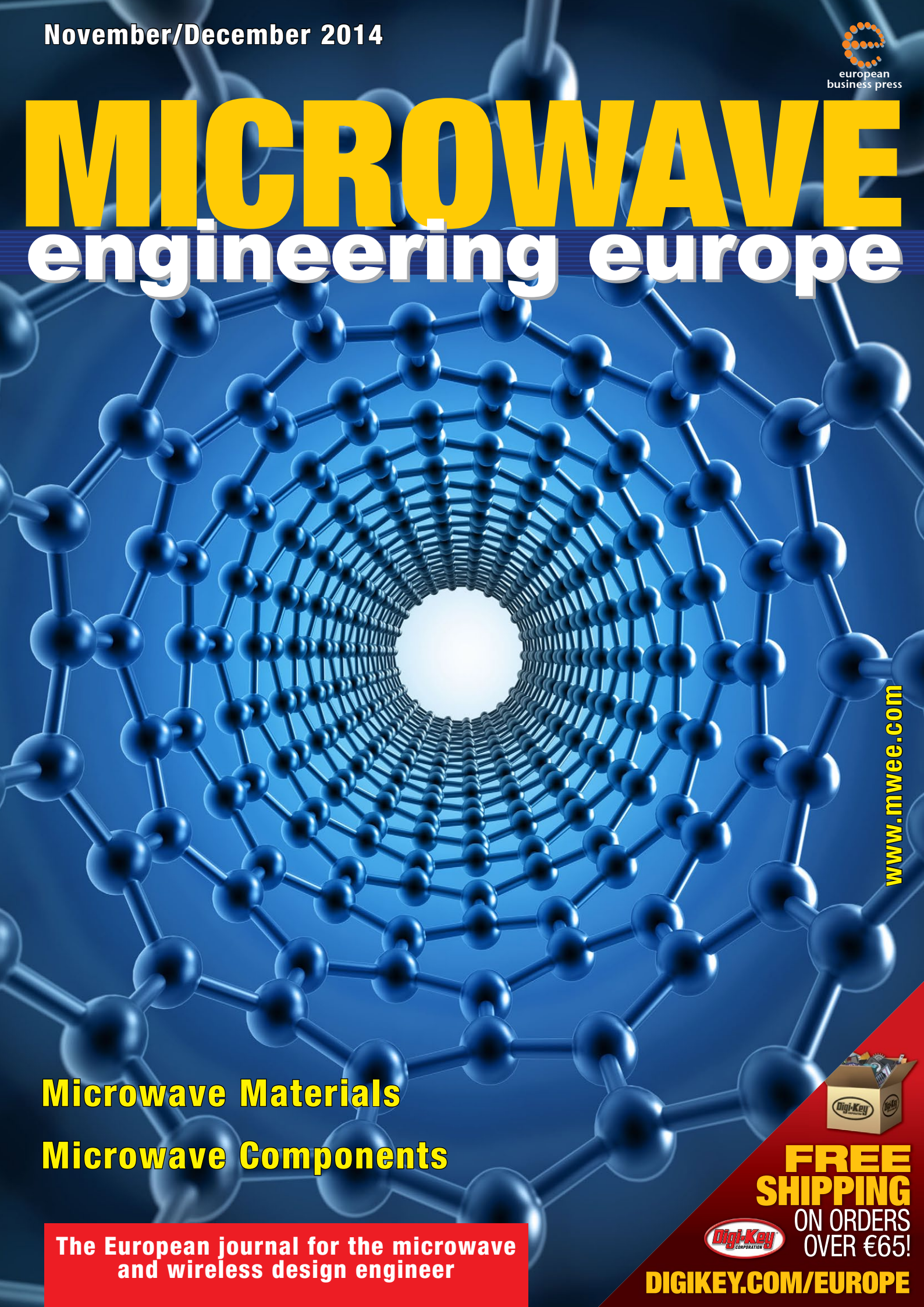
November/December 2014

european business press

MICROWAVE engineering europe



www.mwee.com

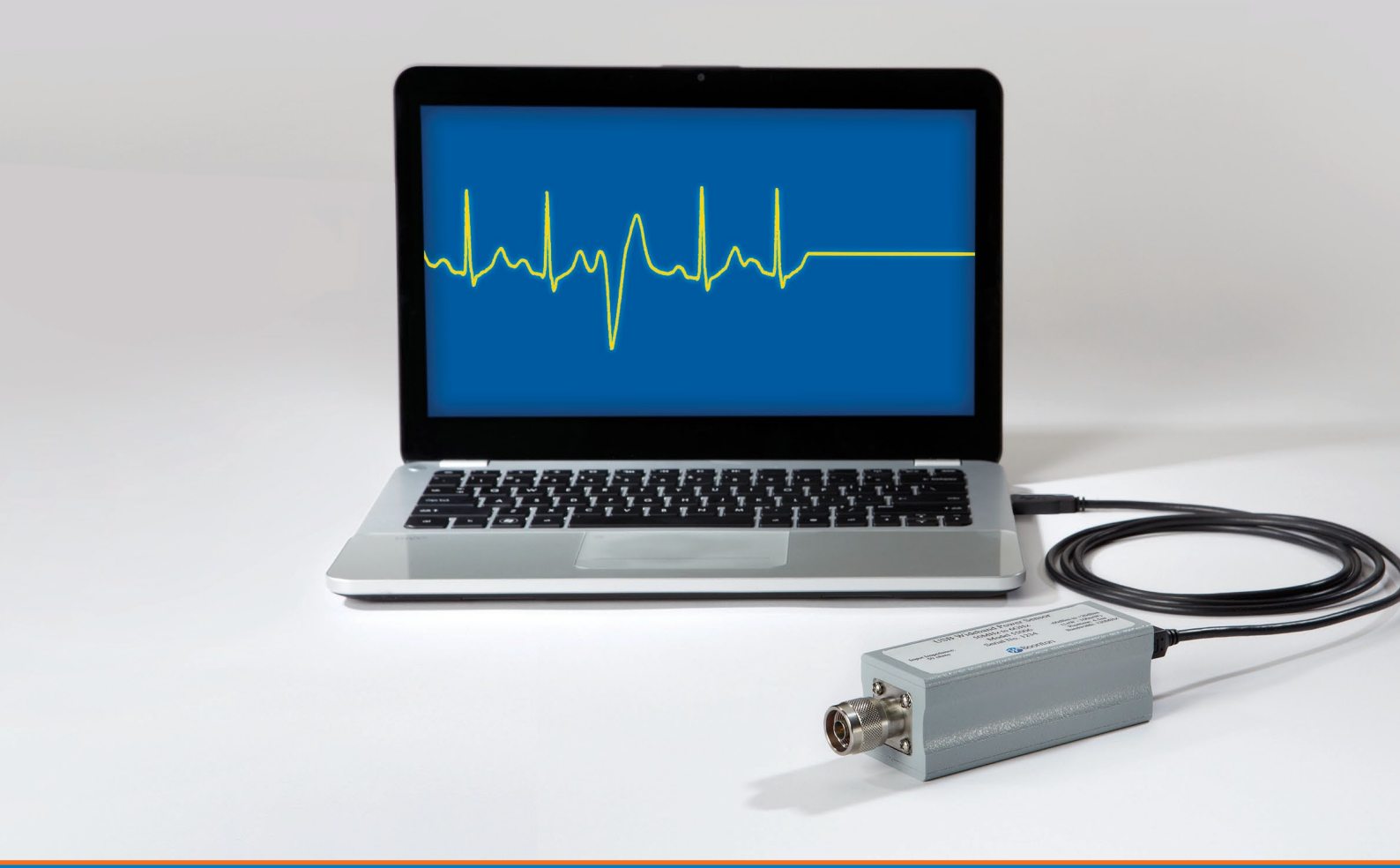
Microwave Materials

Microwave Components

The European journal for the microwave and wireless design engineer

FREE SHIPPING ON ORDERS OVER €65!
DIGIKEY.COM/EUROPE

Missing a Pulse Can Be Deadly.



The Smartest, Fastest and Only Real-Time USB Peak Power Sensor.

Don't fall victim to conventional power measurement techniques that will leave you missing valuable data - we capture every pulse with no missed glitches. The new **55 Series** delivers unsurpassed speed and accuracy for the most demanding RF power measurements thanks to Boonton's **Real-Time Power Processing™** technology. With this revolutionary technique, all processing steps take place in parallel, guaranteeing gap-free signal acquisition and reliable capture of all transients, dropouts or interference.

The new Boonton **55 Series** delivers real results no one else can see.

Taking Performance to a New Peak.

- Real-Time Power Processing™ for gap-free analysis
- 100 MSa/sec SUSTAINED sample rate is world's fastest
- 10 GSa/sec effective rate for superb waveform fidelity
- <5 ns risetime and 70+ MHz video bandwidth
- 100 ps time resolution for enhanced trigger stability
- Triggered acquisition speeds over 40,000 sweeps/sec
- Capture and analyze data more than 100x faster than conventional power sensors

For more information visit us at boonton.com or call +1 973-386-9696.

Watch measurements come alive with **Real-Time Power Processing™**

Wireless Telecom Group
Boonton Microlab Noisecom

Boonton

*A shipping charge of €18.00 (£12.00) will be billed on all orders of less than €65.00 (£50.00). All orders are shipped via UPS for delivery within 1-3 days (dependent on final destination). No handling fees. All prices are in euro and British pound sterling. If excessive weight or unique circumstances require deviation from this charge, customers will be contacted prior to shipping order. Digi-Key is an authorized distributor for all supplier partners. New product added daily. © 2014 Digi-Key Corporation, 701 Brooks Ave. South, Thief River Falls, MN 56701, USA

Contents

MICROWAVE engineering europe

Editor In Chief
Jean-Pierre Joosting
Tel. +44-7800 548-133
email: jean-pierre.joosting@eetimes.be

Advertising Production
Lydia Gijsegom
Tel +32 (0) 2 740 00 50
email: lydia.gijsegom@eetimes.be

Circulation & Finance
Luc Desimpel
Tel +32 (0) 2 740 0055
email: luc.desimpel@eetimes.be

Art Manager
Jean-Paul Speliers
Tel +32 (0)2 740 0052
email: jean-paul.speliers@eetimes.be

Accounting
Ricardo Pinto Ferreira
Tel +32 (0)2 740 0051
email: financial@eetimes.be

Publisher
Andre Rousselot
Tel +32 (0)2 740 0053
email: andre.rousselot@eetimes.be

European Business Press SA
7 Avenue Reine Astrid
1310 La Hulpe - Belgium
Tel: +32 (0)2 740 00 50
Fax: +32 (0)2 740 00 59
www.microwave-eetimes.com
VAT Registration: BE 461.357.437
RPM: Nivelles
Company Number: 0461357437

© 2014 E.B.P. SA

- All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording or any information storage or retrieval system without the express prior written consent of the publisher.
- The contents of Microwave Engineering Europe are subject to reproduction in information storage and retrieval systems.
- Microwave Engineering Europe is published ten times a year. Apply for a free copy of the journal online at www.microwave-eetimes.com/subscribe
- Subscriptions: Microwave Engineering Europe is available on subscription to others at 150 Euro. Refunds on cancelled subscriptions will only be provided at the Publisher's discretion, unless specifically guaranteed within the terms of the subscription offer. Paid subscription queries tel: +32 2 740 00 50
- Printed by Corelio

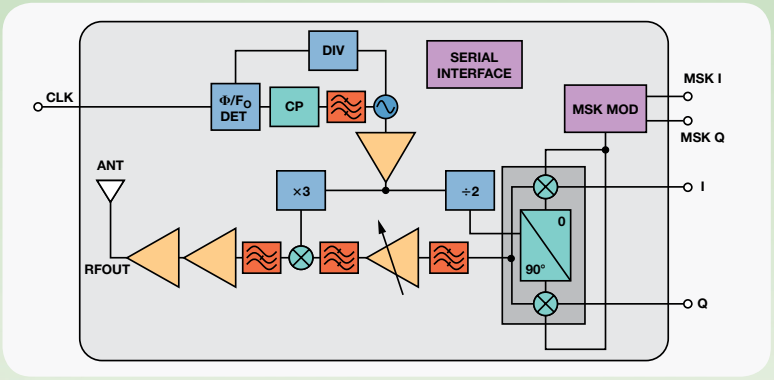
Superior Solutions for Multi-Gbps Communications and Sensors

60 GHz Antenna-in-Package Transceivers

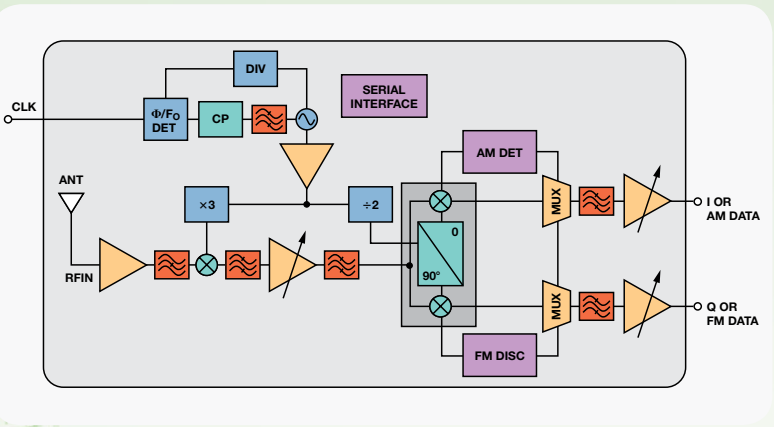
Gbps bidirectional data link solutions for wireless sensor, communications, and test applications

Features

- Covers 57 GHz to 64 GHz frequency band
- Complete analog baseband-to-RF solution
- Antenna-in-package (AiP), EIRP = 17.5 dBm
- Integrated frequency synthesizer
- Universal analog I/Q baseband interface
- Up to 1.8 GHz RF bandwidth
- Compact 7 mm × 11 mm QFN plastic packages



HMC6000LP711E transmitter.



HMC6001LP711E receiver.

