VEHICLE electronics

The monthly magazine for automotive electronics engineers

Sony and Vodafone in 5G autonomous driving tests

Sony and Vodafone have started 5G driving tests in Germany of a prototype for autonomous driving and making better use of cabin space.

The Vision-S prototype is being tested on a course in Aldenhoven, Germany.

With the evolution of communication technology, 5G is becoming increasingly proliferated, and technological innovations such as improved safety and convenience that take advantage of 5G's low latency, large capacity and high speed are expected in the mobility field.

To increase the performance of 5G in a real environment, it will be necessary to optimise the antenna shape and layout, as well as the modem control in the TCU (telematics control unit) to maintain an uninterrupted connection even when traveling across base stations.



Vision-S prototype for testing 5G technology

For this project, Sony will apply technologies and expertise it has cultivated through the development of smartphones, including hardware and software design for communication systems, the formulation of communication quality evaluation indexes, and the analysis of propagation characteristics in field tests.

The prototype is equipped with 5G network connectivity, which enables a continuous connection between the in-vehicle systems and the cloud to synchronise data and control signals, and update the systems over the air.

Sony will conduct driving tests to verify the possibility of low-delay transmission of various sensor data acquired from the vehicle to the cloud, and real-time control from the cloud to the vehicle, and proceed verification and development for optimisation of the communication environment even in vehicles running at high speed.

"Real time mobile communication turns cars into databases on wheels," said Hannes Ametsreiter, CEO of Vodafone in Germany. "In our 5G Mobility Lab, the Vision-S prototype learns to communicate in real time."

Issue 89
May 2021

IN THIS ISSUE

2: Vector and Wind River collaborate

4: Argus and Microsoft security

5: Chip shortage shuts JLR plants

7: Harman hub for Android developers

9: GWM uses Ambarella AI chip

10: Skyworks buys SiLabs automotive

12: Scania picks QNX for safety

13: Sensors reduce car repair costs

17: Conti radar at Auto Shanghai

21: Testing for automotive antennas

29: Hyundai Mobis concept cars

33: Product news

38: Contact details

Vector and Wind River collaborate on Autosar SOA

Wind River is collaborating with Vector to deliver service-oriented architecture (SOA) capabilities for developing adas and automated driving based on Autosar Adaptive so vehicle functionality can be enhanced over time.

The joint offering comprises Vector's Autosar Adaptive technologies and the Wind River Studio, which includes the VxWorks rtos. Wind River Studio is a cloud-native platform for the development, deployment, operation and servicing of mission-critical intelligent systems.

This should support safety-critical applications that require hard real-time, deterministic performance and allow auto manufacturers to deliver SOA components to address a mixed-criticality environment.

Intelligent serviceable ECUs merge domain functions and features that are decentralised, helping car makers reduce ECU complexity and extend the value and life of the vehicle with communications to connected cloud services, offer software-as-a-service, increase automated operations, and use machine-generated data to accelerate data-driven decision-making.

This will be powered by SOA, a technology enabler that defines a way to make software components reusable via service interfaces that use common communication standards.

"With SOA approaches, car makers can reduce complexity and maximise software reuse for greater speed and efficiency in the development, deployment and management of a vehicle's entire lifecycle," said Cyra Richardson, chief product officer at Wind River.

Making everything sound right



Streaming services, audiobooks, digital radio and podcasts mean drivers have access to a wider range of music and spoken word entertainment than ever. But while it has long been possible to adjust settings to optimise the sound for different genres of music and outputs, it has not always been straightforward to do so, especially on the move.

The Beosonic feature of the B&O sound system in Ford cars lets drivers and passengers adjust the sound exactly as they want with one touch.

"Whether you prefer to listen to classical music, the latest hits or a favourite podcast, we want to ensure that it is easy to enjoy your preferred choice to its maximum potential," said Jan Schroll, connectivity manager at Ford of Europe.

To tune, test and perfect the Beosonic equaliser, Harman's acoustic engineers used an eclectic playlist of 25 songs to evaluate and define the attributes for four sound moods. The tuning process involved listening to these 25 songs in static and dynamic driving situations, using the trained ears of acoustic engineers and the latest measuring instruments and microphones.

Trimble provides GNSS positioning for VSI Labs

Trimble has become the GNSS precise-positioning and orientation technology supplier for autonomous vehicle research firm VSI Labs.

The collaboration provides the opportunity to showcase Trimble RTX technology as a precise-positioning correction source for car manufacturers and their suppliers. Coupled with Trimble's inertial positioning, RTX plays a pivotal role in a vehicle's ability to maintain accurate and reliable lane-discipline during autonomous driving.

"The integration of Trimble's precise RTX positioning is a key element of VSI's technology stack for adas and autonomous vehicle applications," said Stephen Ruff, general manager at Trimble. "VSI Labs is a leading researcher of best-in-class technologies critical to autonomous vehicle development."

Suitable for on-road driving applications, RTX corrections operate on a single, global network. Drivers are not subject to the coverage outages that can exist when relying on local positioning systems requiring line-of-sight to a positioning source or radio, cellular or internet connections.

When occasional obstructions are present, such as a bridge, tunnel, or deep urban or rural canyon, Trimble augments its GNSS positioning with inertial technology to maintain continuous positioning and orientation while on the road.

This is being used on the road today by a number of OEMs and tier-one suppliers to improve the functional safety and performance of adas for passenger vehicles.



Trimble provides in-lane positioning for VSI Labs vehicle research programme

Consumers have logged more than 11 million kilometres using RTX for lane-level positioning.

"VSI Labs is thrilled to have Trimble's RTX technology on board," said Phil Magney, president of VSI. "Trimble's positioning capabilities allow us to really expand our applied research on the safety and performance of autonomous and adas driving."

Airbiquity extends NXP collaboration

Airbiquity has expanded its multi-year technology collaboration with NXP to pre-integrate and demonstrate efficient, secure and scalable automotive software updates and data management for intelligent connected vehicles.

The latest integration effort showcases essential vehicle-wide support for evolving software-defined vehicles using Airbiquity over-the-air (OTA) software update and data management services, an NXP service-oriented gateway serving as the primary ECU, and additional NXP automotive processing platforms serving as secondary domain ECUs.

They have pre-integrated the most recent versions of the Airbiquity OTAmatic software update and data management platform with the NXP S32G2 vehicle network processor to provide centralised in-vehicle software and data management orchestration, including support for the Uptane automotive security framework.

"Airbiquity's OTAmatic was specifically designed to enable OTA software updates and data collection services for every ECU in a vehicle," said Keefe Leung, Airbiquity vice president.

The NXP automotive processing platforms serving as secondary domain ECUs are an i.MX 8QuadMax for the head unit, i.MX 6Quad for the instrument cluster, S32K148 for body control and S32S247TV for EV and powertrain control.

"NXP's latest collaboration with Airbiquity addresses the need to extend OTA services and data management across intelligent connected vehicles to help fuel today's software-driven automotive digital transformation," said Brian Carlson, marketing director at NXP.

Argus and Microsoft partner on cyber security

Argus Cyber Security's suite has been integrated with Microsoft's Azure IoT platform to provide in-vehicle and off-board monitoring, analysis and mitigation of cyber attacks from the cloud.

Argus' cyber security suite, integrated with Azure IoT for automotive applications, includes Argus Fleet Protection for automotive security operation centres, in-vehicle insights from Argus Connected ECU protection, and update capabilities with software updates over the air (OTA).

This end-to-end cloud offering is among the first to provide vehicle manufacturers full visibility into the cyber health of their fleet with on-board and off-board monitoring.

This collaboration provides vehicle makers easier access to security-related in-vehicle information as well as coverage of security events.

Connected ECU protection, deployed on connected ECUs such as telematics, infotainment centres and adas units, detects operating system anomalies and suspicious activity in the vehicle according to user-defined threat models.

Threat models can be based on UNECE R 155 (WP.29), the Mitre attack framework, or any other chosen model. Alerts from the vehicle are sent to Argus Fleet Protection where they are fused with insights from other sources in dedicated automotive threat hunting and investigation modules.

By integrating end-to-end automotive cyber security with Azure IoT, vehicle manufacturers can leverage data across a wide range of sources to build a more accurate, all-encompassing cyber intelligence picture.

Moreover, with Argus Delta OTA update technologies, vehicle makers can implement security updates OTA to reduce exposure immediately to cyber risks, while reducing vehicle downtimes and deployment costs.

"We are very excited about joining the world's leading companies running on Microsoft Azure," said Miki Hakak, vice president at Argus Cyber Security.



Renault leads blockchain initiative to track car parts

Renault, Faurecia, Knauf Industries, Simoldes and Coşkunöz, with help from IBM, have signed a contract to deploy Xceed (eXtended Compliance End-to-End Distributed) blockchain technology to trace the compliance of thousands of parts assembled in a vehicle in almost real time.

This follows the testing of Xceed at Renault's Douai plant, and will be deployed to partner plants around Bursa in Turkey, Douai in France and Palencia in Spain. It is now open to global OEMs and suppliers, regardless of size, throughout the supply chain.

"Xceed is a powerful tool for transforming the automotive industry by enabling operational excellence for the whole ecosystem, including smaller players that would not have been able to invest in such technology otherwise," said Odile Panciatici, coordinator of the Xceed project at Renault.

Xceed can improve responsiveness and efficiency during a time when regulations are becoming increasingly stringent.

The ambition is to provide compliance and conformity traceability for the entire ecosystem of the European automotive industry. It can meet regulation and customer demand while bolstering European industrial competitivity and technology.

Xceed is designed to be inclusive for all automotive industry players worldwide.

It uses blockchain to create a trusted network for sharing compliance information between parts and systems makers throughout the supply chain to end vehicle makers. The platform should help ensure more efficient compliance management, while respecting each company's confidentiality, intellectual property and data ownership.

Based on Hyperledger Fabric, an open source blockchain protocol, Xceed has been developed in partnership with IBM. It can be deployed in a hybrid cloud architecture with multiple cloud providers so each member can run on the cloud platform of their choice.

"Xceed is our first initiative in the automotive industry that is targeting to tackle component compliance traceability at scale, leveraging the value and benefits of blockchain," said Dirk Wollschläger, industry general manager at IBM.

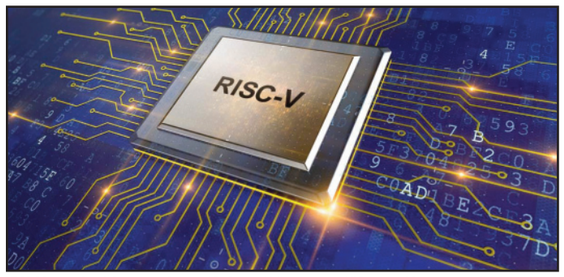
SiFive licenses Risc-V IP to Renesas

SiFive is licensing the use of its Risc-V core IP portfolio to Renesas.

Renesas is exploring the use of Risc-V cores optimised for automotive applications to expand high-end SoC and MCU development capabilities.

"Risc-V is an important element in providing additional capabilities and options for new and existing customers," said Takeshi Kataoka, senior vice president at Renesas.

