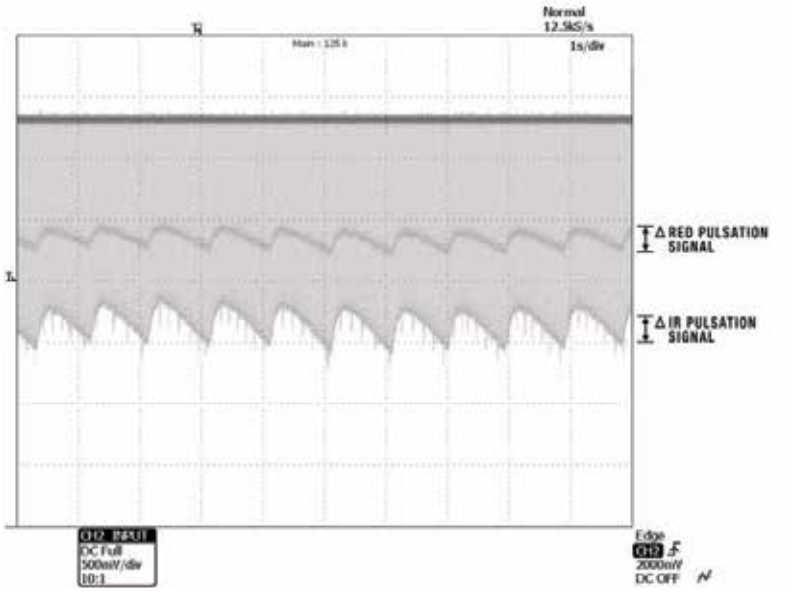



**Figure 2: Real-time Red and Infrared (IR) pulsation signals, as captured by an oscilloscope**

type of pulse oximeter flashes the red and infrared lights alternately through a body part, such as a finger, to a photodiode sensor.

The photodiode is normally utilized to receive the non-absorbed light from each LED. This signal is then inverted using an inverting operational amplifier, or op amp. The resulting signal represents the light that has been absorbed by the finger, as shown in Figure 2.

The pulse amplitudes (Vpp) of the red and infrared signals are measured and

converted to Vrms, in order to produce a ratio value, as given by the equation below…

**Ratio=**
**(Red_AC_Vrms/Red_DC) /**
**(IR_AC_Vrms/IR_DC)**

The SpO2 can be determined using the ratio value and a look-up table that is made up of empirical formulas. The pulse rate can be calculated based on the pulse oximeter's Analog-to-Digital Converter (ADC) sample number and sampling rate.

A look-up table is an important part of a pulse oximeter. Look-up tables are specific to a particular oximeter design and are usually based on calibration curves derived from, among other things, a high number of measurements from subjects with various SpO2 levels. Figure 3 shows an example of a calibration curve.

## Circuit Design Description

The following example will detail the different sections of a transmissive pulse-oximeter design. This design, as shown in Figure 4, demonstrates the measurement of both the pulse rate and blood oxygen saturation levels.

## Probe

The SpO2 probe used in this example is an off-the-shelf finger clip that integrates one red LED and one IR LED, plus a photodiode. The LEDs are controlled by the LED driver circuit.

The red light and IR light passing through the finger are detected by the signal-conditioning circuit, and are then fed into the 12-bit ADC module that is integrated into the Digital Signal Controller (DSC), where the percentage of SpO2 is calculated.

## LED Driver Circuit

A dual single-pole, double-throw analog switch, driven by two PWM signals from the DSC, alternately turns the red and infrared LEDs on and off. In order to acquire the proper number of ADC samples and still have enough time to process the data before the next LED turns on, the LEDs are switched on and off according to the timing diagram in Figure 5.

The LED current/intensity is controlled by a 12-bit Digital-to-Analog Converter (DAC), which is driven by the DSC.

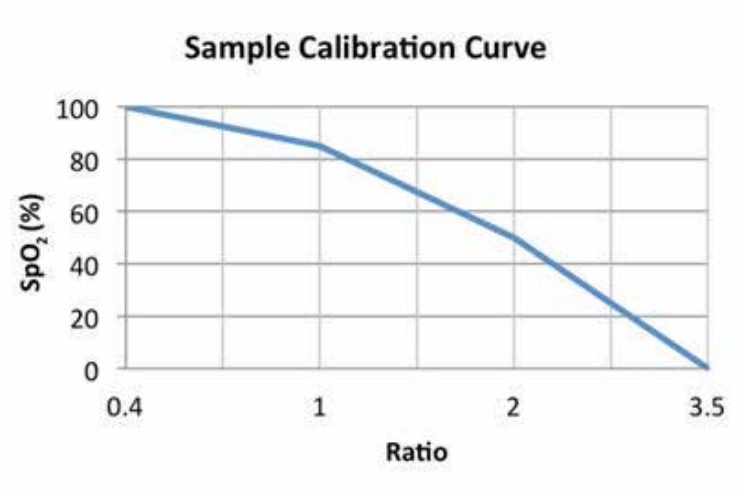



**Figure 3: Example calibration curve**

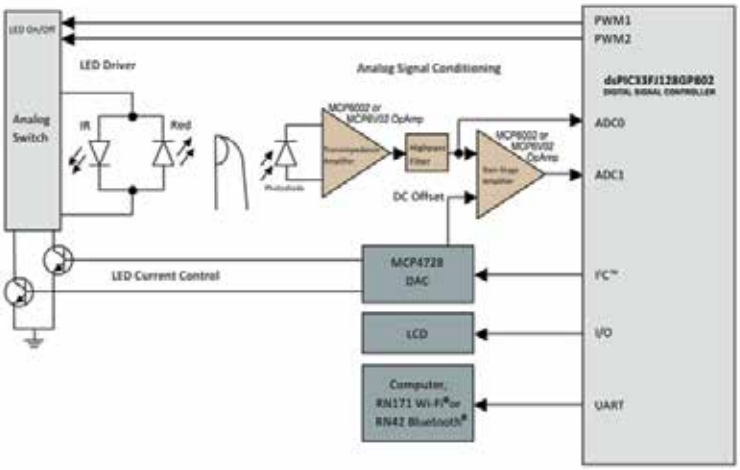



**Figure 4: Transmissive pulse oximeter system block diagram**

Analog Signal-Conditioning Circuit

There are two stages in the signal-conditioning circuit. The first stage is the transimpedance amplifier, and the second stage is the gain amplifier. A high-pass filter is placed between the two stages.

The transimpedance amplifier converts the few micro amps of current, which are generated by the photodiode, to a few millivolts. The signal received from this first-stage amplifier then passes through a high-pass filter, which is designed to reduce background-light interference.

The output of the high-pass filter is then sent to a second-stage amplifier with a gain of 22 and a DC offset voltage of 220 mV. The values for the amplifier's

gain and DC offset are set to properly place the output signal level of the gain amplifier into the MCU's ADC range.

## Digital Filter Design

The output of the analog signal-conditioning circuit is connected to the DSC's integrated 12-bit ADC module. For this example, we utilized a dsPIC® DSC from Microchip Technology. The dsPIC33FJ128GP802 used in this design enabled us to take advantage of not only its integrated DSP capabilities, but also of Microchip's Digital Filter Design Tool.

One ADC sample is taken during each LED's on-time period, and one ADC sample is taken during both LEDs' off-time periods. Due to the challenges of taking light-based measurements through organic tissue, the filter design tool was used to implement a 513th-order, digital-FIR, bandpass filter, which enabled us to filter the ADC data. This filtered data was then used to calculate the pulse amplitude, as shown in Figure 6.

## The specifications of our FIR bandpass filter are:

| | | |
|---|---|---|
| Sampling Frequency (Hz): 500 | Passband (-dB): 0.1 | Ripple |
| Passband Frequency (Hz): 1 & 5 | Stopband (-dB): 50 | Ripple |
| Stopband Frequency (Hz): 0.05 & 25 | Filter Length: 513 | |
| FIR Window: Kaiser | | |

## Conclusion

The home-medical and fitness markets are growing at a rapid pace. The demand for devices that can measure heart rate and blood oxygen levels will only increase over the next few years. Pulse-oximeter reference designs, such as the one described in this article, can be very helpful in providing medical and fitness device designers with a head start toward getting their designs into production and out to market.

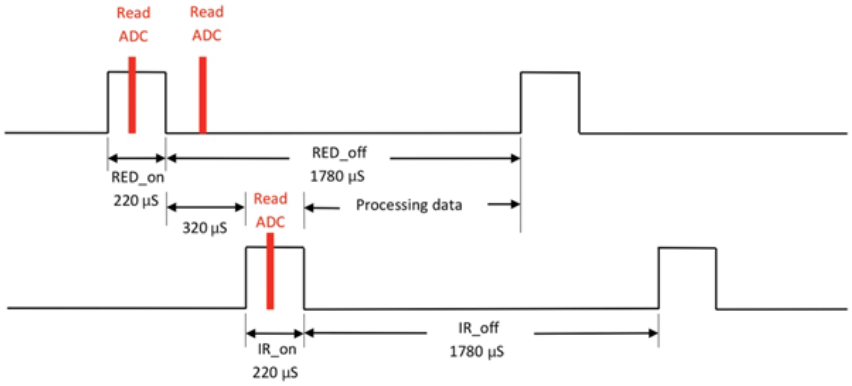



**Figure 5: Timing diagram**

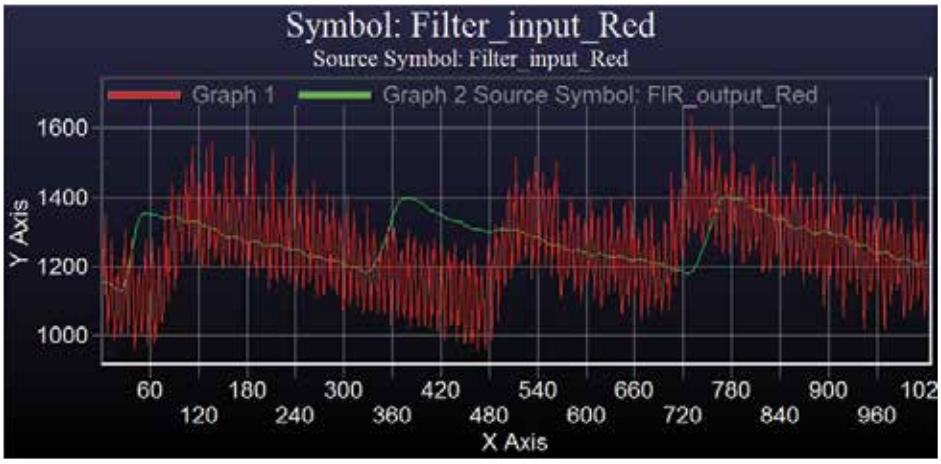



**Figure 6: Input and filtered data**
**Graph 1, shown in red, is the input signal to the FIR filter**
**Graph 2, shown in green, is the output signal from the FIR filter**
**X-Axis shows the number of ADC samples**
**Y-Axis shows the ADC code values**



## Resources

Pulse-Oximeter Design

• Principles of Pulse Oximetry Technology (2002). Oximetry.org. Retrieved April 23, 2014: http://www.oximetry.org/pulseox/principles.htm

• Microchip Technology Inc., Online Medical Design Center: http://www.microchip.com/pagehandler/en-us/products/medical/pulseoximeter.html/

• Or go to and find Pulse Oximeter under the left Applications navigation bar:http://www.microchip.com/medical

• Webster, J. G. (1997). Design of Pulse Oximeters. Bristol and Philadelphia: Institute of Physics Publishing.

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• Fluke Biomedical. (2007). Index 2XL SpO2 Simulator User Manual.

# Meeting Functional Safety Requirements Efficiently Via Electronic Design Tools and Techniques

› Philippe Roche, STMicroelectronics, and Adam Sherer, Cadence Design Systems

**In an intelligent electronic system, unexpected errors can lead to unplanned, unexpected behavior. This can be a potentially dangerous proposition for, say, an automotive manufacturer, as well as a costly occurrence for consumer product developers. Compliance to the latest safety standards can be a laborious, time-consuming process. Fortunately, there are now technologies available that can automate the process of meeting functional safety requirements. This paper examines these functional safety solutions, showing how these technologies and tools can help engineers efficiently and effectively create safe, reliable products.**

## Introduction

Intelligent electronics are everywhere these days, from smartphones to cars, airplanes, trains, power plants, pacemakers, and even refrigerators. This intelligence fuels powerful products with simple interfaces built on top of sophisticated electronics. However, as design complexity grows, the risk that unexpected errors will lead to unplanned, unexpected behavior grows. While the risk of personal injury for errors in, say, automotive designs may be obvious, we also cannot overlook the risk of financial loss associated with a fickle consumer who throws away the smart watch that freezes every time an alpha particle hits it during a sunny summer run.

Compliance to safety standards takes considerable effort, from staying up-todate on the latest standards to managing data in spreadsheets and documents and refactoring the verification environment to fit the traditional tool flow. While forgoing safety is clearly not an option, there are technologies available now that automate the process of meeting functional safety requirements, making the process more efficient than before. Efficiency is, after all, more desirable than ever in this environment of increasing system complexity.

This paper will discuss design and

verification tools that can provide the assurance that systems on chip (SoCs) are functionally safe at the IC and system levels. While functional safety is pertinent to an array of application areas, we will focus our discussion on the automotive space. Automotive applications, guided by a clear set of standards, provide a good illustration of the concerns and requirements around functional safety.

## Why is Functional Safety Important?

Functional safety refers to the concept that an overall system will remain dependable and function as intended even in the event of an unplanned or unexpected occurrence. Moreover, the system is assured to avoid unacceptable risk of physical injury or damage. Meeting Functional Safety Requirements Efficiently Via Electronic Design Tools and Techniques By Philippe Roche, STMicroelectronics, and Adam Sherer, Cadence Design Systems In an intelligent electronic system, unexpected errors can lead to unplanned, unexpected behavior. This can be a potentially dangerous proposition for, say, an automotive manufacturer, as well as a costly occurrence for consumer product developers. Compliance to the latest safety standards can be a laborious, time-consuming process. Fortunately, there are now technologies available that can automate the process of meeting functional safety requirements. This paper examines these functional safety solutions, showing how these technologies and tools can help engineers efficiently and effectively create safe, reliable products. For SoCs, especially as we move deeper into the submicrons, susceptibility to errors becomes greater. For example, phenomena that we cannot really see - from radiation sources to large magnetic fields and internal wear (common cause failure) - can be highly disruptive to advanced node SoCs. Imagine the repercussions if the most significant bit flips (single event upset) in a chip that controls the transmission of the car you're driving down the highway, causing your vehicle to drop into a different gear. It's not just lives at risk - it could be as simple as a company's brand image if their device constantly reboots. On a more positive note, having a higher degree of safety can differentiate your product, as well as consumers' perceptions of it. As basic design requirements go, dependable design is becoming as critical a criterion as meeting power, performance, and area (PPA) specifications.

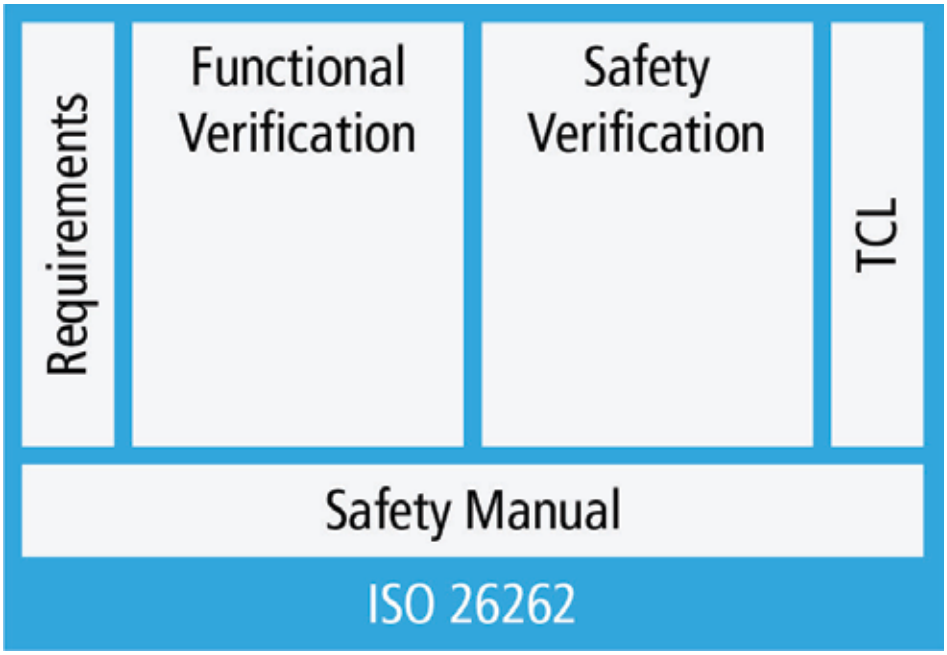


**Figure 1: Elements of ISO 26262 from a verification perspective**

## What Does Functional Safety Require?

The design of safety systems involves the following:

- Redundancy, which provides multiple processing paths to limit the risk that any one error will upset the system; the tradeoff here is that redundant systems do consume IC area that could otherwise be used for additional functionality
- Checkers, which monitor the systems and trigger error response and recovery features when necessary; the tradeoff here is that while checkers don't consume too much area, they may provide only partial recovery Safety engineers must implement requirements tracing from the system to components, and ensure their development flow aligns with tool confidence level (TCL). Quality measurement involves functional verification at all levels of abstraction and for all system elements, as well as safety verification, which measures response of systems to undesired/unplanned events. Finally, it is important to record and report functional safety measures in order to have a verified

system. From a process standpoint, to achieve safety verification, safety engineers need to be able to take their functional verification environment and essentially replay pieces of it while injecting errors (faults) into their system. Redundant logic can "vote" on the correct data to eliminate errors, maintaining continuous operation. Checkers monitor for erroneous data within specified time periods and apply error corrections. As an example, consider the pressure sensors in the power windows of cars. When operating correctly, pressure sensors prevent power windows from, for example, closing on the fingers of a curious child who's playing with the window's up/down switch. Imagine what might be missed if the checker on these sensors samples only every five seconds vs. every quarter of a second.

