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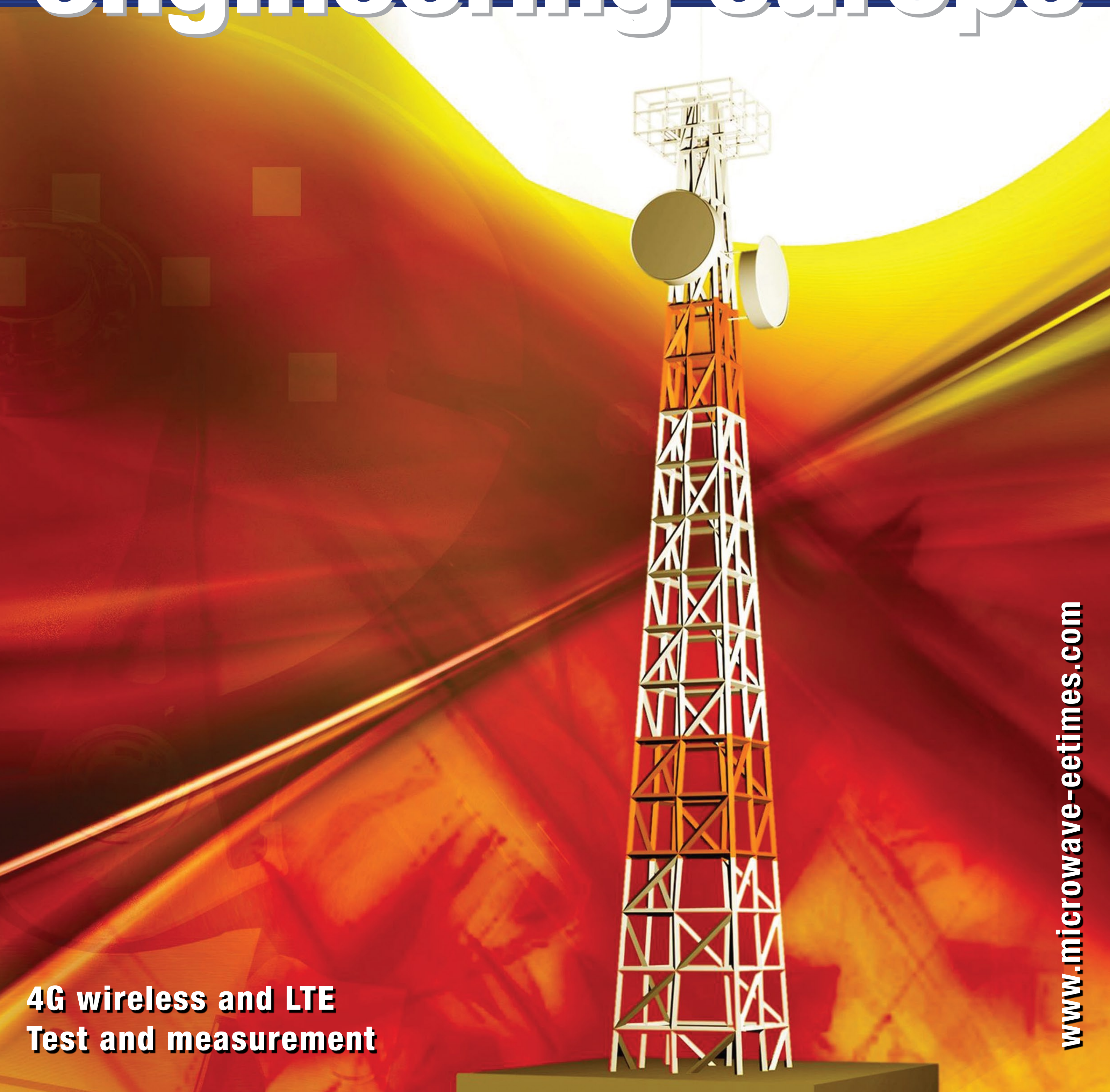

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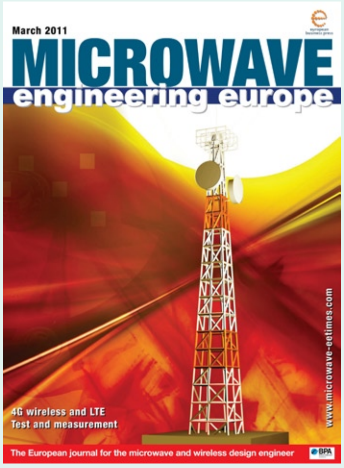

This month's cover represents the growing push to 4G and LTE technologies to cope with ever increasing demands placed on networks to deliver the capacity needed to satisfy consumer trends in data usage and video demand in a cost-effective way.

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IN BRIEF

CSR announces merger with Zoran

CSR PLC and Zoran Corporation have entered into a merger agreement under which Zoran will merge with CSR for an equity value equivalent to approximately US$679 million.

CSR is a global leader in wireless connectivity and location. Zoran provides market-leading imaging and video technology for digital camera, home entertainment and multifunction printer products. In 2010, Zoran had total pro forma revenues of $441 million.