The SiFive platform is based on Risc-V vector processors with AI ISA extensions. A differentiated software toolchain enables the development of scalable products for AI and ML applications.



SiFive is licensing Risc-V core IP to Renesas

The Risc-V processors are pre-integrated with trace, debug and security compatible with tools to simplify heterogeneous integration and migration. The portfolio is silicon-proven and available in manufacturing foundries.

"Our roadmap of advanced, high-performance Risc-V processor cores and AI accelerators will deliver significant core performance increases with the capabilities needed to meet automotive application requirements, along with enhanced AI capabilities," said Patrick Little, CEO of SiFive.

Chip shortage shuts two Jaguar factories

Jaguar Land Rover has temporarily closed two of its UK factories due to the chip shortage.

"Like other automotive manufacturers, we are currently experiencing some Covid-19 supply chain disruption, including the global availability of semiconductors, which is having an impact on our production schedules and our ability to meet global demand for some of our vehicles," said a company statement.

As a result, its Castle Bromwich and Halewood manufacturing plants will close.



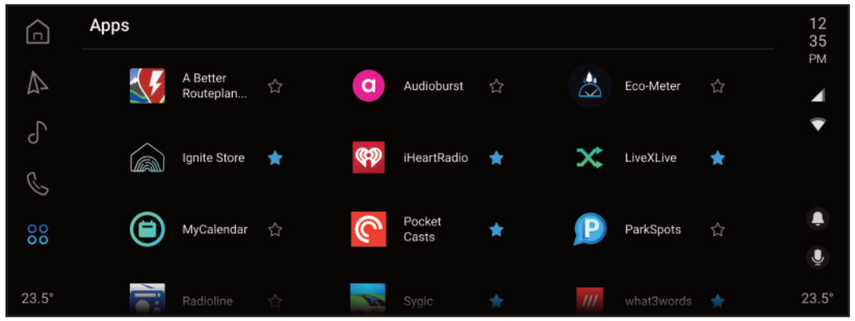
Harman sets up developer hub for Android Automotive

Samsung subsidiary Harman has started a developer hub dedicated to the Android Automotive developer community.

Through the Ignite Store Developers Portal, those developing to the Android Automotive open operating system can deploy automotive apps, which OEMs can then scale, manage and leverage the digital touchpoints with their customers through the firm's Ignite Store.

Android developers can benefit from toolkits, technical documentation, access to APIs and Harman's existing network of OEMs, while automotive manufacturers can more easily infuse technology, control experiences and implement digital revenue generators through a curated store featuring apps that are pre-certified.

"The third-party applications and services area offers significant opportunity for mobility innovation – today and going forward – with limitless possibilities to connect, protect and entertain drivers and their passengers," said Sripriya Raghunathan, senior vice president at Harman. "We built the Harman Ignite Store Developers Portal through years of automotive expertise to help connect Android developers with automotive manufacturers, so together we can increase the effectiveness and availability of in-vehicle applications on the cloud."



App tray examples in the Ignite Store Developers Portal

She said Android developers could more easily engage target audiences.

"OEMs have a streamlined way to drive new experience opportunities around their brands, and consumers can enjoy enhanced experiences per mile in their vehicles through access to their favourite content," she said.

Developers can access the portal to create and deploy media applications for Ignite Store through a self-service platform. Developers will receive access to resources including toolkits, technical documentation, best practices, code samples, trainings and other development aids, along with the ability to collaborate, test and document applications directly within the portal.

OEMs will have access to expert teams within Harman who will help affirm newly-developed apps and place each through a confirmation process to ensure it is effective and appropriate for the mobility environment.

Automotive manufacturers will have full discretion over the in-vehicle implementation of the applications through the Ignite Store.

Volvo partners Aurora to develop autonomous lorries

Volvo has entered a partnership with US self-driving company Aurora to develop on-highway autonomous lorries.

The initial focus is on hub-to-hub applications for customers in North America. Automation is aimed at creating tangible benefits for customers and society in terms of productivity, safety, sustainability and energy efficiency.

This partnership will centre on the integration of the Aurora Driver into Volvo's on-highway lorries and the development of transport-as-a-service.

"Creating a viable autonomous on-highway offering requires close partnerships with both customers and tech partners to develop the needed capabilities," said Volvo Autonomous president Nils Jaeger. "This partnership brings our goal of transport-as-a-service an important step closer and will accelerate our commercial offer for hub-to-hub applications."

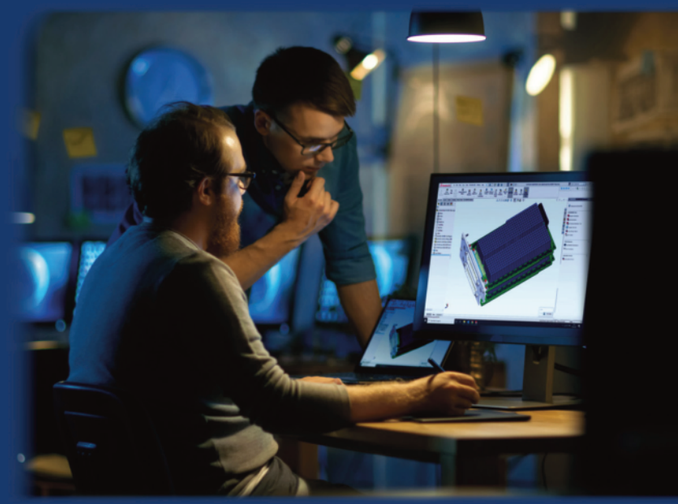
PXI Signal Switching, Simulation & Software

Design, Deploy & Sustain
your automated test system more effectively...

...by taking advantage of Pickering's deep portfolio of 1,000+ PXI, PCI, LXI and USB products, services and expertise.

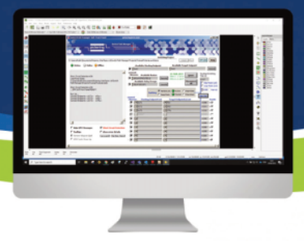
Reduce your PXI test system switching cost 30-40% and design what you need.

pickeringtest.com/pxisavings





PXI, PCI, LXI & USB
Switching & Simulation
1,000+ Modules Available



Application Software & Software Drivers



Diagnostic Test Tools & Expert-level Support

pickeringtest.com
01255 687900 | uksales@pickeringtest.com

pickering

Project wants to make restraints suit occupants

Veoneer, camera-based in-cabin monitoring software firm Emotion3D and testing and simulation company AVL are working together to develop personalised and situation-aware restraint control technology.

Current passive safety systems, such as airbags, follow a few-sizes-fit-all development approach and thus perform best for a small number of specified body physiques, the most common being the average male at 175cm and 78kg. This is suboptimal for everybody who deviates from these averages – children, elderly people and most women.

A study at the University of Virginia found seatbelt-wearing females were 73% more likely to suffer from serious injuries than seatbelt-wearing male occupants.

The Smart-RCS project is being conducted within the European Commission's Horizon 2020 Fast Track to Innovation funding programme.

"Smart-RCS will provide personalised and situation-aware protection for everybody," said Tom Herbert, product director at Veoneer. "This is an important step to increase safety for everyone."

Over the next 24 months, the project partners plan to develop a restraint control system to personalise the actions of passive safety systems in event of a crash. Using a 3D sensor for understanding the vehicle interior, the system will consider a range of relevant, personal and situational factors such as body physique, position, pose, weight and gender.

"The project consortium combines all expertise required to build such a ground-breaking innovation and to make it ready for automotive production." said Florian Seitner, CEO of Emotion3D.



Restraints should suit different shapes and sizes



GWM launched multi-channel AI vision system based on Ambarella CV25 CVflow processor

GWM in-cabin sensor uses Ambarella AI processor

Great Wall Motors (GWM) has launched a camera based in-cabin sensing system that is based on the Ambarella CV25AQ CVflow AI vision processor.

The system is integral to the Wey Mocha flagship SUV, which was launched at April's Auto Shanghai as the first model from GWM's Coffee Intelligence driving platform.

This is an AI system that advances the future of automotive technology via intelligent cockpits, drives, and automotive electronic and electrical technology.

"Ambarella and GWM have a strong history of successful collaboration, with several generations of vision systems already in production for a variety of car models," said Fermi Wang, Ambarella CEO. "Our companies worked together even more closely to develop this Ambarella CVflow-based multi-channel AI vision system."

The CV25AQ can support various simultaneous, multi-camera channel combinations for recording and/or in-cabin sensing, with the entire system meeting Euro NCap 2025 standards. Additionally, it performs reliable visual processing under complex lighting conditions and plays a role in GWM's intelligent drive process.

The AI vision chip architecture has low power consumption and the AI engine accelerates various neural network algorithms.

There is support for the Automotive Ethernet AVB protocol and TC8 certification.

It is qualified to AEC-Q100 grade two.

Skyworks buys Silicon Labs automotive business for $2.7bn

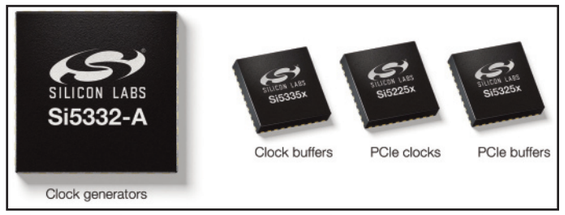
Skyworks is buying the infrastructure and automotive business of Silicon Labs for $2.75bn.

The transaction includes Silicon Labs' power, isolation, timing and broadcast products, intellectual property, and more than 350 employees. Silicon Labs and Skyworks say they will collaborate to ensure a seamless transition for customers, suppliers and employees.

"The outcome of this deal is a measurable testament to the industry-leading solutions and strong financial performance the world-class infrastructure and automotive team delivered the last 25 years," said Silicon Labs CEO Tyson Tuttle.

Mark Thompson, general manager of the infrastructure and automotive business, will join Skyworks, reporting directly to Liam Griffin, CEO of Skyworks.

"We are pleased to welcome the infrastructure and automotive team to Skyworks when this transaction is completed," said Griffin. "This acquisition will broadly expand our capabilities across high-growth end markets including automotive, communications and industrial, creating new and highly compelling opportunities for Skyworks."



Silicon Labs automotive grade timing products

Silicon Labs expects to receive an estimated $2.3bn in net proceeds after taxes and transaction fees. The company intends to return approximately $2.0bn to shareholders through a combination of special dividends and/or share repurchases after the transaction closes.

The boards of directors of both companies have approved the transaction, which is expected to close in the third quarter of 2021 subject to customary closing conditions and regulatory approvals.

Silicon Labs expects total Q1 revenue to be approximately $255m. This represents an increase of roughly five per cent sequentially and 19 per cent year-over-year.

After the divestiture, Silicon Labs will be a pure-play specialist in intelligent, wireless connectivity for the IoT.

Amphenol partners TactoTek to develop IMSE connectors

TactoTek and Amphenol are collaborating to develop automotive grade connectors for in-mould structural electronics (IMSE).

IMSE parts integrate printed electronics and electronic components within 3D injection moulded plastics. They combine structure, electronic functions and cosmetics in single piece, seamless smart surfaces.

TactoTek IMSE parts often connect to external system electronics or host systems.