60 GHz Transceiver Solutons

Part Number	Frequency (GHz)	Function	Antenna Gain (dBi)	P1dB (dBm)	NF (dB)	Maximum Gain (dB)	Gain Adjust (dB)	Phase Noise @ 1 MHz (dBc/Hz)	Package	Power Dissipation (W)
HMC6000	57 to 64	60 GHz integrated Tx	—	12	—	38	17	–86	Chip	0.8
HMC6000LP711E	57 to 64	60 GHz integrated Tx with integrated antenna	7.5	10	—	36	17	–86	AiP	0.8
HMC6001	57 to 64	60 GHz integrated Rx	—	—	6	67	65	–86	Chip	0.6
HMC6001LP711E	57 to 64	60 GHz integrated Rx with integrated antenna	6.5	—	6	65	65	–86	AiP	0.6
EKIT01-HMC6450	57 to 64	60 GHz integrated Tx/Rx evaluation kit	6.5 to 7.5	10	8	—	—	–86	—	—

Hittite™ MICROWAVE PRODUCTS FROM ANALOG DEVICES

analog.com/hittiteMW

ANALOG DEVICES

The coming age of smart factories

To compete with low labour cost countries, factories in Europe are looking at the idea of smart factories. Of course the key to all this is internet and wireless technology, or more specifically an industrial version of the Internet of Things (IoT).

An early example of this approach can be found at the Siemens Electronics Manufacturing Plant in Amberg (EWA), which represents an advanced example of the company's Digital Enterprise Platform — a production environment that could become standard ten years from now.

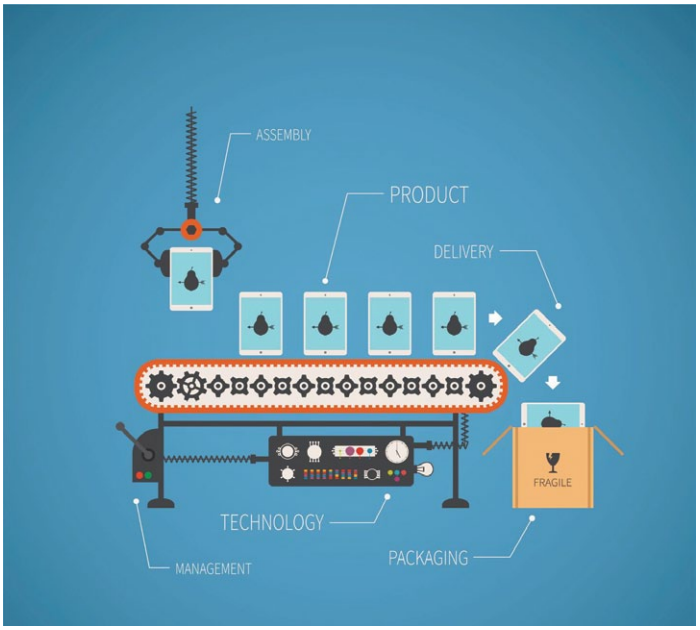
This system marks the a step towards the creation of Industry 4.0. A project in the high-tech strategy of the German government, Industry 4.0 promotes the computerization of the manufacturing industry. In the United States, an initiative known as the Smart Manufacturing Leadership Coalition is also working on the future of manufacturing.

Industry 4.0 promotes the idea of a fourth industrial revolution where real and virtual manufacturing worlds will merge. Factories will then be largely able to control and optimize themselves. However, this requires a lot of communication, both wired and wireless, much akin to the concept of the IoT.

With all the machine/sensor data on the cloud, analyses and actions can be taken to optimize manufacturing, predict failures, schedule maintenance, automatically replenish inventory, and even customize finished product specifications to reflect market dynamics. Throwing in 3D printing will even enable factories to make parts specific to a single product. Such customisation to a single unit would potentially cut costs dramatically for low volume industries. It could potentially enable one to order a customised product over the internet, which is delivered to the doorstep in days.

Maxim will be illustrating the power of this concept at Electronica 2014 with a Beer Mug Factory demonstration where visitors can get a free customized mug made in front of them—then have it filled up at happy hour!

Building smart factories will require adding intelligence and communications to systems, which will be achieved through the use of miniaturized processors, storage units, sensors, and transmitters that will be embedded in nearly all conceivable types of machines, unfinished products, and materials. Smart tools and 'intelligent' software agents will also be added to the mix for structuring data flows. Smart factories will be largely autonomous as even products will communicate with one another and with production systems in order to optimize manufacturing processes. Software agents will monitor each step and ensure that production specifications and regulations are complied with. The key here is that everything will have information embedded into it so that the factory software can optimise production.



Another important consideration is that of defects. Smart factories could bring the defect level down to almost zero. Siemens once again demonstrates this point at its Amberg plant. Among the products Siemens has produced at this location since it was founded in 1989 are the Simatic programmable logic controllers (PLCs). Amberg currently manufactures more than 1,000 versions of this product which controls machines and plants, and automates production. Simatic controls the onboard systems of cruise ships as well as industrial manufacturing processes. Simatic also controls production in Amberg itself. Products made for some 60,000 customers all over the world are ready for dispatch within 24 hours.

With a production quality rate of 99.9988 percent, the plant is a showcase factory in its field. Karl-Heinz Büttner, Head of the EWA, said, "I don't know of any comparable factory in the whole world that achieves such a low failure rate." The factory makes some 12 million Simatic products each year and, with 230 working days a year, this means that one product leaves the plant every second.

Production is largely automated. Machines and computers handle 75 percent of the value chain autonomously. Employees are responsible for the remaining quarter of the work. The only time a human hand touches the basic component – an unpopulated printed circuit board – is at the start of production when an employee places it on the production line. From that moment, everything is machine controlled.

While smart factories will be concentrated at a plant, they will borrow a lot of technology based on the emerging IoT. For security reasons smart factories would most likely close their networks and use hardware authentication methods to verify machines on the network. However, secure lines to the outside world will be needed to communicate with suppliers and customers. How security is implemented will be one of the challenges in developing smart factories to their maximum potential.

The IoT itself will be very widespread from consumer products such as running shoes through to medical devices and connected cars. Security here will also be a challenge in the near future.

In the end, smart factories are coming, whether driven by the need to compete with low-cost producers by driving down manufacturing costs or the need to eliminate defects in expensive high-end products, where failure is a costly proposition, or even to cater to a low-volume custom-product market.

By Jean-Pierre Joosting

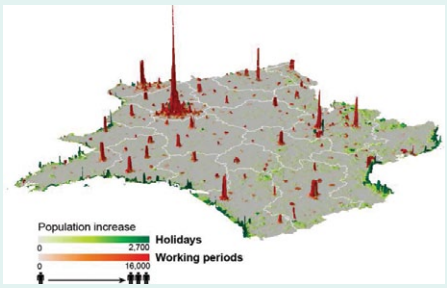
Mobile phones can be used for accurate population mapping

An international study, including the University of Southampton, has shown population maps based on anonymous mobile phone call record data can be as accurate as those based on censuses.

Their findings show maps made using mobile records are detailed, reliable and flexible enough to help inform infrastructure and emergency planners; particularly in low income countries, where recent population density information is often scarce. Southampton geographer and senior author on the study, Dr Andy Tatem, says: "Proving the resilience and accuracy of using mobile phone records to map populations was crucial for us, as it has many advantages over traditional census information.

"At the moment mapping of populations is constrained by the logistics of census surveys, which just provide a single snapshot of population distributions every ten years. However, anonymous phone data can be examined regularly to map daily, weekly or monthly changes across an entire country, at less cost and with greater flexibility.

"Every time a person uses a mobile it sends information to a receiving tower and gives an approximate location of where they are. When this information is repeated multiple times, over millions of users, we can extract a detailed picture of population density and how it changes over time in a given area."



Population increases in France are illustrated, with both work and holiday periods combined. Credit: Dr. Andy Tatem.

The team, led by the Université catholique de Louvain and the Université libre de Bruxelles and working as part of the WorldPop Project and Flowminder Foundation used the anonymised mobile phone records of 19m users in Portugal and France, for several months in 2007 and 2008, to generate maps showing the densities of users in different geographic areas. These maps were found to be as accurate as traditional census-based maps, which the researchers generated from data from the National Institute of Statistics and Economic Studies of France and the National Institute of Statistics of Portugal. Furthermore, by combining the mobile and census information with data from satellite imagery, the spatial resolution and accuracy of the census-based maps was greatly improved.

Smart watches in-use to reach over 100 million by 2019

A new report by Juniper Research has forecast that more than 100 million smart watches will be in use worldwide by 2019, with a host of premium brand launches over the next 12-18 months bringing the category into mainstream consumer consciousness.

According to the report, differentiation is now shifting from hardware towards other features that allow new capabilities, such as GPS and NFC connectivity. It argues that these functionalities are likely to become standard in the next few years, particularly as Apple has offered payment and NFC capability via the Apple Watch.

The report finds that smart watches will slowly gain more sales outlets as brands outside the technology sector, such as luxury watch maker TAG Heuer, enter the smart watch space; and high functionality and premium branding means that the average smart watch price will remain above $200 until 2020 at the earliest.

www.juniperresearch.com

Sensor market for handheld computers to triple

The market watchers from IHS estimate that the global revenue for sensors in smartphones and tablet computers will climb from $2.3 billion in 2012 to $6.5 billion in 2018, with emerging devices representing the fastest-expanding segment of this market. In this field, the IHS experts see a surge from just $24 million (2012) to $2.3 billion in 2018. In 2013 alone, this segment exhibited a dramatic growth when worldwide sales rose to $500 million - an increase by the factor of 20. The term 'Emerging sensors' refers to novel devices including fingerprint, optical pulse, humidity, gas, ultraviolet (UV) and thermal imaging. In contrast, "established" sensors in the sense of this market research include motion sensors, light sensors and MEMS microphones.

Apple initiated the market for fingerprint sensors in mobile devices with the release of the iPhone 5s in 2013. Against this background, IHS forecasts that shipments of fingerprint-enabled devices will reach 1.4 billion units in 2020 - more than four times the 317 million units expected to be shipped by the end of 2014.

www.ihs.com

Blu Wireless gets $3.7m for 60 GHz baseband IP

Blu Wireless has closed a $3.7m (£2.3m) funding round lead by a major international customer intending to exploit the company's HYDRA baseband System IP for new 60 GHz applications in 2016. The investment included $0.7m (£0.4m) follow-on funding from existing investors.

This investment will allow the company to drive further growth in the company, doubling in size to 50 staff, and bring to market the first high volume products using the HYDRA System IP by early 2016. HYDRA baseband technology uses a flexible parallel processing architecture to efficiently support the complex modulation schemes required for emerging multi-gigabit mmWave wireless communication standards.

www.bluwirelesstechnology.com

ET market to grow to 4 billion units by 2018

Envelope Tracking (ET) adoption rates will soar according to a new forecast analysis published by the global ET chip company, Nujira Ltd. The company's research predicts that the total market for ET will exceed 4 billion units a year by 2018, representing a $3 billion market opportunity over the next five years as ET becomes ubiquitous across the 4G smartphone market.

Since the launch of the first ET-enabled phone in 2013 the market has expanded rapidly with ET technology now featured in 15 flagship LTE phones from Apple, Samsung, LG/Google, HTC, Sony, ZTE and Amazon, with others in the pipeline. Nujira expects that those phones alone will account for around 125 million unit shipments of ET chips in 2014. In the next two years ET adoption is expected to cascade down from high-end smartphones to the mid-tier sector, which together are forecast by Strategy Analytics to surpass a billion units by 2016.

Nujira also expects that further opportunities will emerge for ET technology in WiFi, driven largely by the new high data rate 802.11ac standard. Today's WiFi PAs achieve less than 10% energy efficiency, and the market is ripe for high bandwidth ET solutions which can cut current consumption by 75%. Nujira anticipates that the first ET-enabled WiFi solutions will be shipping in 2016, with rapid adoption by 2018 across access points, smartphones, and "Internet of Things" applications – a potential market of 2 billion units a year.

www.nujira.com/market

Wearable technology market primed for growth

Twenty percent of American adults already own a wearable device and the adoption rate – on par with tablets in 2012 – is quickly expected to rise, according to PwC's Consumer Intelligence Series.

PwC's latest report, "The Wearable Future" is an extensive U.S. research project that surveyed 1,000 consumers, wearable technology influencers and business executives, as well as monitored social media chatter, to explore the technology's impact on society and business.

While fitness bands, smart watches and other wearables are already established in the market, many of them have under-delivered on expectations. Consider that 33 percent of surveyed consumers who purchased a wearable technology device more than a year ago now say they no longer use the device at all or use it infrequently. Price, privacy, security, and the lack of "actionable" and inconsistent information from such devices are among consumers' main apprehensions with the bourgeoning category. In fact, 82 percent of respondents were worried that wearable technology would invade their privacy and 86 percent expressed concern that wearables would make them more vulnerable to security breaches.

That said, 53 percent of millennials and 54 percent of early adopters say they are excited about the future of wearable tech. The top three potential benefits are: improved safety; healthier living; simplicity and ease of use

For wearables to be most valuable to the consumer, it needs to embrace the Internet of Things; transform big data into super data that not only culls, but also interprets information to deliver insights; and take a human-centered design approach, creating a simplified user experience and an easier means to achieve goals.

www.pwc.com/structure

Rohde & Schwarz demos 5G test setup

At the 5G Global Summit on October 20/21 in Busan (South Korea), Rohde & Schwarz presents a compact test setup for signal generation and analysis at frequencies up to 67 GHz. The setup comprises the vendor's high-end vector signal generator SMW200A for frequencies up to 20 GHz, a harmonics mixer from its subsidiary Radiometer Physics GmbH (RPG) and the spectrum analyser FSW67. This equipment enables users to evaluate new technologies for the 5G PHY air interfaces and thus drive the development of components, antennae and chipsets for future base stations and terminal devices.