## Key Safety Standards: IEC 61508 and ISO 26262

The foundation functional safety standard is IEC 61508, which addresses the assessment and reduction of the risk that unexpected errors will lead to unplanned behavior. It defines assessment methods for requirements tracing, functional safety, and TCL, culminating in an audited safety integrity level (SIL, ASIL for automotive). A variety of industrial standards are derived from IEC 61508, including the automotive safety standard, ISO 26262.

All of these standards have one thing in common - the massive amount of data collection and analysis needed to achieve the safety integrity level. Massive can mean tens of person-years in the development cycle for a product line, translating into millions of dollars in added development expense. With an increasing number of OEMs and tier 1 integrators requiring an audited ASIL certificate, the challenge is to find immediate solutions that can evolve as your product grows in complexity.

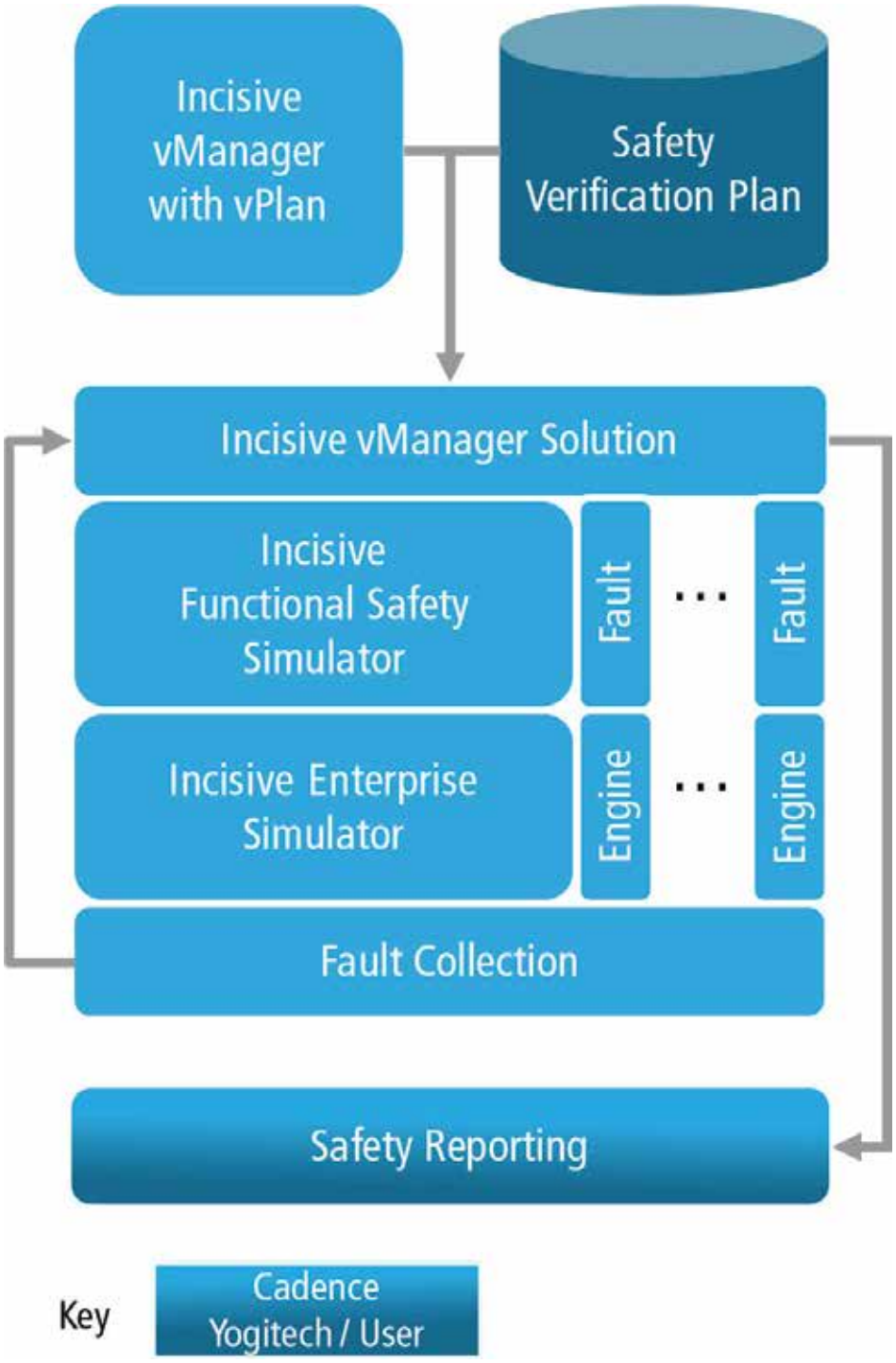


**Figure 2: A functional safety verification flow**

## Safety Needs to Address Now

Requirements tracing, functional

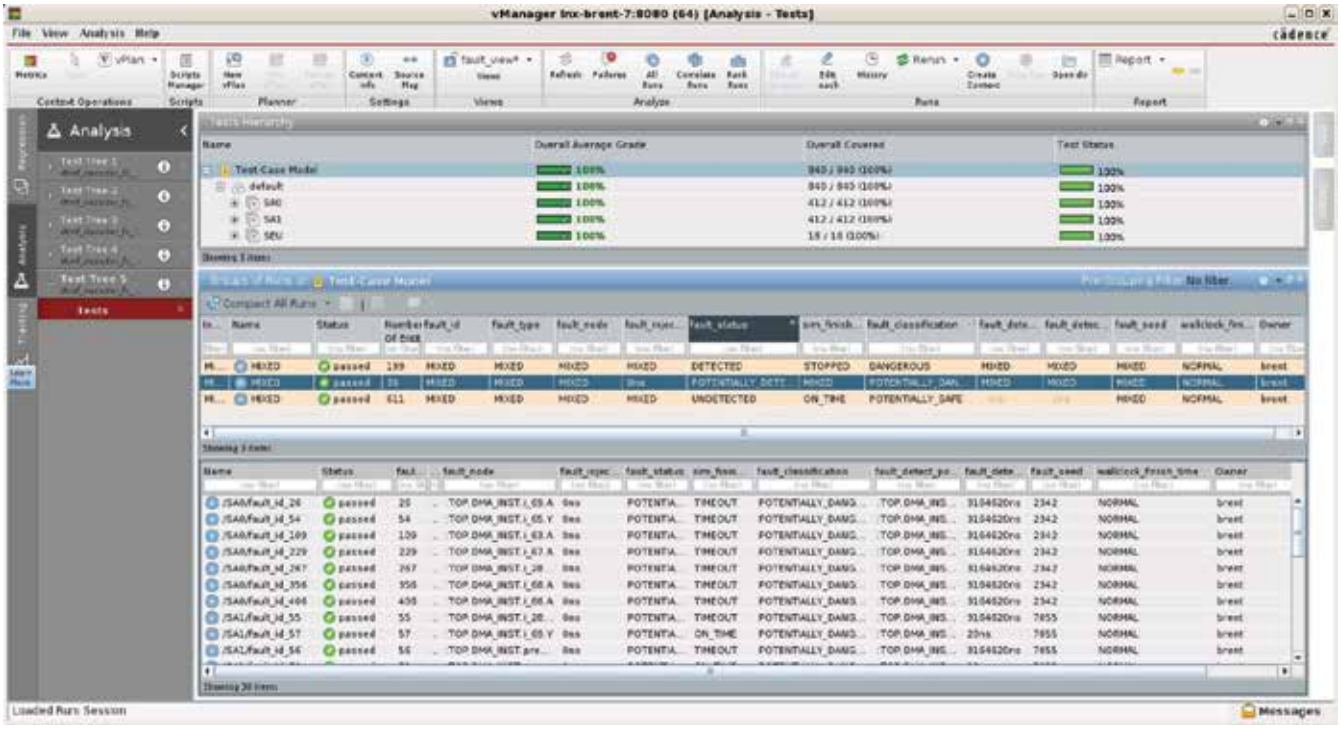


**Figure 3: Leveraging metric-driven verification to provide a comprehensive functional safety regression analysis**

safety assessment, and TCL for digital designs are the core requirements that have to be met today. The design and test teams start by identifying potential safety issues, along with the checking and error correction systems that can detect those faults. Those requirements are captured in a safety plan that augments the functional verification plan. These metric-driven verification plans monitor sets of metadata through both the functional and safety verification flows. For the functional flow, the metadata includes well-known coverage, test completion, and other metrics using conventional verification flows. While the functional safety flow adds a new technology for fault injection and detection, it needs to integrate seamlessly with the conventional flows for two critical reasons - efficiency and tool confidence. Safety verification is a complex task so the teams need to reuse the environments already created in the conventional flow. Along these lines, achieving a TCL1 for the flow is dependent on both a well-known flow and redundant tooling. By fitting the fault injection and requirements tracing within the conventional flow, a TCL1 assessment for the flow is justified.

As simulation provides a means for functional verification of systems, fault injection allows for functional safety assessment by simulating the behavior of the system under various error conditions by momentarily or permanently changing the values seen in a given simulation. Faults models include manufacturing-time stuck-at-0 and stuck-at-1 faults, as well as single event upset faults and transient faults that can occur while the ICs are functioning in the system. Given this, fault simulation helps safety verification engineers cover a wide range of possible system malfunctions.

While the TCL assessment is important, the efficiency of fitting in the conventional functional verification flow is equally important. Part of the safety assessment requires fault analysis at the gate level, which can be achieved with a fault injection using a well-proven gate-level simulator. However, the temporal faults can require longer simulations with more of the SoC context. This context can include both analog circuits and software, implying the need for mixed-signal and hardware-based verification. Moreover, the gate-level simulation can be exceedingly long, so safety engineers need to develop the safety verification at higher levels of

abstraction, develop the RTL for the immediate need, and then replay the verification at the gate level as needed for, say, a ISO 26262 audit in the automotive space. Therefore, the fault injection technology and requirements tracing must work well with conventional verification flows.

## Safety Requirements on the Horizon

While digital functional safety simulation is the critical starting point, it is not sufficient to demonstrate safety only in the complex SoCs being deployed in vehicles. The systems throughout the vehicle, especially powertrain, safety (i.e. braking), and chassis systems that require Automotive Safety Integrity Level D (ASIL D) certification, involve digital, analog, design for test (DFT), AUTOSAR-based software components, and design and verification IP.

Functional safety solutions must expand to have analog/mixed-signal verification that matches that for digital, including requirements tracing, fault injection, and metrics collection. Doing so will allow both internally developed and commercially accessed design IP and verification IP to be assessed in the complete system. As these systems become increasingly large and dependent on software, hardware-based verification systems will be needed to run enough cycles to inject faults in the running system and measure the combined digital, analog, and software system response.

## Long Term View of Safety

In the full view, the safety of the vehicle depends on more than the individual ICs. It depends on the interaction of those ICs in the electronic control unit (ECU). This implies that level analysis is needed to develop fault models for board-level signal and power integrity on the traces between the ICs. It also implies that safety monitoring needs to be designed at higher levels of abstraction, suggesting the need for fault analysis in the earliest phase of design where the modeling is abstracted using algorithmic and untimed design models. These systems then need to be traced through implementation and final verification, completing the system view of functional safety.

## Tools and Techniques Tools and Technologies that Address Functional Safety

Cadence has been in the fault simulation business for more than 25 years. It is now expanding to provide an end-to-end functional safety solution, based on its proven Incisive® functional verification platform, that reduces the automotive ISO 26262 certification effort by 50%. The solution accomplishes this efficiency gain by automating what is otherwise a time-consuming manual verification process of fault injection and result analysis for IP, SoC, and system designs. For safety requirements tracing, the solution integrates permanent and transient fault simulation.

Fulfilling the traceability, safety verification, and TCL requirements of ISO 26262, Cadence's functional safety solution includes the Incisive Functional Safety Simulator and a functional safety regression capability in the Incisive vManager™ solution.

Incisive Functional Safety Simulator offers seamless reuse of functional and mixed-signal verification environments to accelerate the time to develop safety verification. The simulator provides 10X the runtime performance compared to the interpreted Incisive Verifault-XL engine traditionally used in functional safety simulation. With the simulator, users benefit from fault identification during elaboration and the ability to reuse their SystemVerilog, Universal Verification Methodology (UVM), and e functional verification environments unchanged. The solution simulates the unaltered design under test (DUT); faults are injected during simulation and can propagate through SystemC, analog transistor or behavioral models, and assertions. The simulator also supports multiple fault types, including single event upset, stuck-at-0/stuck-at-1, and single event transient.

The functional safety analysis capability in the Incisive vManager solution automatically generates a safety verification regression from the fault dictionary created by the simulator. The Incisive vManager solution can then track millions of detected, potentially detected, and undetected faults introduced into simulation to verify the safety systems in a design. The capability also highlights potential and undetected fault runs for further debugging.

Both of these technologies will be available in the Cadence® System Development Suite. Incisive vManager solution has already been used in production by several US and European automotive IC suppliers. In fact, the first ISO 26262-certified chip used the Cadence solution with a requirements management tool. Cadence is continuing to expand its functional safety solution to

encompass more hardware, software, and IP components.

## Summary

As discussed in this paper, meeting functional safety in automotive designs is only the beginning. Safety requirements touch a multitude of application areas, from medical devices to industrial equipment to military systems and much more. Complying with safety specifications can be laborious and time-consuming. However, electronic design tools, technologies, and methodologies - such as those offered by Cadence - can automate the process. By doing so, these tools and techniques can make it faster and more efficient for SoC designers to ensure that their chips will function as intended once inside the end products, even in the face of errors or other unplanned or unexpected circumstances.

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2. P.Roche, "Changing the radiation paradigm with sub-28nm CMOS technologies", tutorial, International Reliability Physics Symposium, IRPS, Hawaii, April 2014
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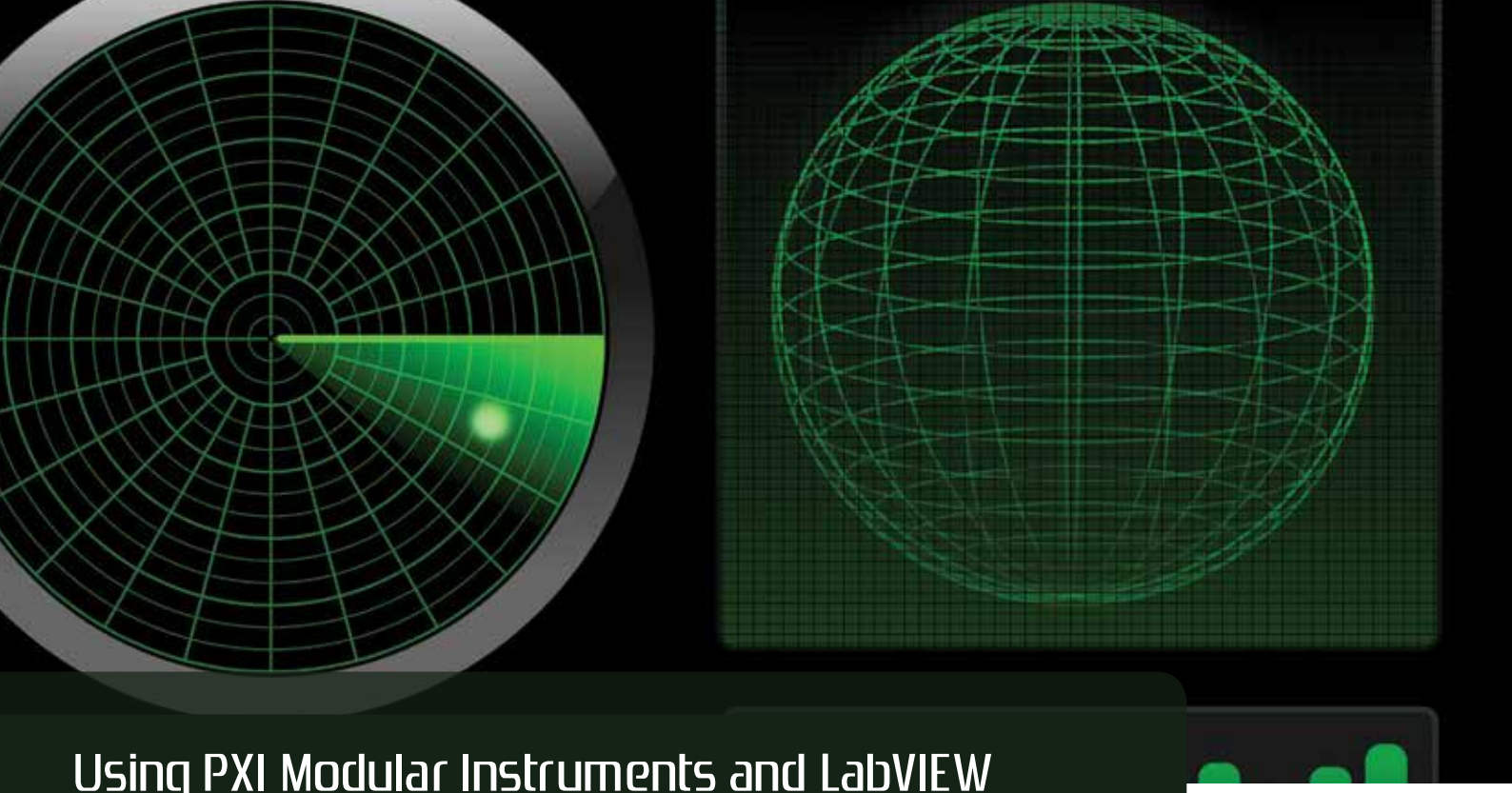

# Using PXI Modular Instruments and LabVIEW for Secondary Surveillance Radar ATE


› Vishwanath Kalkur - Captronic Systems Pvt Ltd
Mondeep Duarah - Captronic Systems Pvt Ltd


**"With the ATE for SSR we created using NI PXI modular instruments and LabVIEW, our customer reduced radar test time by 90 percent compared to earlier desktop instrument manual connections. Our customer also saved 60 percent of costs compared to other ATEs built with traditional box instruments."**

**- Vishwanath Kalkur, Captronic Systems Pvt Ltd**

## The Challenge:

Using PXI Modular Instruments and LabVIEW for Secondary Surveillance Radar ATE

## The Solution:

Using NI PXI modular instruments, along with the NI LabVIEW FPGA Module, to create a customized, scalable solution to test the entire range of radar function.