"Standardised in-mould connectors further simplify integrating IMSE smart surfaces in all types of products, whether vehicles, appliances or smart homes," said Paavo Niskala, senior vice president at TactoTek.

TactoTek works directly with OEMs and brands to develop production-ready prototypes.

Call for urgent investigation into how cars communicate

An urgent investigation is needed into the technology that allows self-driving cars to communicate, according to researchers from Leeds University.

They say digital interfaces may be unable to communicate safety and legal information, which could result in accidents.

The team has produced a study arguing that the terms and conditions presented to drivers via an interface will be subject to intense scrutiny.

The researchers are calling for an urgent review of the technology before automated cars are introduced onto roads.

The research was supervised by Jo-Ann Pattinson and Subhajit Basu.

"The main safety messages surround the extreme difficulty most drivers will encounter when an AV suddenly transfers the driving back to them," said Basu.

Let's get digital

12-13 MAY 2021

STREAMING LIVE



Join us online this Spring for our Detroit edition of AutoSens

Through our powerful digital platform, we look forward to bringing you an interactive online event, including multiple livestream channels, chat and discussion, matchmaking, and more.

Find out more at auto-sens.com

AutoSens

Organised by SENSE MEDIA

LG lighting module boosts brightness and uniformity

LG Innotek has developed Nexlide-E, an automotive lighting module that produces bright and uniform light.

This module is made of three parts. First, an LED package acts as the light source and is mounted on a thin substrate. Then, optical resin covers the package and substrate for protection. Finally, a 0.2mm thick optical film is attached on top of the package to spread the light brightly and evenly.

The module can be used for taillights, stop lamps and headlights.

Maximum brightness has been raised from 80 to 130cd, an increase of 63% over the firm's previous product. Stop lamps in Europe and North America must be 110cd or higher.

Due to its brightness, this module can replace multiple automotive lamps with different brightness standards into one module. It also improves power efficiency, making it suitable for electric and hydrogen vehicles.

The optical film improves the lighting performance. A micropatterning technique in the film produces a variety of lighting effects.

Micropatterns can be changed according to the type of optical film to increase brightness by collecting the beam, produce a surface light source by diffusing the light or even produce a three-dimensional light shape.

This lets the firm produce custom lighting modules without complex design changes or using additional components such as an inner lens.

The first vehicle equipped with the Nexlide-E is expected to be mass-produced before the end of this year.

"The Nexlide-E is an innovative product that satisfies the customer needs for distinctive automotive lighting designs that give characters to vehicles," said vice president Insoo Ryu.



Nexlide-E automotive lighting module

The company is developing another type of optical film that further raises the brightness and uniformity of the light. It is also developing the Nexlide-C+, a 3D lighting module that produces 3D light shapes without any devices such as a half-mirror that assists 3D effects within a lamp.

Scania picks QNX as safety-critical OS

Scania has chosen Blackberry QNX to provide the safety certified operating system (OS) and hypervisor for its computing platforms in its next electrical architecture generation in heavy goods vehicles.

This will effectively build the high-performance backbone on a single software base.

Scania has committed to use QNX software in three ECUs for its digital cockpit, telematics and central co-ordinator platform to deliver a safe and secure foundation on which software can be developed.

"We chose Blackberry QNX due to the company's history in safety certified embedded software, combined with its cyber-security expertise," said Mikael Adelsberg, senior vice president at Scania.

QNX is used in more than 175 million vehicles globally. It has been pre-certified to safety standards including ISO 26262, and has been recognised by independent auditors at TÜV Rheinland as an Asil D safety-certified commercial hypervisor.

"The commitment from Scania to take on increased responsibility of its vehicles' software content is commendable, and we're excited to see this replicated across the market," said John Wall, senior vice president at Blackberry.

SENSORS

PROTECTING THE PROTECTORS



Simon Vogt explains how protection at sensor level can cut the cost of car repair

Manufacturing a car is both highly complex and expensive. It requires thousands of parts, including between 60 and 100 high-quality sensors, with many built into the engine to ensure the owner can identify and prevent possible issues before they result in breakdowns and expensive repairs.

Sensors are being deployed throughout the vehicle to meet evolving security and efficiency standards as well as to address environmental standards.

Engine sensors measure voltage, fuel temperature, oxygen levels and much more, ensuring the vehicle is operating at peak efficiency. Their use in today's connected car is already highly extensive and is set to increase exponentially.

In a report last year, consultant Deloitte says that by 2030 half the cost of a car will be accounted for by its electronics, of which sensors with semiconductors will be a major part. Consequently, these sensors will need to be protected to prevent increased breakdown.

Deloitte and Gartner predict the use of non-optical sensors such as environmental sensors, fingerprint, inertia and magnetic sensors will increase at a compound annual rate of more than seven per cent. By next year, the semiconductor content of a car will on average be $600, Deloitte calculates, although not all related to sensors.

The rise of adas has already vastly expanded the range of applications for sensors. Adas technologies are totally reliant on sensors to automate or assist with

a multiplicity of driver functions such as parking, blind-spot monitoring, safe braking and collision-avoidance. Adas implementation, according to Deloitte, is growing at a rate of 24 per cent a year.

This growth in the application of sensors will increase hugely with the switch to electric vehicles, which is by far the most significant development in the entire automotive sector. Governments in developed economies are now actively promoting the changeover. The UK government has, for example, forbidden the sale of diesel or petrol cars by 2030. EVs will require a multiplicity of sensors as part of a new approach to operation, maintenance and sustainability.

Looking further down the road, once autonomous vehicles have become part of everyday reality, sensor technology will be as utterly essential as the electricity in their batteries. Without camera, radar and lidar sensors, these vehicles are unable to function. Whatever the vehicle or its drive train, the problem remains that with many sensors necessarily exposed to the elements, something is bound to break, leak or need upgrading.

The increase in sensors is also being driven more recently by OEMs collecting data from their fleet on the road to report on malfunctions should they occur, as well as study the performance of their vehicles. The collected international data are then analysed by firms such as Tesla to understand how their products and systems are performing globally and to improve the design and manufacture of future cars.

The failure of sensors brings



Consumers' reliance and their expectations are growing

multiple risks. The first is it will result in damage to the car that will lead to the need for expensive repairs – and recent industry estimates indicate that some car parts can cost well over £1000 to repair or replace. The second is it will render the car unusable even if there is nothing mechanically wrong with the rest of the vehicle.

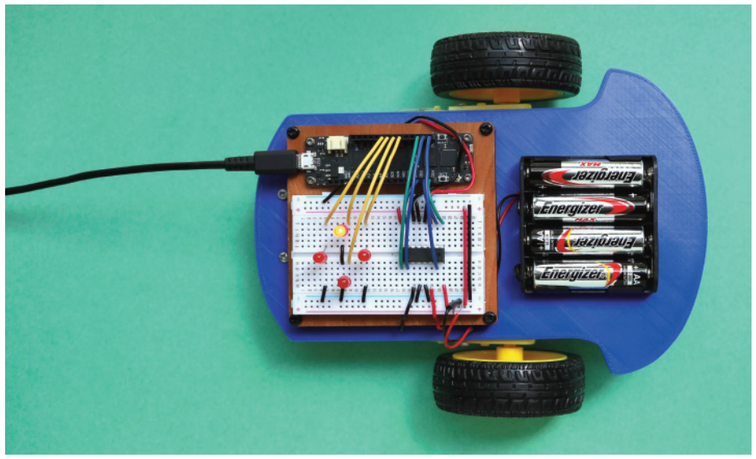
Either eventuality is likely to cause brand damage.

Failing sensors can also inflict significant environmental damage by causing an increase in emissions, alongside performance and drivability problems. There is also the risk of reporting back bad, unclear or no data to OEMs who collect data from their fleets on the road; this could have adverse impact on influencing the design and functionality of future products.

The level of impact sensor failure has on brand image becomes even clearer when the likely impact on the motorist is considered. When an individual is alerted to a fault with their car by a sensor, they have two options: get it looked at or not. If the fault allows them to continue to drive and it is not convenient for them to go get the car checked out, they will continue to drive the car, not knowing what damage they are doing.

Faulty sensors also raise stress levels. Consumers will either think repairs are going to be very expensive or worry about being stranded if their car breaks down on the road.

While the growth of adas is steady in vehicles, its associated functional features are becoming the new normal in the automotive market. Consumers' reliance and their expectations on these features to be fully functional have been growing. The latter makes it vital for sensors to be durable to avoid adverse consequences should they get damaged and, more importantly, to preserve consumer confidence.



Sensor technology will be as essential as electricity in car batteries

As vehicles become more dependent on sensors through the expansion of adas and replacement of combustion with electric motors, manufacturers may seek to reassure consumers by offering extended warranty periods in a bid to extend their market share. This may give confidence to some potential buyers, but no warranty or guarantee will be as effective in the market as technology that prolongs the life of devices and systems within each vehicle.

The ideal answer to the high cost of car repairs is protection at sensor level, including liquid proof coatings as opposed to mechanical sealing or conformal coatings, which can degrade when exposed to heat or vibrations. Lasting protection can be provided using the latest nano coating technology that chemically bonds the coating onto the printed circuit board assembly to give thermal durability.

This trumps mechanical seals, which add extra weight and require more space as well as lower the vehicle's energy efficiency and prevent automotive innovation.

Advanced but practical products such as liquid proof coatings can enable manufacturers to make sensors repairable so they no longer require replacement. This will increase vehicle reliability – a vital factor in the considerations of car-buyers.

It will also ensure vehicles are sustainable and environmentally friendly. It will make manufacturers better understand the performance of their fleet on the road and improve future vehicle design at a time when the entire automotive market is under heavy scrutiny.



Simon Vogt is CCO at P2i

SENSORS

RADAR LOVE

A look at the radar sensors Continental is showing at April's Auto Shanghai

Surround radars detect objects such as crossing vehicles, motorcycles and cyclists

For Continental, radar sensors have been a success story for more than 20 years. In that time, the technology company has launched a total of more than 100 million radar sensors on the market worldwide. And development continues.

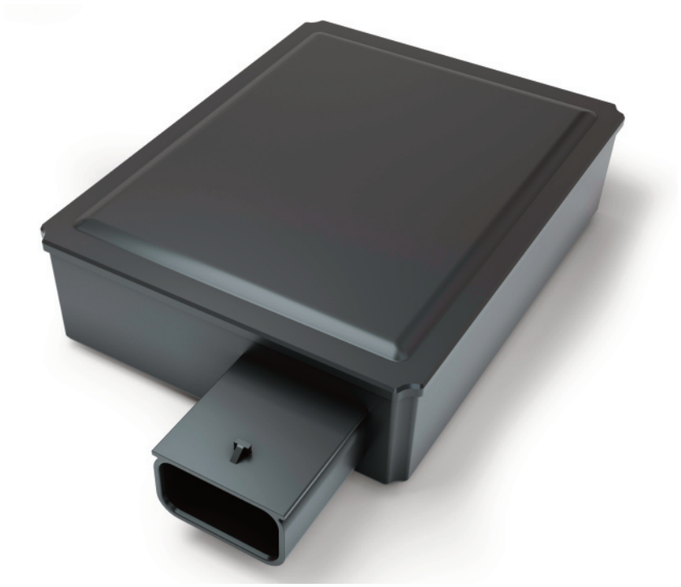
At Auto Shanghai (21-28 April), Continental is presenting the sixth generation of long-range radar and surround radar. Production is scheduled to start in 2023 and initial customer orders have already been received.