5G is intended not only to enhance existing LTE and LTE Advanced mobile data networks but also create a novel technological framework for a range of usage scenarios which include support for a far higher number of communication terminals than today's networks.

www.rohde-schwarz.com

Utilities keen to own cellular networks

Many utility companies prefer to own a wireless network in order to ensure availability and reliability, and they have found that Long Term Evolution (LTE) may be a viable option for utility applications, according to the latest report from Heavy Reading 4G/LTE Insider.

"Recent major outages highlight two of the major reasons why utility companies sometimes consider owning and operating a cellular network: availability and reliability," notes Tim Kridel, research analyst with Heavy Reading 4G/LTE Insider and author of the report.

The cost and availability of spectrum are two major reasons why many utilities will continue to buy service from mobile operators rather than building their own networks, Kridel says. "The utility community continues to argue that it should have access to public-safety networks, spectrum or both," he continues. "If successful, those initiatives would mean a bigger addressable market for LTE vendors."

www.heavyreading.com/4glte

World's smallest wearable mouse

MindStream has announced ThumbTrack™, the world's smallest wearable mouse.

ThumbTrack™ is an ergonomic, wearable ring-shaped mouse that performs all the functions of a traditional mouse using simple thumb movements. The previous Indiegogo crowdfunding campaign raised $31,667, an indication of how much the public is interested this concept.

ThumbTrack™ is a high-tech mouse device offering a responsive 1200 dpi. A single charge of the onboard battery will last up to 15 hours; 7 days on standby. No software needs to be to installed. Three detachable contoured rubber flaps are included that enable it to be worn by all finger sizes.

CEO, Vanessa Laughlin, commented, "Sometimes all it takes to make a good idea into an outstanding one is a bit of innovative thinking. This is exactly what MindStream did when creating ThumbTrack™, the world's smallest wearable mouse."

ThumbTrack™ is the wireless and wearable mouse that fits perfectly on the index finger, and is comfortably worn on either the left or right hand. Forget about cables as none are required. A micro-USB-dongle acts as a wireless receiver that is effective for up to nine feet. It also fits securely in the device's back flap for easy storage.

Laughlin added, "The standard desktop mouse is now relegated to history, a sign of things past. Gone are the risks of Carpal Tunnel Syndrome, or other repetitive strain injuries. Uncomfortable working positions are also a thing of the past. Work without tense muscles and watch output soar."

The team at MindStream has already invested major resources into R&D in order to get ThumbTrack™ where it is today. Over a year in development, several prototypes were built as the design was gradually improved.

www.indiegogo.com/projects/thumbtrack-wearable-mouse-better-than-ever

Sensor uses radio waves to detect subtle changes in pressure

Stanford engineers have invented a wireless pressure sensor that has already been used to measure brain pressure in lab mice with brain injuries. The underlying technology has such broad potential that it could one day be used to create skin-like materials that can sense pressure, leading to prosthetic devices with the electronic equivalent of a sense of touch.

A nine-member research team led by Chemical Engineering Professor Zhenan Bao detailed two medical applications of this technology in Nature Communications.

In one simple demonstration they used this wireless pressure sensor to read a team member's pulse without touching him. In a more complex application, they used this wireless device to monitor the pressure inside the skull of a lab mouse, an achievement that could one day lead to better ways to treat human brain injuries.

Bao's wireless sensor is made by placing a thin layer of specially designed rubber between two strips of copper. The copper strips act like radio antennas. The rubber serves as an insulator.

The technology involves beaming radio waves through this simple antenna-and-rubber sandwich. When the device comes under pressure, the copper antennas squeeze the rubber insulator and move infinitesimally closer together.

That tiny change in proximity alters the electrical characteristics of the device. Radio waves passing through the two antennas slow down in terms of frequency. When pressure is relaxed, the copper antennas move apart and the radio waves accelerate in frequency.

The engineers proved that this effect was measurable, giving them a way to gauge the pressure exerted on the device by tracking the frequency of radio waves passing through the device.

National Instruments joins CROWD for 5G

5G wireless networks will represent a major departure from today's wireless networking structures in terms of bandwidth, management, flexibility and many other aspects. Currently, the state of 5G technologies is in deeply in the pre-commercial phase. National Instruments (NI) now has entered joined EU research project CROWD to define 5G wireless technologies.

CROWD stands for Connectivity management for energy Optimised Wireless Dense networks and is one of the European Union's Framework 7 projects. The consortium researches the combination of small- and large-density cells in a heterogeneous wireless network for an efficient architecture in which small cells meet traffic hot-spot needs while large cells offer reliable coverage for high-mobility users. As a CROWD member, NI will research reliable high-speed data access at all points in dense networks through small cell densification.

ni.com/5g

Qualcomm set to snap up CSR to cover the IoT

Qualcomm Incorporated has announced that it has reached agreement with CSR plc regarding the terms of a recommended cash acquisition through which the entire issued and to be issued ordinary share capital of CSR will be acquired by Qualcomm Global Trading Pte. Ltd, an indirect wholly owned subsidiary of Qualcomm Incorporated.

The acquisition complements Qualcomm's current offerings by adding products, channels, and customers in the important growth categories of Internet of Everything (IoE) and automotive infotainment.

At £9.00 per share, the acquisition of the entire issued and to be issued ordinary share capital of CSR is valued at approximately £1.6 billion ($2.5 billion based upon an exchange rate of USD:GBP 1.6057). This cash offer has been unanimously recommended by the CSR board of directors.

www.hubersuhner.com

Multi-DUT PXI approach reduces small cell manufacturing cost

By Thomas Deckert, Senior Systems Engineer, National Instruments, www.ni.com

Small cell base stations are a key technology that will increase capacity and coverage of today's cellular mobile networks. In fact, the growth in the small cell industry is creating a new cost structure of base station manufacturing test. Due to the growth in small cell deployments, base stations are becoming an increasingly high-volume product. As a result, challenges such as reducing the cost of test and maximizing test throughput are becoming increasingly important in device manufacturing. Multi-DUT testing can provide great cost and throughput benefits. This article talks about the major aspects of setting up multi-DUT test systems and also discusses the advantages of the PXI modular platform to implement such systems.

Small cells – high-volume production demands low test cost

As the adoption and usage of smart phones continues to rise, mobile network operators see the demand for data rate and coverage growing – exponentially (Figure 1). Cisco's Visual Networking Index estimates that from 2013 to 2018 there will be an 11-fold increase in global mobile data traffic. A view commonly held in the industry is that by 2020 operators must improve mobile network capacity 1000-fold, compared to the beginning of the decade to meet market demands.

Smalls cells are a critical technology in addressing the challenge of delivering higher network capacity. Their coverage area is much smaller than that of traditional "macro cells" (couple of 100 meters versus several kilometers). Small cell base stations operate at lower transmission power, have a smaller size and cost less than macro base stations. However, mobile operators will install – and vendors must manufacture – them in much larger numbers than their bigger counterparts (Figure 2).

A number of engineering challenges arise from testing small cell base stations in a high-volume manufacturing environment – and one of the largest concerns is the cost of test.

A big factor in lowering test cost is to increase test throughput. Increase in throughput improves overall production output – and one of the most basic ways to improve throughput is to use high-speed test equipment. Another important factor test engineers should consider is how much their test equipment is utilized.

Utilize your equipment

One of the most important first steps in optimizing a manufacturing line is to better utilize test equipment. In typical manufacturing test of traditional base stations, expensive components such as spectrum analyzers, vector signal analyzers and generators frequently sit idle for long periods of the time. One of the first steps to maximizing test equipment utilization is to use advanced test executives such as TestStand to implement optimized test procedures that allow pipelined, quasi-parallel testing of multiple devices. To fully appreciate the importance of this approach, let us first have a look at the steps taken in typical manufacturing test and then consider specific aspects of multi-DUT testing in more detail.

Anatomy of a typical manufacturing test

Each produced base station goes through a series of manufacturing test steps that characterize and verify the device (Figure 3). First, the test stand operator loads the unit into a fixture,

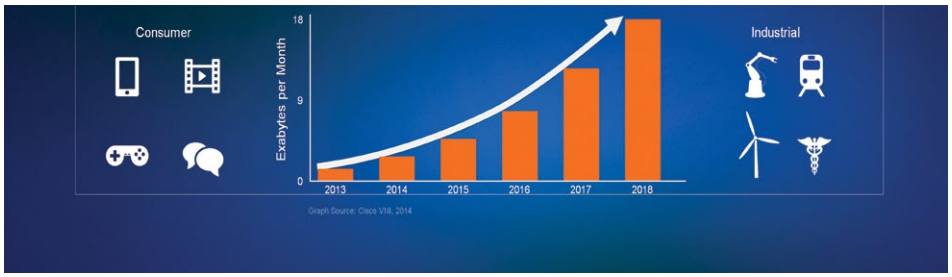


Figure 1: Mobile data traffic increases exponentially.

Figure 2: Small cells can provide cost-effective coverage and vast capacity in dense urban areas and indoor environments.

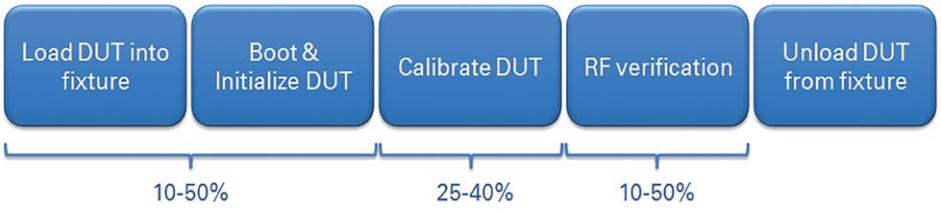


Figure 3: Phases in small cell base station manufacturing tests and typical relative duration.

Redefining RF and Microwave Instrumentation

with open software and modular hardware

Achieve speed, accuracy and flexibility in your RF and microwave test applications by combining National Instruments open software and modular hardware. Unlike rigid traditional instruments that quickly become obsolete by advancing technology, the system design software of NI LabVIEW, coupled with NI PXI hardware, puts the latest advances in PC buses, processors and FPGAs at your fingertips.

WIRELESS TECHNOLOGIES

National Instruments supports a broad range of wireless standards, including:

- LTE
- 802.11a/b/g/n/ac
- WCDMA/HSPA/HSPA+
- GSM/EDGE
- CDMA2000/EV-DO
- Bluetooth

>> Learn more at ni.com/redefine

Follow us on *Search* **National Instruments** *or* **LabVIEW**

Austria 43 662 457990 0 ▪ **Belgium** 32 (0) 2 757 0020 ▪ **Czech Republic, Slovakia** 420 224 235 774 ▪ **Denmark** 45 45 76 26 00
Finland 358 (0) 9 725 72511 ▪ **France** 33 (0) 8 20 20 0414 ▪ **Germany** 49 89 7413130 ▪ **Hungary** 36 23 448 900 ▪ **Ireland** 353 (0) 1867 4374
Israel 972 3 6393737 ▪ **Italy** 39 02 41309277 **Netherlands** 31 (0) 348 433 466 ▪ **Norway** 47 (0) 66 90 76 60 ▪ **Poland** 48 22 328 90 10
Portugal 351 210 311 210 ▪ **Russia** 7 495 783 6851 ▪ **Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Macedonia** 386 3 425 42 00
Spain 34 (91) 640 0085 ▪ **Sweden** 46 (0) 8 587 895 00 ▪ **Switzerland** 41 56 2005151 ▪ **UK** 44 (0) 1635 517300

NATIONAL INSTRUMENTS

©2013 National Instruments. All rights reserved. LabVIEW, National Instruments, NI and ni.com are trademarks of National Instruments.
Other product and company names listed are trademarks or trade names of their respective companies. 04749

where the device boots, and may perform a self-test or load firmware. The next step is to calibrate the RF frontends. Then, typical RF transmitter and receiver tests verify items such as delivered output power, frequency error and linearity against specified limits to produce a pass or fail verdict.

The majority of test plans for base stations will execute each measurement sequentially – performing the entire suite of test steps on a single device before moving on to test the next unit. The problem with this approach is that RF test equipment is used only a fraction of the time to do calibration as well as transmitter and receiver tests. Depending on the complexity of the product and the test plan, RF measurements typically take between 30 and 50 percent of the time; the other 50 to 70 percent the RF equipment remains idle (Figure 3).

For large base station equipment that is capable of spanning macro cells, poor test equipment utilization might be acceptable: Such products are made in moderate volumes and typically sell for a lot more than a small cell base station. Small cell base stations more resemble a consumer-grade product in that they are made in larger quantities and come at a lower price than macro equipment. Multi-DUT testing is a cost-efficient approach used by handset manufacturers for some time now. The same technique holds substantial benefits for small cell testing as well.

Multi-DUT testing

Multi-DUT testing (also known as "multi-site") is an advanced test procedure that has the explicit goal of maximizing the utilization of the more valuable test assets such as RF vector signal analyzers. Implementing a multi-DUT test plan requires test engineers to reorganize their test sets and procedures such that they can pipeline the DUTs through the individual test phases (Figure 4). From these modifications, they can reap tremendous benefits in utilization of the instrument and, ultimately, in the cost of test.

There are several questions one may ask in this process: How many devices should be tested in parallel? How must a test be structured for efficient pipelining of the individual phases? What about software and processing requirements? What is a good switching concept to route all the relevant signals from the multiple DUTs to the test equipment? Let us address each of these questions in a bit more detail.