The merged company will provide differentiated, integrated technology that addresses the rapidly growing market for connected, location-aware multimedia devices including handsets, digital cameras and home entertainment equipment. Combining the two highly complementary technology portfolios is designed to uniquely position the merged company to deliver advanced platforms to capture and stream media-rich content.

www.csr.com

Continental, NXP to integrate NFC into cars

Chip vendor NXP and automotive electronics supplier Continental have demonstrated how NFC (Near Field Communications) can be used as an enabler for new applications.

At the Mobile World Congress in Barcelona, NXP and Continental showed how the technology could be used for automotive applications.

They showed a concept vehicle in which an NFC-based keyless entry system was employed. The system unlocks the car as soon as an authorized user held the NFC-equipped mobile handset near to the door, triggering an authentication cycle between car and handset. The phone then is clicked into a socket at the dashboard, where it is then seamlessly integrated into the vehicle's infotainment system. At the same time, the car's immobilizer is deactivated.

www.nxp.com

Body network spars with Bluetooth

An emerging body area network (BAN) technology is gearing up to compete with Bluetooth Low Energy across a broad range of medical and consumer applications. The competition comes as medical devices are increasingly adopting a growing set of wireless network technologies including Wi-Fi and Zigbee.

Backers of the IEEE 802.15.6 effort say the standard could be completed this year and products based on it could ship in 2012. The specification promises a range of implementations roughly on par with Bluetooth bandwidth and range but at much lower power consumption and less interference.

GE aims to use the technology in a broad range of hospital patient monitors. Since 2008, it has lobbied the U.S. Federal Communications Commission to open up spectrum in the 2.4 GHz band for such devices, replacing today's expensive and cumbersome wired links.

"Cables, cables, cables are what we see in the hospital today tethering patients to beds and machines and generating motion artifacts and false alarms," said David Davenport, an engineer in GE's labs, speaking at an evening session at the International Solid State Circuits Conference.

The FCC could rule on the spectrum use this year, opening the door to products in 2012. "The future looks very bright for smart bandages," said Davenport.

The 802.15.6 group is resolving about 100 technical comments on the second draft of its proposed standard. Companies including Broadcom, Texas Instruments and Toumaz Technology are interested in developing chips.

There's no shortage of wireless options for health care systems. Wi-Fi and Zigbee proponents also have big initiatives in medical.

The Continua Health Alliance and the Wi-Fi Alliance announced Tuesday an agreement to work together to promote Wi-Fi in medical and fitness electronics and to conduct joint technical reviews to ensure interoperability. The Wi-Fi group is exploring whether it needs certification standards unique to medical and fitness products.

Continua, which sets standards for connected medical devices, has already adopted multiple wireless technologies including Bluetooth.

As for the 802.15.6 effort, Samsung's mobile phone group has proposed one of three physical layers for the draft standard, targeting links between handsets. It uses an electric field similar to near-field communications to establish connections at 21 or 32 MHz that transmit from 164 Kbits/s to 1.3 Mbits/s of data up to three meters.

A separate narrowband PHY for 802.15.6 proposed by the MedWin Alliance--which includes GE, Philips, TI and Toumaz—targets mainly medical apps running anywhere from 100 Kbits/s to 1 Mbit/s. The PHY is geared for peak power consumption of less than three milliamps, said Anuj Batra, a senior member of TI's technical staff, speaking at the ISSCC event..

The narrowband approach embraces slices of spectrum ranging from the 400 MHz MICS band to GE's 2.4 GHz proposal. It supports as many as 64 BANs co-existing in a 36 square foot space, using constant symbol rates and differential PSK modulation to maximize data rates and simplify radio designs.

Japan's National Institute of Information and Communications Technology sponsored work on a version of the 802.15.6 spec using ultra-wideband technology. It will enable data rates of about 2 Mbits/s over three meters using 7.25 to 10 GHz UWB links, said Huan-Bang Li, a senior researcher in NICT's medical group.

Once the standard is set, the MedWin Alliance is expected to work out a certification process. Despite its broad backing, the technology will be at least a year behind Bluetooth Low Energy which adopted its standard in July.

www.ieee802.org/15/pub/TG6.html
www.bluetooth.com

Is the promise of NFC finally on the horizon?

Near-Field Communication or NFC might be about to go mainstream from a surprising source. Apple's latest iPhone 5, under development, is as usual surrounded in a swirling mist of rumors and what-if scenarios. One of the more intersting of these is the claim that iPhone 5 will have built-in NFC hardware and the speculation is that Apple will seek to tie this into iTunes in some way.

Google has already included NFC in Nexus phones but it has not come to much without a popular payment processing system. Apple could have a more credible system with iTunes. Speculation is also rife that iPad 2 will come with NFC hardware for the same reason.

Does this mean Apple are looking to expand iTunes further and start to compete in the goods and services sector, including established on-line firms such as PayPal? or is this another piece of vertical integration within iTunes and Apple products.

If Apple successfully brings NFC to market it should light a fire under the large credit card companies and banks to make NFC systems work. Afterall, most of the potential revenue associated with NFC will come from payment processing.