Both radar sensors share a software and hardware platform, reducing complexity and thus costs. Testing and development efforts on the customer side are also reduced. Performance is again increased compared with the fifth generation.

As they are scalable, the radars cover a range of applications: from Euro NCap requirements in an entry-level variant to the implementation of functions for higher levels of automation, such as automated lane change, in a premium variant.

The sensors can also be used to cover the requirements of the General Safety Regulation (GSR). Moreover, the radars support a range of vehicle architectures and types through their availability as smart radar, with data processing in the sensor and as satellite radar, with the processing of data in a central control unit.

“Radar sensors are a cornerstone of driving safety” said Frank Petznick, head of the adas business unit at Continental. “In the future, they will provide reliable data in increasingly challenging traffic situations. This includes, for example, autonomous emergency braking for crossing traffic at intersections and the early detection of motorised cyclists, which Euro NCap will also be testing in the future and which is important for automated lane changes. With the sixth generation of our radar sensors, drivers will be even safer and more comfortable on the road in the future.”



Long-range radar and surround radar share a software and hardware platform

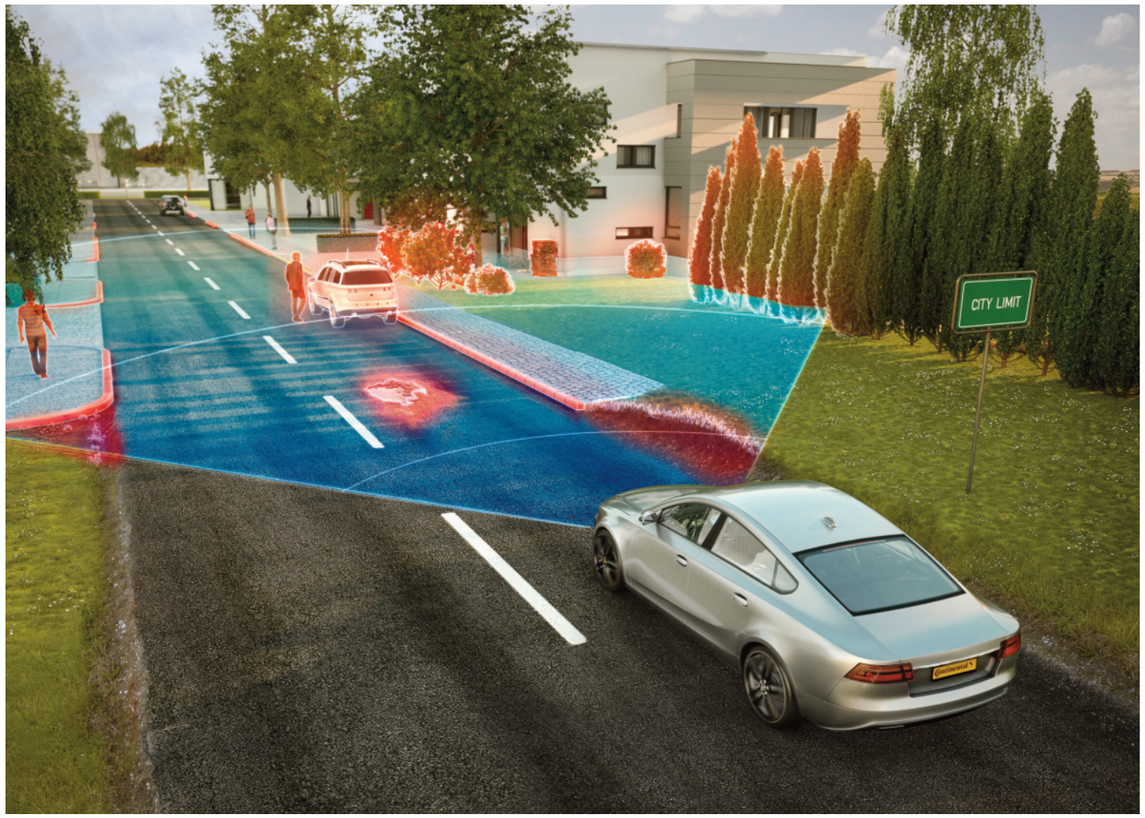
In addition to the development of long-range radar with a range of around 250m, the designs also focus on 360 degrees environmental detection. With a range of around 200m, these future surround radars have significantly greater range than previous short-range radars, thereby laying the foundations for good results in future NCap assessments of assistance systems.

Thanks to greater responsivity, surround radars detect objects such as crossing vehicles, motorcycles and cyclists earlier and more precisely, even when located in particularly difficult installation positions in the vehicle. Especially for the areas on the side of the vehicle, surround radars have features that make advanced driver assistance systems and automated driving more powerful.

Detection

To ensure reliable all-round monitoring of the vehicle’s surroundings using radar technology, radars must be placed at the front and rear corners of the vehicle, behind the painted bumpers. This is a challenge in terms of sensor technology, as reflection and absorption effects on the bumper structure and coating can affect radar signals.

The long-range radar in the middle of the vehicle front thus has a protective cover, a so-called radome, made of radio wave-permeable plastic over the sensor.



Long-range radar covers predictive applications for NCap up to automated driving functions

“This does not work at the vehicle’s corners but, at the same time, the requirements for resolution and range for object detection are increasing,” said Norbert Hammerschmidt, head of programme management radar at the adas business unit.

Several patent-pending ideas increase the responsivity of the radar sensors, which means that despite damping by painted bumpers at the corners, greater detection reliability is available.

In addition, the sensors, with dimensions of around 70 by 55 by 20mm without plug connector and holder, are almost 40 per cent more compact than the fifth generation.

This opens up integration options, for example in the vehicle sill, for implementation of a side radar.

“In general, with the sixth generation, we are also improving the initial conditions for installing radar sensors in the vehicle,” said Hammerschmidt. “Scaling in multiple power levels allows a wide range of vehicle segments to be covered with the Asil-B-compliant platform within a sensor series.”

The surround range and long-range radars work at 77GHz as standard but are prepared for the band between 77 and 81GHz and consequently offer the advantages of a larger frequency band.

Thanks to intelligent algorithms, radars in road traffic also filter out signals from other radar sensors – an important issue with increasing equipment rates – and process only their own signals.

Tried-and-tested properties of the current fifth generation of radar sensors have also been retained in the sixth generation. These include the modular and scalable hardware and software, which allows the sensors to be integrated equally into different electrical and electronic architectures with more or less local sensor intelligence. The scope of functions also includes auto-alignment for correcting a suboptimal sensor alignment.

TEST & MEASUREMENT



Benoît Derat, Mert Celik, Sebastian Schmitz, Winfried Simon and Andreas Lauer discuss augmented over-the-air testing, bringing together full-wave numerical modelling and antenna measurements

CHAMBER MUSIC

Vehicle Electronics

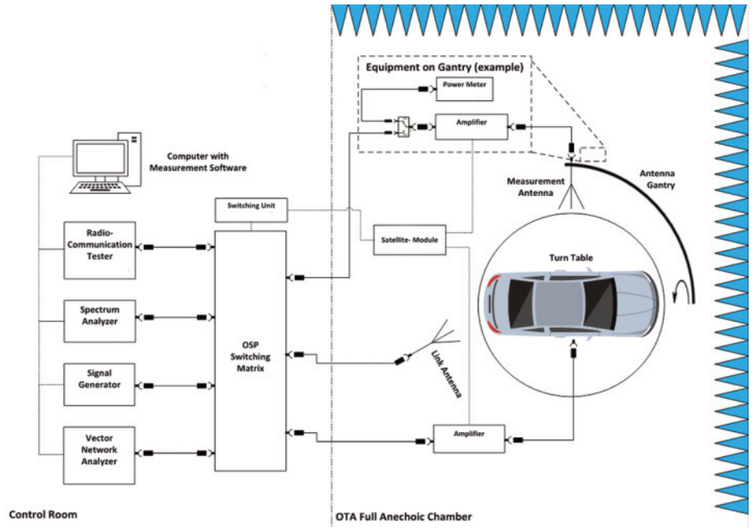


Fig. 1: Full-vehicle OTA test based on 5GAA draft requirements

Evaluating the realistic performance of antennas integrated into complex set-ups has been a long-term challenge, currently highly relevant to automotive connectivity, for example. Numerical electromagnetic modelling offers a cost-effective alternative to device testing, but is often limited by an incomplete or inaccurate knowledge of the device under test (DUT).

While this shortcoming does not apply to test approaches, the implementation of adequate measurement systems, such as full-vehicle over-the-air (OTA) test set-ups, requires large investments and possibly a significant amount of space.

However, there is a way to converge both worlds in an optimal cost-benefit technique, by combining antenna measurements with full-wave simulation.

Tools for 3D electromagnetic modelling have seen extraordinary technical and commercial developments since the early 1990s. Nowadays, there is almost no problem involving a resolution of Maxwell equations that cannot be solved with the right software and computational resources.

Nevertheless, the need for radio frequency measurements continues to grow, and simulations are not foreseen as a full substitute for testing in the near future. The main reason is that full-wave simulations, even performed by an expert, are only as good as the knowledge of the problem which is modelled. In most circumstances, this knowledge is incomplete, even for the device manufacturer.

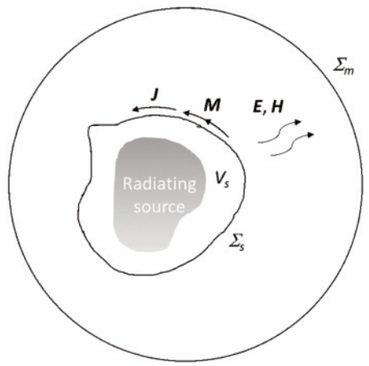


Fig. 2: Equivalent source calculated from complex voltage measurements over a sphere

Taking the example of a mobile phone, some components will come from suppliers, material dielectric properties are not fully characterised, manufacturing tolerances and operating uncertainties of the electronic components are not completely accounted for, and so on.

Measurements do not suffer from a similar lack of knowledge, as no simplifying assumptions are required about the DUT. However, the complexities of experimental set-ups including realistic integration or usage conditions have to be taken into account.

For example, for autonomous driving cars using cellular vehicle-to-everything (CV2X) technology for data communication, the connectivity in cars is developing to unprecedented levels. Evaluating the accurate performance of all transceivers – cellular, WLAN, GNSS and so on – then necessitates including the impact of the complete car on all radiated quantities.

To address these aspects, the 5GAA organisation is standardising the use of full-vehicle OTA testing systems, as shown in Fig. 1, involving the use of 10m or larger anechoic chambers.