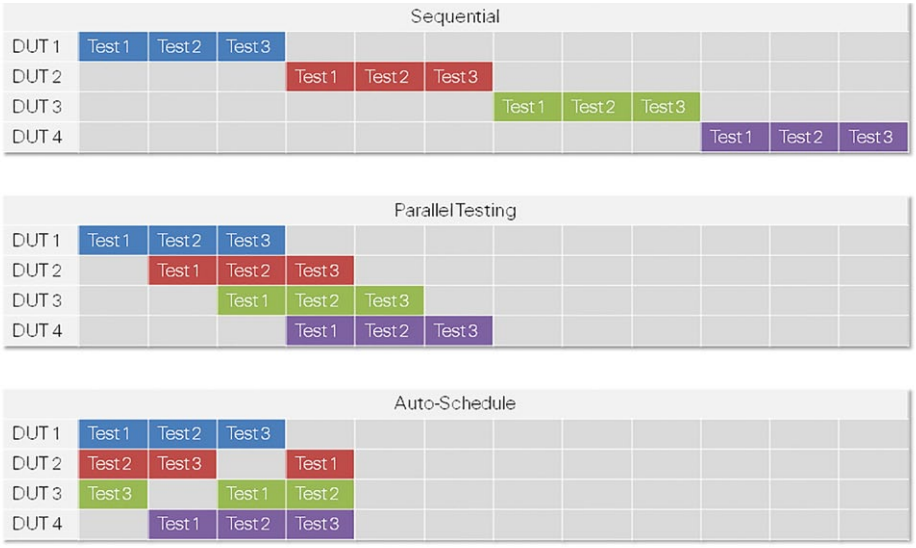


Figure 4: Parallel testing and auto-scheduling reduce test time and, thus, increase test throughput.

How many DUTs?

Choosing the ideal number of devices to test in parallel is depends upon the time allocation of the current test plan. As an example, consider a traditional configuration for testing a single device at a time and where the RF instrument is active half of the time. Then, ideally, one can use this instrument during its idle time to test another device. This way, things like the first DUT booting can happen whilst the second device is measured and vice versa. Typical setups handle between two and ten devices. The exact number and how much more test throughput one can achieve may only be evident after careful inspection of the test procedures. For example, one should identify bottlenecks in the setup and software in terms of data bandwidth and the possibility of parallelizing individual test steps. Let us consider this next.

Writing and running multi-DUT tests

In order to efficiently pipeline a manufacturing test plan, one must carefully examine dependencies between individual steps that may use the same instrument. For example, the test procedure may use a vector signal analyzer for calibration as well as for transmitter testing. Then, if the test executive software performs transmitter tests on the first DUT, it must delay calibration procedures for a second DUT until the tests on the first device conclude. Modern test executives such as TestStand can handle such dependencies but rely on test designers to modularize their test code appropriately. The basic structure should be along the broad general test phases identified earlier: DUT loading and start-up, calibration, and RF verification. Within each phase, the designer should break up the code further to identify all instrument calls. Some examples are the steps of signal generation, capturing RF data on an analyzer instrument and subsequent processing on a computation unit. Structured accordingly, the test code consists of several sections that can run in parallel and several sections for which execution – that is, access to the measurement instrument – must be scheduled in sequential order.

The test executive software itself – which controls the test flow – is another important element of optimizing test time. For multi-DUT testing, one will likely require the possibility for multi-threaded sequence execution. This is useful in instances where the actual acquisition of measurement data by the instrument is much faster than the subsequent analysis on a processing node. In such cases, the analysis phases of multiple tests, if run subsequently one-by-one, would limit the test throughput and cause the instrument to run idle unnecessarily. Parallelization of these processing phases avoids this bottleneck because data acquisition can proceed while the analysis of previously taken samples still runs on. Multi-threading allows test designers to write simple code for individual test steps such as measurement acquisition and subsequent analysis, and allows the test executive to handle parallel processing of multiple measurements.

Naturally, parallelization also requires multi-core computing resources like those available with state-of-the-art PXI controllers.

Auto-scheduling is another feature of advanced test executives. The software itself changes the order of execution of self-contained tests or test steps to maximize instrument utilization and throughput (Figure 4).

The widely adopted NI TestStand has all these powerful features. As off-the-shelf test management software, it allows test designers to easily update test sequences and enables them to re-use test code for future DUTs.

Multi-DUT switching

Another key element in optimizing test systems is the switching of signals from parallel DUTs to the instrumentation. In a manufacturing test environment, so-called fixtures are used to quickly and securely connect all of the relevant interfaces of a DUT with the test circuitry. In the small cell context, a typical fixture would provide multiple RF ports for cellular, WiFi, and GPS technology, and Ethernet and DC connectors would control and power the DUT. Such equipment comes from specialized vendors and may require substantial customization to fit individual base station designs.

In a multi-DUT configuration, test engineers must add signal switching components to their equipment to successively connect one of the multiple DUTs to the instrument (Figure 5). In addition to the RF signals whose parameters are to be measured, there is typically a frequency reference to be shared and trigger signals to be propagated from the DUTs to the test set. Now, let us go into more detail on these switching requirements.

When testing RF ports, one must consider that the nature of testing both transmit and receive signals often requires the use of bi-directional switching. When selecting switches for these signals, engineers should ensure adequate isolation between the signal paths to prevent any interference from impacting measurement results. To that end, apart from a good isolation value itself, the possibility to programmatically terminate the switched ports is extremely helpful. Test engineers will also look for a low voltage standing wave ratio (VSWR) value because this determines the final measurement accuracy through the amount of reflection the switch introduces.

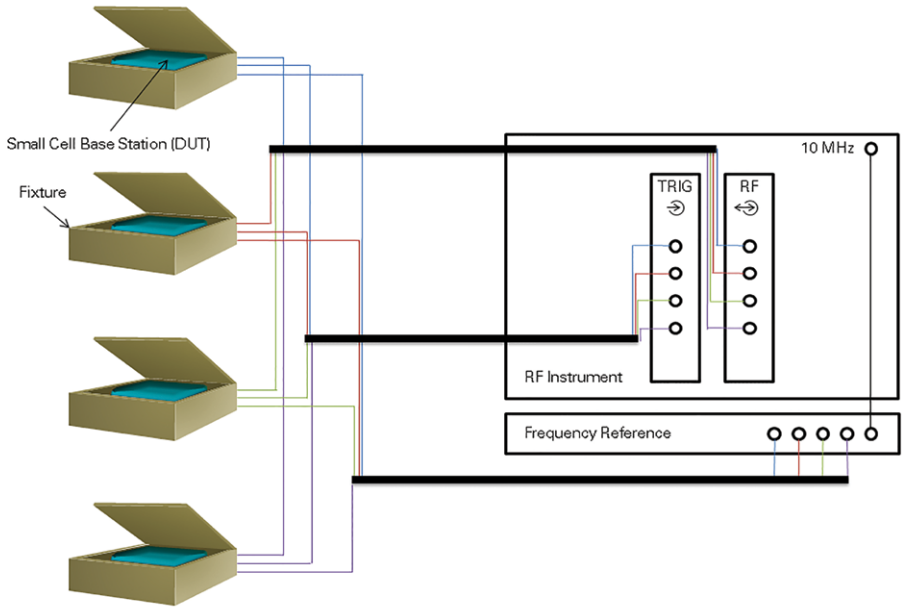


Figure 5: Simplified setup for testing multiple small cell base stations in parallel.

Of course, the switching components must meet all of these requirements within the required frequency range; for a small cell, this includes the 3GPP operating bands for cellular standards, may also encompass 2.4 and 5 GHz WiFi, and perhaps even GPS/Galileo/GLONASS frequencies around 1.6 GHz.

Note that a true RF signal switch simply connects one of its input ports to one of its output ports. This topology allows engineers to take measurements on a single device at a time only. By contrast, products like a combiner/splitter can be used to feed the test signal simultaneously to multiple DUTs to verify their receivers in parallel. This is a common technique used in handset testing. However, generally, this is not possible for base station testing where the DUT – a cellular base station – dictates the timing of when it transmits and expects to receive signals, just as it would in a real cell. In that case, test engineers cannot reproduce the framework to make all the base stations under test align their frame timings. Consequently, it is typically not possible to use a single signal generator to test the receivers of multiple base stations in parallel.

Because base stations expect to receive signals at a time they dictate, one must ensure tight synchronization between the DUT and the signal generator for base station receiver tests. Base station designers can simplify manufacturing tests by providing an output port and a corresponding trigger signal to indicate the start of a frame or similar temporal structure. Then, the signal generator aligns its transmission timing with the DUT's trigger without any need for a time-consuming and error-prone synchronization procedure between the base station and the test equipment. A multi-DUT base station test set should provide input ports for the trigger lines of all DUTs and/or switch between them.

Multi-DUT with PXI

Setting up a multi-DUT test set is relatively straightforward to do with a modular platform such as PXI. "Modularity" in this context refers to a user-defined selection of components where each component – called modular instrument – has a specific purpose. With modular instrumentation, engineers can match test capabilities to their needs much better than with a "one-size-fits-all" traditional instrument.

PXI/PXI Express is one of the most common platforms for modular instrumentation. Since its invention in 1997, PXI has developed into the most prevalent modular instrumentation platform, with over 1,500 modules available from more than 70 vendors. Using PCI bus technology, PXI offers high bandwidth and low latency data transfer to and from instruments, helping to improve test speed (Figure 6).

Example modular instruments include RF signal generators, spectrum

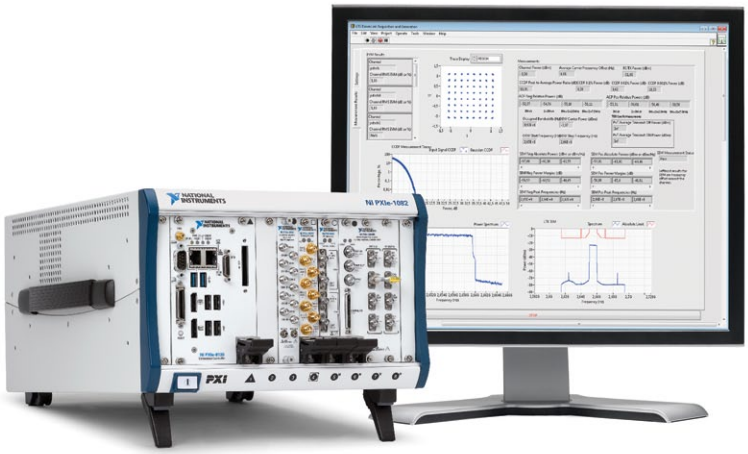


Figure 6: NI PXI modular instruments and extensive RF measurement software including 3GPP, WiFi and GPS testing lower the cost of test for small cell base stations.

analyzers, and – relevant to multi-DUT testing – switches. PXI switches and combiners achieve high analog quality and high density – and are relatively inexpensive compared to the cost of the actual measurement instrument.

One of the most significant benefits of PXI multi-DUT testing is the measurement speed allowed by the PXI platform. Here, the combination of a high-speed data bus (PCI express) and highly capable signal processing technologies (multi-core processors) enables PXI instruments to perform most measurements three to ten times faster than traditional instruments.

Conclusion

Driven by demands for improved network capacity, small cell deployments are becoming increasingly popular with network operators. Consequently, small cell base station vendors are required to increase their manufacturing test throughput and to lower their cost of test. Higher test throughput and lower test cost require new test approaches in the wireless infrastructure industry. Multi-DUT testing helps engineers to improve test equipment utilization and, in turn, throughput and cost.

PXI offers many benefits for small cell testing and its modular architecture lends itself well to the multi-DUT approach. TestStand is a powerful test executive that provides advanced features such multi-threading and auto-scheduling to make productive use of the hardware capabilities.

Setting up a multi-DUT test stand is not for free – it takes some additional hardware, perhaps software upgrades, and test designers must exercise more care in writing their tests – but the speed and throughput benefits far outweigh the slight increase in upfront effort.

iPhones a viable option for monitoring eye disease

The iPhone has been demonstrated to be a portable and effective tool for imaging the inside of the eye, according to results of a study released at AAO 2014, the 118th annual meeting of the American Academy of Ophthalmology.

Researchers from the Ross Eye Institute at the University at Buffalo-SUNY are successfully using an iPhone application as an inexpensive, portable and effective tool for imaging the inside of the eye, including in patients who are challenging to photograph by traditional methods.

Photography plays a critical role in documenting and tracking the progression of eye diseases. One of the most common types of ocular imaging is fundus photography. This requires a specialized low-power microscope with an attached camera to capture photos which can then be reviewed by specialists at another time or location and saved for medical documentation. The standard equipment is generally designed for the adult frame and typically stationed in specialized eye clinics. It may not be accessible everywhere and be incompatible for those too young or too ill to maintain the required upright position. This could result in missed opportunities to document important changes in such patient subgroups.

To address this problem, the researchers used the iExaminer smartphone system (Welch Allyn) and an iPhone to image 28 clinic and hospitalized pediatric patients with a diverse range of retinal and optic nerve conditions. The system consists of a PanOptic Ophthalmoscope (a lighted instrument to examine the inside of the eye) and an adapter that attaches the ophthalmoscope to an iPhone to enable taking photos and videos. It can image key structures of the back of the eye in a single view without necessarily requiring dilation drops. The associated app facilitates capture, storage, and transfer of data. This also makes it possible for real-time telemedicine consultation without violating patient identity as no external facial features are revealed.

"This system could be useful not only to ophthalmologists, but also emergency department physicians, hospitalists and general practitioners," said lead researcher Jiaxi Ding, M.D. "Because it can instantly capture photos and videos of the back of the eye through an undilated pupil, there is potential for prompt telemedicine consultations with an ophthalmologist and getting preliminary triage answers to the patient more quickly than waiting for standard office referral."

www.aao.org
www.geteyesmart.org
www.ojossanos.org

The rise of GaN on Si to take on high-power and high-volume markets

By Jean-Pierre Joosting

GaN technology has already made an impact on the high performance and RF market, but according to MACOM this is just the beginning. The company is in a unique position to offer customers products in most process technologies including GaAs, InP, SiGe, SiPh, GaN and CMOS.

GaN itself comes in two main flavours, GaN on SiC which is ideal for very high power applications and GaN on Si which offers the ability to scale up in wafer diameter, driving costs down as volume rises, exploiting the traditional economies-of-scale offered by CMOS. MACOM expects GaN to disrupt all RF functions and applications.

GaN on Si as a wideband gap semiconductor technology in RF and microwave applications is becoming critical for mainstream commercial applications due to its power density, efficiency and thermal properties. GaN on Si offers 8x the raw power density of GaAs and 4x the raw power density of LDMOS technology. Efficiency ranges from the mid-40s to as much as 70%.

The market potential for GaN is big and the process technology is expected to eventually dominate the high performance RF and microwave market. GaN performance advantages include 5x bandwidth and 2x efficiency over existing products.