The other implication of a successful model for NFC will be a drive for more mobile online payment systems, such as parking meters, toll roads and even point-of-sale.

Though NFC could have many other uses such as a form of electronic signature, or offering the ability to put electronic keys on a handset for access control, these do not offer the potential revenues of payment processing.

Hopefully, the speculation is true and Apple will push NFC, as this will bring much needed competition to the credit card companies and banks as well as make it easier for consumers to pay for goods and services. There are risks, security been the prime problem, and even though NFC has not been tested on a large scale in security terms, built-in hardware and SIM card security has got to be better than the current software password protected websites of the banks.

As we enter this brave new world, Apple and Google seem well poised to evolve in this environment.

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IN BRIEF

Agilent, Altair to do LTE interoperability testing

Agilent Technologies and Altair Semiconductor are to conduct interoperability and validation testing using Altair's 4G LTE chipset in conjunction with the Agilent PXT wireless communications test set and N6070A-series signaling conformance test software.

Altair's LTE chip portfolio includes the FourGee-3100 3GPP LTE baseband processor that supports LTE category 3 throughputs (100-Mbps/50-Mbps DL/UL respectively) and the FourGee-6200 — a multiband RF transceiver that supports any 3GPP LTE band in the range of 700 MHz to 2700 MHz.

In addition to interoperability testing, the Altair chipset will be used for validation of 3GPP test cases running on the Agilent N6070A-series Signaling Conformance Test solution.

www.agilent.com
www.altair-semi.com

U-blox and Rohde & Schwarz team up on Galileo and GLONASS

U-blox and Rohde & Schwarz have successfully concluded a simulation of the soon-to-be-deployed European Galileo satellite positioning system. The test, carried out with the SMBV100A vector signal generator and its GNSS simulation options, verified the u-blox proof-of-concept and the compatibility of u-blox receiver technology with the Galileo transmission protocol.

The Galileo satellite system is the EU's answer to the US NAVSTAR GPS satellite positioning system. It will provide a high-accuracy positioning system upon which European nations can rely, independent of foreign-based satellite navigation systems.

The cooperation with Rohde & Schwarz is also being extended to the Russian GLONASS satellite system which is targeted to be fully operational with 24 satellites in 2012.

www.u-blox.com
www.rohde-schwarz.com

ST-Ericsson launches the Igloo open source community

ST-Ericsson has launched the Igloo open source community together with a developer board, the Snowball, to accelerate the development of system and software innovations with the company's cutting-edge smartphone and tablet platforms. Together, the low cost, feature-rich developer board and community will facilitate and drive innovation of software for Android, Ubuntu and MeeGo embedded devices based on ST-Ericsson's platforms.

The production-grade small-sized Snowball developer board combines ST-Ericsson's newly announced Nova A9500 dual-core application processor, with MEMS-based 3D gyroscope, accelerometer, magnetometer, and barometer, together with GPS and connectivity features. Calao Systems designed the board, while Linaro developed the board's low-level software, which is optimized for the Nova A9500's ARM dual Cortex A9-based architecture.

At the heart of the Igloo community will be the web portal, where device developers, manufacturers and application developers can gather, exchange information and ideas, and even solve problems collectively. ST-Ericsson has selected open source specialist Movial to develop, support and run the Igloo community. Two versions of the Snowball developer board will be sold by Calao Systems from the second quarter of 2011.

www.igloocommunity.org
www.stericsson.com

WLAN chipset market to double in 2011 courtesy of Wi-Fi

With Wi-Fi functionality becoming a standard feature in a host of electronic devices spanning televisions, cameras and car entertainment systems, shipments of wireless local area network (WLAN) chipsets will double in 2011, according to new IHS iSuppli research.

Shipments of WLAN chipsets, mainly Wi-Fi compatible devices, are projected to reach 738.9 million units this year, up a resounding 101.5 percent from 366.8 million units in 2010. Shipment of the chipsets will rise to exceed 1 billion units in shipments next year and then hit more than 2 billion units by 2014.

"As Wi-Fi increasingly develops into a standard wireless networking interface for innumerable devices, the easy interconnection capabilities inherent in the technology will open the door for an even greater range of consumer electronic devices to be seamlessly connected and networked," according to Jagdish Rebello at IHS.