The corresponding costs are as large because the space requirements and the realisable test scenarios are still limited. A close to real-world test would result in unreasonable effort, time

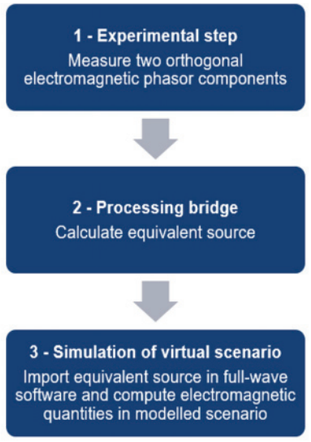


Fig. 3: Flow-chart of the measurement and simulation combination technique

and cost for measuring the OTA performance of an integrated 5G millimetre-wave antenna module. In addition, no test chamber will offer the possibility of assessing the effects of various grounds on the measured metrics, or an actual link budget in a car-to-car transmission.

To overcome the limitations in both antenna simulations and measurements, the best of both the numerical and experimental methods can be combined; measure the part of the problem that cannot be accurately modelled, and compute the portion which is too costly or complex to measure.

Combination

Combining measurements and simulations is a straightforward outcome of fundamental results in wave physics.

It is well-known from the Huygens-Fresnel principle or the equivalence theorem, that the six components of the electric E and magnetic H field vectors outside of the volume V_S, encompassing a radiating source within a surface Σ_S, can be exactly computed from only two of the electromagnetic field components over Σ_S, or associated surface electric and magnetic currents J and M, see Fig. 2. Conversely, proven techniques can solve the inverse problem of calculating the currents J and M, from two characterised components of E and/or H over a closed surface Σ_m, containing Σ_S.

Imagine now that Σ_m is a sphere surrounding an antenna. A test probe scans Σ_S and delivers two voltages at each sampling point, which relate to the local orthogonal spherical-coordinate phasor components E_θ and E_φ. Knowing the magnitude and phase of these voltages over the sphere is then sufficient to derive a model of the source, equivalent to the antenna under test, in the sense that it would generate the same E and H fields outside of Σ_S.

Once this new radiating object is created, there is no need to know the details of the DUT to model its operation and integrate it in a more complex environment. The new equivalent source can be imported in an electromagnetic simulator. Additional conditions can be introduced and more quantities computed to simulate the influence of nearby scattering objects on the radiation pattern, the link budget with another antenna, the exposure of a person standing in the near-field, and so on. The flowchart of Fig. 3 illustrates this combination technique.

Implementation

Although there are multiple ways to implement the three steps described in Fig. 3, we chose to detail here the one we selected as our example. The general principle of the approach could be applied in a completely different way, where planar near-field free-space scanning is used. The measured plane-wave spectrum serves as an equivalent source and the field in a nearby multi-layer dielectric object is later computed out of a transmission line model.

In the chosen example, the measurement data are acquired (step one) with a system including the fully anechoic mobile antenna measurement chamber, shown in Fig. 4, and a vector network analyser (VNA).

The chamber has tip-to-tip dimensions of 0.64 by 1.25 by 0.93m between absorbers and contains a distributed-axis positioner with a 360°-rotating azimuth table supporting the DUT, and a gantry arm providing

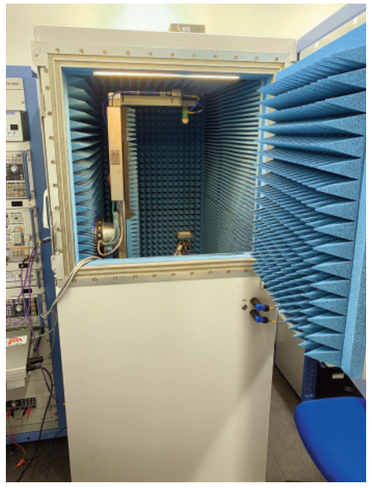


Fig. 4: Full anechoic chamber with spherical scanner – DUT positioned at the azimuth pole and measurement probe supported by the elevation arm

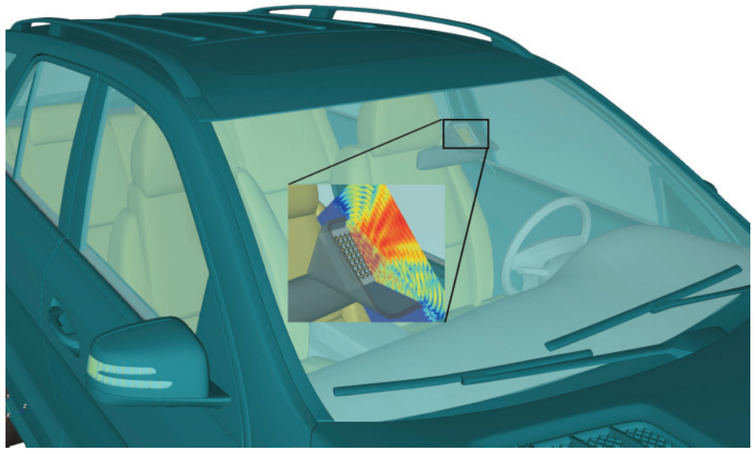


Fig. 5: 5G millimetre-wave antenna array integrated in the rear-view mirror of a car

elevations from 0 to 165°, which carries the measurement probe.

The achieved mechanical precision of this spherical scanner is better than 0.03° in both dimensions.

The probe is a dual-polarised Vivaldi antenna, suitable for direct far-field and spherical near-field measurements at frequencies from 12 to 90GHz. The probe tip retains a separation of 50cm from the centre of the coordinate system. This centre is accurately located using built-in lasers.

The centre of the DUT can be accurately positioned at this point, thanks to a crank at the azimuth, allowing fine DUT height adjustment.

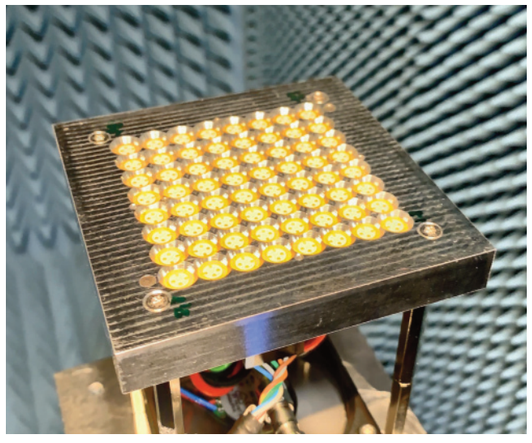
In the test setup, three ports of the VNA are used: port one feeds the RF signal to the DUT via a cable going through the azimuth pole; ports two and three collect received signals simultaneously by connecting to a feedthrough at the chamber side, from which two cables run to the two polarisation ports of the probe.

Rotary joints are integrated at both the azimuth and elevation, to avoid all cable movements. After a full measurement run, complex S_{21} and S_{31} are obtained for all acquired angular positions.

Step two is performed with the fast irregular antenna field transformation algorithm (FIAFTA). The FIAFTA has been developed at the Technical University of Munich and implements a generalised minimal residual equation solver for reconstructing equivalent currents over a triangular mesh covering Σ_S, out of the measured S-parameters.

The reference complex far-field of the test probe is injected in the algorithm, which integrates a full probe correction. The resolution of the inverse problem depends on the applied domain boundary conditions.

In this study, we applied the so-called Huygens radiator option, which assumes a fixed free-space impedance boundary condition at



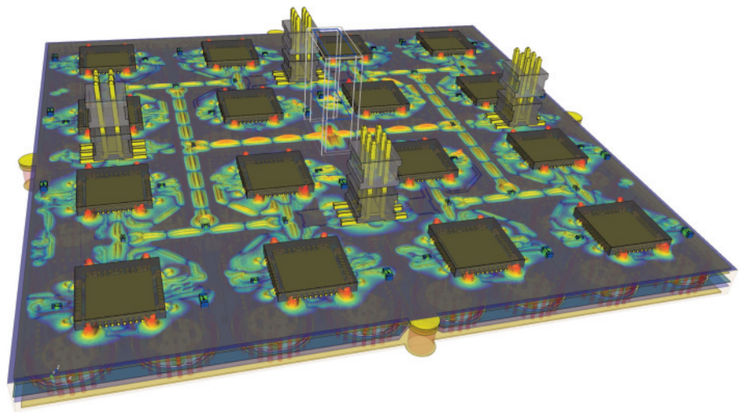


Fig. 6: 5G millimetre-wave phased antenna array: left – physical model, antenna side, placed inside the chamber; right – numerical model – chipset side, showing electric field at chip feed network and antenna feed

Σ_S. The advantage of this approach is to be computationally efficient and deliver solutions to the emissions problems, which are predominantly radiating towards the outside of Σ_S. Subsequently, Σ_S was chosen to be a rectangular box, closely encompassing the DUT.

In step three, the box of equivalent currents was used as an electromagnetic source in the finite difference time domain (FDTD) software.

To import the data correctly, equivalent currents were interpolated so the triangular mesh was converted into a cube. The original triangulation had to be fine enough to ensure the stability conditions of the FDTD were fulfilled. A sampling of $\lambda/15$, where λ is the free-space wavelength, was found to meet this requirement.

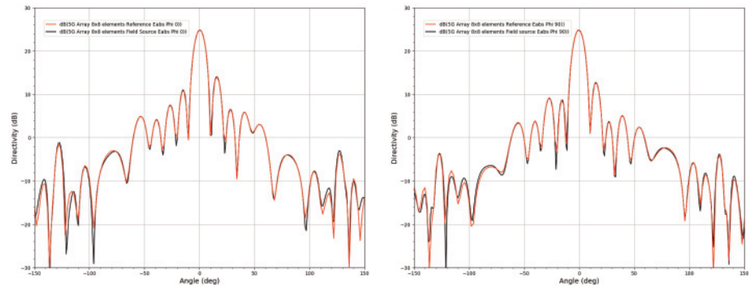


Fig. 7: Directivity patterns at 29GHz for the antenna array: near-field to far-field processed results (red), compared with results reconstructed with the combination technique (black) – azimuth j=0° plane (left); azimuth j=90° plane (right)

Measuring and simulating

Getting back to the full-vehicle OTA topic, using a system as described in Fig. 1 to evaluate the performance of a 5G millimetre-wave module integrated into a car is feasible, but extremely costly and time consuming.

First, the costs of a large positioning system with a mechanical accuracy that meets the requirements of near-field testing in this frequency range are extortionate. Secondly, the car is unlikely to be so positioned on the turntable that the antenna module is at the centre of the coordinate system.

Due to this offset and the small wavelength, the probe would have to scan the upper hemisphere, or at least a large portion of it, with angular resolutions of less than a degree. This results in extremely long test times, as distributed-axis positioners of the necessary size would show typical speeds of 6 to 12°/s in azimuth and 1 to 2°/s in elevation.

On the other hand, performing only a full-wave simulation of the antenna integrated within the car model is also not a completely suitable option, as it would suffer from simplifying assumptions and so cannot guarantee a suitable model of the real item.

We went on to study a use case of particular relevance, where a 5G millimetre-wave transceiver was integrated in the rear-view mirror, behind the windshield of a car, see Fig. 5. The basic idea was to use the measurements of the antenna module as an input to a full-wave computation, where the module was then virtually integrated in a numerical car model.

The specific implementation as described earlier was again used.