Furthermore, GaN is capable of fulfilling all analog functions and applications

GaN on Sic versus GaN on Si

Fundamentally, at a physics level, SiC boules grow 200x to 300x slower than silicon. Thus the cost of producing substrates scales proportionally to production time. For this reason GaN on SiC will remain too expensive for mainstream commercial use. However, it will find use in specialised applications in military and defence and potentially high end communications applications that require relatively high power.

The ability to reduce costs yet benefit from high power density and efficiency lies with GaN on Si. Further, GaN on Si is very complimentary to a silicon roadmap — and is expected to eventually accommodate a lot of CMOS on the die with it.

GaN on Si technology will be driven by power conversion applications, which command unit volumes that are orders of magnitude greater than RF and microwave demand.

According to John Croteau, President and CEO of MACOM, “Put in perspective, a full year’s production for the entire RF and microwave industry can be serviced in a few weeks by a single 8” silicon factory that’s built to service the power conversion market.”

The road to mainstream commercialisation

As GaN transitions from a niche, expensive process to a high-volume commercial process, the technical merits of GaN technology must be fully realized and clearly demonstrated on silicon substrates and, secondly, a scalable, stable supply chain must be established. GaN on Si has already demonstrated its technical merits in terms of power density and efficiency, easily beating GaAs and LDMOS. In the high end RF and microwave market power density and efficiency are critical considerations, hence the massive interest in GaN on Si.

Establishing a reliable and stable supply chain entails two key steps in the manufacturing chain: firstly, a cost-effective and scalable supply of GaN wafers is needed; secondly, the processing of these wafers through high-volume silicon fabs is needed.

To this end, MACOM recently announced an agreement with IQE, a leading supplier of GaAs, who will scale high-volume, cost-effective supply of GaN materials for cost sensitive, high-volume applications. IQE has the operational experience, competence and capital structure to scale production of GaN materials. MACOM also offer the industry’s only secure dual sourced GaN supply chain.

John Croteau contends that as with GaAs, we expect a bifurcation in the GaN supply chain for low volume applications. Cost-sensitive applications will go the path of 8” GaN on Si. At the same time, capital-lite fabs will service diverse, low-volume applications with specialty GaN processes.

“As much as 50% of GaN revenues today are attributable to government programs, not commercial production. Just as GaAs went from esoteric technology to high-volume market mainstay, GaN is now poised to do the same,” says John Croteau.

“At maturity, we believe that GaN on Si will benefit from silicon cost structures that are 3x lower than today’s highest volume GaAs and 100x lower cost than today’s GaN on SiC technology.

MACOM committed to driving GaN

MACOM holds 50 GaN device/materials patents and 200 U.S. and foreign patents. The company has positioned itself to drive GaN on Si to volume production eventually using 8” wafers. By leveraging the scale volume of the silicon industry, which is two orders of magnitude greater than even the GaAs handset market, MACOM expect to soon be able to leverage GaN for cost-sensitive applications.

A variety of packaging options, which support end market applications, is also a critical performance and cost factor which must be considered for a complete product implementation. Recently, the company has introduced surface mount plastic packaging for high power devices. Plastic packaged high power GaN enables designers to adopt conventional surface mount manufacturing and enables system size and weight reductions. In this way, the adoption of GaN in plastic facilitates system manufacturing cost reduction together with test efficiencies associated with high volume plastic packaging. The arrival of GaN in plastic devices has provided system designers the flexibility to reach power levels up to 90 W without the size or weight penalties typically associated with packaged transistors.

RF and microwave component integration led by RFIC/MMIC portfolio covering DC to X-band

By Jean-Pierre Joosting

One of the key trends in RF and microwave is the drive to integrate, which is largely driven by the increasing requirements of the mobile industry. GaAs is a difficult and expensive technology that does not lend itself easily to high levels of integration. Today GaAs is used to build high performance MMICs but silicon or more importantly CMOS continues to close the gap. Here SOI (Silicon on Insulator) which is a CMOS process plays an important role. One particular derivative of this technology is UltraCMOS® from Peregrine Semiconductor, a Silicon on Sapphire substrate that benefits from standard CMOS processing while meeting and even exceeding the performance advantages of GaAs.

Typically, MMIC design techniques, such as Lange couplers, have only been used by III-V technologies. The use of these passive techniques on silicon has always presented a challenge due to silicon's lossy nature at higher frequencies.

UltraCMOS, a scalable, low power sapphire SOI technology, exhibits excellent RF and microwave characteristics. For microwave frequencies sapphire is a significantly lower loss substrate than standard Alumina-based microwave substrates.

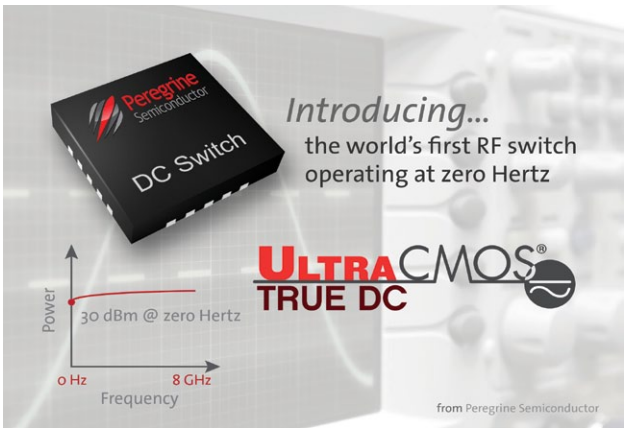
Consequently, UltraCMOS enables designers to use MMIC techniques, which require low loss substrates to work effectively and achieve RFICs/MMICs with less parasitics. MMIC design techniques enable the passive devices to integrated onto the single die without introducing noise.

One key advantage of UltraCMOS is the ability to implement MMIC design rules without compromising microwave performance, while at the same time offering the ability to add control logic and multi-band tuning. Further the technology today is able to span a wide frequency range from DC through microwave frequencies. In particular, the ability to go down to DC is key to enabling new types of circuits.

Combining RF, microwave, analogue and digital circuitry on a single die leads to a concept coined by Peregrine — Intelligent Integration. Further, this covers the entire frequency spectrum from DC through to microwave, currently up to around 10 GHz.

High performance RF has been dominated by III-V materials, that have been typically specialized for a single function and have little or no ability to integrate "ancillary" functions such as ESD, voltage regulators, DC tracking…

UltraCMOS is one way of changing this scenario enabling high performance RF and microwave components to become highly integrated with all the advantages of a low-cost CMOS process.



The UltraCMOS True DC switch covers a wide frequency range from 0 Hz to 8000 MHz.

DC to X-band

To illustrate this point, Peregrine Semiconductor has expanded its integrated product portfolio into DC and X-band frequencies by introducing two integrated products — a True DC switch and an X-band core chip.

Built on the company's UltraCMOS® technology, both products integrate RF, digital and analog components onto a single chip. While integration has traditionally offered high-volume markets the benefit of lower cost, Peregrine uses intelligent integration to offer performance advantages in high-performance markets. Peregrine's integrated products offer benefits such as configurability, flexibility, reliability, repeatability, ease-of-use, a reduced form factor and enhanced performance.

A True DC switch

At the lower end of the frequency spectrum, the company claims to offer the industry's first and only RF integrated switch to achieve true DC capability. With a wide frequency range of 0 Hz to 8000 MHz, the UltraCMOS True DC switch (PE42020) effectively operates in a previously unobtainable portion of the frequency spectrum. This frequency expansion is paramount to markets that rely on accuracy and precision, such as test and measurement.

The True DC SPDT switch features high power handling, 30 dBm at 0 Hz and 36 dBm at 8 GHz, and maintains excellent RF performance and linearity from DC through 8000 MHz. Moreover, it can switch DC and AC peak voltages in the range of +10V to -10V at currents of up to 80 mA, a first for this kind of product.

On a single chip, the True DC switch integrates multiple functions: high-performance switching (RF); DC tracking (analogue); and control logic and impedance control — 50-ohm absorptive or open reflective (digital).

Another unique advantage of the True DC switch is efficient switching time. While low-frequency operation typically requires a slow switching time, the True DC switch uses advanced circuitry to remove this dependence, resulting in a 10 µs switching time, and a 15 µs settling time which is critical for test-and-measurement applications.

The PE42020 features high-linearity (IIP3) performance of 63 dBm, and high port-to-port isolation of 37 dB at 6 GHz. It supports standard +1.8V and +3.3V control logic and operates over a temperature range of -40 to +85 degrees centigrade. The True DC switch also supports 1000V HBM ESD tolerance

and is supplied in a compact 20-lead 4x4 mm QFN plastic package.

Sampling now and shipping in early 2015, the True DC switch (PE42020) is poised to replace problematic mechanical relays and MEMS switches in the test-and-measurement market.

An X-band core chip

At the higher end of the frequency spectrum, Peregrine claims to offer the industry's first integrated X-band, CMOS core chip to utilize MMIC design techniques, enabling highly accurate signal control with minimal power loss. With this X-band core chip, Peregrine combines standard CMOS design with passive MMIC circuitry for a truly intelligent approach to integration at microwave frequencies.

This high-performance, X-band core chip integrates the following on a single die: a seven-bit digital phase shifter; a seven-bit digital step attenuator; high isolation signal-path switching; and a compact digital serial interface control with true CMOS compatibility.

The X-band segment of the frequency spectrum is used by many modern satellite and radar systems, including synthetic aperture radar (SAR) and phased-array radar. Applications include weather monitoring, air traffic control, defense tracking and earth observation. Peregrine's integrated chips offer a significantly reduced form factor delivering a distinct advantage within these systems that are tightly packaged within a small physical area. Additionally, UltraCMOS technology provides the high degree of reliability demanded by these critical applications.

Sampling in early 2015, this X-band core chip delivers the fine resolution and degree of control that is critical for radar applications. The chip offers a maximum power handling of +18 dBm from 9-10.1 GHz and covers 31.75 dB attenuation range in 0.25 dB steps. The phase shifter offers 358 degrees of phase range with a resolution of 7 degrees. It maintains high attenuation and phase accuracy over frequency and temperature and exhibits low power consumption.

The first integrated X-band, CMOS core chip to utilize MMIC design techniques.

www.psemi.com/intelligentintegration

Freescale drives plastic-packaged LDMOS RF power transistors to 300-W CW

By Freescale Semiconductor, www.freescale.com/RF power

RF power amplifiers designed for wireless base stations face huge challenges to accommodate the demands of high efficiency and linearity and lower power consumption. However, there are other applications that add another layer of complexity unparalleled in the wireless world. These applications, including FM and digital TV broadcast, aerospace and defense, land mobile radio, CO_2 lasers, and industrial heating and sealing systems require that RF power transistors be stressed in astonishing ways. Fortunately, manufacturers like Freescale have applied technologies, architectures, and materials to the challenge to make them if not "bulletproof" then extraordinarily robust.

A recent video produced by Freescale demonstrates an RF power amplifier in a fixture being subjected to an enormous impedance mismatch. When power is applied, a flame erupts on the board's microstrip line and like a fast burning fuse sends a stream of fire down the line, through the device (which is only about 1 x 1.5 inches), and back to the source. The fact that the device continues to function exactly as it did before the test seems to defy logic. Nevertheless, devices like these are designed to just withstand this type of abuse along with double their specified RF input power, and wide-ranging DC voltages both lower than and in excess of the data sheet rating.

A tough neighborhood

Wireless applications have their own unique requirements but their operating environments are generally far more stable and not subject to wild variations in DC operating voltages, RF input power, and often (but not always) impedance mismatches. In contrast, the applications mentioned above not only require high RF output power but present some or all of the conditions encountered in wireless infrastructure. Lasers and plasma generators, for example, must ramp up quickly and in doing do place severe stress on RF power transistors and amplifiers that can easily exceed the specifications on their data sheets.

Even in mobile radio applications, in which power monitoring helps maintain RF output power with reductions in supply voltage, the radios do so by increasing drive to the final amplifier, potentially producing an overdrive condition that many devices have difficulty handling. Defense systems are routinely subject to abuse as they are often operated by soldiers who have no time to ensure everything is working "just right" nor the technical expertise required to understand how their radios work. They just need to work, all the time. Freescale's high-ruggedness LDMOS devices can simultaneously shrug off these challenges.

Putting power in plastic

As important as device enhancements, advancements made by Freescale in overmolded plastic packaging are equally important and today serve even devices whose RF power levels are quite high. Freescale was the first semiconductor manufacturer to use overmolded plastic packages in RF power applications, introducing its first device in 1997 after first introducing plastic package technology to automotive and industrial applications in the 1980s.

Overmolded plastic packaging has significant advantages, the most obvious being lower manufacturing cost. However, unlike bolt-down ceramic-packaged devices, they are also compatible with automated pick-and-place manufacturing, which makes them suited for moderate-to high-volume production applications. This factor alone is a significant benefit to OEMs, as it reduces the amount of labour required in assembly when compared to ceramic air cavity packages that are hand soldered to the circuit board. In addition to being time-consuming, manual placement is inherently less precise than automated equipment. That is, the placement accuracy that can be achieved with hand soldering is about 0.12 mm while automated equipment can reach 0.025 mm.

Such accuracy can also reduce or even eliminate the need for tuning required to compensate for the imprecision of hand soldering. Not surprisingly, overmolded plastic packages are replacing ceramic air-cavity packages at higher and higher RF power output levels. The highest yet offered is 300-W CW delivered by the latest Freescale MFRFE6VP300 described below. There are currently a wide array of plastic-packaged LDMOS RF power transistors in the Freescale portfolio, and higher power levels are on the company's road map.