www.ihs.com

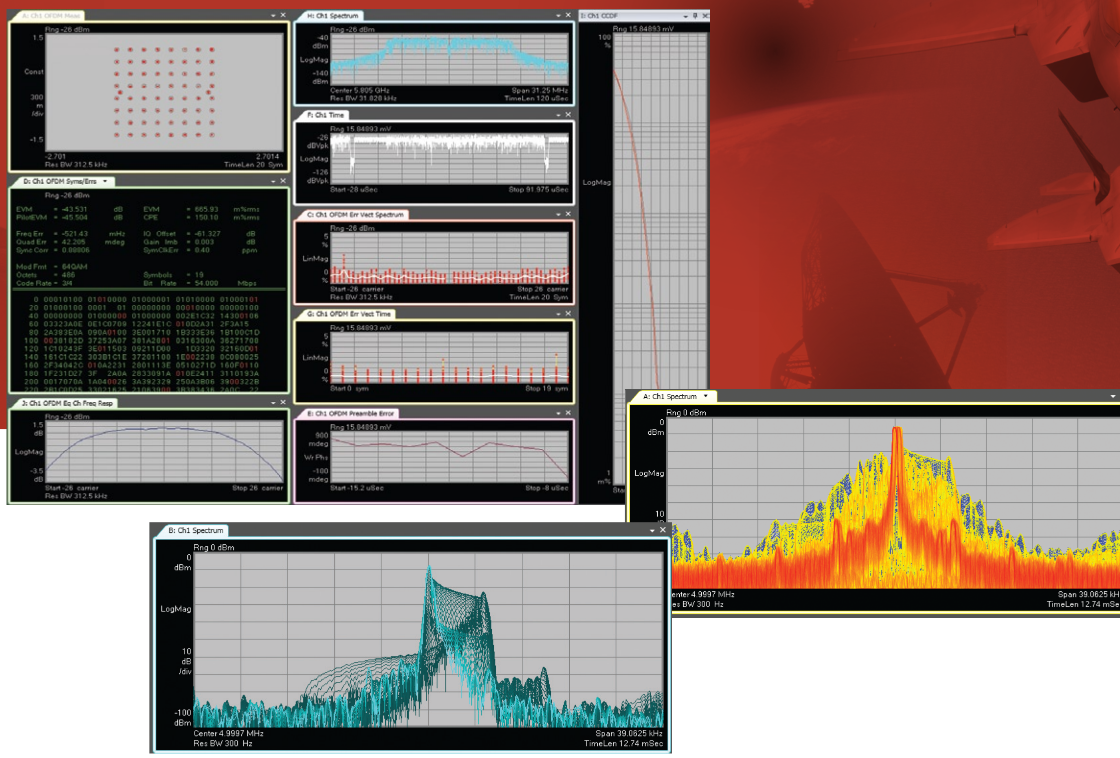
Audi and Alacatel-Lucent demonstrate an LTE-equipped car

At the Mobile World Congress in Barcelona, Audi showed an A8 luxury sedan equipped with LTE broadband communications technology. Audi called the vehicle a "functional prototype". The LTE equipment was based on Alcatel-Lucent's commercially available broadband mobile infrastructure.

During demo rides in the streets of Barcelona, the broadband connection was used to show a number of bandwidth-hungry applications including video streaming, music file download, navigation and web browsing. Audi's board member responsible for technology development, Michael Dick, announced that LTE technology will be integrated into Audi vehicles soon. He referred to the speech auf Audi Chairman Rupert Stadler at the recent Consumer Electronics Show in Las Vegas. There, Stadler announced that LTE technology would be used in cars in early 2011.

www.alcatel-lucent.com
www.audi.com

See through the complexity



A window into what's happening inside your wireless devices

On the leading edge of wireless design, signal interactions can cause the unexpected. Knowing there's a problem is relatively easy.
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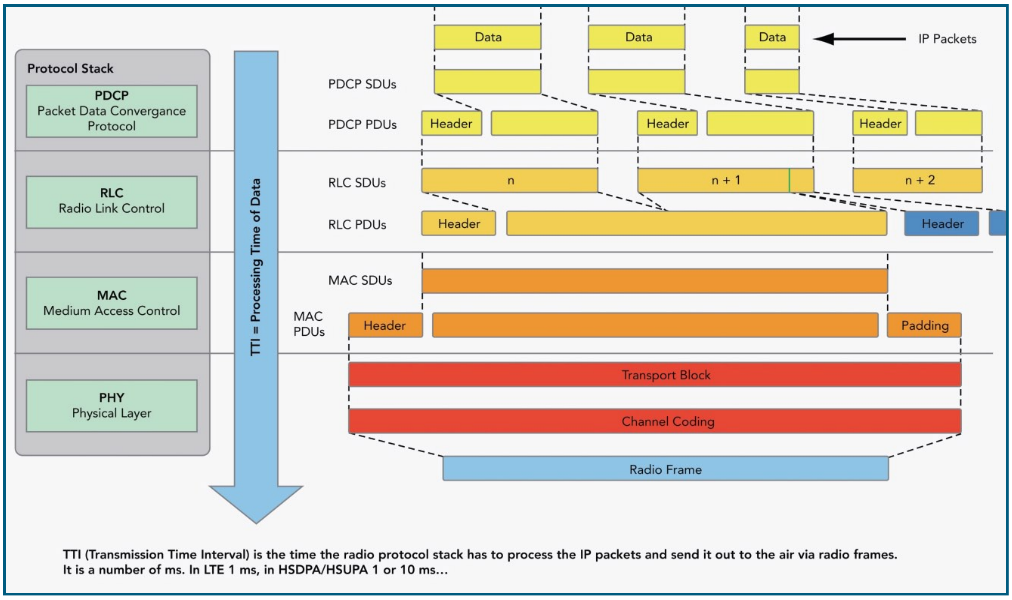
Agilent Technologies