More precisely, the DUT was an 8x8 antenna array with RF front-end module, operating at Ka-band frequencies, see Fig. 6. It used a 1:8 divider to distribute the signal from one waveguide interface to 16 beamforming chipsets. Each chip fed four dual-port circular patch antennas and provided individual phase and amplitude control for every antenna element. Both a physical and a full numerical version of the array were available. The numerical model was as used to design the array, and included all accessible knowledge of its architecture and key parameters.

During the measurement step, the complete sphere around the DUT was scanned with 2° angular steps in both azimuth and elevation. To verify the results, two methods were used to compute directivity data.

First, the acquired near-field data were injected into FIAFTA. The algorithm was also used to create the equivalent current box, then imported in the software, where the fields were propagated via FDTD through the complete computational domain.

Secondly, a far-field multi-level fast multipole method (MLFMM) translation, also supported in FIAFTA, was used to compute directly the far-field radiation pattern out of the measurement data.

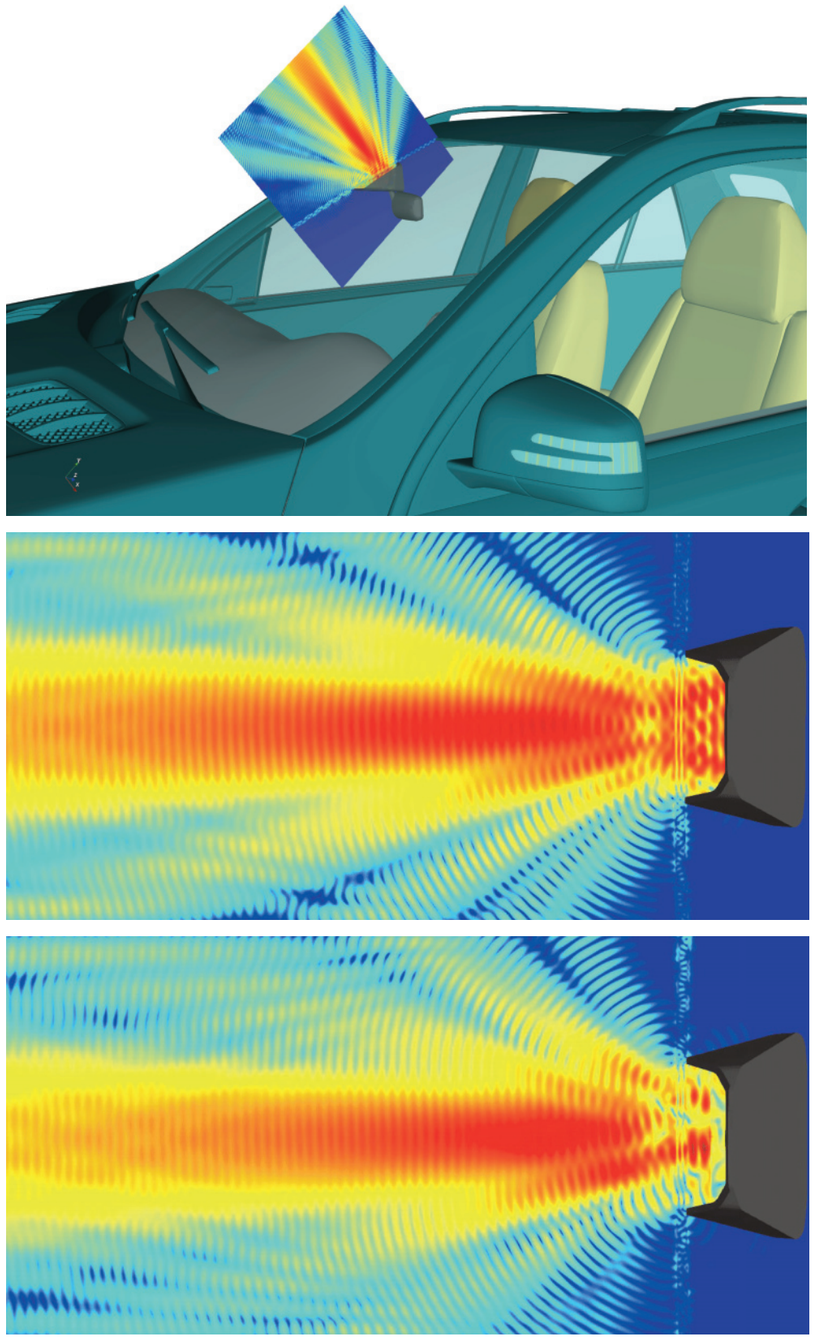


Fig. 8: Electric field magnitude at 29GHz in the vicinity of the integrated 5G antenna module (distributions using 40dB dynamic scale): (a, top) cut-plane orientation with respect to computed model; (b, middle) result of FDTD-only calculations; (c, bottom) result of combination technique

The results are compared in Fig. 7 and show very close agreement across the complete angular region.

Observations of additional near-field distributions at various locations demonstrate complete consistency between fields for $\sum_S$, obtained via FIAFTA only, or through the combination with the software.

In the next stage, the FDTD software was used to simulate the antenna integration into the car structure, see Fig. 5.

Computations were carried out with two different configurations: (i) 100%-numerical, where both the antenna and the vehicle were modelled; (ii) hybrid, where the combination technique was employed, so the array was only represented in the electromagnetic simulation by its measurement-based equivalent source.

Fig. 8 shows a comparison in electric near-field magnitudes at 29GHz calculated with approaches (i) and (ii) in a defined cut-plane. Field distributions show very good agreement, with some differences, especially in the region between the array and the windshield.

Fig. 9 provides the same comparison for far-field directivity patterns, where reasonably consistent results are shown when φ=0° cut. More deviations appear, especially in the sides lobes, when φ=90°.

Differences are to be expected. The FDTD model of the array does not take into account the production tolerances, or the tolerances in the operation of the actual electronics. Additionally, other error contributors arise, such as DUT modelling errors (for

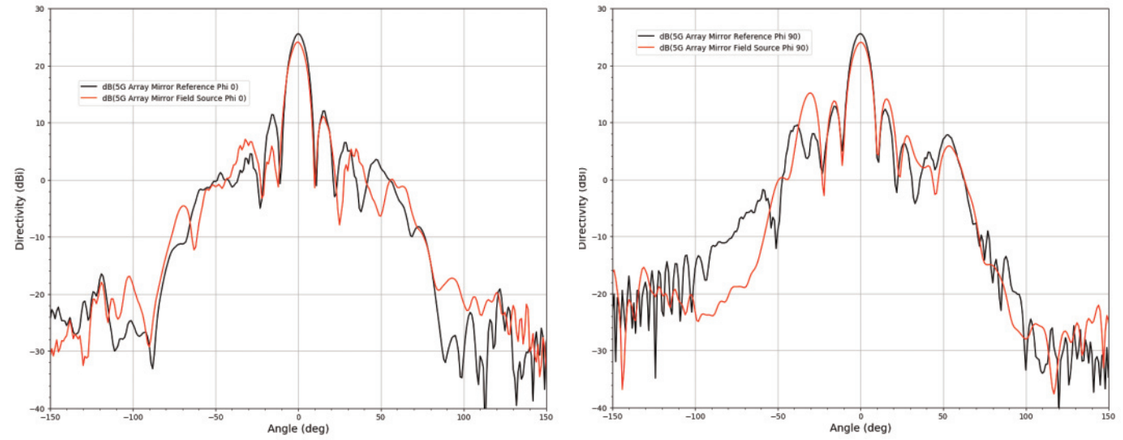


Fig. 9: Directivity patterns at 29GHz for the antenna array, obtained from: full-wave computation only (black); measurement – simulation combination (red) – azimuth j=0° plane (left); azimuth j=90° plane (right)

example imperfect knowledge of dielectric properties), measurement uncertainty, boundary conditions applied at $\sum_S$ for deducing the radiating currents, and so on. A more systematic uncertainty evaluation is certainly required. As such, it cannot not be claimed that either (i) or (ii) delivers the results which are closer to a real implementation.

The combined approach (ii) leads to a much higher computational efficiency than (i). In (i), simulating the full electromagnetic model of the array is rather challenging due to the fine details in the multi-layer structure of the 5G module, and the computational complexity of the scenario.

Simulating the full model requires a computational time of 180 minutes and a ram usage of 108Gbyte for 3600 million FDTD cells.

As these fine details disappear in (ii), the simulation complexity for the combined method drops to 320 million FDTD cells for the same calculation volume, requiring a calculation time of only 15 minutes and 10Gbyte of memory.

Conclusion

As the need to improve antenna designs and their performance in real use cases is constantly growing, along with the complexity of the associated scenarios, working towards converging measurements with the power of numerical computation seems to be an unavoidable way forward.

We presented an augmented measurement or augmented simulation technique, which goes in this exact direction and shows multiple advantages.

Numerical computation can be made more realistic, as no a-priori and in-depth knowledge on the DUT details, including its manufacturing tolerances, is required. Calculations become also more efficient (by a factor 12 in speed and 10 in memory in the studied use case), as much of the complexity in the radiating source modelling is then removed.

Measurements can be made more cost and time effective. In the studied case, a highly expensive full-vehicle OTA facility can be replaced by a 1.3m^2 spherical scanning chamber measuring just the array module.

The influence of the integration of the module in the car is then obtained by processing.

Future work will demonstrate the use of such a technique for further applications, involving measurements with active devices transmitting modulated signals, and including more systematic evaluation of uncertainty contributors.

Benoît Derat, Mert Celik and Sebastian Schmitz work in the systems and projects department at Rohde & Schwarz: Winfried Simon and Andreas Lauer work in the antennas and EM modelling department at IMST

CONCEPT CARS

LIFE AFTER COVID



Hyundai Mobis unveils mobility concepts reflecting post-Covid 19 era

At a conference at its R&D headquarters in Korea in March, Hyundai Mobis revealed two urban shared mobility concept cars, M.Vision X and M.Vision Pop.

The mobility platform has re-interpreted the passenger experience and communication methods from the viewpoint of interconnection and consideration in a contact-free age, and can entertain users through the convergence of new technologies.

"We worked hard to sublimate the changes in life people have had to cope with in the post-Covid 19 era with new mobility technologies," said vice president Cheon Jae-seung, head of the fundamental and advanced lab at Hyundai Mobis. "The new mobility platform, as presented by Hyundai Mobis, contains the spirit of technical exploration, which also enables people to share their thoughts and feel the joy of everyday life."

M.Vision X

M.Vision X uses all the windows as screens and provides contact-free communion with passengers.

Purpose built for four-seater mobility, it provides a customised experience based on a unique interpretation of interior space. X in M.Vision X means the expansion of communication (eXpansion), connected experience (eXperience), and expedition into a new space (eXpedition).

As the windows of the vehicle can be transformed into a display with a special theme (virtual space wall), it is possible to use all 360° transparent windows of the vehicle as screens for watching sports or performances.

Personalised control of the displays in M.Vision X is also possible. Several screens are installed in the windows of the vehicle. Some passengers may use the display as a transparent window and enjoy the outside scenery, while others may use it as a screen to watch a movie. It is also possible to change the indoor seats according to their purpose so they can be used both ways.