Unlike primary radars, SSR calculates the range and azimuth of a target, such as an aircraft, using a bidirectional communication link to gather information, including identity, altitude, and country code. Engineers use SSR in both military and civil aviation, with the former incorporating an identifying friend-or-foe system.

SSR works in different modes to obtain information from the target. The system sends interrogating pulses from the radar in a bidirectional rotating antenna at 1,030 MHz. If a target detects interrogation, the transponder of the target replies with a frame of pulses at 1,090 MHz. Radar at the ground station generates interrogating pulses and requests information such as identity, altitude, or country code from the target represented as mode-A/3A, mode-C, or mode-S. Based on the interrogation answers, the aircraft replies with a standard reply pulse format. The system calculates range and azimuth based on the speed-to-distance relation and rotary antenna position with respect to north or the heading direction.

Today's radars need rigorous testing before they are deployed in military or civil aviation. We developed an ATE using NI PXI modular instruments to facilitate the functionality tests of the radar and physical parameters test of the receiver (Rx) and transmitter (Tx), including Rx bandwidth, Rx sensitivity, Tx power, and Tx pulse

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parameters. Functionality tests included target simulator to the radar at 1,090 MHz, video signal detection, and radar scan converter display using synthetic transistor-transistor logic (TTL) video signal and LAN communication. Reply pulses in the target and multitarget simulators were stationary and trajectory motion. Figure 1 illustrates the overall architecture of the ATE connected to SSR.

## System Overview

We created a system composed of an NI PXI-1042 eight-slot chassis and an NI PXI-8196 embedded controller. We kept the radar either in transmitting mode or receiving mode to test the Tx and Rx functionality. External antenna signals north and azimuth count pulses (ACPs) were generated and simulated through an FPGA board. Target reply pulses were generated through an NI PXI-5671 vector signal generator (VSG) at 1,090 MHz. The system acquired demodulated video signals from the receiver through an oscilloscope card for Rx functionality tests. High-power transmitted RF pulses were acquired through an NI PXI-5661 vector signal analyzer (VSA) to measure Tx signal power and pulse parameters. The synthesized video at the TTL level generated from the radar processing unit was acquired through FPGA digital input and used for a radar scan converter to display the target on a polar plot with its range and azimuth position, info code, altitude, and country code. Figure 2 shows a detailed diagram of the ATE connected to SSR.

Each trigger and sync pulse was synchronized with the interrogating RF pulse of the SSR. To protect the instruments, we switched off the transmitter of the radar during the Rx tests because the radar had a built-in TR module. Both Tx and Rx ports shared the same physical port, which connected to an antenna. The VSA and VSG connected to this same physical port, replacing

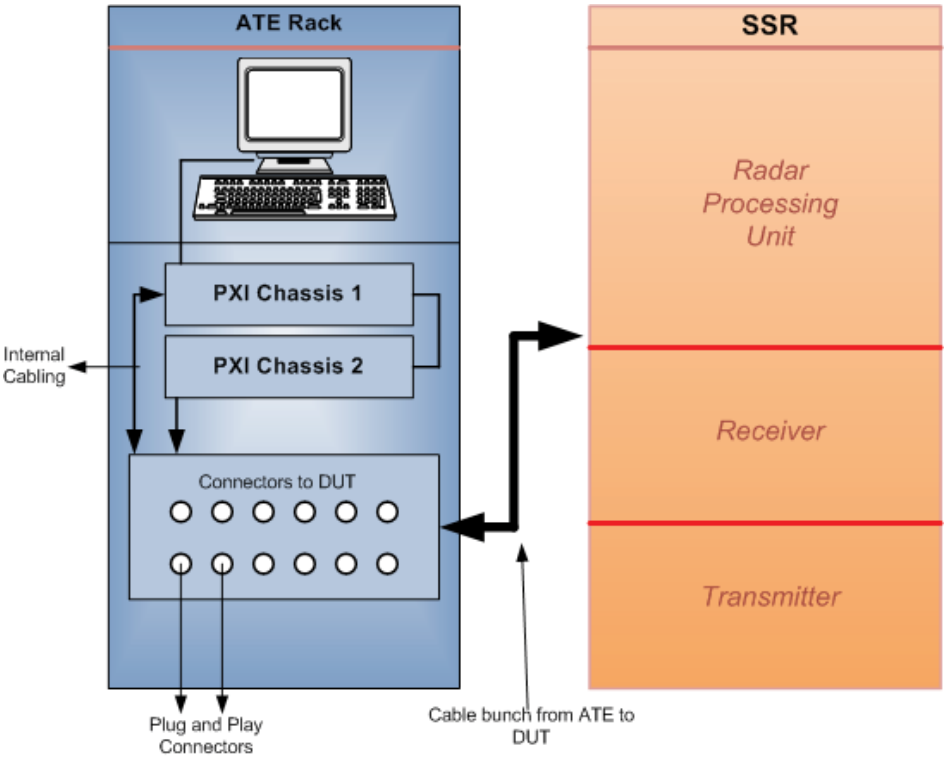


**Figure 1- Overall Architecture of ATE to test SSR**

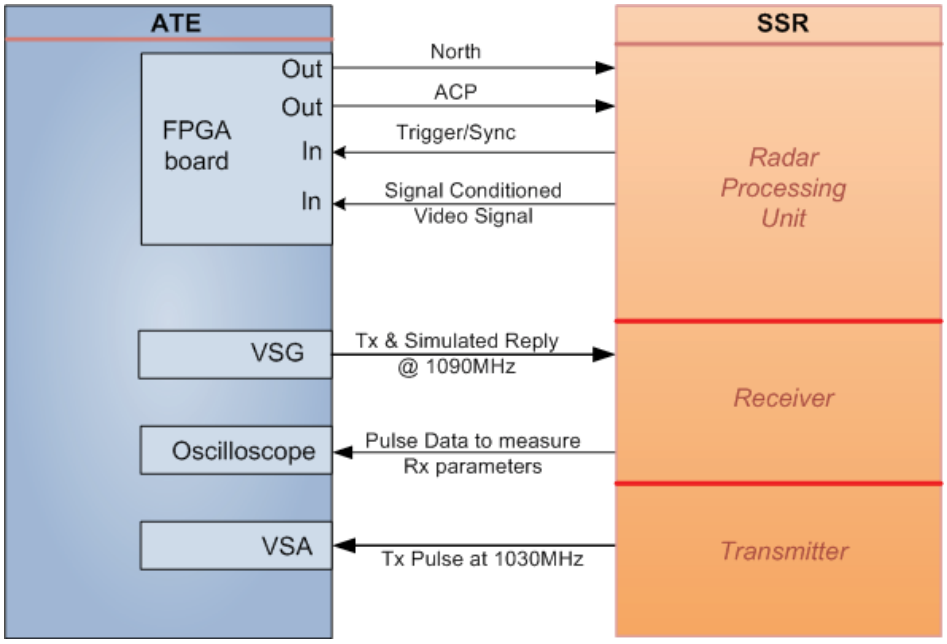


**Figure 2- Detailed Diagram of ATE and SSR**

the antenna and generating and acquiring RF signals at 1,090 MHz and 1,030 MHz.

## Measurement Parameters

### Tx Parameters

Tx out of the radar is connected to the VSA of the ATE with an attenuator. Transmission was a gated sine pulse at RF frequency with a pulse width of approximately 1 µs and pulse repetition time (PRT) of 5 ms.

- Tx frequency stability (1,030 MHz + 0.03 MHz)
- Pulse peak power (2.0 KW)
- Pulse repetition period (ms)
- Output power mode and PRF stability
- Output power selection and sectoring
- Pulse spacing
- Pulse shape
- Duty cycle (0.01 percent to 66 percent)
- Pulse width (µs)
- Pulse rise time (ns)
- Fall time (ns)
- Frequency spectrum

### Rx Parameters

Rx in the radar is received by the RF pulses generated through the VSG, which was synchronized with a trigger/sync pulse. Each sync pulse was synchronized with the interrogating pulse. After receiving a sync pulse to the trigger port of the VSG and FPGA, the RF pulse out was generated through the VSG. The Rx video out was connected to the oscilloscope card to measure the following Rx parameters:

- Receiver sensitivity
- Receiver bandwidth
- Receiver dynamic range
- Receiver frequency stability
- Phase differential measurements
- Reception chain operational sensitivity (STC)
- Reception chain side lobe suppression (RSLS)

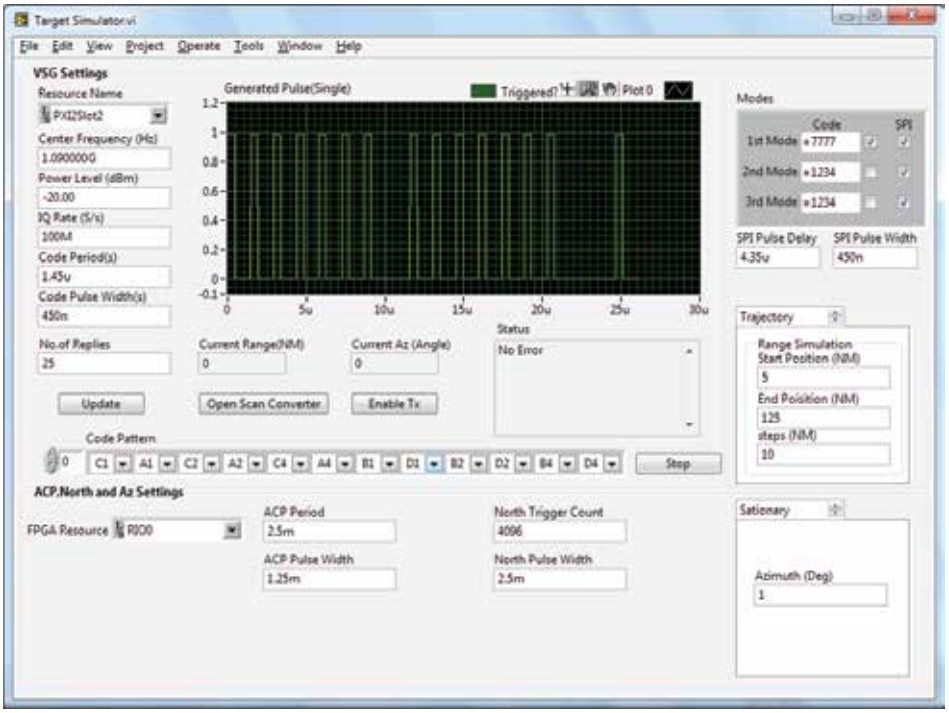


**Figure 3- Target Simulator Software Screen**

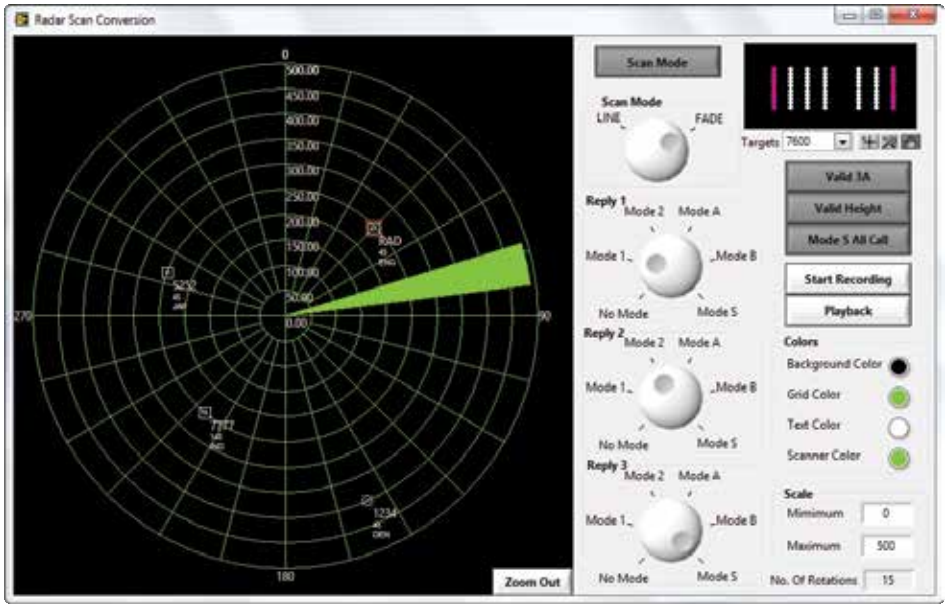


**Figure 4- Radar Scan Converter**

## Functional Test

In the functional test, the system generated the antennal simulation signals, such as north and ACP. It simulated multiple targets at different azimuths and ranges in both stationary and trajectory motion, and represented the transponder's

azimuth and range in a radar scan conversion application.

## Target Simulator

We can conduct proper functional test of an Rx through target simulation using the VSG based on sync pulses. In this case, the ATE acts as a target signal generator coming from the antenna. Each interrogation is synchronized by a trigger pulse connected to both the VSG trigger and the FPGA. Users can configure the range and azimuth to simulate with the target. When a target is ready for simulation, the VSG generates the reply RF pulses of a target after the azimuth count is reached in the FPGA and the next sync trigger is received from the radar. The user can select reply code and mode, and scripted pulses are generated at the specified range and azimuth. Targets are simulated for stationary and trajectory motion. A user configures moving paths at different trajectories. The system can simulate multiple targets at different ranges and azimuths from the same VSG. Different code patterns are applied to the reply pulses as specified by the user. Reply pulses are a sequence of pulses spaced 1 µs apart with a pulse width of 450 ns. Each target's replies are framed with F1 and F2 pulses at the beginning and end of the sequence. The number of pulses in a frame is derived by the mode of interrogation selected in the GUI. Each sync pulse can have a different mode of reply based on the interrogation mode selected. Such three-reply pulses are separately configurable and can be generated through the VSG with reference to each sync pulse. Figure 5 illustrates reply pulse generation with range delay, azimuth, and code simulation.