How a testing technique borrowed from IP network engineers aids development of high-bandwidth radio network equipment

By Eduardo Gonzales Reyes, Field Applications Engineer, Anritsu (Sweden), www.anritsu.com

Link adaptation (also known as scheduling), first introduced as a feature of HSDPA technology under the 3GPP protocols, is the method by which cellphone radio networks assign radio resources. Under this scheme, the radio protocol in the Base Station delivers data (for down-link transmission) and assigns resources (for up link transmission) every Transmission Time Interval (TTI) (see Figure 1). Since a TTI can be as short as 1 ms, this scheduling technique provides enormous flexibility to match traffic routing and throughput rates to the available resources. It is the key to the high throughput, stability and efficient use of bandwidth that characterise today's 3G and LTE networks.

Figure 1: Processing functions that must be executed in each TTI.



A fundamental problem in the implementation of link adaptation has, however, bedevilled the development of cellphone equipment: the inability of conventional test set-ups to adequately pinpoint errors and failures in the functioning of link adaptation schemes.

This article proposes a test set-up – already in use successfully by network engineers developing and using IP/Ethernet equipment – that will detect scheduling errors in fine detail, down to the level of individual TTIs.

Conventional strategies for testing link adaptation

Traditionally, functional and performance testing are two distinct parts of the protocol and system verification process. Scheduling is usually included in the functional testing domain; at the same time, this function has a fundamental impact on performance (data throughput).

The traditional functional test methods generate huge logs, because every TTI (that is, every 1 ms) the scheduler software receives inputs and makes decisions. This means that log analysis is tedious and time-consuming – and so is not done. Instead, link adaptation is usually function-tested using simple but limited configurations that do not come close to covering the range of real-world use cases.

Performance-testing of link adaptation is accomplished by measuring data throughput. And since link adaptation function testing has a limited scope, full verification of the function has to wait until performance tests take place. For obvious reasons, this is usually at a late phase in a development project. Very often, problems in link adaptation performance have to do with bugs in functionality. If these problems are detected during performance test, the functionality has to be corrected – and this might mean that parts of the device have to be redesigned and verification partially re-run. Accurate and precise performance test data is therefore a valuable resource, enabling the development engineer to focus debugging and reverification efforts exactly where needed.

Unfortunately, today's conventional performance test set-ups provide extremely imprecise outputs. They consist of a server application running on a PC or Unix workstation, and a client application running on a dial-up PC. The server and client application implement the datacom protocol (such as ftp transfer), make the measurement and provide the result.

The problem is that Windows or Unix operating systems (OS) typically provide timing accuracy of around 500 ms. It is true that the actual transmission of packets in Windows applications is usually implemented using NDIS technology, which gives better timing accuracy than Windows itself – but the measurement of these transmissions is effected by the OS.

Worse, even this crude timing accuracy, in the order of hundreds of milliseconds, is not guaranteed by the OS or by computer manufacturers. Since LTE (and some configurations of HSPA and HSPA+) has a TTI of 1ms, it is clear that a Windows-based application can provide no more than an aggregate throughput value at an application level of the OSI stack. Detailed information about the location of functional problems, at the level of individual TTIs, is just not available.

To see the kind of information that could help to debug throughput problems, it is helpful

to study a simplified example (see Figure 2). Consider an IP data stream that is transmitted through a base station. Implementing link adaptation, the scheduler uses the biggest and smallest available block sizes; the same numbers of blocks are transmitted in each size. If we take the smallest Transport Block Size (TBS) to be 256 bits and the biggest 7,480 bits, this would give a total data throughput of around 1,948,000 bits per second, that is, around 2 Mbps. (For the sake of simplicity this example excludes protocol headers from the calculation, and the selected IP header and data sizes are assumed to be 128 bits.)

Now imagine that the next time the same measurement is taken, the performance of the radio protocol has deteriorated (this could be due to a drop in the performance of the protocol software), causing every third large packet transmission to be lost. The lost packets have to be retransmitted by the radio protocol stack, reducing data throughput to around 1,504,000 bits per second – around 1.5 Mbps. This is 25% lower than in the first measurement.

Using the conventional performance test set-up, the engineer has no insight into the cause of the reduced throughput, or the location of the fault – all they see is the rate of throughput. If on the other hand the measurement system offered precise timing, it would be easy to pinpoint the problem simply by measuring packet latency.

A new approach to testing link adaptation

An alternative approach to throughput measurement applied in the datacoms world offers this capability.

In the datacom arena, as in the mobile phone industry, throughput measurements are used to test performance – in this case, of devices such as IP/Ethernet-based routers and switches. Accurate instruments designed for this task provide precise data on the performance of the system under test, in terms of throughput (frame count and packet size accuracy), latency and jitter.

The use of such an IP test set-up (see Figure 3) to test the performance of radio protocol stacks would bring to light the TTI-level errors hidden from the view of conventional server-based test systems.