The core of M.Vision X is the vertical cockpit in the centre of the interior, which looks like a square pillar. On each of the four sides of the integrated centre cockpit is a 71cm display. This integrated centre cockpit communicates with passengers in a contact-free fashion using gesture recognition functions.

As a result, passengers can

control all driving-related functions, for example autonomous driving mode, AI speakers and infotainment. There is also a sterilisation function that uses UV lighting to sterilise the vehicle automatically once the passengers get out of the car.

M.Vision Pop

M.Vision Pop is a small mobility concept based on electric vehicles, developed under the theme of 'Tech Joy'. The focus was placed on giving users pleasure through a convergence of the latest technologies.

The core of Pop is what the firm calls 'phobility', a mix of the words phone and mobility. It means mobility enjoyed on a smartphone. It is technology that introduces the concept of smartphone and steering wheel docking to control the vehicle.

The smartphone in the steering wheel becomes the cockpit of the automobile itself. The smartphone navigation screen interfaces with the front display of the vehicle, and the user recognition or voice recognition function can be used as well. It is also possible to use smartphone sensors for wireless steering of the automobile.

As M.Vision Pop has an e-corner module, each of the four wheels of the vehicle can be rotated up to 180˚. As a result, crab driving, that is the vehicle moving from side to side like a crab, or even 360˚ rotation, is possible. This also makes parallel parking easier.

The e-corner module is technology that integrates the driving, braking, steering and suspension system in each wheel of the vehicle.

Cockpit

Hyundai Mobis also unveiled its latest integrated cockpit system called M.Vics.

This integrated cockpit is in the mass-production stage that integrates all the core technologies of Hyundai Mobis, such as adas, biometrics and blooming sound. In consideration of Covid-19, Hyundai Mobis produced a demonstration video of the integrated cockpit system, and a contact-free promotion targeting global automakers is underway.

Company

Hyundai Mobis is the seventh largest automotive supplier.



M.Vision X uses all the windows as screens

Founded in 1977 and headquartered in Seoul, it specialises in sensors, sensor fusion in controllers and software design capabilities in safety control. Its products also include various electrification components, brakes, suspension, steering, airbags, lights and automotive electronics.

The company has more than 30,000 employees and has been manufacturing in more than 30 regions in ten countries. In addition to its R&D headquarters in Korea, Mobis has technology centres in Germany, China, India and the USA.

At the conference, the firm announced its mid- to long-term strategy for growth moving its focus from automotive component hardware to software and transforming its business model into a platform-oriented company.

In accordance with the Hyundai Motor group's future strategy in electric vehicles, autonomous driving and urban air mobility (UAM), Hyundai Mobis is to reinforce its technologies as an affiliate.

"In the automotive industry, which is quickly evolving into a mobility platform ecosystem, the role of automotive suppliers needs to change as well," said executive vice-president Jung Soo-Kyung, head of the planning division. "We will expand our business as a leading company in platform-based systems that have integrated hardware competitiveness with software."

X-Y-Z

The growth strategy goes under the name Transformation X-Y-Z.

Transformation X is set to



The core of M.Vision Pop is phobility

innovate continuously as a global enterprise for future growth. Hyundai Mobis will use its core technological competences in the field of autonomous driving, electrification and connectivity to expand its business to global automakers. To this end, the company will continue to carry out open innovation such as strategic investment in global enterprises with promising technologies.

Currently, Hyundai Mobis is expanding its collaborations with various partners. Investments have been made in lidar company Velodyne, together with collaborative work for mass-production of a level-three lidar system.

Hyundai Mobis is also aiming to cooperate with Envisics, a UK-based AR-HUD specialist.

Secondly, Transformation Y is to innovate its business model with the company's core technological competencies. Hyundai Mobis will expand its business scope in the new mobility service markets. It is developing a level-four autonomous robotaxi through a technical alliance with Yandex, a Russian IT company.

For business model innovation, Hyundai Mobis is planning to provide dedicated platforms to global automakers or purpose-built vehicle companies. To build the value chain of a new mobility service, the company is also trying to secure smart factory infrastructure using AI and big data.

Thirdly, Transformation Z is set to find long-term new growth businesses and is related to conducting businesses based on innovative technologies. Hyundai Mobis aims to secure long-term growth engines in areas other than the existing automotive business in preparation for at least ten years into the future.

"Currently, we are looking for a business cooperation in the UAM business with the Hyundai Motor group and reviewing areas that Hyundai Mobis can enter as well as other business models," said Jung Soo-Kyung. "It is expected that it will be possible to utilise the business competencies of Hyundai Mobis to electric propulsion system and avionics in the UAM business."

To reinforce its R&D competency, the firm plans to increase direct R&D investment from KRW1tn to KRW1.7tn in 2025.

Touchscreen controller chip addresses large displays

An automotive-qualified touchscreen controller from Microchip is a single chip that addresses display sizes up to 114cm with a wide aspect ratio, supporting LCD and OLED technologies.



The MaxTouch MXT-2912TD-UW reduces the need for multiple touch controllers within a vehicle's HMI display.

This controller is said to provide the highest report rate for wide displays and is independent of the display resolution, helping achieve the same user experience that has become accustomed with a smartphone.

Also supported by the family's intrinsic signal-to-noise ratio, it enables detection and tracking of multi-finger thick gloves through various overlay materials and thicknesses, even in the presence of moisture.

Driven by ISO 26262, the controller contains safety related features, simplifying the display module system's path to functional safety certification.

These include periodic self-test, touch sensor test, internal flash and ram tests, full signal data path integrity checks, and additional microprocessor core testing.

The embedded firmware is developed to Automotive Spice processes.

To support the controller, complementary devices include low-dropout regulators, 8, 16 and 32bit microcontrollers, and Can and Can physical layer controllers.

Software support includes MaxTouch Studio development tool and MaxTouch Analyzer inspection tool for production line testing.

The controller is available in volume production.

Coreless sensor suits EV inverters

A coreless Hall-effect current sensor from Allegro Microsystems is for demanding automotive and industrial systems.

The ACS37610 sensor can measure currents from 100A to more than 4000A flowing through a busbar or PCB trace with a typical 1% accuracy, with no need for an external concentrator or U-shaped magnetic shield.



This can help designers improve efficiency and power density while reducing complexity, cost, footprint and weight.

The device is suitable for electric vehicle high-voltage traction motor inverters, 48 and 12V auxiliary inverters, heterogeneous redundant battery monitoring, overcurrent detection, smart fuses, power distribution units, and power supplies.

The 250kHz bandwidth, dedicated overcurrent and overtemperature fault pin, and built-in diagnostics make it suit safety-critical applications.

Differential sensing technology results in a 2.5x improvement in signal-to-noise ratio (SNR) and 2x lower noise relative to the ACS37612. The lower noise provides resolution for accurate torque control, while the sensor's 4x higher sensitivity enables flexible busbar and PCB designs.

While not mandatory, a slight notch to the current-carrying busbar or PCB copper trace provides further improvements to the SNR.

The ACS37610 has larger Hall element spacing – 2.5mm versus 1.8mm for the ACS37612 – to accommodate wider notches, resulting in virtually no thermal performance degradation and no hotspots.

ESD devices protect vehicle networks

ESD protection devices from Nexperia are aimed at protecting high-speed interfaces for in-vehicle networks associated with infotainment and vehicle communications.

As data rates increase and vehicles feature more electric content, the need for EMC protection becomes more critical. Providing the correct type of protection can be difficult for design engineers.

The firm's Treos technology optimises the three pillars of ESD protection – signal integrity, system protection and robustness – to deliver devices combining low capacitance, low clamping voltage and high ESD robustness.

The PESD4USBx series comprises twelve four-channel ESD protection devices that incorporate Treos.

Signal integrity is ensured by the low line capacitance for each channel – down to 0.25pF – and the sub-0.05pF line matching capacitance.

All have deep snapback combined with a resistance of 0.4Ω. With ESD protection up to ±15kV, they meet IEC61000-4-2 level four and ISO 10605. This is said to be the highest level of ESD protection available in this package size.

Supported interface standards include USB 2.0, Superspeed USB at 10Gbit/s, HDMI 2.0, HDBaseT and the increasing number of automotive AV monitors displays and cameras found in vehicles. The devices also support video links (serdes) GMSL, FPD-Link and LVDS.

They exceed the needs of AEC-Q101 by a factor of two. Furthermore, in the DFN2510D packages (sot 1165D and 1176D), side-wettable flanks are available as standard, allowing the use of automatic optical inspection.

The devices are available as samples and in production quantities.

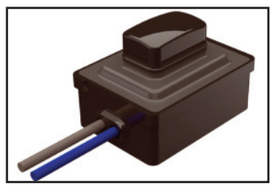


Pushbuttons handle harsh environments

Pushbutton switches from Premo have an electrical, mechanical and waterproof performance designed for vehicle access and other applications in harsh environments.

Many vehicles use keyless entry where LF antennas, pushbuttons and LEDs are assembled in the door handle.

The PB-Sx is a 100% sealed component against ingress of water and pressurised water (IP6k9), functional conditions (20k pulses underwater), and mechanical life endurance above 10E5 with a nominal push-force of 12 ±3N.



An interior design feature avoids breakage due to random assembly operations, where an external shear forces can be applied against the handle or even as a result of frictional impacts against a sidewall of the vehicle in narrow passages.

V2X module uses 5G

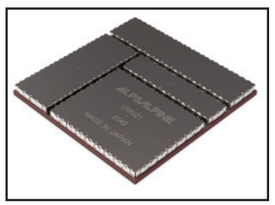
To accelerate social implementation of 5G for automobiles, Alps Alpine has developed the UMNZ1 5G NR module.

The automotive industry is poised to benefit from 5G given the transformations already underway in connected cars, autonomous driving, sharing and services, and electrification.

Used with V2X giving vehicles the capability to communicate and interact with everything around them, such as road infrastructure, other vehicles and pedestrians, 5G is expected to contribute to greater sophistication of in vehicle infotainment.

One application is enabling functions essential for autonomous driving.

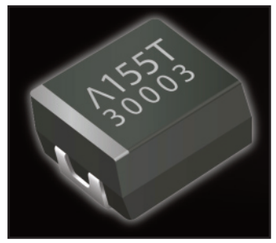
The module with C-V2X features complies with 3GPP release 15. By suppressing heat generation and using an original structure for dissipation of heat inside systems after mounting, module performance is increased.



Chip capacitor series expanded

AVX has expanded and improved its AEC-Q200-qualified TCQ series of automotive conductive polymer chip capacitors.

Two case sizes have been added bringing the total to five, plus there are several more capacitance and voltage ratings, 36 extra part numbers for a total of 52, and twice the reliability specified in AEC-Q200.



The capacitors have a compact and robust form factor that's suited to space-constrained, harsh-environment applications including body electronics, cabin controls, comfort and infotainment systems, aftermarket automotive electronics, DC-DC converters, and coupling and decoupling.

They have conductive polymer electrodes that enable a benign failure mode under recommended use conditions.

