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MICROWAVE engineering europe

Antennas

Cover feature: Pure, precise signal generators help designers create next-generation wireless devices

www.microwave-eetimes.com

The European journal for the microwave and wireless design engineer

IN BRIEF

CEVA continues to dominate DSP IP

CEVA, Inc., has announced that it has been ranked by leading research firm The Linley Group as the worldwide leader in DSP IP shipments in 2011, with a 90% market share. The market share numbers were published in The Linley Group's recent report, titled "A Guide to CPU Cores and Processor IP".

"CEVA continues to be the most successful supplier of DSP IP — its licensees shipped more than one billion chips in 2011," said J. Scott Gardner, an analyst at The Linley Group and co-author of A Guide to CPU Cores and Processor IP. "CEVA has an impressive customer base for its DSP portfolio, especially in communications and multimedia. Furthermore, with the 4G transition well underway, high-performance programmable DSPs are required to efficiently handle complex multimode baseband processing. CEVA is well positioned to capitalize on this trend."

www.ceva-dsp.com

LTE RAN equipment revenues triple in Q1 2012

A recently published report by Dell'Oro Group indicates that the challenging macro economic environment is not preventing operators from building out their LTE networks. In contrast to the slowdown in sales momentum for the 2G/3G mobile Radio Access Network (RAN) equipment, the LTE market showed few signs of slowing down.

Highlights include: LTE RAN revenues up more than 160 percent versus 1Q11; more than 60 commercial LTE networks at the end of 1Q12; 15 million LTE subscriptions at the end of 1Q12, up 70 percent Q/Q; and TDD LTE markets commercialized in Japan.

The report also reveals that Ericsson and Alcatel-Lucent maintained the first and second spots in LTE revenue share while sales to Softbank Mobile's Wireless City Planning drove Huawei and ZTE into the first two spots in LTE TDD

www.DellOro.com

Mobile operators face a massive increase in network cost due to mobile data explosion

The tremendous growth in mobile data traffic — Solon Management Consulting expects a more than 15-fold increase between 2011 and 2016 for Germany alone — will put strong pressure on operators.

Mobile operators face significantly higher cost for providing additional network capacity. According to the Solon white paper "Mobile Data Growth: How operators can handle the traffic explosion" recently released, the cost for access and backhaul network could almost double within five years. Solon recommends a set of measures that will enable operators to provide bandwidth in a more cost-efficient way.

"Mobile operators need to act now to meet the mobile cost challenge," warns Stephan Kalleder, Principal at Solon and author of the white paper. Without adequate countermeasures, network expenditures will increase from 12 per cent of revenues in 2011 to 23 per cent of revenues in 2016 according to Solon estimates. "Since voice revenues are expected to grow moderately at best, the future profitability of mobile operators is strongly determined by how quickly they can improve the network cost base," says Kalleder.

Mobile operators can take two major approaches to significantly reduce the risk of cost outstripping data revenues: optimization of the existing infrastructure and network sharing.

www.solon.de

Nordic takes aim on step up to the WSN platform

Fabless chip company Nordic Semiconductor ASA is ready to take its business to the next level, which is the combination of wireless transceivers, sensors and digital processing.

Nordic is looking to move beyond RF said Svenn-Tore Larsen, CEO. "We have the analog part. What we need to do is integrate more digital and the sensor. We need to establish the platform,"

The concept of wireless sensor networks (WSNs) based on tiny motes that combine sensing, with analog, digital, RF and an energy source has been discussed many times over the last decade. But Larsen indicated that the idea's time may be coming soon. However, the optimum platform would vary from application to application.

"We are working in five university projects around the world; in Asia, the United States and in Scandinavia. It's important to pick right sensor; to pick the right technologies before they get too expensive."

www.nordicsemi.com

Mindspeed and China Mobile collaborate on TD-SCDMA/TD-LTE small cells

Mindspeed Technologies will form a joint development lab with China Mobile Communications Corporation to support the operator's recent deployment of time division synchronous code division multiple access (TD-SCDMA) femtocells.

"With close support and collaboration from chip vendors and infrastructure companies like Mindspeed, femtocell technologies in China Mobile's TD-SCDMA network have achieved commercial deployment. This joint development brings a significantly improved customer experience and further demonstrates that small cells will play important roles in wireless broadband services," said Gu Yihong, assistant general manager at China Mobile Jiangsu Suzhou Branch. "The convergence of TD-SCDMA, TDD-LTE, GSM and Wi-Fi is a fast evolving technology trend, and we appreciate TD-Femto ecosystem companies like Mindspeed that are driving this shift with mature solutions."

www.mindspeed.com

RFMD.

Complete Front Ends for AMI/Smart Energy and ZigBee® Applications

RFMD offers single-chip integrated front end modules (FEMs) developed for high performance AMI and ZigBee applications. Developed for easy integration with the TI Chipcon transceivers, these FEMs and their associated reference designs enable customers to shorten time-to-market, cut costs, reduce size, and improve performance—especially the spurious response. The RF6505CC2530 is the 2.4-2.5GHz reference design utilizing TI Chipcon CC2530 transceivers and the RF6505. The RF3858CC1101 is the 868-915MHz reference design utilizing TI Chipcon CC1101 transceivers and the RF3858. Each of the RFMD® FEMs meets the RF front end requirements for 802.15.4g and is supplied 100% DC- and RF-tested. These reference designs address customers' needs for proven design technology, enhancing efficiencies, and providing range extension for higher output levels from 100 mW to 1W. Reference design documentation is available free of charge; all reference designs are fully tested, and come with schematics, bills of material, and Gerber design file documents.

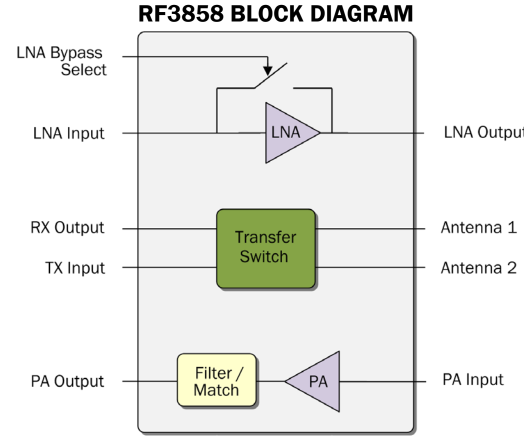
Reference Designs materials for TI, Atmel, Freescale, Ember and SiLabs can be found at www.rfmd.com/ZRG0611.

SPECIFICATIONS

Architecture	*Freq Range (MHz)*	*Gain (dB)*	*Avg P_{OUT} (dBm)*	*V_{CC} (V)*	*Current at P_{OUT} (mA)*	*Package*	*Part Number*
PA, SP2T, DP2T, LNA	2400 to 2500	28.0	27.0	3.6	500	3.5 x 3.5 x 0.6	RF6505
PA, DP2T, LNA	902 to 928, 868	30.0	31.5*	3.6	950	8.0 x 8.0 x 1.2	RF3858

*At PA OUT

RF3858 BLOCK DIAGRAM

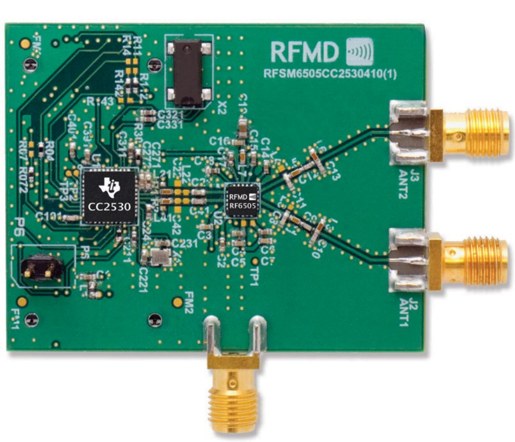


FEATURES

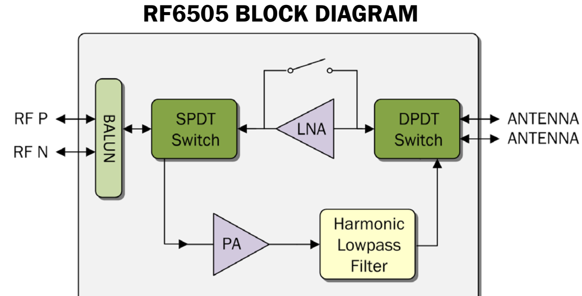
- **Integrated PA, Tx harmonic filtering, LNA, and switches**
- **High power: up to >1W**
- **High gain: 28 to 31dB**
- **High efficiency: >55%**

APPLICATIONS

- **ISM Band**
- **Smart Energy**
- **Automatic Metering Infrastructure (AMI)**
- **Alarm Systems**
- **Home Area Network (HAN)**



RF6505 BLOCK DIAGRAM



RFMD

Mobility. Connectivity. Energy.

IN BRIEF

Qualcomm, Samsung form wireless power alliance

Mobile technology companies Qualcomm Inc., and Samsung Electronics Co. Ltd., have announced the formation of the Alliance for Wireless Power (A4WP).

The mission of the organization is to promote global standardization of wireless power transfer for the charging of consumer electronic equipment.

The A4WP will focus on a new wireless power transfer technology that provides spatial freedom for charging electrical devices in cars, on tabletops and for charging multiple devices simultaneously, Qualcomm said. Companies joining Qualcomm and Samsung in the AW4P include: Ever Win Industries, Gill Industries, Peiker, Powermat Technologies, and SK Telecom.

www.qualcomm.com
www.samsung.com

Murata selects Black Sand CMOS PAs

Japanese passives to power supplies giant Murata Manufacturing Co. Ltd. (Tokyo, Japan) has selected CMOS power amplifiers from Black Sand Technologies Inc., (Austin, Texas) for use in RF front-end modules for 3G mobile phone handsets.