The test system proposed by Anritsu would operate as follows:

- The mobile device (a handset or other user equipment (UE)) sets up a dial-up to the base station simulator (eg Anritsu's MD8430A for LTE) using the radio protocol stack. This creates a data link between the base station and the dial-up PC.
- An IP test instrument (eg Anritsu's MD1230B data traffic generator and analyser) generates a defined IP data stream. This goes through the base station simulator, the radio protocol stack (which schedules the data transmission) and the radio stage. Once the IP data is received by the UE it is sent to the dial-up PC.
- The IP soft bridge in the dial-up PC transfers the IP data from the COM port (from the dial-up) back to the IP instrument (through an Ethernet port).
- The IP instrument receives the returning data stream. It can now calculate trip time, jitter, throughput and error rates by comparing each received packet with the transmitted time and contents.

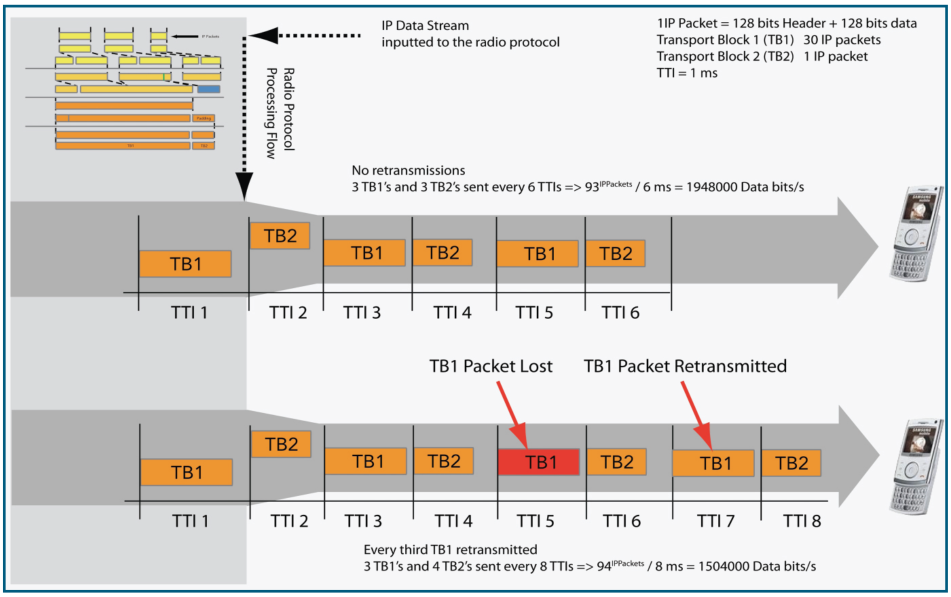
For uplink measurements the process is the same but in the reverse direction.

Benefits of the new set up

The IP instruments are much more accurate than any PC/Unix application both for timing measurements (round-trip time and jitter) and packet count and size (throughput and packet/bit error rates) measurements. Typically this type of instrument offers timing accuracy measured in single-digit μs (and for some measurements even ns). Moreover, this timing accuracy will be guaranteed by the instrument manufacturer.

Another advantage of IP instruments is the repeatability of the IP data stream. The PC/Unix-based solutions implement a real data

Figure 2: The effect of packet retransmissions shows up in reduced data throughput.



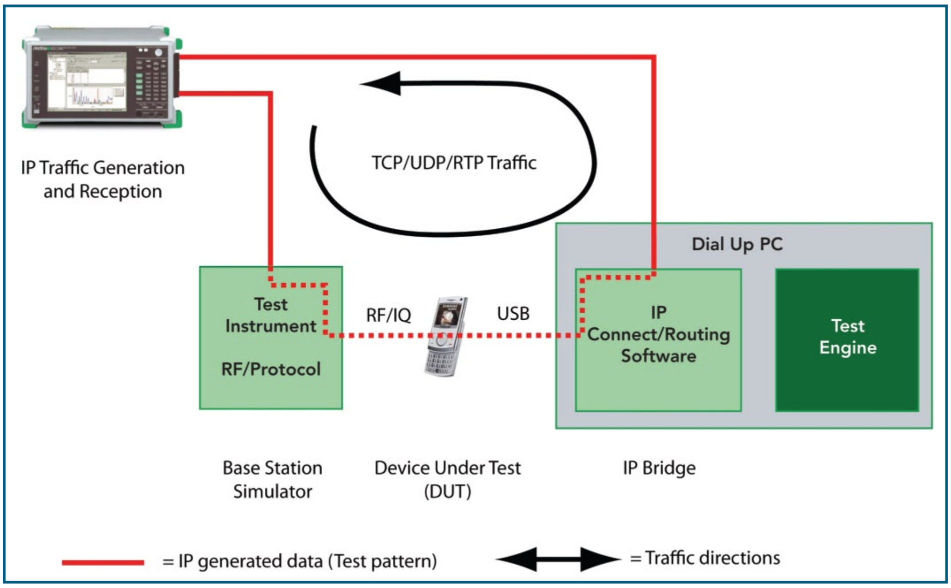


Figure 3: Anritsu's proposed test set-up mirrors that found today in IP network systems.

protocol stack (e.g. TCP in an ftp application) which dynamically reacts to changes in the available transmission bandwidth. This makes it impossible to get relevant information about radio protocol performance without looking at the TCP logs. This exacerbates an already tedious process: the user now has to analyse the TCP log before working through the radio protocol log.