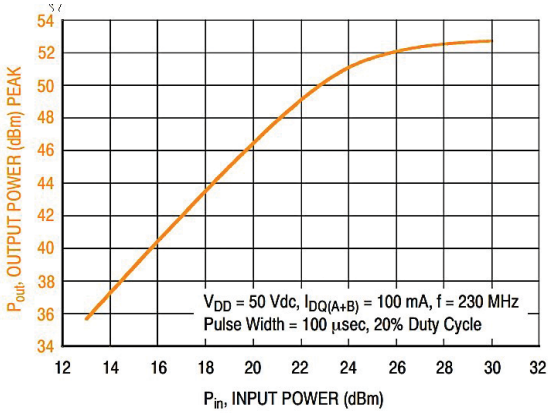
Achieving power levels of 150-W CW delivered by the MRFE6VP5150 and 300-W CW by the MRFE6VP5300 requires packages to simultaneously accommodate 225°C die operating temperatures and high heat dissipation without compromising electrical performance, ruggedness, or reliability. Thermal resistance (measured in °C/W), is a measure of the effectiveness of a die/package combination in transferring heat into a heat sink or cold plate. As removing heat from the die becomes more difficult as thermal resistance increases, the latter must be reduced to the lowest possible level. Since the first overmolded plastic packages were introduced, Freescale has made consistent advances in this area, leading to the current ability to match and sometimes even exceed the thermal performance of ceramic-packaged LDMOS FETs while producing the same RF output power.

Reaching higher power levels

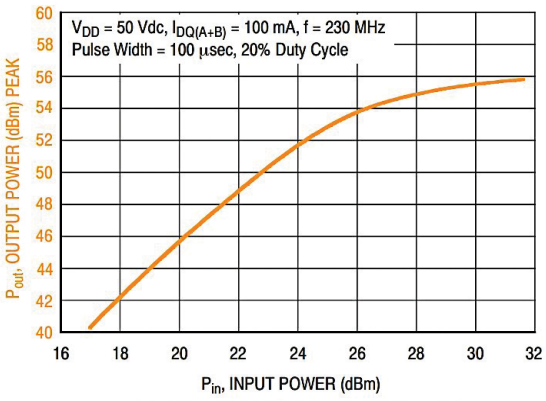
Freescale's MRFE6VP5150 and MRFE6VP5300 are excellent examples of this capability. They are available in straight-lead and gull-wing packages, operate over a frequency range of 1.8 to 600 MHz, have high efficiency of at least 75%, and combine excellent overall performance with the level of ruggedness typically associated with ceramic packages. They will deliver their rated performance without failure or performance degradation when driven by twice their rated RF input power into an impedance mismatch (VSWR) greater than 65:1 at all

phase angles. A 65:1 VSWR is for practical purposes a direct short, as it represents a return loss value of zero.

Since its days as Motorola Semiconductor, the company has rated its products conservatively. They are tested at frequencies both below and above their specified operating ranges to ensure they will deliver their rated output levels with considerable margin. This is depicted in Figure 2a, which shows the RF power output of the MRFE6VP5150 operating at 230 MHz with an input signal having a pulse width of 100 µs and a 20% duty cycle. P1dB RF output power ranges from slightly over 3 W with a 13 dBm input signal to over 158 W with 30 dBm of drive. In Figure 2b, the MRFE6VP5300 operating at the same frequency and with similar input signal characteristics delivers about 10 W with 17 dBm of drive and greater than 398 W with just over 31 dBm of drive.



f (MHz)	P1dB (W)	P3dB (W)
230	159	182



f (MHz)	P1dB (W)	P3dB (W)
230	313	370

Figure 2: The MRFE6VP5150 (a) (left) delivers up to 159 W (P1dB) at 230 MHz with 30 dBm of drive. The MRFE6VP5300 (b) (right) delivers up to 398 W (P1dB) with slightly less than 32 dBm of drive.

The MRFE6VP5300 and MRFE6VP5150 ARE in full production quantities. Freescale provides a wide range of support tools including broadband fixtures, models, and reference designs.

VectorStar™ Network Analyzers are technologically and economically smart.

Anritsu's industry-leading technology delivers performance where it really matters. The VectorStar 70 kHz to 145 GHz flagship broadband system provides industry-best performance in all three critical performance areas: broadband frequency coverage, dynamic range, and measurement stability.

Whatever your starting requirement, feel safe in the knowledge that Anritsu's VectorStar offers the expandability you need in the future. As your needs grow, so can your VectorStar.

The VectorStar ME7838 Series broadband VNA offers the widest available single frequency sweep from 70 kHz to 110, 125, and 145 GHz with mmWave bands to 1.1 THz.

Learn more at www.anritsu.com

www.anritsu.com

Europe +44 (0) 1582-433433
©2014 Anritsu Company

Anritsu
envision : ensure

Bluetooth Low Energy: the main challenges the industrial electronics designer faces in realising an ultra-low power Bluetooth design

By Ton Middelman, Technical Business Development Manager, Acal BFi

Bluetooth Low Energy (LE) is gaining support from an increasing number of component and module suppliers. No wonder: this ultra-low power, short-range RF technology will offer a simple means to connect any slave device to, in future, billions of smartphones, tablets and laptop computers.

The fact is, however, that electronics design engineers are already well served by a wide choice of industry-standard, short-range RF technologies, such as ZigBee and Wi-Fi. So does Bluetooth LE have an advantage over these existing standards?

In fact it does, provided the application requires the transmission of short pulses of data and long battery life. But design engineers will only gain the advantages of using Bluetooth LE if they make the right choice of components for their application and market.

Something new, something old

Despite sharing the 'Bluetooth' name with Classic Bluetooth, Bluetooth LE is different in many important ways. Classic Bluetooth is designed to provide an always-on wireless pipe for streaming audio and other streamed data, and supports data rates of up to 3 Mbps. It also features a complex protocol stack, required in part to support the complicated methods for establishing and maintaining a connection between two paired devices.

Bluetooth LE has completely different attributes: it features a simple protocol stack which makes and breaks connections extremely fast, enabling short pulses of data to be transmitted intermittently. It achieves very low power consumption – months or years of operation on a single coin cell – because its mode of operation enables the device to be in a deep sleep mode, with the radio switched off, for most of the time.

In other words, Bluetooth LE is not a low-power version of Classic Bluetooth; it performs a completely different function.

It does share the 2.4 GHz frequency band, an antenna and certain elements of the protocol stack with Classic Bluetooth. As a result, manufacturers of Classic Bluetooth chipsets are able to add Bluetooth LE functionality to their devices at almost no cost. And this means that the smartphones, tablets and laptop computers which in the past universally featured Classic Bluetooth will in future universally feature Classic Bluetooth and Bluetooth LE. (In the consumer-facing marketing term, they will be 'Bluetooth Smart Ready'. Certified Bluetooth LE devices will be 'Bluetooth Smart'.)

This is the principal appeal of Bluetooth LE to designers of industrial electronics systems: for the first time, a simple, cheap wireless technology provides an interface between battery-powered slave devices and smartphones, tablets and laptops. Applications which are expected to take advantage of the new technology include 'appcessories' such as fitness monitors, personal health devices such as heart-rate monitors and pulse oximeters, proximity sensors, for instance in access control systems, and smart watches.

Component companies have been quick to take note of Bluetooth LE's appeal: stand-alone chipsets and highly integrated modules supporting Bluetooth LE are already available. Part of the appeal of Bluetooth LE is that it is, according to its proponents on the Bluetooth Special Interest Group (SIG), a simple radio which is easy to implement.

This might suggest to industrial electronics designers that their system architecture could be based on a Bluetooth LE chipset. After all, a chipset offers a marked unit cost advantage over the equivalent integrated module. A chipset-based design therefore appears to offer users a competitive edge compared to designers who base their system on a more expensive but more integrated module.

So just how easy is it to implement a Bluetooth LE design from scratch?

Hardware and software design issues

Certainly, manufacturers of Bluetooth LE chipsets provide excellent, highly optimised products. The problem for many OEMs is that they are optimised for one thing above all: low unit cost. This means that they are not optimised for ease of use, simplicity or integration.

Bluetooth LE chipsets are aimed at high-volume products, for which the production runs are counted in the hundreds of thousands or millions of units. The key design constraint for high-volume OEMs is bill-of-materials (BoM) cost. They can afford to throw design resources at implementing a system design using low-cost discrete components, including RF chipsets.

Any chipset sourced from a reputable supplier will, of course, be functionally sound, and the unit cost will be competitive. But a Bluetooth LE implementation with a chipset will present considerable challenges to most electronics OEMs. These challenges fall into the following categories:

- RF system design;
- protocol software design;
- compliance testing and certification.

RF system design

A Bluetooth LE chipset will include a 2.4 GHz transceiver and a baseband controller. This must be integrated into a system design which can reliably communicate over the required range. Key design tasks will therefore include configuring and placing an antenna, routing of connections to and from the RF sub-system, and designing the board layout. This design must take account of sources of interference, and ensure that the radio's sensitivity is not compromised. This element of the system design calls for deep RF expertise.

Protocol software design

A Bluetooth LE device must run a Bluetooth LE protocol stack, typically on the system's main microcontroller. Chipset manufacturers normally provide a proto-

col stack 'reference design' free to users: this is not a complete, ready-to-use stack; it should be viewed as a starting point for the user's own stack design.

Again, stack development calls for specialised embedded software development skills.

Compliance testing and certification

All new RF products are required to undergo exhaustive tests to verify:

- that their RF emissions are at permitted frequencies and power levels;
- that they do not generate interference outside their permitted frequency bands.

Testing carried out by independent laboratories is expensive and time-consuming. Design teams are always exposed to the risk of cost and time overruns should a design not pass its compliance tests first time.

Should the OEM want its device to carry the 'Bluetooth Smart' logo, it will also need to undergo independent Bluetooth validation, to verify that it complies with the specifications. Again, it is expensive to design for compliance and to undergo a complete set of Bluetooth Smart certification tests.

(It is possible to use Bluetooth LE technology without certification by the Bluetooth industry body. This may be appropriate for products which are not intended to be marketed to third parties as Bluetooth Smart devices. All new RF products are required to gain regulatory approvals relating to RF emissions and EMI compliance.)

Designers of many industrial and consumer devices which could benefit from Bluetooth LE produce in volumes of hundreds or thousands, rather than millions. Bluetooth LE is undoubtedly a simpler technology to implement than Classic Bluetooth. But the design tasks described above are far from trivial, and entail an investment in design time and design resources which may be out of reach of many OEMs.

So to what extent does the use of a dedicated Bluetooth LE module mitigate the problems involved in chipset-based designs?

Reducing design cost, time and risk

It is possible, by using an integrated Bluetooth module, to eliminate all of the design tasks associated with the use of chipset. How?

First, no RF system design should be required. All of the RF circuitry, including the antenna, is encapsulated within the module (see Figure 1). There is only one RF design constraint: since the module contains the Bluetooth LE antenna, it must not be shielded, so the device's case should be made of plastic rather than metal. When integrating the module, the hardware design functions are typically limited to providing a power supply and a USB or UART interface to the system's host microcontroller.

In addition, a module will be supplied with a complete Bluetooth LE protocol stack. A highly integrated module will include an embedded microcontroller, the main function of which is to run the protocol stack.

Clearly the stack provides the means by which the Bluetooth LE radio transmissions are controlled. Again, a module should make the control functions simple to implement. Ideally the stack functions will be abstracted out into a familiar standard instruction set such as the AT commands familiar to modem users. This means that the system designer can treat the protocol stack in the module as a black box; very little knowledge of the stack's operation is required.

Use of a module also eliminates all of the design risk associated with compliance and certification. A module should be supplied 'pre-certified'. As a standalone device in its own right, it will already have all applicable approvals globally in terms of RF emissions.

Provided the OEM designer follows the module manufacturer's guidelines in relation to input power, layout and enclosure, the complete end product, with the module embedded in it, is guaranteed to pass all required compliance and certification tests (see Figure 2).

The use of a Bluetooth LE module therefore gives OEM design teams the benefits of reduced design cost, design time and design risk.

Balancing the considerations

Each OEM will make its own calculation of the balance of design costs and unit costs: at a certain production volume, the additional unit cost of a module compared to a chipset outweighs the reduced design cost of integrating it in a host system.

RN4020 Bluetooth® 4.1 Low Energy Module

Figure 1: a module such as the RN4020 from Microchip integrates the entire Bluetooth LE RF circuit including the antenna. The RN4020, housed in an encapsulated 10 mm x 17 mm x 2 mm package, includes a ceramic-on-board antenna, 2.4 GHz Bluetooth LE transceiver, a microcontroller with a complete embedded Bluetooth LE protocol stack, and UART and USB interfaces.

Bluetooth® SMART

Figure 2: A pre-certified Bluetooth LE module eases the certification process, allowing the host product to carry the Bluetooth Smart logo.

In addition, a module provides a fixed set of features, such as support for certain modes of operation or 'profiles', defined in the Bluetooth 4.x specification. A minority of applications might find their requirements are not met by the features provided in commercial off-the-shelf Bluetooth LE modules.

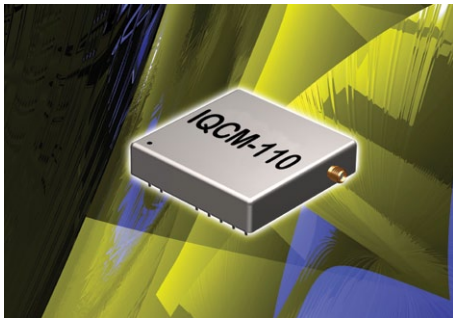
Industrial designers, however, should take care not to under-estimate the scale of the RF design, software design and certification tasks involved in implementing a chipset-based design. While Bluetooth LE is a simpler technology than Classic Bluetooth, it is not simple – unless the design is based on an integrated module.

Acal BFi provides design and supply-chain support to OEMs developing Bluetooth LE designs across Europe.

www.acalbfi.com

GPS disciplined OCXO

-20 to 75°C temperature range



IQD's latest addition to its range of advanced oscillator modules is its IQCM-110 series of GPS disciplined OCXOs.

The design incorporates an internal GPS receiver with a 1PPS output and is housed in a 14-pin 60mm square package. When coupled to an external aerial via the incorporated SMA connector, in the event of the loss of the GPS signal the highly specified 10 MHz OCXO will switch-in with a holdover capability of 1.5 µs for a 24-hour period thereby maintaining lock until restoration of the reference signal.