Integrating the PA together with other RF front-end components into a single module allows for better optimization of performance, battery current, size, and cost, said Black Sand.

Mobile device manufacturers have long sought a viable CMOS alternative to GaAs that will enable them to benefit from an improved supply chain, higher reliability, and lower cost.

Diehl said that envelope-tracking (ET), the method of matching PA voltage to the instantaneous power output required was something that CMOS PAs enabled but that the market seemed to be applying it more to 4G than to 3G communications.

ww.blacksand.com
www.murata.com

Sequans increases throughput threefold with LTE interference mitigation technology

Sequans Communications SA said it has added an interference mitigation algorithm to its LTE chip platforms that the company says can increase throughput by more than three-fold and can increase network capacity by up to two fold.

Sequans (Paris) said its Active Interference Rejection (AIR) technology was co-developed with technology partner ArrayComm Inc., a Silicon Valley firm specializing in multi-antenna signal processing. AIR works by forming a receive beam toward the useful signal, and spatial nulls in the direction of interfering signals, Sequans said.

"LTE spectrum is limited and interference is becoming an issue for operators as network traffic increases," said Bertrand Debray, Sequans' chief technology officer, in a statement.

Debray said that while network-based interference mitigation techniques are specified in future releases of the LTE standard, these techniques are not available currently. "We designed Sequans AIR in response to this, and have developed a powerful interference solution that can be implemented on today's LTE networks for significant benefits to end users and network operators," Debray said.

Sequans said AIR is designed to work in any LTE network (TDD or FDD), regardless of eNode B, carrier frequency or channel bandwidth. AIR works today on LTE Release 8 and 9 networks and will work on future Release 10 and 11 networks.

www.sequans.com

ESA to use Chalmers amplifiers to receive signals from space probes and satellites

Researchers at Chalmers have developed and built 30 ultrasensitive, cryogenically cooled amplifiers for receiving satellite signals. They will be used, for example, in the receiver of the Cebreros tracking station, which will be upgraded within a few weeks. Cebreros provides daily information on the space projects Venus Express, Mars Express and Rosetta.

The European Space Agency (ESA) will be using the amplifiers throughout the world to receive signals from its space probes and satellites — to measure data that is currently buried by noise. The amplifiers from Chalmers have several advantages over their predecessors. Their primary benefit is that they add less noise to the satellite signal, which enables major possibilities for space research.

The amplifiers are built with MMICs, which means that they are complete components that are much easier to assemble.

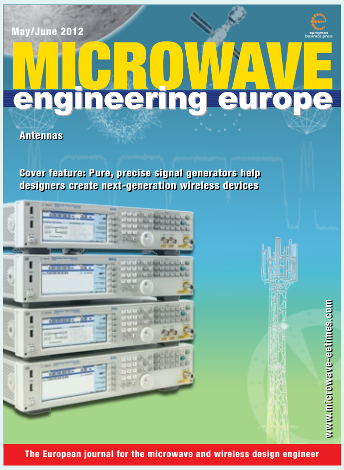
www.chalmers.se, www.es.int

Agilent Technologies develops voice-over-LTE test system with Brüel & Kjær

Agilent Technologies has announced that its PXT wireless communications test set is available for testing voice quality on Voice-over-LTE (VoLTE) 4G phones with the Brüel & Kjær PULSE audio analyzer and Head and Torso Simulator (HATS).

Transporting voice over a packet-based LTE cellular infrastructure poses challenges that make voice-quality testing essential. The Agilent and Brüel & Kjær solution combines standards-based test methods with real-world base station emulation, RF test and functional test to ensure that VoLTE phones will meet user's expectations. The Brüel & Kjær PULSE audio analyzer and HATS system support testing based on commonly used international standards such as ITU-T P.862 PESQ, 3GPP2 and 3GPP audio test specifications. The Agilent PXT wireless communication test set incorporates flexible base station/network emulation, RF parametric and functional tests into one integrated unit.

www.agilent.com, www.bksv.com



This month's cover shows the latest signal generators from Agilent Technologies. From the pure and precise MXG to the cost-effective EXG, the X-Series signal generators are designed to keep pace as system designers continue to drive for better RF performance.

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LTE to drive wireless growth for a decade

LTE or Long Term Evolution is just begining to roll out, and as was the case with 3G, the process will span around a decade or more. As network operators address issues such as cost — LTE networks are more expensive — in an environment where revenues are flat, LTE will gather momentum. Then there are the technical issues such as how to best implement small cells, carrier aggregation and backhaul.

As the market addresses these issues and CMOS processors and DSP-based devices integrate more and more functionality, equipmnt and deployment costs will drop.

As revenues are a key issue and voice is the dominant driver of wireless operator revenue, even today, VOIP will be a key requirement along with all the issues of Quality of Service. However, since LTE is an IP based protocol, VOIP is the only route available to operators, unless they keep a 3G, 2G or GSM network running in parallel. Cost once again rules out this scenario in the longer term.

In recently released report, Exact Ventures found that the IP multimedia subsystem (IMS) Core market in the first quarter nearly tripled year-over-year, in major part due to significant voice-over-LTE (VoLTE) deployments in North America.

"While the IMS Core market showed very strong growth during the quarter it is still a relatively small market, accounting for just 10 percent of the total — wireline plus wireless — voice core market," said Greg Collins, Founder and Principal Analyst at research firm Exact Ventures. "The transition away from circuit switching to an all IP core network based on IMS is just beginning and is expected to last well over a decade," commented Collins.

In a another report Dell'Oro Group indicates that the challenging macro economic environment is not hindering operators from building out their LTE networks. This is in contrast to the slowdown in sales momentum for the 2G/3G mobile Radio Access Network (RAN) equipment.

Dell'Oro Group reports that LTE RAN revenues are up more than 160 percent versus 1Q11with more than 60 commercial LTE networks at the end of 1Q12.

If we are to deliver the wireless society of the future then we will need to migrate to LTE and LTE Advanced. However, the process will take many years and this important growth industry as a long way to run.

Jean-Pierre Joosting
Editor (jean-pierre.joosting@eetimes.be)
www.microwave-electronics.com

Agilent's pure, precise signal generators help designers create next-generation wireless devices

By Agilent Technologies

In RF communications, the seemingly insatiable demand for content continues to drive up data rates, modulation bandwidth and distortion requirements. As designers reach for new levels of performance, so must the instrumentation they use to characterize their devices.

From 9 kHz to 6 GHz, the analogue and vector versions of Agilent's MXG and EXG X-Series signal generators (Figure 1) provide industry-leading performance in five areas: phase noise and spectral purity, bandwidth, error vector magnitude (EVM), adjacent-channel power ratio (ACPR) and output power. The MXG and EXG take that performance into new areas with advanced capabilities such as real-time baseband signal generation that supports applications in cellular communications, wireless networking, audio/video broadcasting, and navigation (e.g., GPS and GLONASS). Through these contributions, the MXG and EXG enable testing that reveals the true performance of components, receivers, power amplifiers, and other electronic devices.

Delivering wide modulation bandwidth —with accuracy

One recent example is the gigabit speed of the emerging IEEE 802.11ac wireless networking standard. It operates in the 5-GHz band and uses 256QAM modulation at bandwidths up to 160 MHz. This places a heavy burden on the signal generators used in device testing because the achievable level of modulation accuracy typically declines as signal bandwidth increases.

To meet this need, the MXG uses advanced modulator circuits and innovative calibration techniques to overcome the I/Q and frequency-response problems that generally worsen with increasing bandwidth. This enables the MXG to provide modulation bandwidths up to 160 MHz with flatness up to ±0.2 dB and EVM up to 0.4% (Figure 2).

One key to this combination of bandwidth and accuracy is the use of an internal calibration source and factory-calibrated channel corrections that extend from the modulator to the RF output. Together, these technologies minimize errors in amplitude, group delay and I/Q, thereby ensuring excellent flatness and modulation accuracy. The combination of calibration source and channel corrections also provides wide modulation bandwidth accuracy without requiring user intervention such as manual I/Q adjustment.

This can be useful in the testing of smartphones, which can have three or more transceivers running at the same time while other similar devices are operating nearby. The MXG's wide-bandwidth modulator can produce a test signal composed of a complete spectral segment that includes the desired signal plus adjacent and alternate channels as potential interferers—and perhaps spurious or transient signals, too.

Delivering pure signals at high output levels

In applications such as the development of multi-carrier power amplifiers (MCPAs), large signals are needed to drive an amplifier into its nonlinear region to produce harmonics, intermodulation and compression. In a signal generator, high output power is useful only if test signals can be produced with high quality in areas such as harmonic distortion, broadband noise, ACPR and EVM.

Figure 1: Available in analogue and vector models, Agilent's X-Series signal generators cover a variety of needs, from continuous-wave signals to advanced receiver testing.