IP instruments, on the other hand, can always send the same data pattern, allowing the user to focus on radio protocol analysis.

One more aspect of repeatability comes from the fact that the radio protocol chops and reformats the information to be transmitted several times as it progresses through the stack. How this process is performed depends on the size of the initial IP packet supplied to the radio protocol. So to achieve repeatability it is critical not only to send the same number of packets with the same jitter characteristics, but to repeat the IP packet sizes at every measurement. This can be done with an IP analyser, but not with PC/Unix based applications.

If the IP data stream is correctly defined, and the radio protocol configuration is known, this measurement method very quickly gives detailed information on the performance of the radio protocol stack of the UE.

Adopting an IP test method in the world of radio transmission

The obvious question at this point is, if the benefits of using existing commercial IP analysers are so obvious, why has this technique not already been adopted by the mobile phone industry?

The answer is in the radio protocols. Compared to protocols in the datacoms world, radio protocols are extremely complex; since the adoption of Fast Link Adaptation technology, they have become even more dynamic. Because of this higher level of complexity, great care has to be taken in designing the IP data streams and in correlating the results of IP measurements with radio protocol performance in order to derive the benefits of repeatability and precise error-location described above.

So there is a learning process for mobile phone developers to undergo in order to implement this technique from the datacoms world. But if the mobile industry can successfully adopt IP analysis techniques, the potential is to improve the performance of handsets through accurate location and characterisation of protocol-level errors. By improving the functional integrity of devices, developers can also achieve faster completion of operators' acceptance tests and gain higher scores in their device benchmarking tests.

RF test system characterizes radar modules ten times faster

The TS6710 test system from Rohde & Schwarz is a highly flexible, turnkey standard solution for manufacturers of AESA radar equipment. Its modular architecture allows it to be configured for product development or for use on production lines.

Predefined test cases and the easy compilation of complete test sequences simplify operation significantly. The user can also adapt all test cases individually to specific customer requirements. Moreover, when configuring a test system for a customer, the module does not require any detailed information about the modules to be tested. Claiming to be the fastest system on the market, the TS6710 can characterize the 25,000 measurement results of a transmitter-receiver module (TRM) in less than four minutes. The compact test system consists of only three instruments and covers a frequency range from 1 Hz to 24 GHz.

The importance of AESA radar, which is based on electronic beam steering, is increasing significantly in outer-space applications as well as in aerospace and defense. In July 2010, for example, the multinational Euroradar consortium decided to develop AESA radar intensively. To facilitate this and similar initiatives, the TS6710 was developed as a turnkey test system designed for the development and production of AESA radar modules. The compact solution consists of only three instruments: a ZVA network analyzer for RF measurements, an OSP-TRM control platform for RF signal switching and conditioning, and a TSVP test platform for TRM control and supply.

The speed and performance characteristics of the TS6710 are outstanding. The complete characterization of a module with about 25,000 measurement values takes less than four minutes. This means that the TS6710 is ten times faster than other systems available on the market. The system can also measure the S-parameters for all phase attenuation combinations, the noise factor, output power and intermodulation as well as spurious emissions. Extremely short measurement times are an enormous advantage especially in production, where only about 2500 measurements per TRM are required. Under these circumstances, a TS6710 can complete a test run in less than 15 seconds. Two modules can be tested at the same time with a single system. Optionally, users can even characterize as many as eight DUTs in parallel.

The TS6710 takes relevant safety and secrecy regulations and requirements into account.

To configure the system for a customer, Rohde & Schwarz does not require detailed information about the modules to be tested. The operating frequency, for example, is a core parameter of AESA radar systems. With the TS6710, the manufacturers do not have to reveal it. Since the frequency range extends from 1 GHz to 24 GHz as standard, users do not need to specify the bandwidth of the particular module they are working with – unlike with other systems. The test system covers all relevant frequency bands including even future broadband radar.

A comprehensive library of TRM test cases makes operation easy.