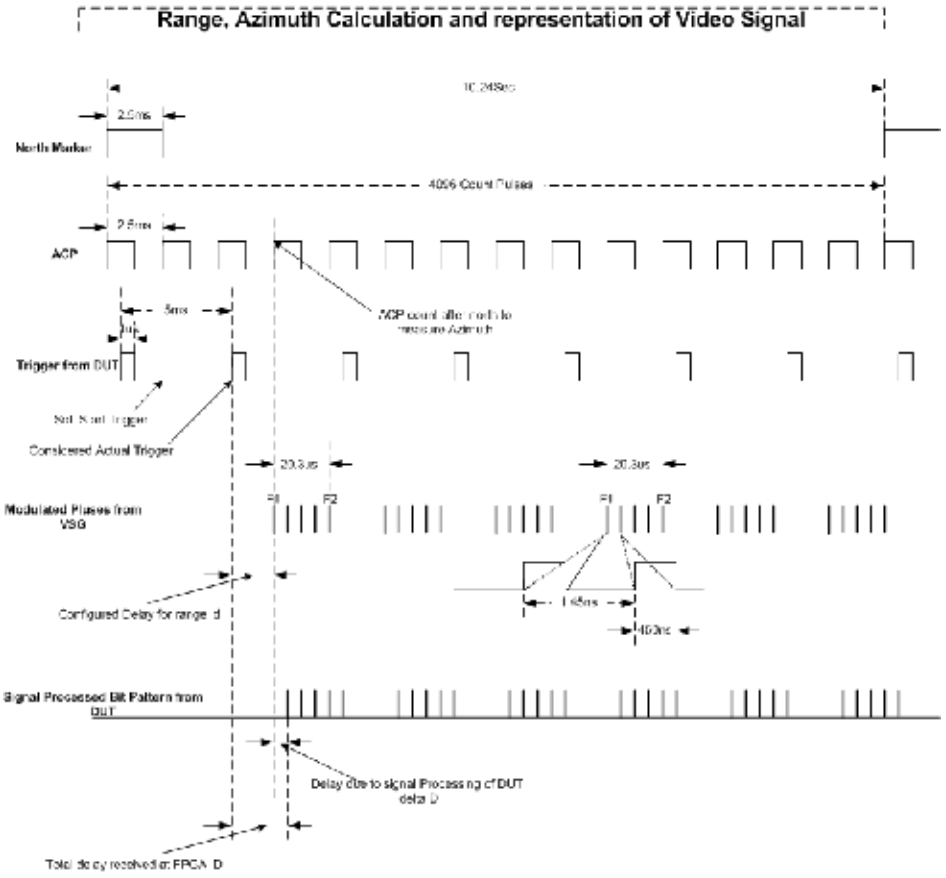


**Figure 5- Pulse Formats**

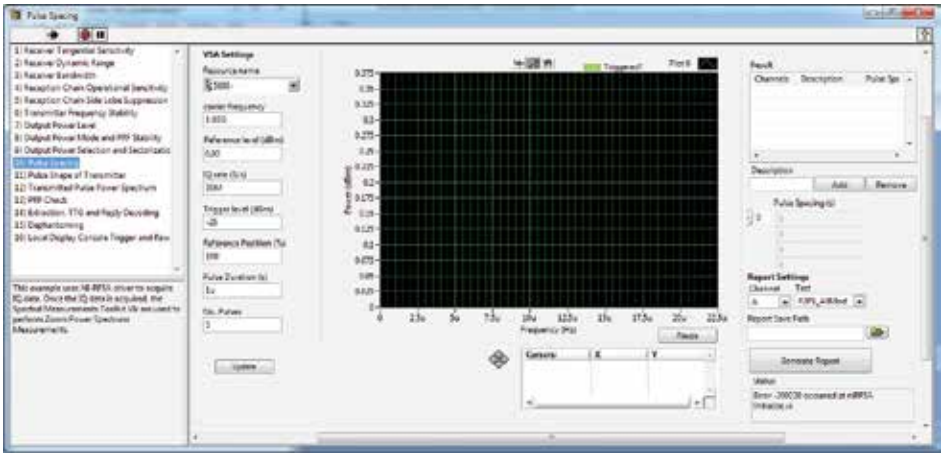

**Figure 6- Sequence of Tests**

## Radar Scan Converter

The system acquires and processes video signals from the radar in the TTL format through the FPGA board. The reply pulses from the target are demodulated in the

receiver of the radar and raw video signal is processed in the radar processing unit. This processor provides synthesized TTL pulses that represent the reply frame.

This frame is decoded in the FPGA with a precise width of individual pulses. Because the receiver also picks up noise from the antenna, some unwanted noisy pulses of the desired range are generated out. We developed an algorithm to discard these noise pulses and decode the actual frame. The FPGA then calculates the range and azimuth of the target, with the information code, altitude, and country code of the target.

The system can receive synthetic TTL video using this format: actual target acquired from the antenna, simulated target internally generated in the radar, and target simulated through the VSG base on the interrogation pulse.

Figure 4 shows the scan converter display decoded through the FPGA. Figure 5 illustrates the ACP; north simulation through the FPGA; trigger/sync pulse acquisition; reply pulse simulation based on the range and azimuth selection; acquiring the TTL video signal; and decoding the reply frame.

Modulated pulses from the VSG contain a carrier of 1,030 MHz RF wave.

## Antenna Simulation

The north marker pulse generation through the FPGA output and the ACP generation through the FPGA digital output provide antenna simulation. We created a user-configurable GUI based on LabVIEW to set the pulse width, PRT, and azimuth counts per north revolution to simulate antenna parameters.

## Software Features

We developed a modular, editable sequence of tests to test total functionality. Users can select either automatic or manual mode for individual parameter test. With a diagnostic panel, users can access the individual PXI instruments for loop-back or self-test. Figure 6 illustrates the sequence of tests present in ATE.

## Reducing Radar Test Time With the NI Platform

With the ATE for SSR we created using NI PXI modular instruments and LabVIEW, our customer reduced radar test time by 90 percent compared to earlier desktop instrument manual connections. Our customer also saved 60 percent of costs compared to other ATEs built with traditional box instruments. In addition, the new system replaces the pulse generators and modulator with a single NI PXI VSG, which provides complete functionality test of target simulation, raw video acquisition, and target detection, making it a closed-loop tester.

We plan to upgrade the system to test the redundant six ports of the radar with an automated switching incorporation. We will use an NI PXI-2596 SP6T multiplexer for the upgrade to avoid long cables and connections.

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# Considerations In Selecting The Right Contact For Your Interconnect System

› Danny Boesing, Samtec, Inc.

Many articles on interconnects discuss bleeding edge new technologies, new products, or provide guidelines on optimizing system performance. Having said that, standard pitch (2.54, 2.00, or 1.27 mm centerline) board-to-board interconnects are still huge sellers and ubiquitous in the electronics industry.

These two-piece connectors are not as sexy as using ultra-high-density interconnects with PAM4 to achieve 56 Gbps serial channels, but they look mighty appealing if your job is to identify and design-in reliable board-to-board interconnect systems.

There are several design factors that determine the success of the interconnect system. Two of the most important considerations are selecting the right contact, and selecting the right plating for that contact.

Selecting the right contact helps ensure your interconnect system will meet the standards it is supposed to meet – whether it is a high-cycle application, or high shock and vibration, or an interconnect that is going to see very little stress in its life.

The following is a basic overview of contact design considerations:

## CONTACT BASE METAL:

Three commonly used contact base metals include phosphor bronze (PhBr), beryllium copper (BeCu), and brass. Brass has a tensile strength of 69 MPa - 434 MPa (Mega Pascal, unit of pressure and tensile strength). Compare this to Phosphor Bronze with 131 MPa - 552 MPa, and BeCu with 965 MPa - 1205 MPa.

Obviously, in industrial, high-risk, hostile-environment applications, a greater yield/tensile strength would be desired, and in other applications a more cost effective option would be appropriate. Brass is generally only recommended for simple, low-cycle applications. While not as conductive as brass, phosphor bronze boasts a higher tensile strength. For the best of both worlds, beryllium copper not only offers the highest strength of the three, but its conduction is close to that of copper, making it well-suited for strong, reliable connections.

## CONTACT DESIGN BY END-APPLICATION:

High reliability, high cycle contacts are usually made of beryllium copper. BeCu provides a strong combination of mechanical and electrical properties for high reliability interconnections. High reliability contact systems frequently have multiple points

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| Model | Freq. (GHz) | Gain (dB) | $P_{OUT}$ (dBm) | IP3 (dBm) | NF (dB) | DC (V) | Price $ ea. (qty 20) |
|---|---|---|---|---|---|---|---|
| CMA-81+ | DC-6 | 10 | 19.5 | 38 | 7.5 | 5 | 8.95 |
| CMA-82+ | DC-7 | 15 | 20 | 42 | 6.8 | 5 | 8.95 |
| CMA-84+ | DC-7 | 24 | 21 | 38 | 5.5 | 5 | 8.95 |
| CMA-62+ | 0.01-6 | 15 | 19 | 33 | 5 | 5 | 7.45 |
| CMA-63+ | 0.01-6 | 20 | 18 | 32 | 4 | 5 | 7.45 |
| CMA-545+ | 0.05-6 | 15 | 20 | 37 | 1 | 3 | 7.45 |
| CMA-5043+ | 0.05-4 | 18 | 20 | 33 | 0.8 | 5 | 7.45 |
| CMA-545G1+ | 0.4-2.2 | 32 | 23 | 36 | 0.9 | 5 | 7.95 |
| CMA-162LN+ | 0.7-1.6 | 23 | 19 | 30 | 0.5 | 4 | 7.45 |
| CMA-252LN+ | 1.5-2.5 | 17 | 18 | 30 | 1 | 4 | 7.45 |

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of contact, usually three to four "fingers." (FIGURE 1: Multi-finger, heat-treated BeCu contact for high cycle applications)

At the other end of the spectrum, some interconnect systems have a relatively stress-free life with few cycles, possibly in an office environment. A single beam contact system is usually sufficient for these types of applications, and if it is made of phosphor bronze or beryllium copper, it will usually withstand up to 100 cycles.

A third contact option is one designed for high-retention, or "rugged" applications. The geometry of the contact beams increase the normal force and withdrawal force of the mating terminal. Long beams and therefore extended insertion depth make it rugged. (FIGURE 2: Phosphor bronze contact designed for rugged applications.)

While the focus of this article is contact design, we would be remiss if we did not mention insulator design in any discussion of rugged interconnect applications. Plastic insulator design features that are useful in environments requiring rugged connectors include:

- Board locks on connectors that mechanically lock two together two printed circuit boards.
- Positive latching systems on discrete wire and IDC cable systems. Manually activated latches can increase unmating force by up to 200%.
- Screw downs which secure the connector mechanically to the board.
- Weld tabs, which significantly

**FIGURE 1: Multi-finger, heat-treated BeCu contact for high cycle applications**

**FIGURE 2: Phosphor bronze contact designed for rugged applications**

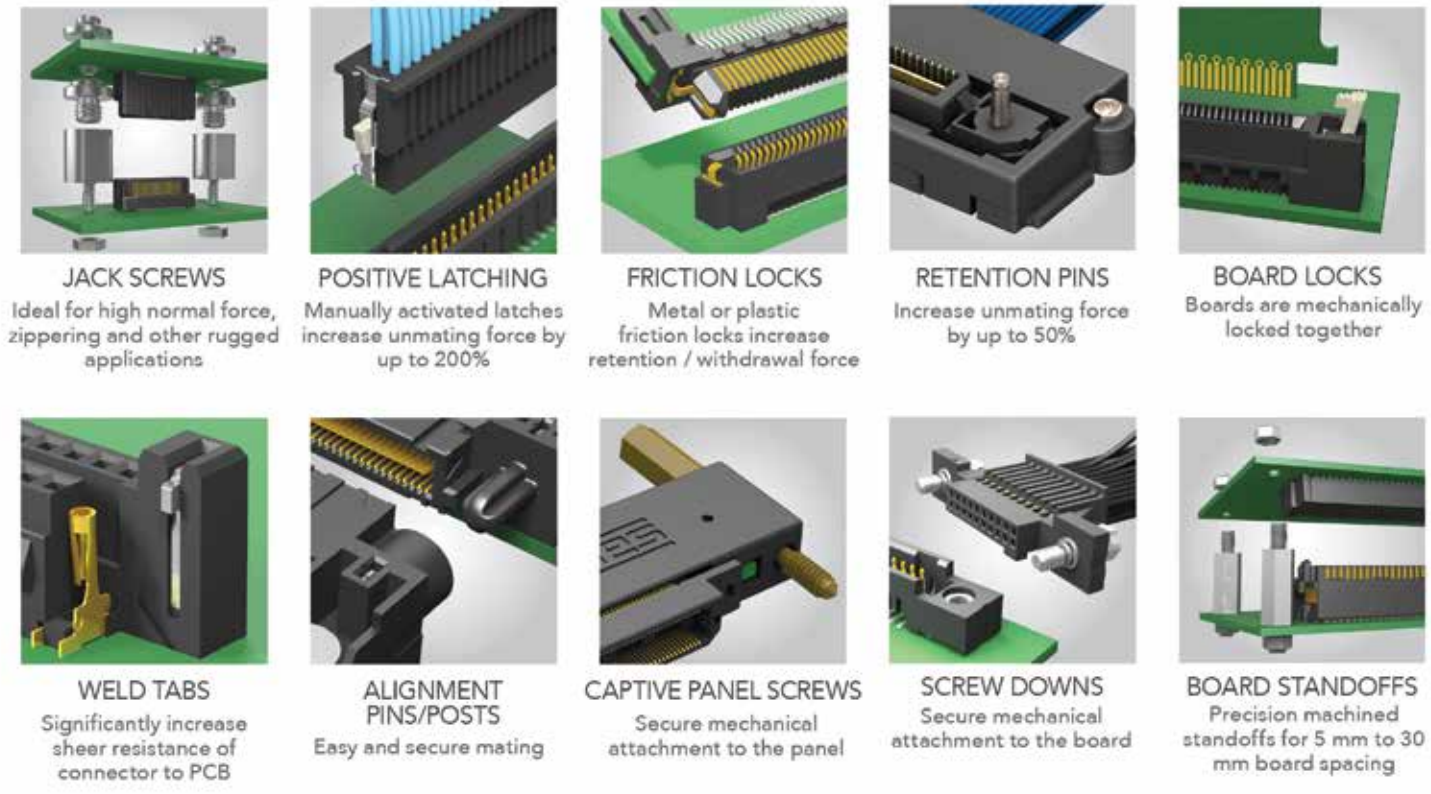



**FIGURE 3: Rugged features on insulators which increase the ruggedness of the connector**

increase shear resistance of the connector to the PCB
(FIGURE 3: Rugged features on insulators which increase the ruggedness of the connector)

**PLATING:** Plating is another critical design factor that determines the success of the interconnect system. The best plating finish is whatever material meets your requirements at the lowest cost.

Gold is generally specified for high reliability or low voltage and current applications. Even in very hostile environments, it will remain free of oxides which could cause an increase in contact resistance. Gold is also used for contacts that will see a large number of cycles because excellent electrical connection can be made with minimum contact pressure.

Gold is a significant cost adder to most interconnect systems. Of course gold is susceptible to price fluctuations. The impact of the price of gold on a connector has been alleviated with the adaptation of using less gold in non-critical applications. Originally, Bellcore specifications required 50 µ inches of gold plating over nickel, for applications including leads, cables, and grounding points.
In a bid to remain competitive but still employ the advantages of gold, many companies lowered their minimum gold plating thicknesses to 30 µ or 10 µ inches, or even flash gold.

Tin is a low-cost alternative to gold plating. It has good conductivity and solderability, but forms an oxide coating which must be penetrated for electrical connection. It is also susceptible to a form of corrosion known as fretting. Tin is used in connector systems where fewer cycles are expected, or where the contact can be designed to apply high normal forces which will cause sufficient sliding (i.e., wiping action) during lead insertion, to break the tin oxide surface film.
The wear caused by this wiping action is one factor that limits tin plated contacts to fewer cycles than gold. It also requires an increased plating thickness, often 150 µ inches. While economics are an important consideration, the requirements of a particular product are more likely to dictate which plating is used. Selective gold/tin plating is a popular plating option because it provides designers with the best of both worlds. The critical contact area has the reliability of gold, and the tail has the lower cost and solderability of tin.

# Getting Connected to Increase Productivity in Industrial Applications

› Mark Patrick, Mouser Electronics

**Implementing wireless connectivity through pre-certified wireless modules could represent the simplest solution to joining the Industrial Internet of Things.**

Control, particularly when implemented in a programmable or 'adaptive' way, lies at the heart of automation; nowhere are the benefits of automation more apparent than in the industrialised world. Feedback is a fundamental part of control and bringing these two elements together is a concept upon which embedded electronics is based.

As every engineer will confirm, feedback loops are essential to control; being able to quantitatively measure an output in a closed-loop as a result of changing input(s) underpins control in many applications. Within electromechanical applications, sensors form an important element in feedback and control, and analysis of the data they generate is fuelling an evolutionary step in industrial automation.

The benefits of data analysis in financial sectors is nothing new, but the fact that the analysis of industrial data can lead to significant productivity gains in all its sectors is now driving the rapid evolution of the Industrial Internet of Things (IIoT).

## Building an ecosystem

Even as a subset of the much larger Internet of Things (or Internet of Everything, as it is also known) the IIoT still represents a massive opportunity; a market that is expected to be worth trillions of dollars within a couple of decades. While it evolves, its implementation is still open to interpretation and so offers companies of any size a chance to be a part of it. Anything that can deliver productivity gains through harnessing the power of the IIoT will be attractive to companies where margins are closely monitored.

In reality, fully exploiting an IIoT strategy requires much more than just using a sensor to measure the wear on a bearing or the flow of a fluid. It will require an ecosystem of hardware, software and services that, when brought together, will create a closed loop able to provide significant insights into industrial processes. This new landscape is likely to bring small, agile companies into close contact with larger incumbents, creating collaborations that will become commonplace thanks to the IIoT.

An IIoT framework will comprise many elements; from gathering

data and storing or transferring that data to a server, to its analyses and the formulation of results, and ultimately acting on those results. The companies that can most benefit from the IIoT aren't necessarily best placed to implement such a framework; it will instead fall to providers looking to bring the value of the IIoT to a wide range of customers. This is already in evidence as some companies reposition themselves to provide all or part of an IIoT framework. Electric Imp is one example, it now offers a Connectivity Platform comprising hardware (or 'nodes'), software (including an operating system), cloud-based services and management tools. Some of its customers are already using this platform to gather real-time data across a number of industries including commercial refrigeration, HVAC systems and manufacturing equipment.

## Wireless Connectivity Provides the Feedback

While sensors provide the ability to measure almost any real-world parameter, it is connectivity that provides the feedback to an IIoT framework. Connecting industrial equipment that is often large, in challenging environments or even constantly moving is difficult. While there are many wire-based approaches to this, such as CAN, Industrial Ethernet or RS232/422 as an example, they all exhibit the same drawback of needing a physical connection. In a growing number of applications, wireless connectivity has been proven to offer significant advantages, not least the flexibility of having no physical connection. Most wireless protocols have been conceived to offer security and robustness, and are capable of operating in almost any environment. With volumes driven by the consumer sector, the hardware needed to implement a wireless connection is now available at a compellingly low price point, enabling module manufacturers to compete with the cost of wire-based connectivity while offering all of the advantages inherent with a wireless solution.