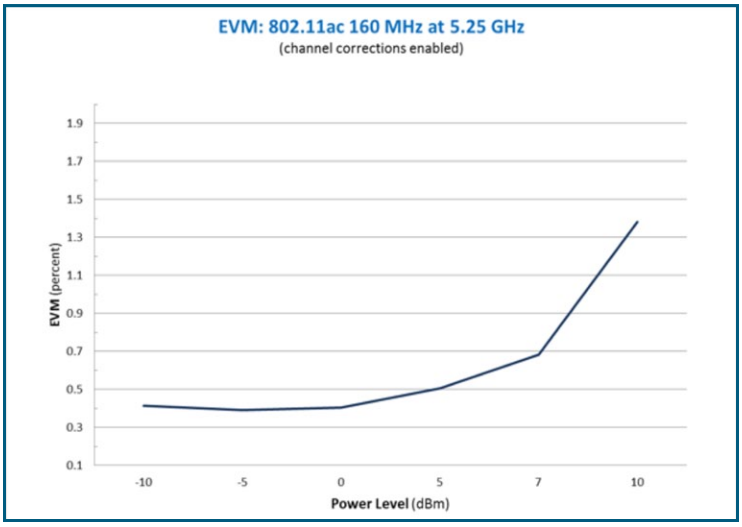


Figure 2: With option 1EA, the MXG provides excellent EVM performance.

The MXG and EXG combine output power of up to +27 dBm with low EVM and low ACPR of up to -73 dBc (W-CDMA TM1, 64 DPCH). This provides a one-box solution that is pure and powerful enough to support direct testing of high performance MCPAs as well as components and systems.

External power amplifiers are sometimes used with RF signal generators; however, this adds cost and complexity to the test solution. It will also degrade performance by adding amplitude error that is outside the signal generator's calibration loop.

Applying excellent performance to complex signals

To help developers quickly create high-quality signals that meet the needs of specific standards and measurements, the MXG and EXG are compatible with Agilent Signal Studio software. This suite of signal-creation tools addresses cellular communications, wireless connectivity, audio, video, positioning, tracking, and general-purpose applications.

Signal Studio has two operating modes: waveform playback mode and real-time mode. Waveform playback mode supports two levels of functionality, basic and advanced. These are used to create and customize waveform files of finite length by configuring signal parameters, calculating the resulting waveforms and downloading the files for playback by an MXG, EXG or other Agilent instrument. Basic capabilities support creation of partially coded, statistically correct signals for stimulus/response measurements. Advanced options support creation of fully channel-coded signals for analysis of, for example, receiver BER, FER, BLER and PER.

In real-time mode, a graphical interface provides a direct instrument connection for parameter transfer and closed-loop or interactive control during signal generation. Continuous data or closed-loop testing is becoming increasingly important in the testing of several wireless standards: 3GPP LTE TDD and FDD; digital video; Global Satellite Navigation Systems; GSM/EDGE; 3GPP2 CDMA; and 3GPP W-CDMA. All these are supported by the corresponding versions of Signal Studio.

Enhancing real-time baseband generation

To support real-time mode, the MXG and EXG include a powerful internal real-time baseband generator and processor-accelerator ASIC. The baseband generator also supports custom or flexible modulation types including constellations as dense as 1024QAM.

These capabilities support creation of complex signal scenarios of extremely long durations. In satellite navigation, an MXG or EXG can generate signals representing up to 32 GPS+GLONASS satellite channels with real-time control of satellite visibility and power with more than 24 hours of simulation time (Figure 3). In DVB applications, this solution supports up to two hours of playback or continuous PN23 data sequences.

Real-time generation is especially useful during throughput testing of real-world channels. An example configuration is shown in Figure 4. In testing such as LTE HARQ, the X-Series signal generators can receive TTL-level feedback signals and reconfigure the transmission signal while maintaining the link. This enables highly realistic testing of throughput over impaired channels.

Simplifying signal simulation

The replay of an arbitrary waveform file is often an easier way to handle highly customized signal-simulation applications. In such cases, an important but simple technical advance is deep waveform memory: the MXG has up to 1 GSa and the EXG up to 512 MSa.

With 1 GSa, the MXG's playback capacity ranges from seconds to hours of a continuous signal without repeating, depending on the selected sample rate. This capability generally exceeds conformance requirements and can, in some cases, provide an alternative to real-time signal generation.

Generating true performance

To know a device's behavior, a designer will explore many paths. That vision helped inspire the development of the X-Series signal generators. These instruments produce the essential signals—from simple to complex, from clean to impaired—that enable detailed testing of components and receivers at and beyond their limits. From the pure and precise MXG to the cost-effective EXG, the innovative X-Series signal generators are designed to keep pace as system designers continue to drive for better performance in RF communications and connectivity.

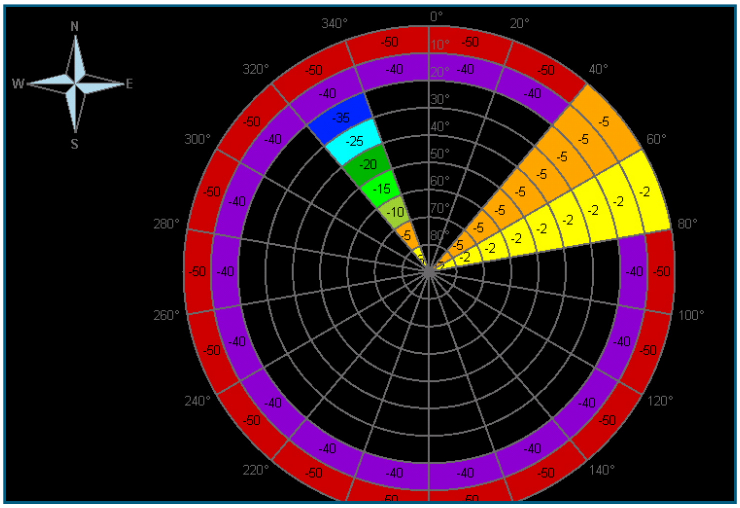


Figure 3: Software-based configuration of parameters such as antenna patterns enhances creation of realistic signal scenarios in the testing of GPS or GLONASS systems.

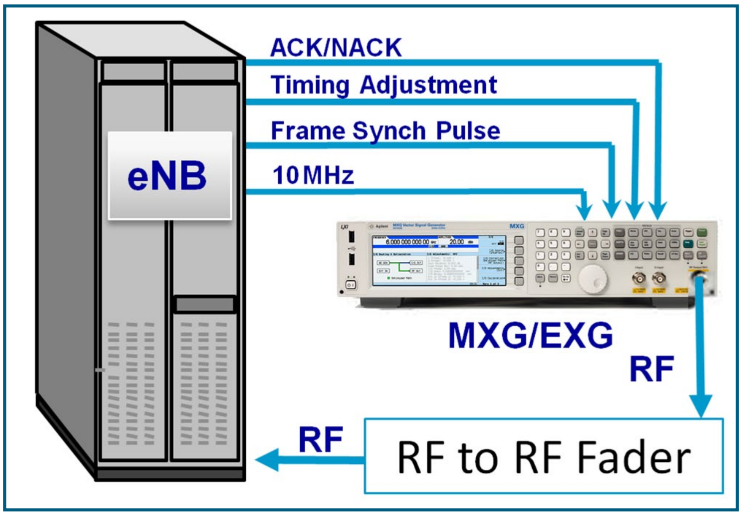


Figure 4: To enable closed-loop testing, TTL-level feedback signals are used to control a real-time baseband generator in the RF source.

Tuning components enable better wireless performance

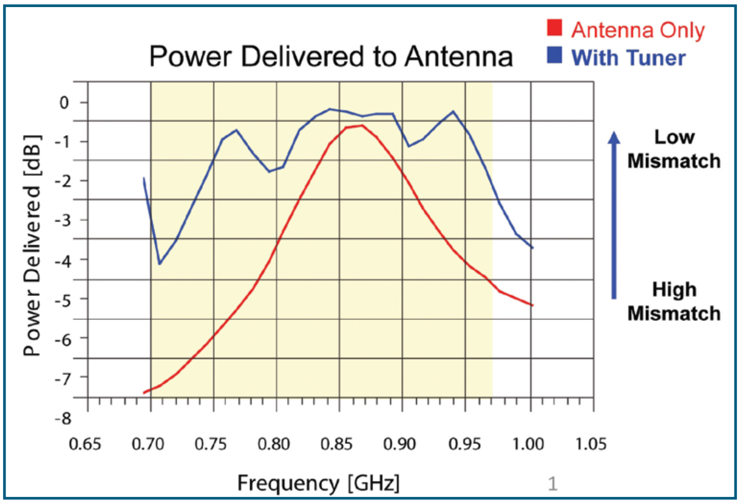
By Richard Whatley and Duncan Pilgrim, Peregrine Semiconductor

3G/4G connections, Wi-Fi® protocol connections, Bluetooth® technology, GPS, and RFID technology are now becoming the norm in mobile devices such as mobile handsets, inventory-control handheld computers, and machine-to-machine (M2M) terminals. All of this functionality is increasing the complexity of the RF front-end. Simultaneously, the global increase in wireless data transmissions and the move to 4G/LTE networks requires better signal quality, and higher efficiencies in mobile devices. Specifically, as more bands are added to the network to support the increasing demand for data capacity, the components in the wireless system must support wider bandwidths with lower loss. As a result, the latest mobile terminals require more filtering and RF front-end components that offer better linearity. By deploying mobile devices with tunable components, operators can improve the link between the radio and the base station, get a better data connection, reduce the number of required base stations, and more effectively manage a network.

Over the past several years, numerous technological approaches have shown promise to satisfy the need to tune everything from mobile handset antennas, to filters and frequency synthesizers. In today's wireless market, designers can immediately reduce circuit complexity by using tunable matching networks to extend the frequency range and performance of a single antenna, or by implementing tunable low-pass, band-pass, and notch filters with selectable rejection ratios. A viable tuning technology can dramatically improve wireless radio performance.