The standard operating temperature range of the module is -20 to 75°C but other temperature ranges and holdover specifications can be considered upon request. The required power supply is 5 V with the output being standard HCMOS. Current consumption is 2 A maximum during warm-up with this reducing to 1 A once the steady-state condition is reached.

The design incorporates an internal adaptive algorithm which enables the module to 'learn' the parameters of the GPS signal after a period of 2 days of lock so that the holdover function can start in the event of signal failure. An internal alarm is built-in to indicate lock failure and subsequent restoration of signal..

www.iqdfrequencyproducts.com

Product line starts with 8 GHz RF switch

has a low insertion loss of 0.4 dB

The first in a line of radio frequency switch ICs, and featuring ultra-high isolation and linearity, the F2912 is an absorptive 50Ω SP2T RF switch aimed at base stations (2G, 3G and 4G), microwave backhaul and front haul, test equipment, CATV headend, WiMAX radios, and wireless systems.

The device boasts a frequency range of 300 kHz to 8 GHz, achieving broad bandwidth without sacrificing performance across the entire frequency range. A low insertion loss of 0.4 dB provides low path loss without compromising isolation performance.

High isolation of 60 dB at 2 GHz reduces signal leakage between adjacent RF port paths, while a high OIP3 of +64 dBm reduces intermodulation distortion.

A P1dB of 30 dBm, providing 1 W compression point, ensures rugged operation for a variety of applications. Switching time is around 1 µs.

The device has 3.3 V and 1.8 V control logic consistent with common FPGA and microcontroller logic levels – no negative supply/control voltage is required. DC current from a 3.3 V line is 20 µA. Operating temperature range is -55 to 125°C for high reliability in harsh thermal environments.

www.idt.com

Development system

brings the Internet of Things to the vehicle

Freescale Semiconductor has introduced a comprehensive hardware/software development system for enabling automotive grade Ethernet connectivity for next generation infotainment, instrument cluster, camera telematics and rear seat entertainment designs.

The system will support real-time data transport throughout the vehicle and replace expensive digital technologies and other alternatives.

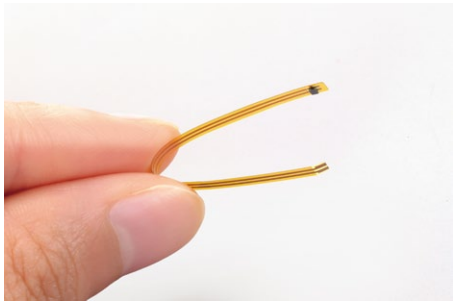
The comprehensive SABRE (Smart Application Blueprint for Rapid Engineering) for Auto Infotainment (AI) development system leverages the proven performance and scalability of Freescale's i.MX 6 series applications processors to speed and simplify Ethernet Audio Video Bridging (AVB) deployment. The development system helps connect a broad array of onboard multimedia nodes using automotive-grade Ethernet components and is optimized for hardware/software integration.

The company has also introduced automotive-grade AVB Ethernet software stacks engineered to work seamlessly with the development system's hardware for a truly comprehensive solution.

www.freescale.com/sabreai

Low profile flexible film temperature sensors

for mobile and wearable devices



Murata has announced that it is about to commence mass production of a range of surface-mounted NTC temperature sensors that are packaged on a flexible printed circuit (FPC) film.

With an FPC thickness of approximately 100 µm, they can be easy routed inside complex designs and tight spaces. Owing to their low heat capacity, the sensor's thermal responsiveness is excellent. Measuring 50.00 x 3.17 x 0.55 mm the sensors are ideal for sensing the housing temperature of smartphones and tablets. They are also ideal for use in wearable products for sensing body surface temperature. The FTNT55XH103FA1A050 sensor can measure temperatures in the range of -40 to + 125°C and has an accuracy, at 25°C of ±0.4°C. Resistance at 25°C is 10 k ohm ±1%.

www.murata.com

Fixed frequency synthesizer

delivers low phase noise

Z-Communications is offering an RoHS compliant fixed frequency synthesizer,

designated model SFS11600H-LF. It is designed to generate an output signal at 11.6 GHz while being fixed to an external 100 MHz reference oscillator. The X-Band PLL features phase noise performance of -98 dBc/Hz at 1 kHz and -103 dBc/Hz at 10 kHz offset.

The SFS11600H-LF is designed to deliver a nominal output power of 0 dBm into a 50Ω load and operates with a VCO voltage supply of 5 Vdc while drawing 85 mA (typical) and a phase locked loop voltage of 3.3 Vdc while drawing 40 mA (typical). This low noise fixed frequency synthesizer features harmonic suppression of -30 dBc and spurious suppression of -65 dBc.

The synthesizer is housed in the company's standard SFS-L1 package measuring 2.54- x 2.54- x 0.56-cm (1.0- x 1.0- x 0.22-inches. The SFS11600H-LF is also ideal for automated surface mount assembly and is available in tape and reel packaging.

www.zcomm.com

Wideband digital channel simulator

includes arbitrary waveform generator

IZT has added an arbitrary waveform generator (ARB) to its IZT C3040 wideband digital channel simulator. The ARB enables the IZT C3040 to emulate other traffic on the satellite transponder, signals in adjacent bands or interference scenarios. With the internal ARB memory, the IZT C3040 now supports the generation of user-defined signals, for example using MATLAB, which increases its flexibility.

Maximum sample rate of the ARB is 160 MSps, which corresponds to a maximum signal bandwidth of 100 MHz. A user configurable variable sample rate converter allows the use of lower sample rates. The frequency offset and power of the ARB signal can be varied through software while the emulation is running.

The IZT C3040 is a wideband digital channel simulator for satellite or unmanned armed vehicle (UAV) data links. It enables system engineers to create realistic scenarios for testing their product in a laboratory environment, without having the satellite itself available.

"With the new ARB feature, we have extended the IZT C3040 channel simulator's ability to support even more complex test cases, and our customers can now test a wider range of scenarios," says Rainer Perthold, CEO of IZT Labs.

www.izt-labs.de

Dual-band RFID antennas

suit worldwide frequency bands

HUBER+SUHNER has announced a range of dual-band UHF RFID antennas designed specifically for integration into package and goods identification systems. The Sencity® SPOT-L antennas support both European ETSI UHF (865 to 868 MHz) and USA/Canadian FCC UHF (902 to 928 MHz) RFID bands which allows RFID system designers to develop solutions for a global roll-out.

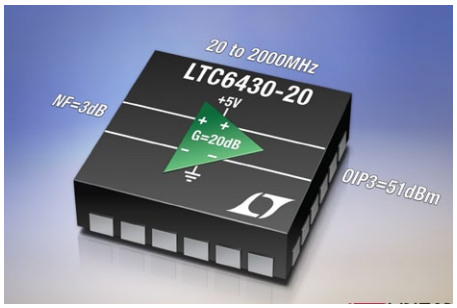
The antennas feature a matching tag reading range which, combined with a very low profile (11.5 to 15mm), make them suited for use as a conveyor portal antenna or as an under-belt antenna in RFID system applications including warehousing, industrial automation, distribution, retailing and logistics.

There are two flat panel, Sencity® SPOT-L portal antennas in the range which can be placed on the conveyor sides or as a gate. Model 1309.19.0002 measures 773- x 312- x 15-mm while 1309.19.0003 measures 480- x 312- x 15-mm. The under-belt flat panel antenna, Model 1309.17.0110, measures 1020- x 380- x 11.5-mm and can be mounted directly under moving belts.

All three models are left hand circular polarized, DC grounded and come with a cable pigtail. Other key features of interest to system designers include an operating temperature range of -30°C to +50°C, ingress protection to IP54 and shock and vibration resistance to IEC 60721-3-4

www.hubersuhner.co.uk

20-dB gain broadband differential amplifier



LTC6430-20 is a 20 MHz to 2 GHz differential input and output 20 dB gain amplifier that offers linearity of +51dBm OIP3 (output third order intercept) and 2.9 dB noise figure at 240 MHz.

It has OP1dB (output 1-dB compression point) of +23.9 dBm. The LTC6430-20 is offered in an A-grade version, which is 100% tested and guaranteed to a minimum OIP3 of +44.8 dBm, with a typical of +48.3 dBm at 380 MHz. Its gain is also guaranteed at minimum of 19.6 dB and maximum of 22.1 dB. A B-grade version offers a typical OIP3 of +46.3 dBm at the same frequency.

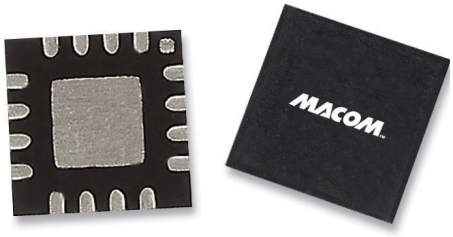
The LTC6430-20 is suitable for amplifying IF and RF signals in low distortion, high dynamic range transmitters or receivers at frequencies to 1.5 GHz. Higher frequencies up to 2 GHz can be achieved with appropriate impedance matching. The LTC6430-20's linearity characteristics are particularly notable when the device is used as an IF amplifier driving differential inputs of high speed A/D converters in main receivers or digital predistortion receivers whose performance relies on low distortion and high dynamic range. The device is suitable as a low noise amplifier for a wide range of broadband and narrowband radios that operate in the VHF/UHF bands.

Both inputs and outputs of the LTC6430-20 are internally 100Ω matched differential from 20 MHz to 1.2 GHz, and have a 20.5 dB power gain with a frequency response flatness of better than 0.5 dB over that frequency range.

www.linear.com

High power SP3T 100 W reflective switch

M/A-COM Technology Solutions Holdings has announced a high power PIN diode SP3T switch in a common anode configuration, operating from 30 MHz to 3 GHz.



The MASW-011030 is designed for military and civilian customers who require higher CW and pulsed power operation for radio applications.

This device is capable of handling 100-W CW incident power at a base plate temperature of 85ºC, delivered in a single 7-mm HWFN 16-lead plastic package.

The MASW-011030 is manufactured using MACOM's hybrid manufacturing process featuring high voltage PIN diodes and passive devices and is a high power switch ideal for use on land mobile radio and MIL-COM applications that require higher power.

Covering 30 MHz to 3 GHz, this device delivers 40 dB isolation at 2 GHz with insertion loss of 0.35 dB and is 1B HBM ESD rated.

www.macom.com

Tiny eCompass

features soft gyro features for smart devices

MiraMEMS cliams to offer the smallest eCompass available combining a 3-axis accelerometer and 3-axis magnetometer, which is pin to pin compatible with the g-sensor family and can provide a gyroscope feature with software supported.

With the MiraMEMS Xmotion™ software enabled, the da213/da312 eCompass products provide 9 DoF (Degree of Freedom) with soft gyroscope for smartphones and wearable devices under a limited cost budget.

The dc213 comes in the 2- x 1- x 1.1-mm LGA package, and the dc312 measures 3- x 3- x 1.0-mm. Both of them are pin to pin compatible with the g-sensor family, providing an easy upgrade path.

MiraMEMS' 6 axis eCompass combo sensor provides the same performance as discrete sensors but in a limited space, which can significantly reduce customer's cost and PCB area. Incorporated with the Xmotion™ software solution, middle to low-end smartphones can also run sophisticated 9 DoF motion games, without suffering the high cost and power consumption of gyro hardware.

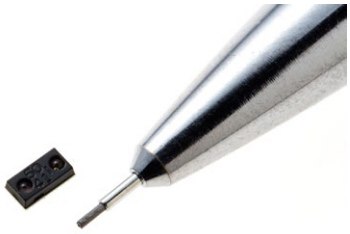
Key features include a standard I2C interface and dedicated programmable interrupt. The accelerometer offers a ±2g, ±4g, ±8g, ±16g scalable range, with 14 bits high resolution.

The magnetometer boasts a ±48 Gauss wide range with16 bits high resolution.

www.MiraMEMS.com

Compact gesture sensors

combine three detectors in one



From Sharp Devices Europe, GP2A-P052A00F and GP2AP054A00F gesture sensors are aimed at a new wave of applications that are responsible for the ongoing double-digit growth in the gesture sensor market.

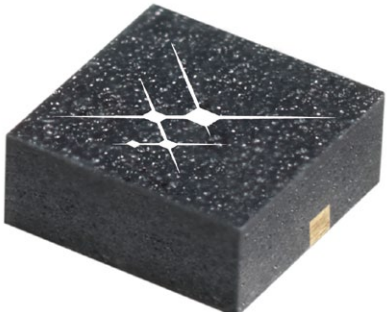
Sharp's approach has been to include three different functions on a single sensor chip, resulting in several advantages for device makers. Sharp was the first to develop a component that integrates an ambient light sensor (ALS), gesture sensor, and proximity sensor all in a single package. Since the sensor chip brings along its own LED infrared emitter, manufacturers no longer need devote time and resources to selecting a suitable infrared LED for their sensors. This lowers costs and increases accuracy and reliability. The ALS sensor enables innovative features to control the brightness of the LCD backlight. The all-in-one design also saves valuable device real estate, allowing for more compact designs without sacrificing functionality.

A gesture sensor works by emitting an infrared beam and detecting the reflected IR, allowing the location of the respective object, such as a hand, to be calculated. As the hand moves, the intensity of the reflected infrared light changes and the sensor detects motion.

www.sharpsde.com

Single control, SOI SP2T switch

ideal for WLAN applications



The SKY13453-385LF is a single-pole, double-throw (SP2T) switch intended for mode switching in pre-power amplifier (PA) cellular or WLAN applications.

Using advanced switching technologies, the switch maintains low insertion loss and high isolation for all switching paths.

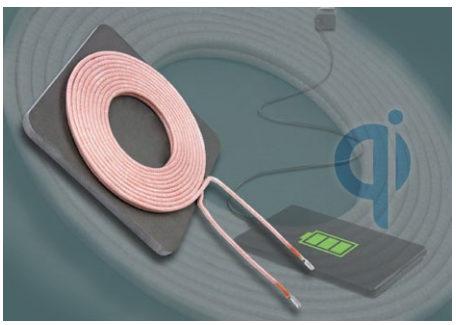
The high linearity performance and low insertion loss achieved by the switch make it an ideal choice for mode switching before the PA in cellular applications. Depending on the logic voltage applied to the control pin (VCTL), the RFC pin is connected to one of the two switched RF outputs, RF1 or RF2, using a low insertion loss path, while the path between the RFC pin and the other RF path is in a high isolation state.