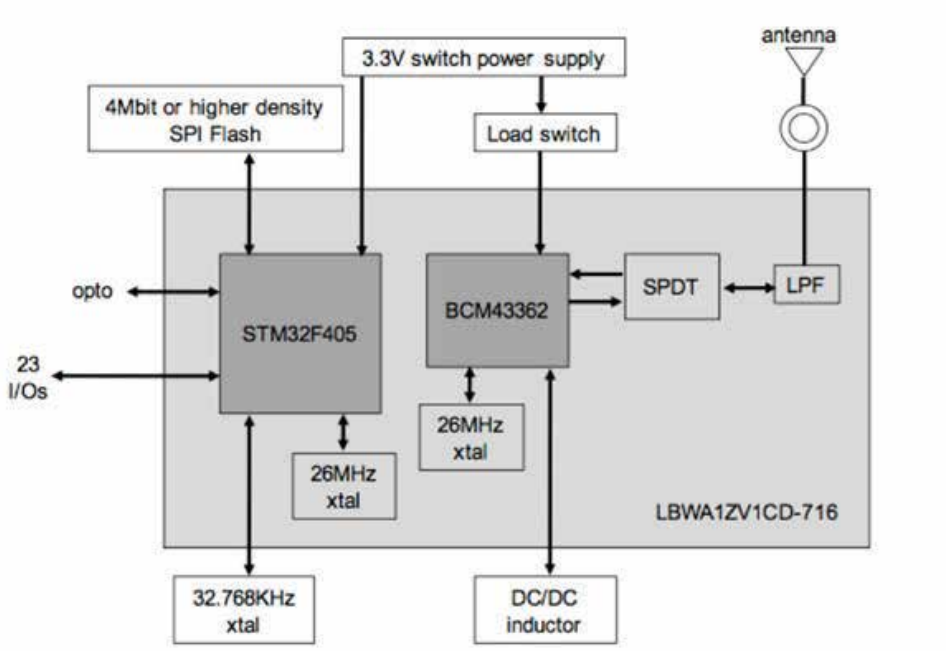



**Figure 1: Block diagram of Murata Electronics' LBWA1ZV1CD-716 module**

As well as a turn-key platform, Electric Imp also provides the elements of an IIoT solution, including a Wi-Fi module developed to connect IoT nodes to its cloud service. The LBWA1ZV1CD-716 smart module is brought to market by Murata Electronics and integrates a Wi-Fi connectivity device from Broadcom with a powerful ARM Cortex-M4 based microcontroller from STMicroelectronics.

Measuring just 10mm by 7.9mm by 1.25mm, the smart module also offers 23 I/Os that can be configured as analogue inputs/outputs, SPI, UART, I2C or general purpose digital I/O. The flexibility of the module's I/O would allow it to be implemented as an IIoT node with minimal configuration, as it is able to host an application and connect directly to the many sensors now equipped with I2C interfaces, for example.

The ability to provide built-in access to its cloud-based services makes Electric Imp a compelling option when adopting an IIoT strategy, however some applications may require a more open approach, by offering the ability to connect to a different network or service provider. In this case it may be necessary to develop more of the middleware needed to interface to a backend, fortunately module developers appreciate this and are now providing modules with Software Development Kits (SDKs), such as the WGM110A1MV1 Wizard Gecko from Silicon Labs.

The module is based on an ARM Cortex-M3 based microcontroller and a Wi-Fi chipset, and as such is able to run IoT applications in a standalone mode. However, for more complex applications, it is also able to run alongside a host (typically more powerful) processor, interfacing through either a UART, SPI or USB interface. In this mode, the module is controlled by the host using Silicon Lab's high-level API, written in C and intended to run on the host processor alongside the IoT application.

## From W-LAN to PAN

While Wi-Fi is positioned to provide a wireless alternative to Ethernet/LAN connectivity, the technology behind Personal Area Networks, or PANs, is also making its way into the industrial sector. Bluetooth, and now Bluetooth 4.0 (known as Bluetooth Smart or Low Energy, also referred to simply as BLE) provides a standard solution for establishing peer-to-peer wireless connectivity or ad hoc networks over shorter distances. This is particularly suitable for applications where data is collected periodically using a handheld terminal, for example. The ENW-89847A1KF PAN1760 from Panasonic is a BLE Smart Module based on the TC35667 from Toshiba. Measuring just 15.6mm by 8.7mm, and 1.8mm high, it provides a pre-certified solution to adding Bluetooth connectivity to a new or existing industrial application.

If wireless connectivity is being fitted retrospectively to an existing installation, as may be the case with many industrial applications, then it may be more advantageous to use a dedicated module that can be controlled using simple instructions from an existing microcontroller or processor. In this scenario, porting or redeveloping the entire application may not be necessary, it may even be possible to replace an existing wire-based connection with a wireless module with the minimum of design effort.

A good solution in this case may be the RN4020-V/RM120 Bluetooth module from Microchip Technologies. This module supports a number of Bluetooth services and is controlled using simple ASCII-based commands sent via the host processor.

## Sub-GHz Solution

Operating in the 2.4GHz frequency range of the ISM (Industrial, Scientific and Medical) licence-free band, modules based on both Wi-Fi and Bluetooth offer simple


**Figure 2: The WGM110A1MV1 Wizard Gecko**

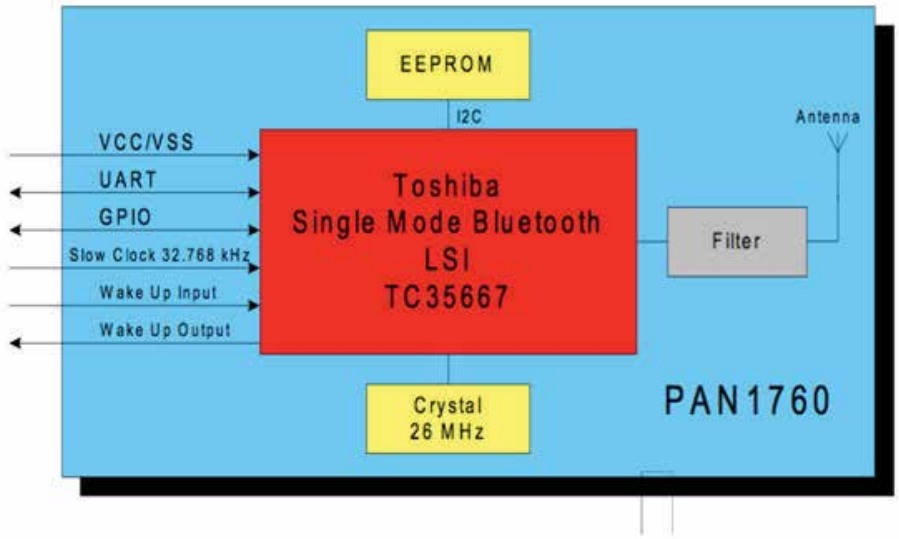



**Figure 3: Block diagram of the ENW-89847A1KF PAN1760 from Panasonic**

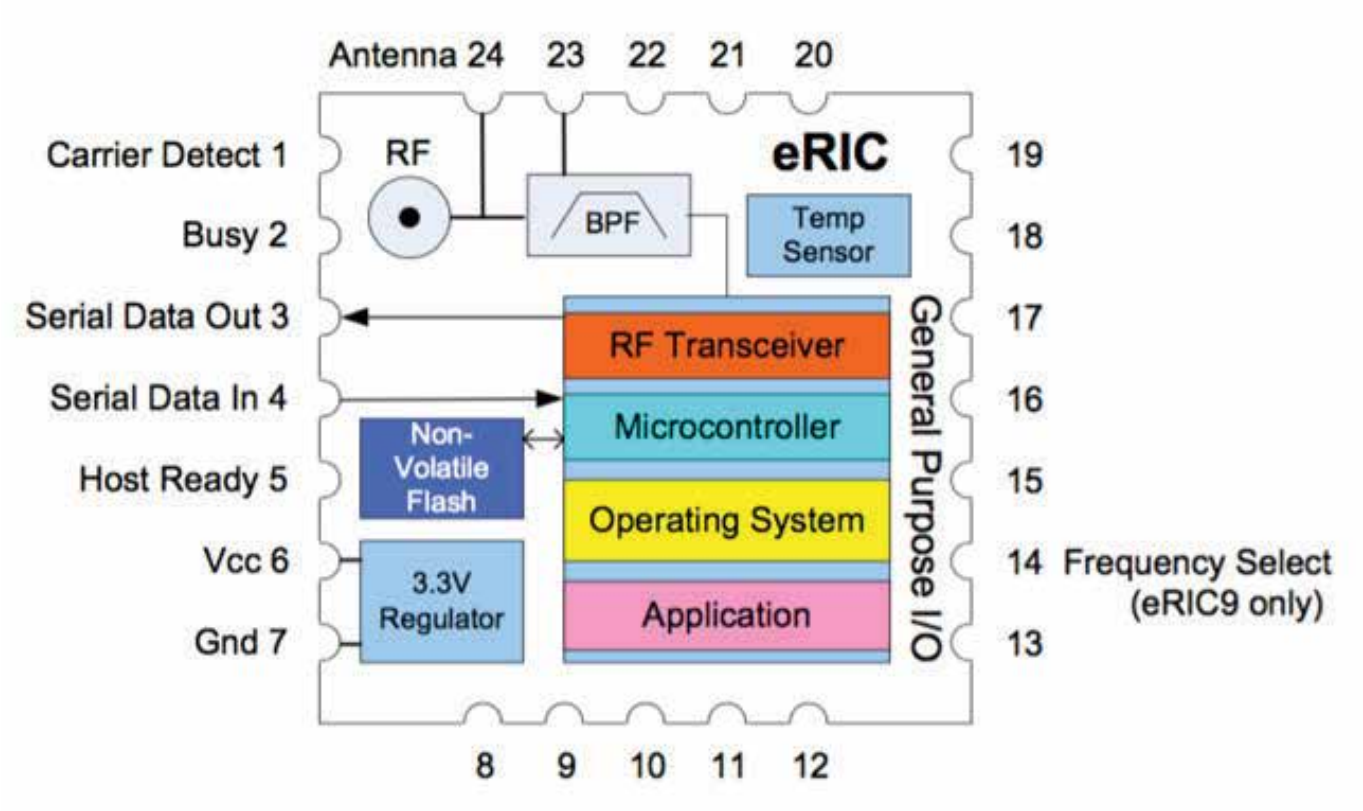



**Figure 4: The ERIC9-FCC module**

access to wireless connectivity, making it simple to design-in or add-on to equipment operating in an industrial environment. However, sometimes the range needed may extend beyond that offered by PAN and W-LAN technologies, while the bandwidth required could still be relatively modest (a few hundred bytes of data on an infrequent basis). In these applications, a wireless solution operating in the sub-1GHz band might be more applicable.

The ERIC9-FCC module is part of the 'easy Radio Intelligent Controller ' (eRIC) range from LPRS. It operates in the 868MHz range for use in the UK and Europe, or the 915MHz range for use in the USA and Canada, and is also pre-certified to ETSI (Europe) and FCC (USA) requirements. Instead of using an IEEE protocol, LPRS has developed its own easyRadio protocol, which comes embedded in the module along with the easyRadio operating system which abstracts away the complexity of running a wireless connection, leaving the end user with the simpler task of accessing the functionality using predefined functions. The surface-mount device measures just 15mm by 20mm by 2.2mm and includes AES 128bit data encryption and a built-in temperature sensor.

## Conclusion

The Industrial Internet of Things forms part of the larger 'Internet of Everything' but it is a significant part; some analyst figures suggest it could represent more than half of what will be considered the IoT in future years.

The potential benefits of adopting the IIoT in terms of increased productivity alone mean its rise is realistically inevitable. Secondary to that, the possible impact of having so much performance data at hand could provide an exponential improvement in the cost-effectiveness of all future industrial applications.

The first step on that journey will be connecting existing devices to cloud-based services, and wireless connectivity in the form of pre-certified modules is emerging as the frontrunner in realising that goal. With a wide range of modules available and, undoubtedly, more on the way, enabling your existing and future industrial applications to benefit from the IIoT could be almost a 'Plug & Play' process.

# Electric mobility: Mercedes-Benz flips the switch: Generation EQ – mobility revisited

Paris/Stuttgart. With “Generation EQ”, Mercedes-Benz shows how electric cars can soon move into the fast lane: the concept vehicle, with the appearance of a sporty SUV coupé, gives a preview of a new generation of vehicles with battery-electric drives. The dynamic exterior design with its new electro-look underlines the focus on the powerful electric drive system: two electric motors, with a system output that can be increased to up to 300 kW thanks to scalable battery components, and permanent all-wheel drive deliver the guarantee of dynamic high-level performance. With a range of up to 500 kilometres and the typical Mercedes strengths of safety, comfort, functionality and connectivity, “Generation EQ” meets every demand in terms of contemporary, sustainable mobility. Also on the inside, the vehicle offers innovative solutions, including a completely new interior concept. Celebrating its world premiere at the Paris Motor Show, “Generation EQ” is the forerunner of Mercedes-Benz’s new product brand for electric mobility, EQ. The name EQ stands for “Electric Intelligence” and is derived from the Mercedes-Benz brand values of “Emotion and Intelligence”.

“The mobility of the future at Mercedes-Benz will stand on four pillars: Connected, Autonomous, Shared andElectric. ‘Generation EQ’ is the logical fusion of all four pillars,” says Dr Dieter Zetsche, CEO of Daimler AG and Head of Mercedes-Benz Cars. “The emission-free automobile is the future. And our new EQ brand goes far beyond electric vehicles. EQ stands for a comprehensive electric ecosystem of services, technologies and innovations.”

## Electric-vehicle architecture for all models

The new generation of electric vehicles will be based on an architecture developed specifically for battery-electric models, which is scalable in every respect and usable across all models: the wheelbase and track width as well as all other system components, especially the batteries, are variable thanks to the modular building-block system. The vehicle concept is thus optimised to meet every requirement of a future-oriented, battery-electric model family. The basic architecture is suitable for SUVs, saloons, coupés and other model series.

Similarly to the latest series-produced models from Mercedes-B enz, the vehicle architecture builds on an

intelligent multi-material mix of steel, aluminium and carbon fibre. This ensures that the requirements in terms of lightweight design, strength and cost efficiency are ideally met.

### Exterior design with new electro-look

"Generation EQ is hot and cool," says Gorden Wagener, Head of Design at Daimler AG. "Its fascination lies in a reinterpretation of our design philosophy of sensual purity, the aim being to create an avant-garde, contemporary and distinctive electro-look. At the same time, the design of the visionary show car, which has been reduced to the essentials, reveals an alluring progressivity."

The monolithic basic form of "Generation EQ" unites the genes of an SUV with the dynamic character of a coupé and a dash of shooting brake at the rear end. The squat, elongated greenhouse gives rise to muscular-purist proportions. The new electro-look is the result of a flowing transition from the gleaming black bonnet across the windscreen to the dark-tinted panoramic roof - an exciting contrast to the alubeam silver paintwork. Scarcely visible body panel joins, concealed windscreen wipers, cameras instead of exterior mirrors and an absence of conventional door handles emphasise the stretched, dynamic silhouette, making the SUV crossover appear as a unified whole while reducing its air resistance. An intentionally reduced side view, broad shoulders and large 21-inch light-alloy wheels make for a dynamic presence even before the vehicle moves off.

### Driver-oriented cockpit with new electro-look

The focus of the driver-oriented cockpit is on simple, touch-based controls with a new electro-look consistently reflecting the exterior styling. The asymmetrical design of the instrument panel with its large, floating wide-screen display is tailored to the driver. The innovative, digital user experience differentiates "Generation EQ" from the familiar control logic in today's vehicles, while giving a peek into the future of user interaction at Mercedes-Benz.

### Interior with new, touch-based controls and no knobs

The interior of "Generation EQ" is characterised by contemporary luxury, this finding its main expression in an all-new user interface, which combines emotive appeal with intelligence and user-friendliness while dispensing with traditional switches and knobs, except for the electric seat adjustment typical of Mercedes. Two of the three narrow spokes on the steering wheel are provided with touch controls, which are integrated into OLED displays (OLED = organic light emitting diode ). They indicate icons and symbols in the respective menus. The driver can swipe through the various menus and confirm their selection with a click.

## SP Devices launches the world's first 14-bit resolution digitizer for Optical Coherence Tomography (OCT) applications

SP Devices, an e2v company, has launched the ADQ14OCT, the first 14-bit digitizer for Swept-Source (SS) Optical Coherence Tomography (OCT) that offers unrivalled noise and distortion performance.

Built on SP Devices' original 14-bit digitizer, the ADQ14OCT has been optimised for the SS-OCT market through variable clock input compatability of 10-1000 MHz and the addition of embedded signal processing functions in the Field-Programmable Gate Array (FPGA). These changes facilitate a simplified system design that increases overall system performance to match the most challenging measurement situations.

The ADQ14OCT utilizes the longest embedded Fast Fourier Transform (FFT) in OCT digitizers and sustains streaming of up to one billion captured wavelengths per second, delivering the market's highest image resolution for SS-OCT.