In addition to improving radio performance, tuning circuitry can reduce radio complexity. This is particularly important for military radios, software-defined radios, and UHV/VHF radios. Modern radios require multiple RF filters to support various bands. These applications can benefit from tunable low-pass and band-pass filters, tunable notch filters, and production centering. In the past, tunable filters have been implemented using a switchable filter bank to select the desired frequency band. Today, a large, switchable filter bank can be replaced by a single tunable DTC filter, reducing radio complexity and cost.

Figure 1: Power delivered to typical cellular handset antenna.



Success in the high-volume cost-sensitive wireless market requires any selected technology to be low-cost, repeatable, reliable, and low power. One such approach has been taken by Peregrine Semiconductor. By applying proven, patented UltraCMOS® process and HaRP™ switch technologies, engineers at Peregrine developed DuNE™ tuning technology, a new design methodology used to develop Digitally Tunable Capacitors (DTCs). These DTCs are monolithic solid-state, digitally controlled variable capacitors targeted for the 100 MHz to 3 GHz range.

Tuning advantages

While wireless devices have long benefitted from tuning, the addition of multiple radios (Bluetooth, RFID, Wi-Fi, and cellular) and the increasing number of frequency bands now make tuning a necessity. Multiple modes and bands require an antenna with broadband coverage. This is nearly impossible to achieve in a small form factor because handset antennas must trade off RF performance for form factor (the smaller the antenna, the lower the performance). Poor handset antenna performance leads to reduced network coverage area, low data rates, dropped calls, and poor battery life. Unfortunately, small antennas often have high mismatch loss on band edges, which reduces the power delivered to the antenna and the radiated power. This, in turn, reduces RF performance.

The ways in which users hold a mobile handset can also degrade antenna performance. This causes increased filter losses, reduced power amplifier output, and increased current consumption. Adding tuning circuitry, such as a tunable matching network, improves radio performance, which translates to "more bars" on the mobile handset. It also simplifies radio complexity, reducing the number of required components and improving cost and footprint.

For example, the antenna in Figure 1 loses 84% of power delivered to it simply due to mismatch at 700 MHz. If this cellular device is required to radiate at a certain power level, it must, therefore, boost its output power to compensate for the energy lost due to mismatch. This reduces transmission efficiency and battery life. Fortunately, this problem can be addressed using tuning technologies, providing a mechanism where energy lost due to mismatch can be reduced.

After adding a tunable matching network, the power delivered to the antenna is increased for a fixed output power for the cellular device, demonstrating an improvement of 0.5-5 dB (see Figure 1). This translates to better radio

efficiency and longer battery life. Further, in comparing a device with a tunable matching network to a network without tunable matching, at 700 MHz the device with the matching network can achieve nearly 3x the data rate at the same distance from a base station.

Evolution of tuning

Historically, tunable RF components have been large, mechanical, and costly. The earliest variable capacitors were realized by sizeable mechanical capacitors that were rotated by a motor (or manually). Then, trimmer capacitors were used to fine-tune circuit performance in a production environment. Today's growing need for tuning technologies did not take the industry by surprise, so several alternatives have been in development to satisfy anticipated needs. Currently, the tuning technologies with the most promise include MEMS switched capacitor banks, BST ferroelectric capacitors, and DTCs based on FET switches.

Selecting a tunable technology

Since tuning may be new to many designers, it is important to understand the figures of merit for a successful implementation in a wireless application. For example, applications such as mobile handsets and military radios require a tunable capacitor with a performance level that is challenging to achieve:

- High power handling: +33 to +42 dBm;
- High linearity: harmonics less than -36 dBm, IMD3 less than -105 dBm;
- Low-loss: Q = 30-100;
- Capacitance: 0.5-20 pF,
- Tuning ratio 3:1-10:1;
- Low total power consumption <1 mA;
- Fast switching speed: 10 µs;
- Reliable, rugged, suitable for high volume production

Specifically, for antenna applications, the tunable component must provide a wide impedance tuning ratio and a high quality factor, while handling RF power levels up to 2 W and meeting the stringent harmonics and IMD distortion requirements for 3G/4G operation [1]. Given the maximum GSM transmit power of +33 dBm and the voltage multiplication that can occur in matching networks under mismatch conditions, the tunable component must also linearly tolerate RF voltages of up to 30 Vpk, corresponding to over +39 dBm in 50 Ω.

To support cellular GSM RX/TX tuning, the tunable component must be reliable over 10^{12} switch cycles and have a <10 µs switching speed. The cellular handset application environment also requires small size, low cost, high reliability, and high yield for economical high volume mass production. Until the development of DuNE DTCs, the lack of electrically tunable reactive components meeting these very tough specifications prevented the adoption of tuning matching networks in mobile wireless devices.

Integration is another important consideration in the selection of tunable component technology. In addition to economies of scale, the silicon-on-sapphire process used in DuNE DTCs enables the monolithic integration of multiple tunable components on one die together with analog circuitry and a shared digital control interface. The die can then be flip-chip mounted on module laminate. This is a significant improvement over GaAs processes that require a separate CMOS control chip and wire-bond assembly. A module containing the single die implementation of multiple DTCs with a serial interface, coupled with SMD inductors, enables a low cost implementation with a reduced module footprint and assembly cost (see Figure 2).

DuNE™ DTCs

The DTC shown in Figure 2 is based on a solid-state, monolithically integrated CMOS switched capacitor bank, where each switch is realized as a stack of field effect transistors (FETs) instead of a single FET. This stacking approach enables high RF power handling and high linearity, and it uses the same RF switch technology with an insulating sapphire substrate that is in high volume production in 2G/3G/4G handsets.

The DuNE DTC is programmed through a 2-or 3-wire serial interface, designed using existing UltraCMOS switch FETs combined with MIM capacitors. The DTC can be used either in a series or shunt configuration, enabling the use of this component in many different tunable circuits.

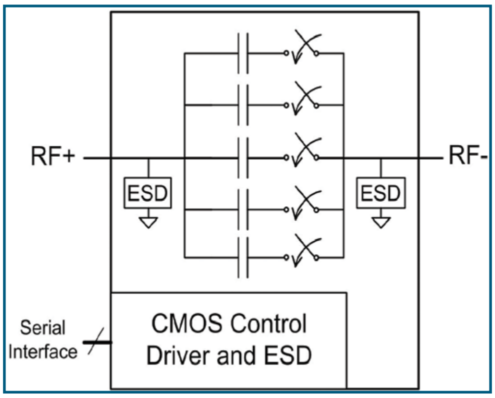
Tunable matching networks

Figure 3 shows a schematic for a single-path, tunable matching network using DuNE DTCs.

This particular design targets multi-band LTE/WCDMA/GSM applications on UMTS-FDD Bands I, II, III, IV, V, VIII and XII. It is implemented with three tunable components and biasing and control circuitry integrated onto a single die. This design controls the DTCs through a serial interface. By employing a reconfigurable coupled resonator topology widely used in band-pass filters and impedance-matching networks, this tunable matching network provides wide impedance coverage in the operating bands of 698 – 960 MHz and 1710 – 2170 MHz. Each DTC in this design is implemented using 4-bit resolution as a tradeoff of resolution versus number of individual tuning states available for the network (4096 for 3 x 4 bit DTCs). This device measures approximately 3 mm^2, so it is suitable for integration into a 3.5 x 3.5 mm module that includes passive components, such as the high-Q wire-wound inductors.

To evaluate the performance of the tunable matching network in the system, a metric

Figure 2: A solid-state DuNE™ DTC for wireless applications.



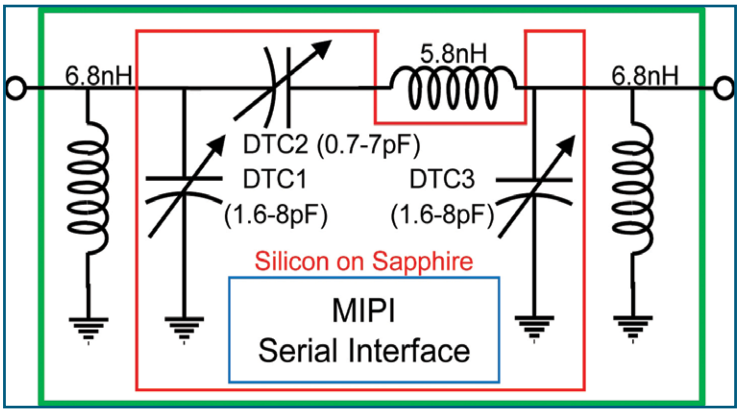
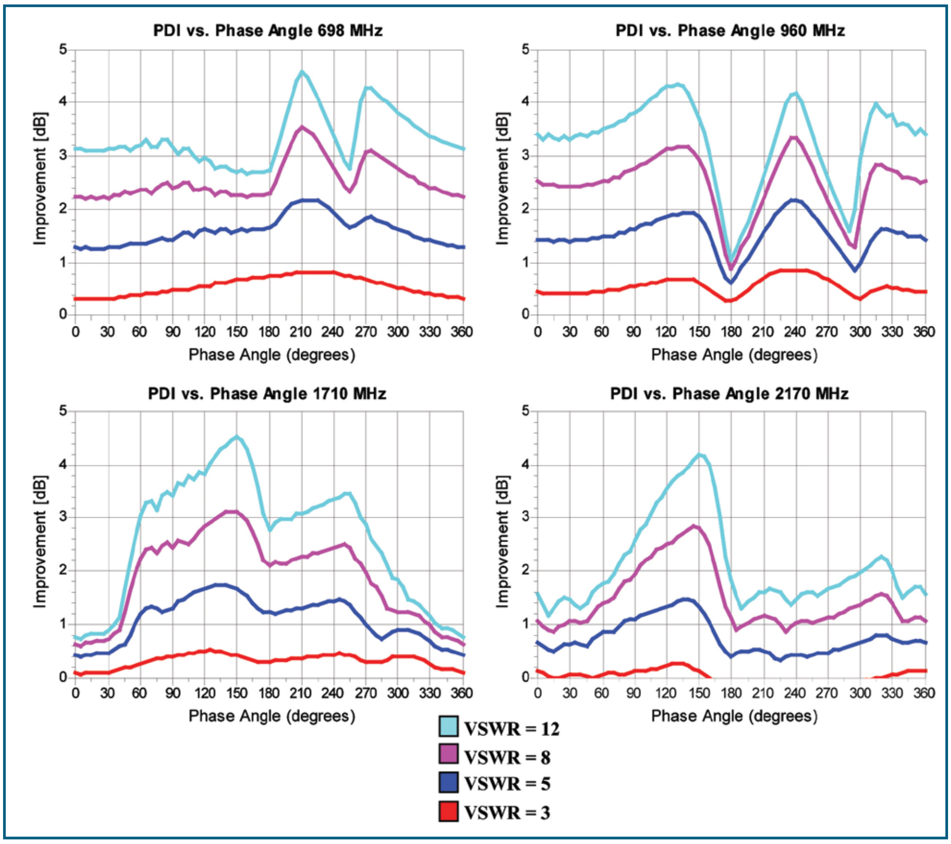


Figure 3: Schematic of a tunable matching network using DuNE™ DTCs.