The switch is manufactured in a compact, 1 x 1 mm, 6-pin QFN package.

www.skyworksinc.com

Wireless charging transmitter coil

offers high efficiency



Vishay Intertechnology has announced a powdered-iron-based, WPC-compliant (Wireless Power Consortium) wireless charging transmitter coil for Qi wireless charging pads.

Offering a durable construction and high permeability shielding, the Vishay

Dale IWTX-4646BE-50 provides high efficiency greater than 70 % at a 19 V input voltage when tested using WPC-compliant transmitter and receiver chipsets and a Vishay Dale IWAS-4832FF-50 receiver coil with 2.7 mm spacing.

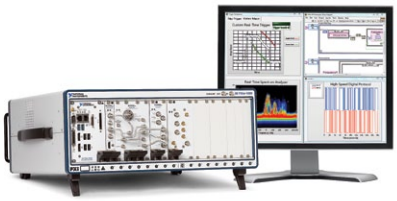
Designed for use in conjunction with the company's WPC-compliant wireless receiver coils, the IWTX-4646BE-50's high-saturation powdered iron is not affected by permanent locating magnets. As an alternative to larger ferrite-based solutions — which can saturate in the presence of a strong magnetic field — the IWTX-4646BE-50 offers a magnetic saturation of 50 % at 4,000 gauss.

The RoHS-compliant device features inductance of 24 µH at 200 kHz with a ±5 % inductance tolerance, DCR of 71 mΩ (± 10 %) at + 25 °C, and Q of 185 typical at 200 kHz. The transmitter coil features a lead length of 40 mm and tinned length of 5 mm, heat rated current of 6 A, saturation current of 20 A, and self-resonant frequency of 7 MHz. AEC-Q200 certification for use in automotive applications is pending, and expected to be complete in Q1 2015.

www.vishay.com

Microwave vector signal analyser

wide bandwidth



National Instruments (NI) claims to offer the industry's widest bandwidth high-performance 26.5 GHz microwave vector signal analyser (VSA) and a fast tuning 20 GHz continuous wave signal generator.

High-performance vector signal analysers deliver a combination of low noise floor, high linearity, and low phase noise. The latest 26.5 GHz VSA combines these attributes with up to 765 MHz of instantaneous bandwidth. With the VSA's bandwidth, engineers can analyse some of the industry's widest bandwidth signals in a single acquisition including radar pulses, LTE-Advanced transmissions and 802.11ac waveforms. In addition, the VSA's fast measurement speed helps engineers decrease time to market and ultimately lower their cost of test. Finally, engineers can program the VSA's user-programmable FPGA with LabVIEW system design software to customise instrument behaviour and address the most advanced RF test applications.

The latest 20 GHz signal generator features an ideal combination of exceptional phase noise and fast tuning time (100 µs). This instrument addresses applications including blocking/interferer generation, high-performance intermodulation distortion test benches and various electronic warfare applications.

www.ni.com/microwave

PC-controlled VNAs

deliver coverage up to 40 GHz

Anritsu Company has expanded its ShockLine™ family of Vector Network Analyzers (VNAs) with the introduction of the MS46122A series.

Incorporating the company's patented shock line VNA-on-a-chip technology, the MS46122A low-cost full-reversing 2-port VNAs are packaged in a very compact 1U chassis, and are optimized for ultra-cost-sensitive test applications in manufacturing, engineering, and education environments.

The MS46122A series includes the first compact VNAs with frequency coverage up to 20 GHz and 40 GHz, respectively. A third model in the latest ShockLine series covers 1 MHz to 8 GHz. The MS46122A ShockLine VNAs offer the best in-class performance in key areas, such as speed, trace noise, stability, and dynamic range. The analyzers minimizes test times and maximizes throughput, making them well suited for testing passive devices such as cables, connectors, filters, and antennas.

Externally controlled via USB from a user supplied PC, the MS46122A VNAs do not contain an embedded computer or solid-state drive. Since there is no on-board data storage and all information is saved on an external user-supplied computer rather than the VNA, making it ideal for secure area operation.

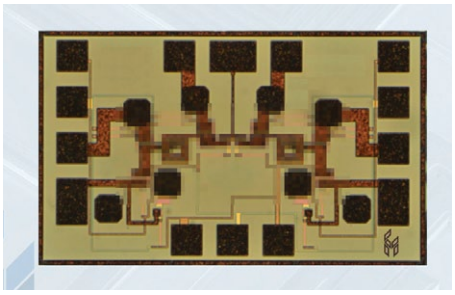
The symmetrical design of the package creates flexibility and convenience when rack-mounting, as the VNAs can face front or back. Because they are only 1U high, the VNAs save valuable rack space and are ideal for space-constrained test environments.

Similar to all the other members of the ShockLine family, the MS46122A VNAs feature the advanced ShockLine Graphical User Interface (GUI) software, which brings extensive test capabilities. Combining the easy-to-use GUI with wide variety of productivity enhancing features enable fast debugging and manual testing of passive RF and microwave devices in engineering and educational environments. The VNAs can be used in automated environments via IVI-C drivers in most popular application development environments such as LabVIEW, LabWindows, MATLAB, C# and .NET.

www.anritsu.com

SPDT non-reflective switch

offers positive gain slope



Custom MMIC has announced the CMD195, a DC-20 GHz non-reflective SPDT switch, to their growing line of control products.

The CMD195 operates across the DC to 20 GHz bandwidth with an insertion loss of 2.5 dB that reduces to 2 dB as the frequency increases. The terminated switch has an isolation of greater than 40 dB, port return losses less than -15 dB, an input 1 dB compression point of +25 dBm, and a switching speed of 1.8 ns. Switching operation is controlled by a pair of complementary logic signals at 0/-5 V.

Ideal applications include microwave radio and VSAT, telecom infrastructure, test instrumentation, and military end-use. The positive gain slope of the CMD195 versus frequency allows for natural gain equalization when multiple switches are cascaded together.

www.CustomMMIC.com

Multi-octave amplifier modules

cover 10 MHz to 30 GHz

The ABA range of ultra wide band amplifiers, recently released by AtlanTecRF, cover a frequency range spanning 10 MHz to 30 GHz.

Designed to be both economical and versatile, the amplifiers include a model to operate over 0.05 to 20.0 GHz in one unit with 24 dB gain, +23 dBm output power and less than 4 dB noise figure, while another spans 12.0 to 30.0 GHz with 30 dB gain, +20 dBm output power and just over 3 dB noise figure.

According to Karen McDermott, AtlanTecRF's marketing co-ordinator, the wide bandwidths and good all-round performance characteristics make these amplifiers suitable for a wide variety of applications — especially for system and test equipment engineers alike.

The stainless steel RF input and output connectors are mostly SMA female or 2.92 mm where the frequency dictates. Housings can be aluminium alloy or copper, gold plated, as required and the operating temperature range of all models is -45 to +85°C.

Another important feature is the high IP3 performance, up to +38 dBm while reverse isolation is often greater than 65 dB and all operated from a convenient +12V DC input.

www.atlanticmicrowave.co.uk

USB and LAN power sensors

feature wide dynamic range for radar and satellite testing

Keysight Technologies has announced the U2040 X-Series wide dynamic range power sensors, consisting of four USB models for wireless and radar applications, and a dedicated LAN model for satellite testing.

The U2040 X-Series has 96 dB dynamic range, spanning -70 dBm to +26 dBm, which enables accurate power measurements of very small signals, critical for applications such as wireless chipset and power amplifier module manufacturing. Users are also able to make both average and time selectivity average power measurements across the full 96 dB dynamic range. This is a significant improvement when compared to conventional power sensors, which often limit time-gated dynamic range measurements at around 50 dB.

With a measurement speed of up to 10,000 readings per second in fast/buffer mode, the U2040 X-Series measures continuously in real time and keeps pace with very fast pulses, up to 10 kHz pulse repetition frequency (PRF). While conventional sensors only provide a snapshot of continuous pulses, leaving dead time where glitches can slip by unnoticed, U2040 X-Series sensors measure every continuous pulse without leaving time gaps in between measurement acquisitions.

The U2040 X-Series provides broadband coverage for any modulated signal, and covers all common wireless signal formats such as LTE, LTE-Advanced with 100 MHz bandwidth, and WLAN 802.11ac with 80/160 MHz bandwidth. Built-in radar and wireless presets allow faster test set up, and for data capture and analysis, engineers can use the Keysight BenchVue software, which is bundled free of charge with each sensor.

www.keysight.com

Extension for high-end network analyzer

allows full characterization of active componentss

The ZVAX-TRM from Rohde & Schwarz was recently shown for the first time at European Microwave Week in Rome. It is an extension unit for the high end ZVA family network analyzers from the the company.

The ZVAX-TRM can be combined with a ZVA to yield a powerful, compact and highly customizable system. The ZVAX-TRM conditions the signals from the network analyzer as required for a given

task and either returns them to the analyzer or outputs them via its integrated high-power test ports. The combined ZVA and ZVAX-TRM enables users in development and production to measure parameters such as compression, noise figure and group delay even on three-port T/R modules, with the DUT having to be connected only once (single-connection device characterization).

Combining the ZVAX-TRM with a four-port ZVA with four internal sources yields a unique system that enables users to perform intermodulation measurements on modules with two conversion stages without the need for external signal generators. Such measurements require up to four signals (RF1 and RF2, LO1 and LO2), which are delivered by the above combination. Plus, measurement time is significantly reduced, since only internal sources are used.

Featuring integrated high-power test ports as standard, the ZVAX-TRM base unit allows bidirectional high-power measurements up to +43 dBm. Diverse hardware options are available to tailor the unit to user requirements. Optional output amplifiers can be inserted into the measurement paths to compensate for internal losses.

When equipped with optional combiners, the ZVAX-TRM can be used to deliver two tone signals for intermodulation measurements as well as for special group delay measurements on frequency-converting T/R modules with an internal LO. The optional pulse modulators allow bidirectional, pulsed signal measurements. The ZVAX-TRM generates the pulsed signals and feeds them to the DUT. The ZVA then performs the measurements, e.g., pulse profile, point-in-pulse, pulse average.

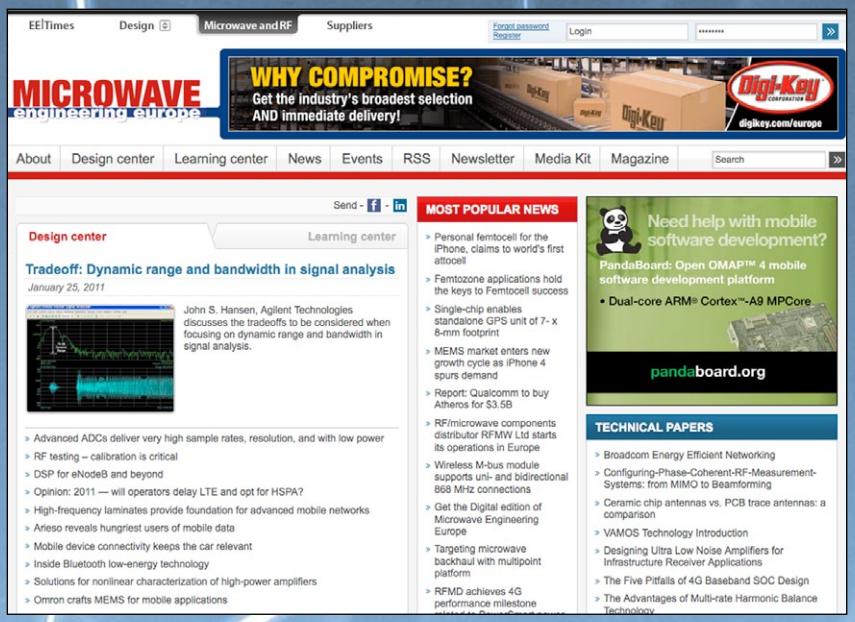
The ZVAX-TRM comes in different models, ranging from 10 MHz up to 24/40/50/67 GHz to match the diverse ZVA models. It can also be used with network analyzers from the ZVT family. The ZVAX-TRM decouples signal conditioning from the network analyzer.

www.rohde-schwarz.com

european business press

For the latest news: www.microwave-eetimes.com

news...
features...
products...
design...
white papers...
newsletter...
digital edition...



www.microwave-eetimes.com

The only European Site dedicated to Microwave and RF offering News, Design, How-to articles as well as an ever growing library of Technical Papers.

WIDEBAND RF SIGNAL PROCESSING SOLUTIONS

BETTER.
BY A WIDE MARGIN.

› 75 dB SFDR at 1.8 GHz Ain

› 80 dB SFDR at 1 GHz Ain

Analog Devices provides the industry's highest dynamic range in wideband RF signal processing solutions – to enable superior designs, in less time, with less risk. In fact, our new GSPS A/D converters deliver 6 dB+ more spurious-free dynamic range than competitive solutions. This performance breakthrough can simplify RF architectures and improve system sensitivity and functionality.

BETTER TECHNOLOGY

- Industry-leading GSPS ADCs with integrated digital downconverters for application flexibility and JESD204B-coded serial digital outputs for simplified interface.
- Portfolio of ADC drivers, DACs, RFICs, clocks, & power components for the complete high-performance wideband RF signal processing signal chain design.

BETTER TOOLS FOR WIDEBAND RF SYSTEM DESIGN

- As a design aid, ADI's GSPS ADC ICs are available on Rapid Development Prototyping and Reference Design FMC modules that seamlessly connect to the Xilinx FPGA development platform ecosystem.
- Modules include validated signal chain hardware, complete HDL code, Linux drivers, documentation, and software reference designs.
- Design tools include Mathworks Simulink® and IIO scope.

Start Prototyping Today!
analog.com/WidebandRF

ANALOG DEVICES