Per Löwenborg, Chief Technology Officer at SP Devices, commented, "We're very excited to unveil a world-leading solution for variable clocking applications and the ADQ14OCT demonstrates our drive to meet the exacting requirements of our customers."

Available with 8 lanes, Gen 2 PCI-e interfaces for high-speed data transfer, as well as with USB 3.0 interface for compact designs. The ADQ14OCT is the first USB SS-OCT digitizer to enable compact instrument designs, and is the most advanced medical imaging digitizer available on the market today.

## Enfucell and Molex have signed a license agreement for manufacturing Enfucell SoftBattery®

Enfucell Oy and Molex, LLC have signed a worldwide, non-exclusive manufacturing license agreement for printing Enfucell's SoftBattery® power sources. Enfucell is strengthening its partner network in order to be able to serve the rapidly growing markets for Internet of Things and wearable devices that utilize printable batteries as power sources.

Molex manufactures electronic, electrical and fiber optic solutions, and brings expertise in printed and flexible electronics, including flex assemblies, PCB assemblies and connector assemblies. The ability to print and integrate power sources to fabricate label- and patch-type devices will further broaden their product offering. Molex also has capability to manufacture printed electronics products in roll-to-roll processes.

Enfucell guarantees capacity to deliver critical battery materials in sufficient quantities to manufacture a minimum of 1,000,000 batteries per year.

Enfucell currently has licensees in Belgium, China, Slovakia, Spain, UK and USA. Enfucell's engineering team is providing product development services and prototyping of SoftBattery® powered devices.

Enfucell is a technology company located in Vantaa, Finland. Enfucell has developed a printable, thin, flexible and eco-friendly SoftBattery® power source, which can be used in various Internet of Things and wearable electronics products and applications. The company was started in 2002, and employs about 10 people. For more information, please visitwww.enfucell.com.

Molex brings together innovation and technology to deliver electronic solutions to customers worldwide. With a presence in more than 40 countries, Molex offers solutions and services for many markets, including data communications, consumer electronics, industrial, automotive, commercial vehicle and medical. For more information, please visitwww.molex.com.

## STMicroelectronics Empowers Wireless IoT-Device Developers with New LoRa™ Kit Leveraging STM32 Microcontroller Ecosystem

STMicroelectronics has introduced a low-cost development kit that leverages the STM32 microcontroller ecosystem for prototyping Internet-of-Things (IoT) devices with LoRa™ Wireless Low-Power Wide Area Network (LPWAN) connectivity.

Priced at just $40, the P-NUCLEO-LRWAN1 kit combines the ultra-low-power STM32L073 Nucleo (NUCLEO-L073RZ) microcontroller board with an RF expansion board based on the proven SX1272 LoRa transceiver from Semtech (I-NUCLEO-SX1272D). The STM32L073 MCU, with its energy-efficient ARM®Cortex®-M0+ core and proprietary ultra-low-power features, provides an ideal host for devices such as utility meters, alarm systems, positioning devices, trackers, and remote sensors. Users can further extend functionality by adding extra expansion boards, such as the X-NUCLEO-IKS01A1 sensor board for motion, humidity and temperature sensing.

LoRa enables long-range communication with several advantages over conventional cellular connections, including lower power and cost. Versatile features include multiple communication modes, accurate indoor and outdoor location awareness, and native AES-128 security. The new kit contains everything needed to build bi-directional end devices that comply with LoRaWAN™version 1.0.1 and support class A and class C protocols. Devices can be activated using Over-The-Air Activation (OTAA) or Activation-By-Personalization (ABP). An application for LoRaWAN certification tests is included in the kit, and the I-CUBE-LRWAN LoRaWAN stack is available and posted atwww.st.com/i-cube-lrwan. Access to the STM32 ecosystem provides rich development resources, including STM32Cube tools and software packages containing sample code and Hardware Abstraction Layers (HALs). These allow porting to any of the almost 700 STM32 MCU variants that cover a wide range of performance, power, packages, and price points. Developers are also free to use familiar IDEs and ARM mbed™ online tools.

The low purchase price of the P-NUCLEO-LRWAN1 kit allows a wide variety of engineers including independent designers, universities, and hobbyists to enjoy a high-end LoRa development experience. It is available immediately and can be purchased directly from st.com or through distributors.


## Analog Devices' Rx/Tx Converters Enable More Reliable Mobile Infrastructure for High-Quality Phone Service

Analog Devices, Inc. (ADI) today introduced highly integrated Rx/Tx converters that significantly improve the reliability, cost, and time to market for microwave and millimeter wave mobile operators and telecom equipment manufacturers. The new HMC8100 and HMC8200 Rx/Tx converters uniquely incorporate a wide array of functions, replacing multiple discrete parts to provide a single-source, high-performance solution for microwave backhaul applications. As reducing the number of components simplifies the design, manufacturers can now be market-ready faster. The significant reduction in board size and associated power consumption further improves reliability and reduces both system cost and operating expenses. The resulting telecom equipment is more dependable in the field, and enables mobile operators to provide a high-quality mobile phone service experience for the end customer.

The HMC8100 IF receiver chip converts RF input signals ranging from 800 MHz to 4,000 MHz down to a single-ended IF signal of 140 MHz at its output. The device includes two voltage gain amplifiers, three power detectors, a programmable automatic gain control block, and select integrated bandpass filters with 14 MHz, 28 MHz, 56 MHz, and 112 MHz bandwidth. The HMC8100 supports all standard microwave frequency bands from 6 to 42 GHz.

The HMC8200 IF transmitter chip converts the industry standard 300 MHz to 400 MHz IF input signal to an 800 MHz to 4000 MHz single-ended RF signal at its output. With IF input power ranges from −31 dBm to +4 dBm,

the HMC8200 provides 35 dB of digital gain control in 1 dB steps while an analog voltage gain amplifier continuously controls the transmitter output power from -20 dBm to +5 dBm. The device also features three integrated power detectors.

## 36V, 2A Monolithic Synchronous Step-Up Silent Switcher LED Driver

The LT3922 is a monolithic, synchronous, step-up DC/DC converter with internal 40V, 2A power switches and an internal PWM generator. Its fixed frequency peak current mode control accurately regulates current within ±2% for a string of LEDs up to 34V. Its integrated PWM generator offers up to 128:1 dimming ratio. If dimming ratios of up to 5,000:1 are required, the LT3922 and an external PWM generator can accommodate these applications. The LT3922's 2.8V to 36V input voltage range is ideal for a wide range of applications, including automotive, industrial and architectural lighting. The combination of a Silent Switcher® topology and spread spectrum frequency modulation minimizes EMI concerns. The LT3922 can drive up to 34V of 350mA white LEDs from an automotive input, delivering in excess of 10 watts.

The LT3922 incorporates a high side current sense, enabling its use in boost, buck mode or boost-buck topologies. It can deliver efficiencies of 93% in the boost topology while switching at 2MHz, offering a tiny and compact solution footprint. Internal LED short-circuit protection enables added reliability. A frequency adjust pin permits the user to program the frequency between 200kHz and 2MHz. Combined with a thermally enhanced 4mm x 5mm QFN package, the LT3922 offers a very compact high power LED driver solution. Other features include frequency synchronization, open and short LED protection and fault indication, programmable UVLO and OVLO, and an accurate LED current monitor. The LT3922EUFD is available in a thermally enhanced 28-lead 4mm x 5mm QFN package. Three temperature grades are available, with operation from –40°C to 125°C (junction) for the extended, industrial grades, and a high temperature grade of –40°C to 150°C. Pricing starts at $3.95 each in 1,000-piece quantities and all versions are available from stock. For more information, visitwww.linear.com/product/LT3922.

Summary of Features: LT3922

- ☐ ±2% LED Current Regulation
- ☐ ±2% Output Voltage Regulation
- ☐ 5,000:1 PWM Dimming at 100Hz & 128:1 Internal PWM Dimming
- ☐ Spread Spectrum Frequency Modulation
- ☐ Silent Switcher® Architecture for Low EMI
- ☐ 2.8V to 36V Input Voltage Range
- ☐ Operates in Boost, Buck Mode & Buck-Boost Mode
- ☐ 200kHz to 2MHz with SYNC Function
- ☐ CTRL Pin with Analog or Duty Cycle LED Current Control
- ☐ Open & Short Fault Detection
- ☐ Shorted LED Protection
- ☐ Accurate LED Current Sense with Monitor Output
- ☐ Programmable UVLO & OVLO
- ☐ Thermally Enhanced 28-Lead 4mm × 5mm QFN Package

Pricing shown is for budgetary use only and may differ due to local duties, taxes, fees and exchange rates.

## STMicroelectronics Extends Automotive ECU Miniaturization by Shrinking in Half Grade-0 Analog ICs

STMicroelectronics has introduced AEC-Q100 Grade-0 op amps and comparators in the space-saving MiniSO8

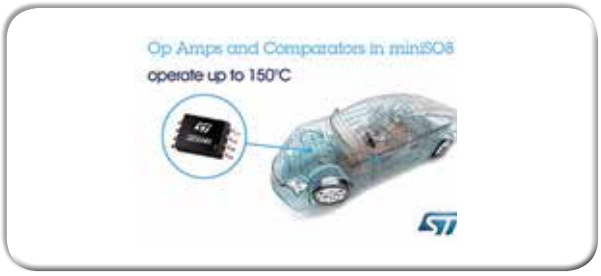
package, giving automotive designers twice the freedom to miniaturize ECUs deployed in the most extreme temperature environments and safety-critical systems.

The LM2904WHYST dual op amp and LM2903WHYST dual comparator in 4.9mm x 3.0mm MiniSO8 are qualified for operation from -40°C to 150°C, with the added advantage of 50% smaller footprint than other Grade-0 parts in standard SO8.

The extremely wide ambient operating temperature range of these ICs ensures robust and resilient performance in systems that are exposed to the harshest conditions. These include under-the-hood electronics such as engine controllers, in-gearbox modules, LED-lighting controllers and safety-critical systems such as ABS controllers that must provide absolute dependability.

The new parts are developed with the benefit of ST's extensive experience working with major automotive Tier-1 suppliers, and can be individually tested up to 150°C as part of Production Part Approval Process (PPAP) tests. As high-quality industry-standard LM2903 and LM2904 devices, they deliver benchmark performance compared to familiar metrics including input bias current, input offset voltage, current consumption, and supply-voltage range.

The LM2904WHYST and LM2903WHYST are in production now, priced from $0.51 for orders of 1000 pieces..




## NI Releases HIL Software Geared to Autonomous Vehicle Testing

NI (Nasdaq: NATI), the provider of platform-based systems that enable engineers and scientists to solve the world's greatest engineering challenges, today released VeriStand 2016, the latest version of its software used by embedded software test engineers to build and run hardware-in-the-loop (HIL) verification systems. Today's engineers face increasingly compressed, shifting schedules and constantly changing requirements driven by the emergence of the connected car and autonomous vehicles. VeriStand and NI's HIL systems are the most open and customizable platforms available on the market to help companies meet these changing demands and future-proof their test systems.

Engineers take advantage of NI's HIL systems to tackle the increasing complexity of embedded software and rising number of testing scenarios required as the newer technologies that make up next-generation vehicles like advanced driver assistance systems (ADAS), automotive radar and vehicle-to-everything (V2X) become commonplace in embedded control systems. By building on open and proven technology software and hardware platforms, NI can quickly add native support for these new technologies to ensure customers can achieve complete software test coverage.

Additionally, with NI offices in 49 countries and a worldwide network of NI Alliance Partners with vertical industry and systems integration experience, turnkey test systems that meet customers' particular application requirements can be delivered and supported.

"Through NI's flexible platform-based approach, we could easily customize the HIL system to integrate specific test requirements for the vehicle electronic controllers," said Zhang Fuli of Beijing Jingwei HiRain Technologies, an NI Alliance Partner. "The NI software and hardware systems made it easy to add functionality to our tests and satisfy the practical requirements of automotive HIL testing while retaining stability and reliability, and reducing the overall development cycle."

VeriStand is the software core of NI's HIL systems. It combines real-time simulation, data acquisition, communication protocols and control into a common platform for the most complete HIL test software on the market today. And unlike traditional HIL software that is defined by the vendor and hard to modify, VeriStand can easily be extended and customized to meet customers' particular test requirements. With the newest release of the software customers can:

- Achieve complete test coverage by taking advantage of the full breadth of NI I/O, including RF and camera processing
- Use their models from over 30 different modeling tool and simulation environments such as The MathWorks, Inc. Simulink® software and IPG Carmaker to test ECUs for the

latest embedded software trends such as ADAS and autonomous vehicles

☐ Create professional looking UIs quickly and interact more efficiently with live tests using the completely redesigned UI manager

☐ Connect with third-party hardware and software through the industry-standard ASAM XIL API

☐ Work more efficiently with extremely large models using the improved model handling engine

For more information about VeriStand and NI HIL systems, visit www.ni.com/veristand andhttp://www.ni.com/en-us/innovations/automotive/hardware-in-the-loop.html.

## ARM enables autonomous vehicles with its most advanced safety processor

☐ The ARM® Cortex®-R52 meets the highest functional safety standards

☐ Delivers the robust, real-time performance needed for next generation autonomous systems

☐ Simplifies the path to safety certification of automotive, industrial and medical

ARM has launched a new real-time processor with advanced safety features for autonomous vehicles and medical and industrial robots. The ARM Cortex-R52 was designed to address functional safety in systems that must comply with ISO 26262 ASIL D and IEC 61508 SIL 3, the most stringent safety standards in the automotive and industrial markets.

The Cortex-R52 is ideally-suited for systems that demand advanced safety features alongside efficient and responsive execution. It will enable applications as diverse as surgical automation, safety management and automotive powertrain control. STMicroelectronics is the first ARM partner to announce it has licensed the high performance processor to enable it to create highly integrated SoCs for the automotive market.

“The Cortex-R52 is the first processor built on the ARMv8-R architecture and it was designed from the ground up to address functional safety,” said James McNiven, general manager for CPU and media processing groups, ARM. “We are helping partners to meet particular market opportunities, especially in fully autonomous vehicles and robotics systems where specific functionality is required for safety-critical tasks. By documenting the strict development process, fault modelling and supporting software isolation, ARM is enabling a faster route to market for partners addressing these applications.”

How the Cortex-R52 works

The Cortex-R52 offers hardware-enforced separation of software tasks to ensure safety-critical code is fully isolated. This allows the hardware to be managed by a software hypervisor policing the execution and resourcing of tasks. By enabling the precise and robust separation of software, the Cortex-R52 decreases the amount of code that must be safety-certified, so speeding up development as software integration, maintenance and validation is easier. The processor also deals with increased software complexity while delivering the determinism and fast context switching that real-time systems demand.

“The Cortex-R52 supports our Smart Driving vision by enabling a new range of high-performance, power-efficient SoCs for any in-vehicle application demanding real-time operation and the highest levels of functional safety, including powertrain, chassis and ADAS,” said Fabio Marchiò, Automotive & Discrete Group Vice President and

Automotive Digital Division General Manager, STMicroelectronics. “The Cortex-R52’s ability to compartmentalize software provides our users with the best solution for safety without loss of determinism. Its virtualization support simplifies the consolidation of applications and functions into a single processor, delivering a shorter integration time.”

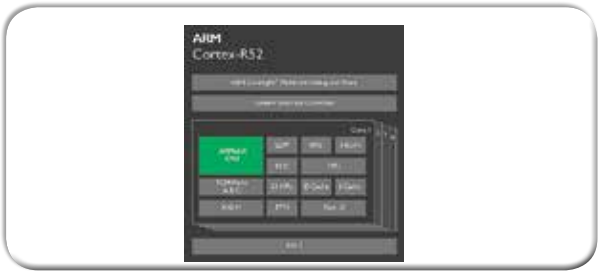
DENSO, a leading global supplier of advanced automotive technology, systems and components is supporting the launch.

“DENSO welcomes the development of new processor technology to drive the evolution of embedded real-time control, which is critical to advancing capabilities for autonomous systems,” said Hideki Sugimoto, Project

General Manager, ePF Advanced R&D Department, DENSO Corporation. “We look forward to seeing the first devices powered by the Cortex-R52.”

The availability of ARM Fast Models and Cycle Models enables software partners to develop solutions for the processor. They further speed the path to market as software developers will get access to the Cortex-R52 early in the design process. The Cortex-R52 offers a thirty five percent performance uplift compared to the Cortex-R5, which is already deployed in a range of safety applications. It has achieved a score of 1.36 Automark™/MHz on the EEMBC AutoBench, the highest in its class, using the Green Hills Compiler 2017.

“Green Hills Software is expanding its support for ARM processors with optimizing compiler solutions for the Cortex-R52,” said Dan Mender, vice-president business development at Green Hills Software. “Through close collaboration with ARM, Green Hills delivers the industry’s highest performing safety certified compiler for the Cortex-R52, enabling customers to develop safety-critical products at the highest certified levels of automotive (ASIL D) and industrial safety (SIL 3).”




## ON Semiconductor Expands Breadth of Options for Low-Light Industrial Imaging Application

ON Semiconductor (Nasdaq: ON ), driving energy efficient innovations, continues to strengthen its position in low-light imaging solutions for industrial markets with the introduction of new products based on interline transfer electron multiplying charge-coupled device (IT-EMCCD) technology.