Figure 4: PDI for various load VSWR conditions and frequencies, and effects of DuNE™ DTCs.



called the power delivered improvement (PDI) has been proposed [2]. PDI is a measure of the performance improvement (in dB) that the cellular device will achieve with a tunable matching network for a given antenna VSWR and phase angle. Figure 4 shows the PDI for various load VSWR conditions and frequencies. When the antenna impedance is at high VSWR (12:1), using the UltraCMOS tuning circuitry improves power delivered to the load by 4 dB or more. The break-even point in power delivery occurs when the load VSWR is approximately 2:1, below which the tuner dissipative losses are higher than mismatch loss without tuner.

Antenna performance can be significantly improved with the addition of a tunable matching network. This will increase the power delivered to and radiated out of the antenna. Initially, we can expect to see tunable matching networks as well as low-pass and band-pass filters, tunable notch filters, and production centering for wireless devices. In addition, the reduced radio complexity through tuning will benefit military radios, software defined radios, and UHV/VHF radios.

References

[1] T. Ranta, J. Ella and H. Pohjonen, "Antenna Switch Linearity Requirements for GSM/ WCDMA Mobile Phone Front-ends", 8th European Conference on Wireless Technology Proceedings, Paris, France, Oct. 2005, pp. 23–26.

[2] R. Whatley, T. Ranta, and D. Kelly. "CMOS Based Tunable Matching Networks for Cellular Handset Applications," IMS2011 Proceedings.

Micro radio delivers scalable output power for small/macro cell active antennas

Ubidyne has launched a unique chip-based power amplifier solution for active antenna design. P-Chip is at the heart of the company's latest micro radio transceiver and delivers scalable output power solutions for both small-cell and macro-cell active antennas. This means that radio equipment vendors and mobile network operators can benefit from economies of scale by using the same micro radio technology for any size of mobile operator cell array and network standard.

Based on the Doherty amplifier design, a single transceiver provides output power between 0.8 W and 6.4 W by parallel use of P-Chips. For example, an array with 16 micro radios can easily exceed the output power of 2 x 40 W of today's available remote radio heads. The P-Chip is the only fully integrated Doherty MMIC (monolithic microwave integrated circuit) power amplifier with more than 39 dBm peak output power, claims the manufacturer. With high levels of integration and few external components, Ubidyne's P-Chip provides low-cost transceiver solutions for the telecom equipment market across a wide range of mobile operator requirements.

All Ubidyne active antenna solutions feature one transceiver or micro radio per antenna radiator to deliver significant performance benefits. The uB700 supports 4G (LTE) in the 700 MHz digital dividend band for broadband mobile networks, while the uB900 supports GSM, UMTS and LTE in the 900 MHz frequency band to address mobile networks in Europe, Africa, Oceania, Asia and the Middle East. Ubidyne is also developing an 800 MHz solution and in the near future will support high-band up to 2.6 GHz as well as multi-band requirements.

Ubidyne's micro radio is the main building block of its active antenna architecture, comprising a complete transceiver that can be used multiple times in a macro antenna array. Each micro radio can be controlled completely digitally and independently by a central hub which enables advanced features like beamforming and electronic tilting as well as a self-healing capability that significantly reduces OPEX for mobile network operators.

www.ubidyne.com

A next-generation radio digital front-end solution for mobile broadband infrastructure

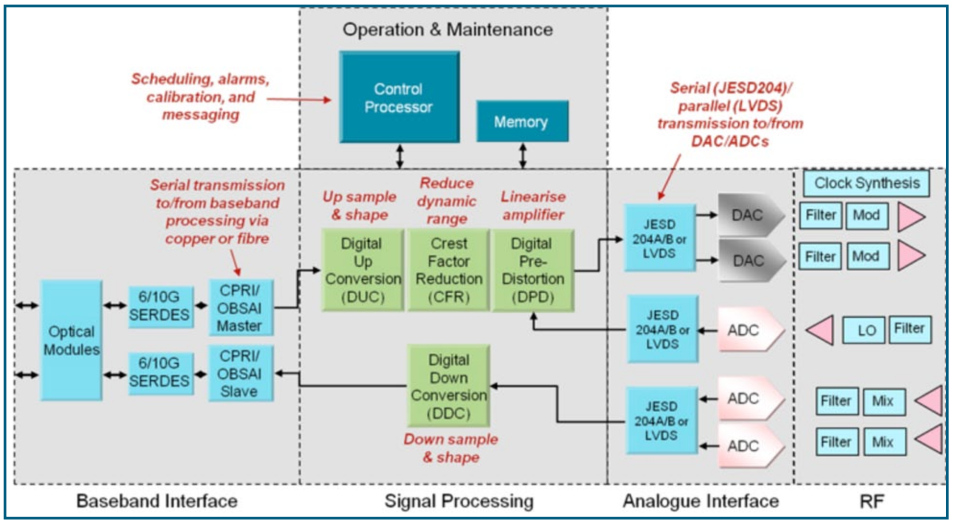
By By David Hawke, Sr Product Marketing Manager, Xilinx Inc

Network operators require significant equipment cost reduction as they strive to increase the network capacity through the use of new air interfaces, higher bandwidth and greater numbers of cell sites. Furthermore, they are looking for more network integration coupled with an increase in operational efficiency. To provide equipment that meets all these disparate needs, manufacturers of wireless infrastructure equipment are looking for solutions that provide greater levels of integration, lower power and cost, but also increased flexibility. The goal is to manufacture equipment that meets the needs of more than one operator while shortening time-to-market. In this article, we'll analyse how a new device from Xilinx, the Zynq™ Extensible Processing Platform (EPP), will help solve these problems for the equipment manufacturers.

The availability of smartphones, tablets and data dongles is driving an explosion in the demand for high-speed, ubiquitous data. In their quest to provide it, network operators are being forced to construct more and more cell sites with an increasing number of antennas per site, using the latest generations of air interface standard such as LTE or LTE-Advanced. Furthermore, the continued decline in average revenue per user (ARPU) has the operators seeking significant cost reductions each year from equipment vendors. To make matters worse, these new networks may have to augment existing voice and data networks that may be based on GSM or UMTS and deployed at different frequency bands.

Adding antennas to support multiple frequency bands, or to increase data rates through multiple-input, multiple-output (MIMO) techniques, is costly but necessary for operators. To reduce the impact on the operational costs associated with the radio mast, equipment manufacturers are looking at methods to reduce the equipment's footprint—that is, its volume and weight—while also achieving lower cost and power. They are continually innovating in the radio transmission domain, from antennas and diplexers/triplexers to the radio itself, in an effort to reduce the mast footprint.

Figure 1: High-level diagram of a typical radio.



There are a number of options that meet the needs of the operators. One is to use multiband antennas, thereby reducing the number of antennas needed to service multiple networks based on GSM, UMTS or LTE. Complementing those multiband antennas, operators can install remote radios on the mast to serve the required frequency bands. Remote radios must also continue to evolve to support multiple air interfaces and wider bandwidth, with less weight and smaller mechanical enclosures, if they are to meet the future needs of operators.

The emergence of antenna-integrated radio is another option. Here, the radio electronics are combined within the antenna enclosure to create a fully integrated radio and antenna, eliminating the need for a separate remote radio and delivering the minimum mast footprint. A further stage of evolution of radio electronics and antenna housing is the recent availability of active antenna systems (AAS). These complex antennas require much greater levels of radio signal processing, providing a capacity increase to the network along with the minimum mast footprint.

Key to reducing the size and weight of the remote radio or antenna is the further integration of the radio electronics. Additionally, in order to support multiple air interfaces such as GSM, LTE, UMTS and others, the radio equipment must be highly flexible and programmable.

Let's review how these radio units could be made more programmable, while providing greater levels of integration.

Figure 1 illustrates a typical radio's architecture and functions. The baseband interface links the system to the copper optical fibres by means of the baseband processing cards, located either at the base of the mast or elsewhere in the cloud. These interfaces typically require high-speed serializer/deserializer (serdes) components running at up to 9.8 Gbits/second (Gbps) for the Common Public Radio Interface (CPRI).