Previously available in three miniature, low-profile case sizes — B (EIA 1210 or EIA metric 3528-21), D (2917 or 7343-31) and Y (2917 or 7343-20) — the series now offers E (2917 or 7343-43) and U (2924 or 7361-43) sizes.

There are 52 part numbers with ratings spanning 10 to 470μF and 2.5 to 50V with a ±20% capacitance tolerance.

DC leakage is 0.1CV and operating temperature from -55 to +125°C.

They also satisfy AEC-Q200 humidity bias testing requirements of Ur at +85°C and 85% RH for 1000 hours due to materials, design and manufacturing innovations

They deliver endurance and stability for 2000 hours at +125°C.

The capacitors exhibit basic reliability of 1% per 1000 hours at +85°C and rated voltage with 60% confidence. They are also 3x reflow compatible at +260°C, lead-free compatible and RoHS compliant.

They are manufactured in an IATF 16949 certified facility. Parts are supplied with pure tin terminations on reels, and standard lead-time is approximately 20 weeks.

Demo board drives lasers up to 220A

A 200V, high current, pulsed-laser diode driver demonstration board from Efficient Power Conversion (EPC) is for use in lidar systems used to create 3D maps for autonomous vehicle applications.

Here, speed and accuracy of object detection is critical.

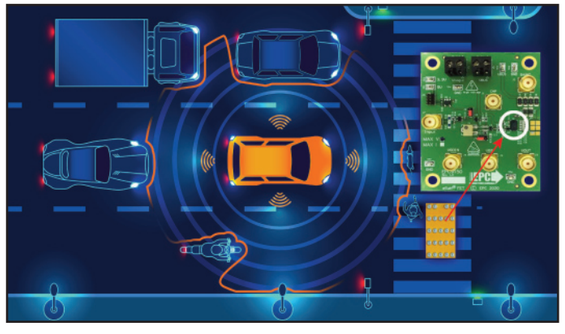
The rapid transition capability of the EPC2034C eGaN fets provide power pulses to drive the laser diodes, VCSELs or LEDs up to ten times faster than an equivalent mosfet and with less area, energy and cost.

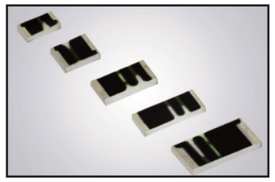
The eGaN fets and integrated circuits provide the high current pulses, narrow pulse widths and small size that make affordable, high performance lidar possible.

Using the 12mm^2 EPC2034C eGaN fet, the EPC9150 board can generate a 220A laser pulse peak in a pulse width that is 2.9ns wide. The high current increases the range of the lidar system, while the short pulse width leads to higher resolution.

The EPC9150 ships with an interposer board, which is a collection of break-away 5 by 5mm square interposer PCBs with footprints to accommodate different lasers, RF connectors and a collection of other footprints for experimentation with different loads.

The use of the interposers allows many different lasers or other loads to be mounted, allowing users to test the performance with the load requirements that are appropriate to their application.





Chip resistors

AEC-Q200 qualified thick-film chip resistors from Vishay Intertechnology have working voltages to 3kV, stability of 1.0% and power ratings up to 1.0W.

The Techno CRHA series is available in five case sizes from 1206 to 2512.

With their high voltage handling capability having a claimed better accuracy and stability than most standard thick-film chip resistors, the devices can help designers reduce component counts, placement costs and PCB size.

Resistance is from 2 to 500MΩ, with tolerances down to ±1.0% and temperature coefficients of ±100ppm/°C.

These specs make the devices suitable for battery management and voltage monitoring, division, and regulation in power inverters and high voltage power supplies for automotive, industrial and medical applications.

The resistors have solder-coated nickel barrier terminations in a three-sided wraparound configuration.

They are RoHS-compliant with exemption, and halogen free.

FPGAs target adas and infotainment

Lattice Semiconductor has expanded its Crosslink-NX family with FPGAs specified for automotive applications such as adas and in-vehicle infotainment.

The FPGAs bring low power, small form factor, high-performance IO and reliability to embedded vision applications for automobiles. They support embedded Mipi D-Phy interfaces with speeds up to 10Gbit/s.

Many automotive radar, lidar and camera sensors are based on the Mipi interface to leverage the economies of scale Mipi provides because of its use in billions of mobile devices over the years.

They meet AEC-Q100 up to grade two (TA = 105°C) and a claimed soft error rate up to 100 times lower than similar competing FPGAs.

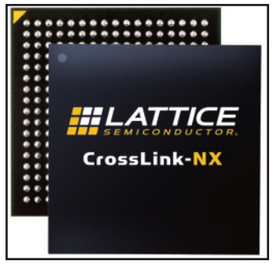
Built on the Lattice Nexus FPGA platform, which leverages an FD-SoI manufacturing process and FPGA architectural innovations to boost power efficiency, these FPGAs are said to deliver up to 75% lower power consumption compared with competing FPGAs. This provides thermal headroom for applications running at higher temperatures.

There is support for multiple fast IOs, including Mipi, PCIe (5Gbit/s gen two) and DDR3 memory.

Features include instant-on performance and IO configuration in 3ms; total device configuration is less than 15ms.

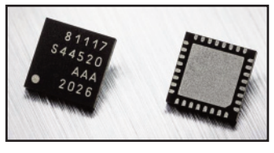
The FPGAs process image data using 170bit of memory per logic cell.

To facilitate the design of FPGA-based systems, they support the latest versions of the Lattice Radiant (v2.2.1) and Propel (v1.1) software tools. They are also supported by Lattice mVision and SensAI stacks so designers can use the stacks' modular hardware, reference designs, neural network IP cores and custom design services.



Driver enables animated lighting

A multichannel RGB LED driver from Melexis supports the Melibu high-speed communication licence-free IP which enables intelligent animated automotive lighting concepts.



The technology is already being leveraged by car manufacturers to enhance the safety features of their latest models.

The MLX81117 extends the Melibu product family with colour-mixing accuracy of delta UV of less than 0.01% to eliminate any distinguishable differences between LEDs.

The communication interface uses a Can-FD physical layer to deliver performance at up to 2Mbit speeds. Melibu also delivers intelligent and high-resolution operation to mitigate temperature-related colour drift, to maintain a consistent and non-distracting user experience under all operating conditions.

Front camera safety package

Renesas has announced a power and functional safety option for systems basedon the R-Car V3H SoC for adas automotive front cameras and driver monitor cameras.

It includes the RAA-271050, a 42V synchronous buck pre-regulator that accepts the vehicle's 12V supply and steps it down to an intermediate supply of 3.3 or 5.0V.

The RAA271000, a seven-channel PMIC, takes the RAA271050's output and steps it down further to the various supply voltages needed by R-Car V3H and its peripherals such as LPDDR4 memory.

Both devices were developed per ISO 26262, and can support safety requirements up to Asil D.

The system satisfies the power and functional safety requirements for the V3H. It provides supply voltages with the current capability to meet all power specifications, including sequence, voltage accuracy and load step response. For safety, it provides the necessary power and digital monitoring functions.

The RAA271050 and RAA271000 were designed to match R-Car requirements with no unnecessary overhead, reducing component cost and PCB area.

Renesas is providing reference hardware that includes the components, speeding design time and reducing testing.

Features include programmable output voltage, sequencing, IO configuration and safety configuration providing flexibility to support V3H and an expansive range of SoCs.

The integrated 12bit SAR ADC with up to 16 external inputs monitors internal and external signals, eliminating the need for an added ADC.

Dynamic voltage frequency scaling adjusts output voltage to reduce power consumption.





Current sensor for power analysers

Yokogawa has launched a current sensor element and upgraded the firmware for its WT5000 precision power analyser.

The enhancements can help improve performance when developing or evaluating electronic devices such as electric vehicle equipment or systems for solar and wind power installations.

The current sensor element runs off the internal DC power supply of the WT5000, making external power supplies unnecessary. This makes set up for measurements easier as the only things required are the current sensor and a connecting cable.

Three sensor connection cable lengths are available –- 3, 5 and 10m. This helps take account of varying test bench layouts, where the power analyser may not be next to the device under test.

The element also improves noise immunity with a low noise power supply and measurement circuit. Previously, reducing the signal-to-noise ratio required external shunt resistors. In this module, shunt resistors are built-in and are included in the shielding in the instrument, increasing noise immunity.

Also, current signals can be measured with a higher degree of precision, even if they are small when using the element and dedicated cable. A step-by-step navigation menu simplifies configuration and use of current sensors.

Firmware is upgraded, with the data streaming function supporting a 50ms to 1s update rate. On the previous version, when using the data streaming function, the WT5000 only offered an update rate measurement interval of 1s. This meant all electrical parameters, such as power and Urms and Irms, were calculated over a period of 1s.

The upgraded firmware also offers a 10ms update rate.

Hall sensor maps battery cells

A graphene Hall Effect sensor from Paragraf suits battery applications such as in the electric vehicle sector.

The GHS01AT is for use in relatively low field environments and normal ambient temperatures. Bringing the magnetic field measurement resolution towards that of more complex magnetic sensors, yet with the small size and ease of use of a Hall sensor, it can address monitoring tasks for which conventional technologies cannot be effective.

It can be used in battery cell analysis when investigating the validity of different battery cell chemistry derivatives and form factors under development. By using these magnetic sensors, it should be possible to get a more detailed and localised point-to-point understanding of battery cell behaviour.

Owing to the performance parameters that it delivers, detailed real-time current density – local cell internal resistance – mapping can be carried out with any variations at different locations in the cell being detected during repeated charge-discharge cycles. If hotspots arise, the local mapping of internal cell resistance in these areas could provide insights into the physical processes occurring in the lead up to their formation.

This might highlight early warning signs that could be monitored in service or scanned for during quality control. It may even provide the information to help develop battery chemistries and design concepts that safeguard against the risk of potential failure or thermal runaway.



The sensors can be used to measure the current flow into and out of cells. The method is an indirect means for measuring real-time magnetic field (current) data, so the battery cell itself and the tabs and busbars feeding into the cells are not disrupted during testing.

By using a 0.34nm thick graphene monolayer, the sensor is not affected by the presence of in-plane stray electromagnetic fields that could impact the accuracy of alternative sensing mechanisms.

The GHS array starter kit board enables simultaneous measurements to be taken from up to eight GHS01AT sensors.

Editor and Publisher:
Steve Rogerson
editor@vehicle-electronics.biz

Advertising Manager:
Diane Trotman
diane@vehicle-electronics.biz

Web Site Manager:
Martin Wilson
admin@vehicle-electronics.biz

Published by: Vehicle Electronics Magazine, 72 Westwood Road, Nottingham NG2 4FS, UK

Web site: vehicle-electronics.biz
Twitter: @velectronicsmag

© 2021 Vehicle Electronics
ISSN 2055-1177

Vehicle Electronics is available to readers worldwide. It will be published twelve times a year in a digital-only format. The magazine complies with GDPR. All rights reserved. No part of Vehicle Electronics may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying or recording on any information storage system, without the written consent of the publisher. The publisher cannot be held responsible for loss or damage to unsolicited press releases or photographs. Views of contributors and advertisers do not necessarily refelect the policy of Vehicle Electronics or those of the publisher.