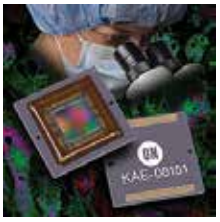
The new 8-megapixel KAE 08151 image sensor is the second device to use the company’s IT EMCCD technology, delivering the same sub-electron noise floor and imaging versatility as the existing 1080p resolution KAE 02150 image sensor . With a 22 millimeter diagonal (4/3 optical format) that matches the imaging path of professional microscopes, the KAE 08151 directly targets high resolution microscopy and scientific imaging applications operating in lighting regimes that can range from sub-lux to bright-light imaging. In addition, a new packaging option is available for both devices in this family which incorporates a thermoelectric cooler (TEC) directly into the package design. This integrated cooler simplifies development of a cooled camera that optimizes the performance available from these devices.

“The compelling combination of performance and flexibility provided by IT EMCCD technology is providing significant benefits for low-light imaging across key industrial imaging applications,” stated Herb Erhardt, Vice President and General Manager, Industrial Solutions Division, Image Sensor Group at ON Semiconductor. “By expanding our product portfolio with a new resolution node and options that simplify the integration process for camera manufacturers, end customers will be presented with even more ways to leverage the advantages of this unique technology.”

IT EMCCD devices combine two established imaging technologies with a unique output structure to enable a new class of low-noise, high-dynamic range imaging. While interline transfer CCDs combine superior image quality and uniformity with a highly efficient electronic shutter, this technology is not always ideal for very low-light imaging because of the overall noise floor of their outputs. Conversely, EMCCD image sensors excel at low-noise imaging, but historically have been available only as low resolution devices with limited dynamic range. Combining these technologies allows the low-noise architecture of EMCCD to be extended to multi-megapixel resolution image sensors for the first time, and an innovative output design allows both standard CCD (low-gain) and EMCCD (high-gain) outputs to be utilized for a single image capture – extending scene detection from sunlight to starlight in a single image.

The KAE 08151 is sampling today in Monochrome and Bayer Color configurations in a CPGA-155 package, with samples incorporating an integrated TEC available in the first quarter of 2017. The KAE 02150, already in

production, is now sampling in a CPGA-143 package that incorporates an integrated TEC. All package options are RoHS-compliant. Both devices will be demonstrated in ON Semiconductor's booth (1C32) at the 2016 VISION trade fair, held November 8-10 in Stuttgart, Germany.



## Microchip Introduces the Industry's Smallest Package and Lowest Power MEMS Oscillators in DSC6000 Family

Microchip announces the availability of the DSC6000 family of Micro-Electro-Mechanical Systems (MEMS) oscillators. The new family is the industry's smallest MEMS MHz oscillator with the lowest power consumption over full frequency range of 2 KHz to 100MHz.

The single-output DSC6000 MEMS oscillators are excellent choices for use as clock references in small, battery-powered devices such as wearables and Internet of Things (IoT) devices in which small size, low power consumption, and long-term reliability are paramount. They also meet the stringent mechanical durability and reliability requirements within Automotive Electronics Council standard Q100 (AEC-Q100), so they are also well suited for under-bonnet applications.

Microchip's DSC6000 oscillators are housed in industry standard 4-pin DFN packages ranging from as small as 1.6 x 1.2 mm up to 7 x 5 mm, and consume just 1.3 mA (typical), less than half the current consumption of the lowest-power quartz-based oscillators. They also have a maximum operating temperature range of -40oC to +85o C and +/-25 ppm maximum drift over this range. They can sustain 500 times more shock and five times more vibration than a quartz oscillator, ensuring rock-solid stability in most operating environments.

Microchip's ClockWorks® online configuration tool allows designers to easily select the right oscillator in terms of frequency, package size, ppm and temperature range and then request complimentary samples of that oscillator through the same tool. The TimeFlash field programming kit provides instant frequency generation by fusing the One-Time Programmable (OTP) memory in a blank DSC6000 part that can be ordered separately.


## ON Semiconductor Introduces Next Generation Fan Motor Drivers to Simplify and Accelerate Appliance Design

ON Semiconductor (Nasdaq: ON ), driving energy efficient innovations, has announced three new devices for driving 3-phase BLDC motors via 180 degree sinusoidal waveforms. Designed for use in cooling fans of household appliances such as refrigerators, as well as games consoles and computing equipment, the LV8811, LV8813, and LV8814 have voltage ranges of 3.6 volts (V) to 16 V, 6 to 16 V, and 3.6 to 16 V respectively. These highly integrated, software-less motor drivers simplify motor control circuit design by eliminating software development time. In addition, these devices reduce acoustic noise and vibration, and enable deployment of energy efficient motor controls. They can be controlled by a single Hall sensor, reducing system costs. Motor speed can be set by either a pulse width modulated (PWM) signal or a DC voltage. Furthermore, their lead angle can easily be adjusted.

The LV8811, the LV8813, and the LV8814 incorporate over-current, over-voltage, under-voltage, and over-temperature protection functions. Also included are locked rotor protection and auto-recovery mechanisms. Soft start-up and shutdown functionality ensures that ongoing operational stability is maintained.

"Appliance manufacturers need to heighten the energy efficiency of their products in order to adhere to the latest

guidelines. They are also under a great deal of pressure from consumers for these products to deliver smooth, silent operation," explains Ikuya Kawasaki, Intelligent Power Solution Business Unit General Manager at ON Semiconductor. "The 180° drive and lead angle adjustment of our LV8811/LV8813/LV8814 offering enable engineers to design systems that attain the elevated performance characteristics that are now being demanded. Moreover, design engineers can save development time and workload, and rapidly roll-out their products."

Packaging and Pricing The LV8811/LV8813/LV8814 are all supplied in RoHS-compliant TSSOP-20J/SSOP-20 packages, and respectively priced at $0.938 (LV8811/LV8813) and $0.785 (LV8814) per unit in 2,000 unit quantities.


## Low ohmic value current sensing resistors from TT Electronics reduce design footprint

TT Electronics, a global provider of engineered electronics for performance critical applications, today launched the LCS series of thin film resistors. For sensing and measurement of DC and AC currents in the sub-3A range, the resistors bring precision thin film resistor performance into the field of low ohmic values for use in very accurate current sensing applications. Most thin film chips have a minimum value in the range of one to 10Ω, but TT Electronics' LCS series uses a proprietary technology to extend this down to 100mΩ. The resistors also feature low sensitivity to temperature variations.

Aimed at designers of power supplies, battery monitoring, process control and point of load converters, the LCS resistors will find acceptance for use in market sectors such as industrial, medical, instrumentation and IT.

The resistors offer a level of precision of ±0.5% and ±50ppm/°C, providing higher precision and temperature stability of current measurement. While there are currently a few thin film chip products below one ohm that use the nickel phosphorus material traditionally used for low value films, TT Electronics' proprietary LCS film system delivers lower TCRs (temperature coefficient of resistance) in the hundreds of milliohms range.

Available in five sizes from 0603 to 2512, LCS resistors feature high power ratings, e.g. 1W for 2512, which is comparable to thick film ratings. This also enables smaller footprints to be used. Enhancing reliability and reducing field failures in industrial applications, LCS also feature anti-sulphur terminations.

A major factor driving the demand for this type of product is the growth of battery powered equipment. The proprietary thin film technology of TT Electronics' LCS bridges the gap between the ohmic values offered by bulk metal chips and those of conventional nichrome thin film chips. Whilst thick film chips are also available in this very low ohmic range, LCS offers superior precision, offering the lowest TCR for precision current sensing available in the 0.1 to 1 Ω range.

LCS series resistors are available from the following distributors: Mouser, Newark, and Farnell. For other franchised distributors, please see http://www.ttelectronicsresistors.com/sales.php.


## STMicroelectronics Boosts Access to High-Performance Embedded Design with New STM32F7 MCU Lines and Ecosystem Extensions

STMicroelectronics has introduced new STM32F7

microcontroller lines and added accessories and options to the development ecosystem, easing access to high-performance embedded design based on the ARM®Cortex® -M7 core.

The latest STM32F722 and STM32F723microcontrollers in the very high-performance STM32F7 series reduce memory footprint by integrating value-added features including code-execution protection and high-speed USB physical-layer (PHY) circuitry that streamline development of connected applications. The STM32F732 and STM32F733 variants come with extra cryptographic features on-chip, such as an efficient AES256 HW engine. There are versatile package options from a 64-pin LQFP up to 176-pin LQFP or UFBGA for projects demanding high I/O count, and 256KB or 512KB of on-chip Flash memory with 256KB RAM.

Extensive pin, package, and software compatibility between the new devices and higher-end STM32F7 variants with 256KB to 2MB Flash memory and 256KB to 512KB RAM in packages up to 216-pin TFBGA simplifies design scaling for product differentiation and future-proofing. STM32F7 projects can also be readily ported throughout the large STM32 microcontroller family, which contains over 700 devices that cover all 32-bit Cortex-M cores and offer a wide range of peripheral, pin-count, and memory options.

ST is also introducing a new Discovery Kit, based on the STM32F769, with expansion connectors that include an 8-pin socket for Wi-Fi modules. The kit supports Power over Ethernet (PoE). Other features include a 512-Mbit Quad-SPI (QSPI) Flash interface and new accessories that enhance flexibility and extend application reach, including the B-LCDAD-RPI1 15-pin single row Flexible Printed Circuit DSI adapter board and B-LCDAD-HDMI1 DSI-to-HDMI adapter, which enhance flexibility to attach a wide variety of displays. The kit can also be supplied with the B-LCD40-DSI 4-inch WVGA capacitive-touchscreen display pre-fitted, or without the display for extra affordability. The B-LCD40-DSI can be ordered separately if needed to upgrade the kit at a later date.

The STM32F769 Discovery Kits (starting from $49) with wireless-ready baseboards are available immediately, as are the DSI and HDMI display-adapter boards and the 4-inch WVGA MIPI-DSI touchscreen LCD. The STM32F722/723 and crypto-enhanced STM32F732/733 microcontroller lines will enter volume production in Q1 2017. Pricing starts from $5.04 (for 10,000 units) for the STM32F722RET6 in LQFP64.


## Toshiba Introduces Single-Chip, Low Pin-Count MCUs for Control of Multiple Motors

ARM® Cortex®-M devices realize efficient motor control and improved power factor

Toshiba Electronics Europe has developed a new range of microcontrollers that allow a single-chip, with a low pin-count (32 to 64 pins), to control multiple motors. The MK4 group is the second offering in Toshiba's TXZ™ family of high-speed, low power consumption microcontrollers that incorporate the ARM® Cortex®-M core.

The new MCUs meet the need to reduce energy and save space in motor control applications ranging from home appliances such as washing machines and refrigerators to power tools, ventilation fans, electric bicycles and industrial motion control.

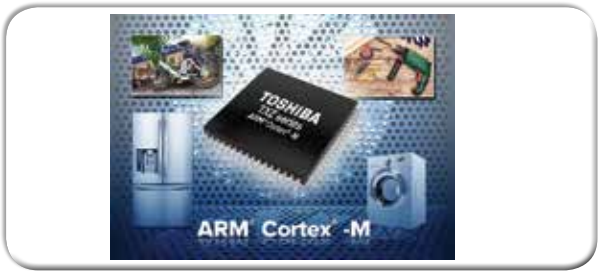
Until now, driving two motors typically required an MCU[1] in a 100-pin type package. Toshiba's 64-pin TXZ family products, however, can control two motors thanks to the ability to detect motor position via an integrated, high-speed AD converter with a 0.5µs conversion speed. The new devices are based on the ARM® Cortex®-M4F operating at up to 80MHz and incorporating a floating point processing unit. As well as the high-precision ADC, the devices feature high-speed Flash memory with 80MHz operation, a co-processor for Toshiba's original vector engine, and 3-channel op-amps with selectable gain. Together, they ensure the new products realize efficient motor control while improving the power factor and system control.

Devices in the TXZ family support the RAMScope

interface, which can confirm parameters in real time without stopping motors by loading parameters relevant to motor control to RAM. A self-diagnostic function that confirms the reference voltage of the ADC, and a CRC arithmetic circuit that identifies incorrect detection for every read operation of the memory are also incorporated. These support load mitigation of the software process required for functional safety[2].

Offering pin counts from 32 pins to 64 pins, the new devices are available with flash memory capacities from 64KB to 128KB. Communication options comprise UART, TSPI and I2C interfaces, while I/O ports range from 24 to 52. Operating voltage range is from 4.5V to 5.5V. Toshiba's integrated Advanced Vector Engine Plus (A-VE+) supports vector control and dead-time compensation, while an advanced programmable motor control (A-PMD) circuit delivers 3-phase output and supports 3-phase interleaved PFC.

Products with a wide pitch for flow mounting and a fine pitch for reflow mounting are included in the line-up. Operating temperature is from -40 to +105°C.




## TT Electronics set to revolutionise the soldier wearables market with its auto-aligning and self-coupling textile-mounting garment connector

mag-Net® offers invisible power and data connectivity with incredible ease-of-use, dependable reliability, improved mobility and superior human factors

Woking, UK, 28 September 2016 – TT Electronics, a global provider of engineered electronics for performance critical applications, today launched its mag Net® soldier connector, the world's first and only C4I2 MIL-spec connector specifically designed for textile mounting. Unlike circular barrel connectors, mag Net® is a robust, flush rectangular solution with a self-aligning, automatic magnetic latching system that enables the easiest ever, one-handed blind mating. This system will be showcased by TT Electronics at the AUSA Exposition in Washington, October 3-5, 2016.

Intended for equipment connection to soldier-worn garments and load-carrying systems, the mag Net® design provides mechanical latching with no moving parts for reliable, jam-free operation. Together with an ultra-lightweight, no-bulk design that maximises mobility and eliminates cable snag hazards, mag Net®'s abrasion-resistant, flush-flat receptacles are virtually self-cleaning and require no protective caps, ensuring maximum durability and full environmental-sealing, both in mated and un-mated conditions. The 8-way contact configuration supports power up to 8A and USB 2.0 high-speed data transmission. Cable plugs can be oriented to allow for cable entry in any direction.

TT Electronics' beta and alpha testing of the mag Net® connector system has received very positive reactions from various military authorities and the manufacturers of rugged equipment. These include: "This is clearly the next generation, it makes all other soldier vest connectors look stone age" and "I think that this really is the future".

The garment part of the mag Net® connector system comprises two elements: A low-cost, garment cage made of thermoplastic, which is strong, durable and chemical resistant, can be easily and securely sewn into clothing by garment manufacturers who may not necessarily be skilled in the integration of expensive wearable electronics. This non-polarised cage provides an aperture into which the second element, the connector receptacle, can be fitted with the desired orientation. The receptacle itself features a ruggedised, lightweight shell and thermoplastics carefully chosen to provide maximum abrasion resistance. The magnets are fitted under the front face of the insert, which is flush to allow easy finger-wipe cleaning, while removable sides in the backshell enable cable or e textile entry from 4 possible directions. Once terminated to the wiring harness, the receptacle is introduced into the cage from behind.

The mag Net® plug connector can be fitted to equipment such as personal role radios (PRRs) or batteries, providing a direct connection to the vest. Plugs feature 'pogo' spring contacts, machined from copper alloy, for high mating cycle resilience and easy cleaning, with an optional first-mate, last-break contact configuration. At the rear, PCB tail contacts provide for flex-print or regular PCB termination. An 'O'-ring gasket and blind

holes ensure environmental sealing when the plug is fitted into an equipment box or enclosure. For cable connections, an over-moulded flying lead assembly, which is fully EMC shielded to MIL STD 461 and Def Stan 59 411, delivers best-in-class ergonomics and minimises snagging. Cable plugs can be over-moulded to match any colour requirement including Multicam®, MTP and Coyote. Both equipment and cable plugs are available in either latching or non-latching versions and the standard garment receptacle can accept either type. Additional key performance parameters for the mag-Net® soldier connector are:

- Endurance 5000 mating cycles
- Operating temperature of -40°C to +80°C
- IP68 (3 metres for 1 hours) mated/unmated
- Corrosion resistance 500hrs salt fog
- Contact resistance <15m ohm
- Fluid and shock resistance to MIL-STD-810G
- RoHS, REACH, WEEE compliant

## STMicroelectronics Drives Power-Module Miniaturization with High-Temperature Surface-Mount Silicon Controlled Rectifiers

STMicroelectronics has introduced the industry's first 800V surface-mount Silicon Controlled Rectifiers (SCR, or thyristor) specified for operation at temperatures up to 150°C without derating, giving freedom to miniaturize power modules for applications that demand high reliability in harsh conditions.

With its 80A current rating, the new TM8050H-8 SCR, housed in the High-Voltage D3PAK (TO-268-HV), enables mid-power applications in the 1-10kW range to leverage surface-mount assembly efficiencies and reduce PCB and heatsink sizes, lowering system cost. The package has very low junction-to-case thermal resistance of 0.25°C/W, ensuring efficient heat dissipation, and a large pin-to-tab creepage distance of 5.6mm that gives a large safety margin in the presence of high applied voltages. A TO-247 package option is also available.

The TM8050H-8 is the latest addition to ST's family of SCRs that all bring state-of-the-art device and package technologies to automotive and industrial power control. Spanning current ratings from 12A to 80A, the devices enable designers to create extremely compact and reliable car or motorcycle voltage regulators, induction motor starters, soft starters, industrial heater or cooker controls, Solid-State Relays (SSRs), uninterruptible power supplies (UPS), and AC-line conditioners.