The signals received at or transmitted to the baseband units need significant digital processing, both before and after they are sent to or come in from the analogue domain. The signal processing required consists of digital up- and downconversion (DUC/DDC), crest factor reduction (CFR) and digital predistortion (DPD). While the DUC/DDC handles the upsampling and shaping, the CFR and DPD are primarily used to increase the radio unit's transmission efficiency by employing digital processing to linearize the power amplifiers.

Interfacing to the data converters (DACs and ADCs) is achieved by using either high-speed parallel LVDS signaling or an emerging protocol known as JESD204[A/B].

The radio frequency (RF) area contains all the modulators, clock synthesis devices, filters

and amplifier circuits that transmit and receive the digital signals to the antennas through power amplifiers.

Control of the whole radio comes in the form of a microprocessor, typically running a real-time operating system such as Linux or VxWorks. This operation and maintenance function takes care of the unit's alarms, calibration, messaging and overall control—a job that generally requires a large amount of interfacing to other components, such as SPI/I²C, Ethernet, UARTs and of course memory.

Traditionally, suppliers have implemented digital radio signal processing using a combination of ASIC, ASSP and FPGA devices. ASIC devices have the least flexibility and often result in features being omitted due to specification lockdown early in the design cycle. They do often deliver the lowest device cost—but at the expense of high development and NRE costs, and poor time-to-market. ASSP devices tend to have limited flexibility in the sense that they are often designed for a number of use cases, but may not be applicable to others. FPGAs have seen an increased use in digital radio due to their inherent flexibility, which makes them able to support whatever the equipment needs while providing the ability to continually deliver new features as customer requirements become known. In many cases FPGAs are found next to ASICs and ASSPs in these applications, to provide features these other devices lack.

Figure 2 illustrates construction of a 2x2 radio using a combination of ASSPs, FPGAs and microprocessors.

ASSPs are often slow to adapt to the needs of the market, demonstrated by the absence in them of any serial interfacing technology such as CPRI or JESD204. This necessitates a companion device such as an FPGA with built-in serdes, or a low-cost version leveraging external serdes to complete the implementation. Such a setup, however, demands a large number of components. The PCB space is large, the power supply complexity high, and overall power and cost high.

No wonder, then, that equipment vendors are seeking an alternative method.

Xilinx® products have continued to evolve, reaching a point where equipment manufacturers can implement all the digital radio hardware and software in a single device. These FPGAs have full hardware and software programmability along with a suite of communication peripherals hardened for low cost and power. This new device family capable of such integration

Figure 2: Typical 2x2 radio implementation based around ASSPs.

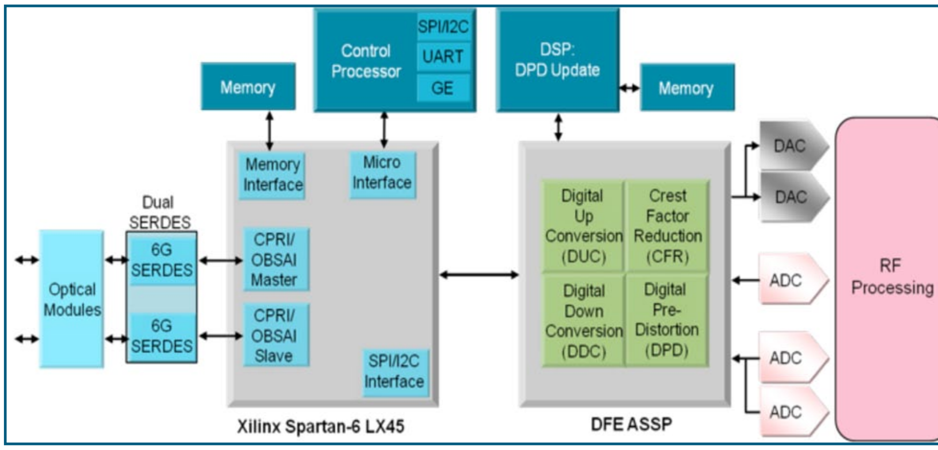
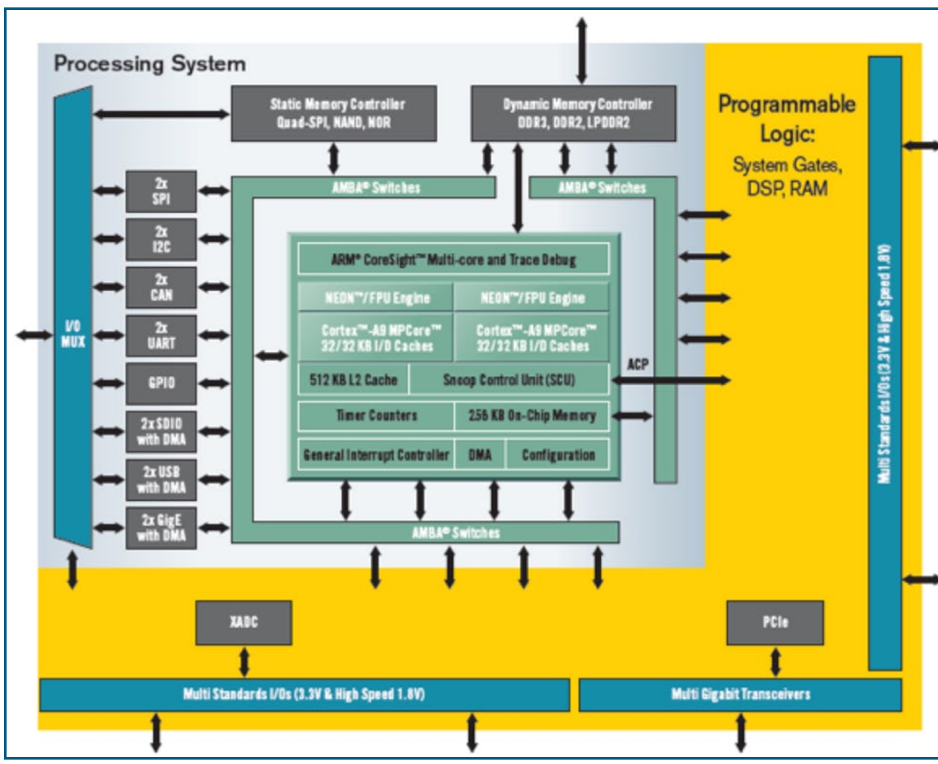


Figure 3: The new Zynq EPP family from Xilinx.



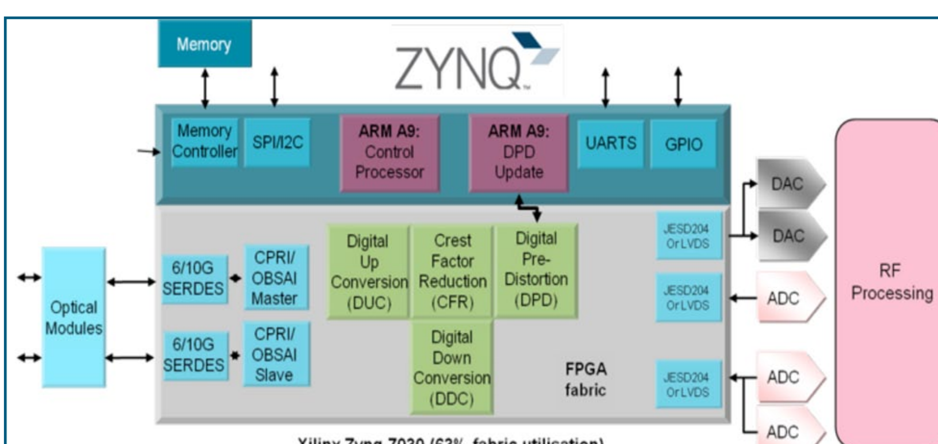


Figure 4: 2x2 LTE radio in Zynq.

is called the Zynq Extensible Processing Platform (EPP), available today from Xilinx.

The Zynq EPP, shown in Figure 3, provides dual ARM® Cortex™-A9 processor cores capable of up to 2000 Dhrystone MIPS per core, with a double-precision floating-point unit. Included in the processor subsystem are dedicated communication peripherals such as memory controllers, Gigabit Ethernet, UARTs and SPI/ I^2C. Adjacent to the processor subsystem is the high-performance programmable logic containing 500-MHz DSP blocks, 12.5-Gbps serdes and abundant internal RAM. Multiple wide, low-latency, high-bandwidth buses connect between the processor subsystem and the programmable logic, while shared memory interfaces ensure that no performance bottlenecks occur.

Figure 4 illustrates how equipment makers could use Zynq to implement all of the functionality required in present-day remote radios. Using the processor subsystem available on Zynq, it's possible to implement the scheduling, calibration, messaging and overall control on one of the available ARM processors. With the other ARM processor, designers could implement coefficient calculation often used in DPD designs. Many of the required peripherals necessary to complete the solution are also hardened, such as memory controllers, SPI/ I^2C, UARTs, Gigabit Ethernet and GPIO, saving power and cost, with no impact on the programmable logic fabric.

Complementing the processor subsystem, the programmable logic is used to implement the high-performance signal processing required of present and future wideband radios. The DSP blocks ensure the digital filters required in DUC/DDC, CFR and DPD designs are implemented efficiently and with lower power. Interfacing to the DACs/ADCs are the device I/Os using LVDS, or serdes using JESD204. CPRI interfacing is also implemented on available serdes.