With low dynamic resistance (RD) and on-state voltage (VTO) of 5.5 mΩ (TJ = 150°C) and 0.85V respectively, and leakage current of 20µA max (at 800V, Tj = 25°C), the TM8050H-8 ensures extremely high energy efficiency under all operating conditions.

The TM8050H-8 is in production now, priced from $2.20 in TO-247 or $2.50 in High-Voltage D3PAK.

For further information please visit www.st.com/tm8050h-d3pak-nb


## Improve Digital Support of Battery Charging and DC-DC Conversion Applications with New Digitally Enhanced Power Analog Controllers from Microchip

A new Digitally Enhanced Power Analog (DEPA) controller designed to regulate current, regulate voltage and monitor temperature is now available from Microchip Technology Inc.(NASDAQ: MCHP), a leading provider of microcontroller, mixed-signal, analog and Flash-IP solutions. The device improves digital support for battery

charging and is ideal for DC-DC conversion in server, consumer, industrial and automotive applications.

The MCP19124/5 handles configurable charging algorithms for any chemistry, with capabilities for cell balancing and super capacitor charging. No other single-chip battery charging solution can be configured with any desired charging profile, for any battery chemistry, voltage or cell arrangement. Users may develop their own unique charging methods and implement them as well. Any voltage, current, temperature or duration can be used to trigger a transition to a new portion of the charge profile. These devices are also well suited for any DC-DC application requiring tight voltage or current regulation; capable of supporting flyback, boost, SEPIC, or Cuk topologies.

Benefits of the MCP19124/5 include:

- A unique combination of independent voltage and current control loops. Either the current control loop can regulate to a specified target current, or the voltage control loop can regulate to a target voltage. Each analog control loop has a separate feedback network for independent pole-zero placement and the ability to perform zero cross detection for quasi-resonant operation.
- The ability to dynamically switch from a voltage target to a current target, or vice-versa, by switching between the two control loops. The internal architecture ensures this transition is monotonic, without glitching or transient events. This control configuration even allows for pre-positioning of the output voltage at open or no load conditions, greatly minimizing transients when a load is applied.
- A full suite of configurable, adjustable performance parameters. These parameters are set in the internal registers of the device (no external components required), and the settings are dynamically adjustable during operation.
- Integrated linear regulator, MOSFET drivers, 8-bit PIC® microcontroller core, analog-to-digital converter, precision oscillator and analog control loops for a compact solution.

“Smarter, more capable battery charging solutions have become vitally important for our customers,” said Keith Pazul, director of marketing for Microchip’s Analog, Power, and Interface Division. “Customers have been asking for the ability to run their own proprietary battery charging profiles in compact, customizable charge circuits, and now they can. This is the most flexible, most capable single-chip charging solution on the market today.”

For more information about MCP19124/5, visit http://www.microchip.com/wwwproducts/en/MCP19125

Pricing and Availability

The following devices are available in volume production with pricing in 10,000 unit quantities:

- MCP19124-E/MJ, 4 x 4 mm QFN package, starting at $2.87
- MCP19124T-E/MJ, 4 x 4 mm QFN package, starting at $2.87 (tape and reel not available for samples)
- MCP19125-E/MQ, 5 x 5 mm QFN package, starting at $3.03
- MCP19125T-E/MQ, 5 x 5 mm QFN package, starting at $3.03 (tape and reel not available for samples)


## Toshiba Announces Qi-certified 15W Wireless Power Transmitter System

Connected to a microcontroller, “TC7718FTG” realizes a wireless power transmitter system compliant with Qi standard. Toshiba’s original cutting-edge CD-0.13 process realizes a small package and high efficiency, making system integration easy while securing a small footprint. A 15W wireless transmitter formed with the new IC will recharge devices quickly, at a rate equal to or shorter than wired chargers. The IC is suitable for use in wide range of applications including mobile devices, such as smartphones and tablets, and industrial devices.

A wireless power transmitter system using “TC7718FTG” is compatible with a 5W receiver system using Toshiba’s 5W receiver IC “TC7764WBG”, and a 10W receiver system using its 10W receiver IC “TC7765WBG”, both of which are in mass production. In combination with a 15W receiver

IC “TC7766WBG” already certified as the Qi v1.2 EPP compliant, the wireless power system can receive up to 15W.

Toshiba is the industry’s first[3] company to provide Qi v1.2 EPP-certified products for both 15W wireless power transmitters and receivers.

Main Features

- WPC Qi v1.2 compliant (in combination with a microcontroller)
- Full-bridge gate driver (also compatible with half-bridge): 1ch
- Built in LPF[4] for recovery of ASK signal
- Built in LDO (3.3V output)

Application

Charging stand for mobile devices (smartphones, tablets) and industrial devices etc.

Main Specifications

| | |
|---|---|
| Part Number | TC7718FTG |
| Transmitter/Receiver | Transmitter |
| Transmission Method | Electromagnetic induction |
| Operating voltage range | 4.5V to 25V |
| Operation Frequency | 110kHz to 205kHz |
| Package | P-VQFN36-0505-0.40 |

[1] Qi: The international standard for wireless charging defined by WPC.

[2] MP-A2: A wireless power transmitter system defined by WPC that uses a 12V single coil.

[3] As of September 28, 2016, Toshiba survey.

[4] LPF (Low Pass Filter): A filter that passes signals with a frequency lower than a certain cutoff frequency and attenuates signals with frequencies higher than the cutoff frequency.


## Economical Open Frame Ac-Dc Power Supplies Deliver up to 280 W in a Compact Package

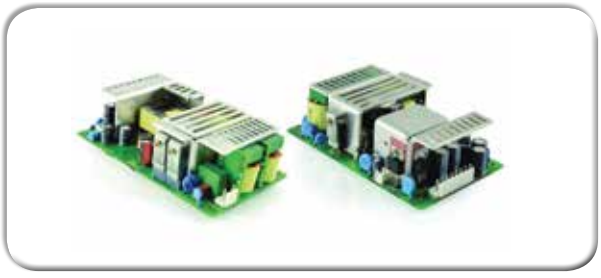
CUI Inc announced the expansion of its VOF open frame ac-dc power supply family with the introduction of 185, 225 and 280 W models. The VOF 185, VOF 225 and VOF 280 series are higher-power additions to CUI’s latest-generation open frame ac-dc power portfolio ranging from 6 to 150 W. Designed to offer a combination of economy and performance in a compact, industry standard 3” x 5” footprint, the single output power supplies deliver efficiencies up to 91% and no-load power consumption as low as 0.5 W at 230 Vac for energy-conscious ITE, industrial and consumer electronics applications.

The three new VOF series feature a wide universal input voltage range of 90 to 277 Vac and offer output voltage options of 12, 15, 24, 36 and 48 Vdc. All models provide an operating temperature range at full load from -20 up to +50°C with forced air cooling, derating to 50% load at +70°C. The new power supply family also carries UL/cUL and TUV 60950-1 safety certifications while meeting EN 55022 Class B and FCC Class B limits for radiated emissions.

The series has an MTBF of 250,000 hours minimum at full load at 25°C ambient, calculated per MIL-HDBK-217F. Protections for over voltage, over current and short circuit are included as well as 0.98 typical power factor with active PFC.

The VOF-185, VOF-225 and VOF-280 are available immediately with prices starting at $69 per unit at 100 pieces through distribution. Please contact CUI for OEM pricing.

Visit CUI’s booth (Power Hall A2, Booth 613) at electronica 2016 where the company will be showcasing the three new VOF series and the rest of their power portfolio ranging from 1 W to 12,000 W. electronica is the world’s leading trade fair for electronic components, systems and applications, and will be held at the Messe München in Munich, Germany from November 8-11, 2016.



## Rohde & Schwarz supports 5G signal generation and analysis based on Verizon 5G open trial specifications

Rohde & Schwarz has successfully demonstrated the generation and analysis of 5G signals based on the characteristics as specified in the Verizon open trial specifications. The R&S SMW200A vector signal generator and the R&S FSW signal and spectrum analyzer both provide outstanding test and measurement capabilities, resulting in an EVM performance of 1 % when applying these 5G signals.

In July 2016, Verizon Wireless, a tier 1 network operator in the United States, supported by leading infrastructure, chipset and terminal manufacturers, published technical specifications that describe the physical layer characteristics of a 5G signal. The specified signal is derived from LTE and adapted to be used at cm frequencies, initially 28 GHz but also 39 GHz. Those frequencies were recently allocated for 5G wireless communications by the local regulator, the Federal Communications Commission (FCC). The proprietary signal is a multicarrier OFDM signal with a subcarrier spacing of 75 kHz. It is aiming for a bandwidth of 100 MHz per component carrier. Up to eight carriers can be aggregated. The basic mode of operation is TDD.

Thanks to their built-in flexibility, the Rohde & Schwarz signal generation and analysis instruments already support the basic characteristic of the specified 5G Verizon signal. The R&S SMW200A vector signal generator equipped with theR&S SMW-K114 5G waveform candidate software option makes it easy to configure OFDM signals with the required 75 kHz subcarrier spacing and 100 MHz bandwidth. Additionally, preamble and user data settings enable creation of 5G signal with the basic characteristics as specified by the Verizon 5G technical forum. This means that reference symbols can be set, and data modulation such as QPSK, 16QAM, 64QAM and even higher-order modulation schemes such as 256QAM can be applied.

Using the R&S FS-K96 OFDM vector signal analysis software in combination with the R&S FSW signal and spectrum analyzer allows the full characterization of such a 5G signal by simply loading into the software a configuration file that reflects the parameterization of the 5G Verizon signal.

When characterizing DUTs such as newly developed power amplifiers for the cm frequency range, test instruments themselves can influence the measurement results. Rohde & Schwarz achieved outstanding performance with theR&S SMW200A and R&S FSW in the trial. When using the test instruments to measure the EVM of a 5G signal at 28 GHz, measurement results were below 1 % across a 10 dB power sweep, meaning that the test instruments did not impact the measurement.

With these testing capabilities, Rohde & Schwarz as a leading supplier of test and measurement solutions for LTE-Advanced and LTE-Advanced Pro, shows its commitment to provide continuous support of 5G test capabilities. Further information about these can be found here: http://www.rohde-schwarz.com/ad/press/5g

## Tektronix Enhances Optical Modulation Analyzer Software Enables Leading Edge Coherent Research on Multi-Channel Optical Transport Systems

Tektronix, a leading worldwide provider of measurement solutions, today announced a series of enhancements to its optical modulation analyzer (OMA) software. The latest release provides optical research engineers with the ability to evaluate multi-channel coherent modulation schemes with confidence using a single measurement system. Engineers can now calibrate and control multiple OMA's to easily acquire and analyze simultaneous data from multiple channels such as different wavelengths or fiber cores.

"This release of our OMA software will improve the multi-channel test experience for researchers developing advanced coherent optical communication and networking technologies such as QAM or DP-QPSK," saidBrian Reich, general manager, Performance Oscilloscopes, Tektronix. "We are reducing the cost of setting up multiple OMA systems and we're reducing the time between receiving multiple OMA hardware systems and getting calibrated, synchronized data from those systems."

Included in this release is a new visual OMA setup tool that facilitates reconfiguration of the oscilloscopes and coherent receiver front-ends so that the same hardware can be used for many different applications like PAM4 research or increased channel count in DP-QPSK testing.

The need for multi-channel coherent research is growing with the use of spatial (or modal) division multiplexing that requires an OMA to down convert and digitize data for each channel. Multi-carrier communication applications also require one OMA per wavelength channel when the wavelength separation is more than the OMA bandwidth.

Pricing and availability

The new software will be available for download by the end of 2016. For details on the full range of Tektronix Coherent Optical Solutions, go to: http://www.tek.com/application/tektronix-coherent-optical-solutions.

Wondering what else Tektronix is up to? Check out the Tektronix Bandwidth Banter blog and stay up to date on the latest news from Tektronix on Twitter and Facebook.

## Mastering station from Rohde & Schwarz looks to the future with HDR, floating point processing and enhanced IMF workflows

The new software release of the R&S CLIPSTER mastering station from Rohde & Schwarz provides an expanded tool set for high dynamic range workflows, enabling more flexible color processing. Both Dolby Vision and HDR10 are supported. IMF subtitles and compositing directly on the timeline simplify localization workflows. Rohde & Schwarz has enhanced its multiple award-winning, complete solution by adding these and many other new features tailored to the needs of post production and content distribution.

R&S CLIPSTER has established itself as the complete mastering and deliverable solution for premium content. The new functions allow content creators to master their films and TV content more quickly and reliably. The superiority of R&S CLIPSTER is especially evident in productions with higher resolutions, higher frame rates and enhanced colors (bigger better pixel): the new floating point processing enables color management in realtime up to 4K.

R&S CLIPSTER 6.1 has extended the IMF feature set to include localization of subtitles. And the new alpha compositing feature enables data such at title sequences and text clips in multiple languages to be easily exchanged directly on the timeline. Content that has been mastered for a specific region can now be modified for worldwide distribution. Support of Dolby Vision and HDR10 metadata in IMF (PQ, SMPTE2086) allows content to be delivered for all current HDR consumer standards. R&S CLIPSTER has integrated the new HEVC and ProRes 444 XQ formats for delivering content in the high resolution high dynamic range (HDR) and wide color gamut (WCG) formats. The additional output of audio via HDMI simplifies quality control.

One highlight of R&S CLIPSTER 6.2 is the enhancement of the HDR workflow to include image processing with floating point processing. This enables the wide dynamic range of the HDR material to be precisely converted. Rohde & Schwarz has succeeded in importing a high-quality master such as a linear OpenEXR file and rendering it in the output color space with the appropriate quantization (12-bit PQ/SMPTE ST 2086). This is necessary in order to meet the constantly growing HDR color management requirements. R&S CLIPSTER 6.2 takes the next step toward a flexible HDR mastering solution. In addition, an optimized architecture and the accelerated hardware enable image processing in realtime up to 4K 120p. Other features include support for the Avid DNxHR® codecs and the ability to process HDR metadata for Dolby Cinema.

Stephen Birdsong, Product Manager Post Production Solutions at Rohde & Schwarz says: “We have worked very hard on making R&S CLIPSTER what it is today – the standard for DCI and IMF mastering. The system is extremely versatile in post production and supports numerous workflows. Users appreciate the absolutely reliable playback over professional display interfaces as well as the realtime, timeline-based image processing. Post production providers rely on this proven solution to meet the high delivery requirements for film and TV productions.”

The new version of the R&S CLIPSTER 6.1 mastering

station will be available in the third quarter of 2016.

## NI Demonstrates mmWave 802.11ad Wireless Test Technology

NI (Nasdaq: NATI), the provider of platform-based systems that enable engineers and scientists to solve the world's greatest engineering challenges, announced today a technology preview of its new 802.11ad, or WiGig, test solution at EDI CON USA 2016. Highlighting new capabilities in the emerging field of mmWave test, NI is demonstrating parametric testing of an 802.11ad radio using its mmWave instrument technology.

This demonstration of a new 802.11ad test solution is based on NI's wideband mmWave transceiver technology used by leading automotive and wireless infrastructure researchers to prototype advanced radar and 5G systems. It consists of a vector signal generator and vector signal analyzer operating at 55 to 68 GHz with more than 2 GHz of instantaneous bandwidth. This new technology for 802.11ad testing also complements NI's comprehensive product portfolio for wireless test, including existing solutions testing 802.11a/b/h/j/n/p/ac/ax, Bluetooth, GSM, UMTS, LTE/LTE-A, FM/RDS, GNSS and more.

"With proposed 5G bands at 28, 38, and 73 GHz, WiGig at 60 GHz, and automotive radar at 77 GHz, mmWave is the next frontier of wideband instrument technology," said Jin Bains, vice president of RF R&D at NI. "With our newest 802.11ad test solution, we are excited to work alongside leading chipset vendors to develop new solutions for the next generation of wireless test."

NI's mmWave transceiver technology introduces a new approach to 802.11ad testing that offers customers an alternative to slow, expensive and low-performing traditional instruments. To further refine this technology, NI is working with leading semiconductor vendors as part of a lead user program.

"802.11ad is a critical addition complementing WiFi technology, enabling multi-gigabit wireless throughput for demanding consumer and mobile applications such as UHD video streaming, as well as enabling high bandwidth data transmission for wireless infrastructure including mobile backhaul and wireless access points," said Anand Iyer, director of mmWave product marketing at Broadcom Limited. "NI's developments in mmWave test solutions have allowed us to address various testing challenges like reducing test costs and providing high-volume manufacturing and over-the-air test capabilities."

The 802.11ad test solution is a vital part of the NI platform and ecosystem that engineers can use to build smarter test systems. These test systems benefit from more than 600 PXI products ranging from DC to mmWave and feature high-throughput data movement using PCI Express Gen 3 bus interfaces and sub-nanosecond synchronization with integrated timing and triggering. Engineers can take advantage of the development productivity of the LabVIEW and TestStand software environments, along with the out-of-the-box experience with interactive soft front panels for making basic measurements and debugging. Supported by a vibrant ecosystem of partners, add-on IP and applications engineers, the NI platform helps to significantly lower the cost of test, reduce time to market and future-proof testers for tomorrow's challenging requirements.

To see a demonstration of this new 802.11ad test solution, visit NI's booth #313 at EDI CON USA 2016, or find more information about NI's RF and wireless solutions at www.ni.com/rf.

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