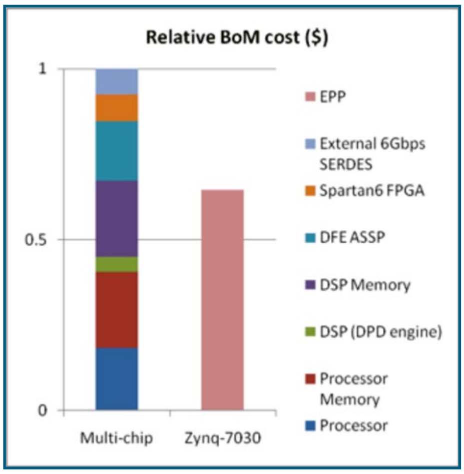
The benefits of using Zynq are significant. Figures 5 and 6 illustrate the savings in cost and power this architecture can achieve, compared with off-the-shelf ASSPs. This example assumes 20-MHz signal bandwidth, with two transmit and two receive paths. Zynq can also support much wider bandwidths and a greater number of antennas.

For this 2x2 20-MHz LTE example, the Zynq solution provides up to 50 percent savings in power, with an overall materials-cost reduction of 35 to 40 percent over an equivalent ASSP implementation. Furthermore, Figure 7 also shows how the reduction in component count results in a saving in packaged area of up to 66 percent over the example in Figure 2, to the same functionality presented in Figure 4.

This allows a large reduction in the required PCB footprint. Equipment vendors are now able to dramatically shrink the equipment, allowing greater levels of integration with a significantly smaller mast footprint than previously possible.

There are many other major benefits of using Zynq. Zynq reduces power supply complexity and cost, while increasing unit reliability. This increase in reliability has an impact on back-end costs associated with field returns, and allows for greater network reliability. In addition, lowering the power draw also reduces the thermal dissipation and makes it possible to use smaller, lighter heat sinks and mechanics. Finally, the Zynq solution also combines full flexibility in both hardware and software, allowing unit specifications to be locked down later in the design cycle. This reduces time-to-market, mitigates risk and supports new features long after the equipment has been shipped.

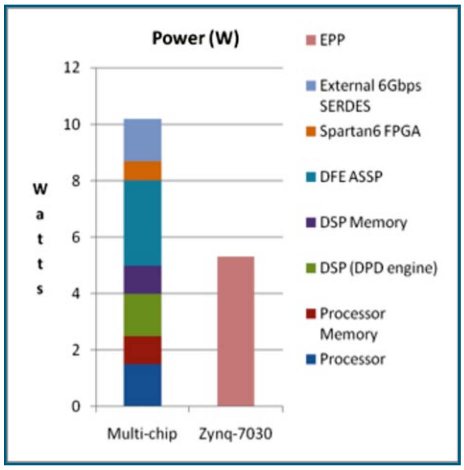
Figure 5: Reduction in relative bill-of-materials (BOM) cost using Zynq.



Conclusion

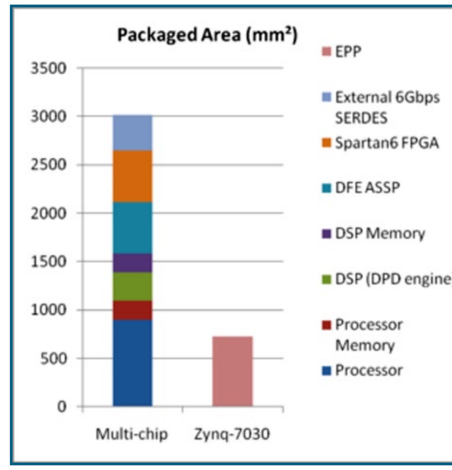
The explosion in demand for ubiquitous high-speed data is driving continued innovation in tower-mounted antenna and digital radio solutions. All of these solutions have one thing in common – the need to be smaller, lighter, lower in cost and in power, but at the same time, highly integrated and with high levels of flexibility to cater to the differing demands of the networks.

Figure 6: Reduction in power using Zynq.



With its dual-core processor subsystem and high-performance, low-power programmable logic, Zynq is the solution to many of the challenges equipment vendors now face as they strive to serve the network operators. Whether the equipment is a remote radio, antenna-integrated radio or active antenna, the Zynq EPP offers the unparalleled ability to create products with maximum flexibility, maximum integration and the lowest overall cost, power and weight. For more information on the Xilinx Zynq EPP product, please visit www.xilinx.com/products/silicon-devices/epp/zynq-7000/index.htm.

Figure 7: Reduction in packaged area using Zynq.



In addition to FPGA and EPP devices, Xilinx also provides high-performance IP cores for radio in the form of DUC/DDC, CFR and DPD signal-processing solutions, along with connectivity solutions for OBSAI/CPRI and JESD204[A/B]. For more information, please visit www.xilinx.com/applications/wireless-communications/index.htm.

Imec demonstrates a low-power 7 Gbps 60 GHz transceiver

Imec, in collaboration with Panasonic, has developed a prototype of a 60 GHz radio transceiver allowing to reach data rates of 7 Gbps over short distances at very low power consumption.

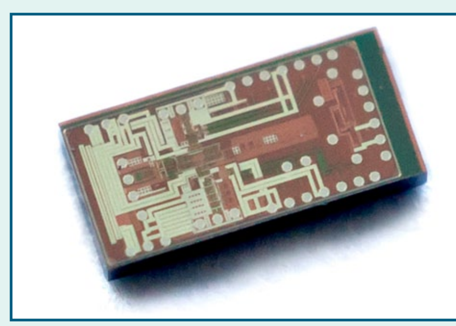
The chip achieves this performance over the 4 channels specified by the IEEE802.11ad standard. Imec's low-power 60 GHz solution is an important step towards adoption of 60 GHz technology in low-cost battery-operated consumer products such as smart phones and tablets.

Today's wireless consumer electronic products increasingly include data-intensive applications, while applications below 10 GHz such as WLAN face spectrum scarcity. This drives wireless system designers to explore higher frequency bands such as the unlicensed band around 60 GHz. This band is available throughout the world and enables multi-Gbps wireless communication over short distances. However, to enable 60 GHz radio solutions for portable mass-market products, cost, area and power consumption need to drastically decrease. Imec's ultra-low power CMOS-based solution is an important step to solve these challenges.

Imec's transceiver front-end prototype IC (integrated circuit) achieves an EVM (error vector management) better than -17 dB for QAM16 modulation in the 4 channels specified by the IEEE802.11ad standard, reaching data rates of 7 Gbps over short distances. The IC is implemented in 40-nm LP (low-power) digital CMOS targeting low-cost volume production. The TX (transmitter) signal path, consisting of a power amplifier (PA) and a mixer, consumes only 90 mW with 10.2 dBm OP1dB.

The RX (receiver) signal path, consisting of a low noise amplifier (LNA) and a mixer, consumes only 35 mW with a noise frequency (NF) of 5.5 dB and 30 dB gain. ESD (electrostatic discharge) robustness is more than 4 kV HBM (human body model). The compact core area of only 0.7-mm^2 makes this transceiver front-end solution particularly suitable for use in phased arrays. The area is kept low thanks to the use of lumped components even at 60 GHz, and very compact mm-wave CMOS layout techniques. Continuous research done at imec on power efficient CMOS PAs enables further important reductions in the power consumption of the transmitter section. The front-end is now further being integrated into a beamforming transceiver prototype.

Imec's low-power 7Gbps 60GHz transceiver IC implemented in 40nm low-power CMOS.



www.imec.be

Amplifiers and mixers

target backhaul radios to 46.5 GHz

Hittite Microwave has released two amplifier and three mixer products for microwave and millimeterwave radios, military sensors, test and measurement equipment and SatCom applications from 24 to 46.5 GHz.

The HMC1040LP3CE is a self-biased GaAs MMIC low noise amplifier (LNA) which operates between 24 and 43.5 GHz and delivers 23 dB gain, 2.2 dB noise figure and output IP3 up to +22 dBm. This versatile LNA consumes only 70 mA from a +2.5 V supply while the output P1dB rating of +12 dBm enables it to serve as a LO driver for many of the company's balanced, I/Q and image reject mixers.

The HMC1016 is a four stage GaAs PHEMT MMIC medium power amplifier die which operates between 34 and 46.5 GHz. This amplifier provides 22 dB of gain, +26 dBm of saturated output power, and 17% PAE from a +6 V supply. Output IP3 is as high as +37 dBm.

The HMC1041LC4 and HMC1042LC4 are compact I/Q MMIC mixers which cover RF frequencies from 17 to 27 GHz and from 15 to 33.5 GHz respectively. Each mixer utilizes two double balanced mixer cells and a 90 degree hybrid.

The HMC1043LC3 is a special purpose triple balanced mixer which accepts 16 to 22 GHz at the IF port and 26 to 32 GHz at the RF port.

www.hittite.com

Antenna Magus version 4.0

now offers over 200 antennas

MAGUS (Pty) Ltd, Computer Simulation Technology AG (CST), EMSS - EM Software & Systems-S.A. (Pty) Ltd announce the release of the fourth major version of Antenna Magus. With this major version 4.0 release, Antenna Magus has crossed the 200 antenna mark. Antennas can be designed for a wide range of objectives (like frequency, gain, impedance and substrate properties...) and validated simulation models of user-designed antennas can be exported to FEKO® and CST MICROWAVE STUDIO®.

Antenna Magus 4.0 offers application specific designs which are optimised for various applications like WLAN, GPS and other broadband applications. This new capability focusses on solving application specific problems where design objectives are predefined by the application area, or where complex topologies preclude algorithmic synthesis as a design approach. Users can now explore and investigate multiple novel antenna topologies, accessing designs that have been pre-optimised to meet industry specific standards for relevant applications. The latest release also offers 168 new and updated parametric export models.

www.antennamagus.com
www.cst.com
www.feko.infox

Wi-Fi modules target the Internet of Things

Extending its portfolio of embedded Wi-Fi modules, Alpha Micro Components has introduced the Gainspan GS1011MIPS and GS1011MExS, two of the smallest modules on the market. At just 19.4- x 28.7-mm, the modules provide a significant reduction in footprint and are ideal for any power critical cost sensitive wireless application in the emerging Internet of Things arena. Despite the small form factor, the GS1011MIPS and GS1011MExS offer complete 802.11b ultra low power Wi-Fi client or AP solutions.

The GS1011MIPS provides low power Wi-Fi connectivity with +8 dBm of transmit output power, while the GS1011MExS is an extended range device offering best in class transmit power of +18 dBm. Both modules offer easy system integration and minimal use of host resources.

www.alphamicro.net

High linearity I/Q converters *target 17 to 27 GHz applications*

Four MMIC upconverter and downconverter devices from RFMD offer high performance and low cost for high frequency applications. The RFUV1702 and RFUV1703 upconverters incorporate an integrated frequency multiplier (x2), LO buffer amplifier, a balanced single sideband (image rejection) mixer followed by variable gain amplifier, and DC-decoupling capacitors.

The RFRX1701 and RFRX1702 downconverters incorporate an image rejection mixer, LO buffer amplifier, and integrated LNA. Each device is packaged in a 5 x 5mm QFN to simplify both system-level board design and volume assembly.

The RFUV1702 upconverter covers 17.7 GHz to 19.7 GHz with a minimum conversion gain of -5 dB and OIP3 (maximum gain) of +28 dBm. The RFUV1703 upconverter covers 21 GHz to 26.5 GHz with a minimum conversion gain of -10 dB and OIP3 (maximum gain) of +27 dBm. Both feature an IF frequency of DC to 4 GHz, maximum conversion gain of 21 db, Noise Figure (NF) of 9 dB and image rejection of ≥15 dBc.

The RFRX1701 downconverter covers 17.7 GHz to 26.5 GHz with an LO frequency of 6.85 GHz to 15.25 GHz, conversion gain of 13 dB, and NF of 2.5 dB. The RFRX1702 downconverter covers 17.75 GHz to 19.7 GHz with an LO frequency of 6.85 GHz to 11.85 GHz, conversion gain of 12 dB, and NF of 2 dB. Both feature an IF frequency of DC to 4 GHz, IIP3 of 6 dBm and image rejection of 15 dBc.

www.rfmd.com

120 W SPDT switch

for LTE base stations and military communications

M/A-COM Technology has introduced a 120-W PIN diode SPDT switch for network applications and military communications.

The MASW-000936 T/R switch offers high isolation of 50 dB at 2.7 GHz, low insertion loss, and high Tx RF input power handling of 120 W at 85°C. Packaged in a surface mount 4-mm 16-lead PQFN, the switch is ideal for applications requiring small footprint operating between 0.05 to 6.0 GHz, including LTE and WiMAX base stations, radar, land mobile, and two-way radios. Key features include a 0.05 to 6.0 GHz range, 0.2 dB insertion loss (antenna to transmitter), 50 dB isolation (antenna to receiver at 2.7 GHz), 23/24 dB input return loss (Rx/Tx), and transmitter IIP3 of 72 dBm.

www.macomtech.com

Waveguide filter

for narrowband data applications

The WG-Series waveguide filter from RLC Electronics is designed to cover a narrow frequency band in order to facilitate point-to-point routing of data over the network.

The waveguide filters maintain low loss and high rejection. The filters cover narrow frequency bands above both 18 GHz and 26.5 GHz. Typical applications include the interconnection of transmitters and receivers (transceivers) with antennas.

www.rlcelectronics.com

2048 QAM radios

enhance spectral efficiency by 25% to 100%

DragonWave has announced higher modulation modes of up to 2048 QAM on its Horizon packet microwave products. This higher modulation allows the radios to transport up to 37% more data through existing microwave channels, which significantly improves spectral efficiency.

When the company's Bandwidth Accelerator feature — the only wire-speed bulk data compression technology — is enabled, spectral efficiency is further enhanced 25% to 100% depending on traffic patterns.

Additionally, all Horizon packet microwave radios also support hitless adaptive modulation, bringing operators the benefits of higher capacity delivery by the new modes when link properties permit—even on existing links that have been designed for lower modulation modes. Horizon Quantum can provide two carriers per radio each capable of 1024 QAM, delivering up to 2 Gbps in a single radio with Bandwidth Accelerator.

www.dragonwaveinc.com

Pure-CMOS dual-mode Wi-Fi/Bluetooth RF front-end IC for mobile applications

RFaxis has announced its RFX5000 RF front-end integrated circuit (RFeIC™) to enable wireless connectivity for next-generation 802.11a/n/p wireless connectivity applications in the 5 GHz band. The technology supports PCs, ultra-mobile devices, high definition multimedia streaming devices, routers/access points, as well as wireless access in vehicular environments (WAVE).

The RFX5000 RFeIC is a single-chip/single-die, integrated RF front-end on pure complementary metal oxide semiconductor (CMOS) silicon and covers the 802.11a/n/p frequency band (4.90 to 5.95 GHz). The RFeIC comprises with a power amplifier, low noise amplifier, antenna switch, on-chip harmonic filters, power detection, matching circuitry, CMOS compatible control logic and ESD protection on all package pins.

Key specifications of the RF front-end integrated circuit include 30 dB Tx and 12 dB Rx small signal gain, 120 mA quiescent current, 2.7 dB noise figure, and +17 dBm linear output power (EVM <3%). The RFX5000 RFeIC is available in a standard 3- x 3- x 0.55-mm QFN package.

www.rfaxis.com

Signal analyser

millimeter-wave to 325 GHz

Agilent Technologies claims that its EXA signal analyzer is now the most cost-effective millimeter-wave signal analyzer, covering frequencies up to 44 GHz. With external mixing, it can cover up to 325 GHz.

Like other Agilent X-Series signal analyzers, the EXA is versatile, expandable, offers the broadest set of measurement applications, and can be easily upgraded. In addition, its portability versus the PXA signal analyzer (16 kg versus 22 kg) makes it ideal for millimeter-wave applications in aerospace/defense and wireless communications backhaul.

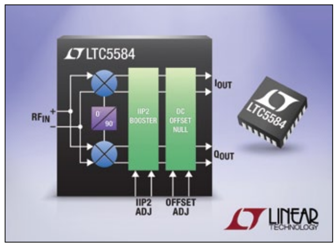
The EXA's exceptional sensitivity (under –140 dBm/Hz across the V-band with Agilent's smart harmonic mixers) enables accurate measurement of spurs and harmonics. Along with its excellent phase-noise performance (-106 dBc/Hz typical at 10 kHz offset, 1 GHz carrier), the EXA is able to meet tighter regulations and test requirements for millimeter-wave device design and performance verification.

The EXA is a member of the Agilent X-Series signal analyzers, with frequency coverage from 10 Hz to 44 GHz.

www.agilent.com

Wideband I/Q demodulator

boosts zero-IF receiver performance



Linear Technology has unveiled an ultra-wide bandwidth direct conversion I/Q demodulator with linearity of 31 dBm IIP3 and 70 dBm IIP2. The LTC5584 offers best-in-class demodulation bandwidth of over 530 MHz, supporting the latest generation of LTE multimode and LTE Advanced receivers, as well as digital predistortion (DPD) receivers. The I/Q demodulator operates over 30 MHz to 1.4 GHz, covering a broad range of VHF and UHF radios and the 450-MHz/700-MHz LTE frequency bands.

The LTC5584 has two built-in calibration features. One is advanced circuitry that enables the designer to optimize the receiver's IIP2 performance, increasing from a nominal 70 dBm to an unprecedented 80 dBm or higher. The other is on-chip circuitry to null out the DC offset voltages at the I and Q outputs. Combined with a 9.9 dB noise figure, these features enhance the dynamic range in receivers. Further, the device exacts P1dB of 12.6 dBm and 13.6 dB noise figure.

www.linear.com

Cross domain analyzer

interference analysis up to 43 GHz in a single box

The Advatest U3800 2-channel vector/spectrum signal analyzer available from Rohde & Schwarz claims to be the first to allow the simultaneous phase-coherent signal analysis of two unknown RF signals with high dynamic and high bandwidth in a single, compact instrument.

The phase-synchronous operation mode of this spectrum analyzer is the fundamental precondition for doing phase difference measurements in any RF multi-path application without the need to take out a partial component from the transmission path. The analyser can realize internal vector calculation of two signals. Consequently, it can be used for quick and accurate detection of reception problems caused by inter-circuit interferences or by radio wave reflections.

The simultaneous, phase-synchronous measurement of two signals can be used for more efficient identification of noise sources. Three Advantest models are available: U3841 (2 x 3 GHz), U3851 (2 x 8 GHz), and U3872 (2 x 43 GHz).

www.rohde-schwarz.com

CALENDAR

MTT-S International Microwave Symposium
17th - 22nd June 2012
Palais de Congrès de Montréal
Montréal, Canada
http://ims2012.mtt.org

EMC 2012
5th - 10th Aug 2012
David L. Lawrence Convention Center
Pittsburgh, PA, USA
www.emc2012.isemc.org

IBC Exhibition
6th - 11th September 2012
RAI Amsterdam
The Netherlands
www.ibc.org

ICUWB2012 - 2012 IEEE International Conference on Ultra-Wideband
17th - 20th Sept 2012
Syracuse, New York
USA
www.icuwb2012.org

European Microwave Week
28th Oct - 02nd Nov 2012
RAI Amsterdam
The Netherlands
www.eumweek.com

Electronica 2012
13th - 16th Nov 2012
Messe München
Munich
Germany
www.electronica.de