www.rohde-schwarz.com

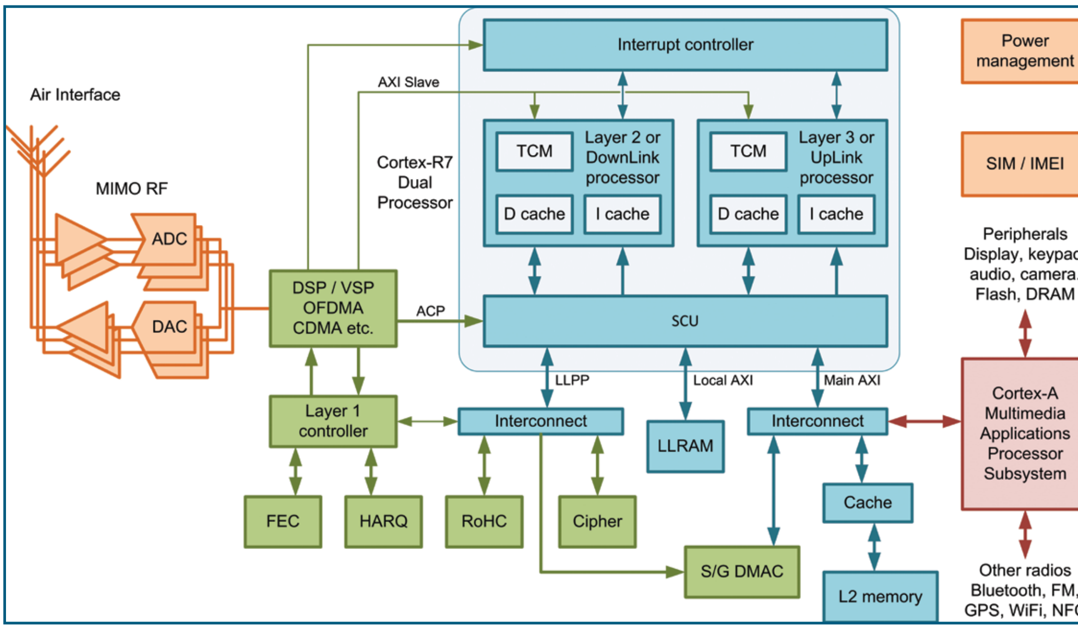
Practical implications of LTE on mobile baseband architecture implementations

By Chris Turner and Richard York, ARM, www.arm.com

It should be widely appreciated that implementation of new LTE and LTE-Advanced mobile communications standards is only made practical by advances in semiconductor manufacturing technology. Moore's law makes possible the millions of logic gates and Megabytes of memory required to run 4G in a baseband processor chip that is small enough, low enough in cost and miserly enough in energy consumption to be used in a mobile handset or portable tablet computer. However, the processing demand from LTE is enormous and so the very latest DSP and general-purpose processor architectures must be designed to take advantage of the semiconductor capability. This is the case with the latest real-time embedded processor from ARM, the Cortex™-R7 processor, which has an extremely powerful superscalar architecture capable of delivering over 1,500 Dhrystone MIPS from a square millimeter of 40 nm silicon, when running at a clock frequency of 600 MHz.

Besides extreme performance, the Cortex-R7 processor has a number of key system integration features that make it highly suitable for LTE baseband protocol stack processing. These baseband software protocols are layered with layer-1 driving the DSP modem hardware, layer-2 managing the radio connection and layer-3 making the call, identifying the handset to the network and dealing with location and mobility. This is highly complex software that is tightly integrated with the DSP modem hardware, and, for high data rate LTE and LTE-Advanced, it typically requires a dual core Cortex-R7 processor configuration if it is to run efficiently. In fact, such dual processor configurations are already common in today's 3G and HSPA mobiles, and almost always running on either ARM11 or ARM Cortex-R4 processors.

Figure 1: Illustrative LTE baseband system.



Hardware integration using real-time interrupts

Integration with the modem hardware is achieved through the use of many real-time interrupts; over 50 in many designs. These interrupts arrive from the modem at high frequencies (for example, at LTE symbol rate of 14 interrupts per millisecond) and must be rapidly processed in the Cortex-R7 processor to manage the modem and the radio as they constantly adapt to changing signal conditions and download or upload data at a high rate. Many small fragments of data flow in and out of the system and these must be error checked, re-transmitted if required and assembled or disassembled to and from finished IP packets that pass in and out of the user's applications. Simultaneous data streams may be present for audio, video and data communications together with control data for the handset's interface to the cellular network. This is a hugely complex and high performance processing task.

An LTE baseband modem and processing system is illustrated in Figure 1. Various hardware blocks are identified for the LTE standard's Forward Error Correction (turbo code), Hybrid Automated Resend reQuest (HARQ) and ROlbust Header Compression and Ciphering (RoHC) for security. There is also a Scatter-Gather DMA Controller that keeps track of all the fragments of data flowing in and out of the system. The modem is responsible for OFDMA coding and decoding of the radio signal and is implemented using DSPs or a Vector Signal processor, VSP.

The system illustrated uses a dual core Cortex-R7 processor for layer-2 and layer-3 protocol processing with much of the layer-1 work being done by sequencers and state machines within the modem hardware. However, some layer-1 tasks will also be performed by software in the Cortex-R7 processor. This system demonstrates a number of key features in the architecture of the Cortex-R7 processor, designed to ease practical implementations of an LTE baseband system.

Flexibility and balanced performance

First, the two processor cores can access all memory and peripherals via a shared Snoop Control Unit (SCU) that incorporates address filtering and provides a fully coherent and consistent view of memory for all of the processors and accelerators. Software architects have the flexibility to allocate tasks between the processors to balance performance loading and the interrupt frequency plan. Address filtering can then be configured to allow each processor access to the regions of memory and peripheral registers that are required for its tasks. The system will perform Asymmetric Multi-Processing (AMP) with each processor running its own instance of a Real-Time Operating System, but with shared access to memory and peripherals.

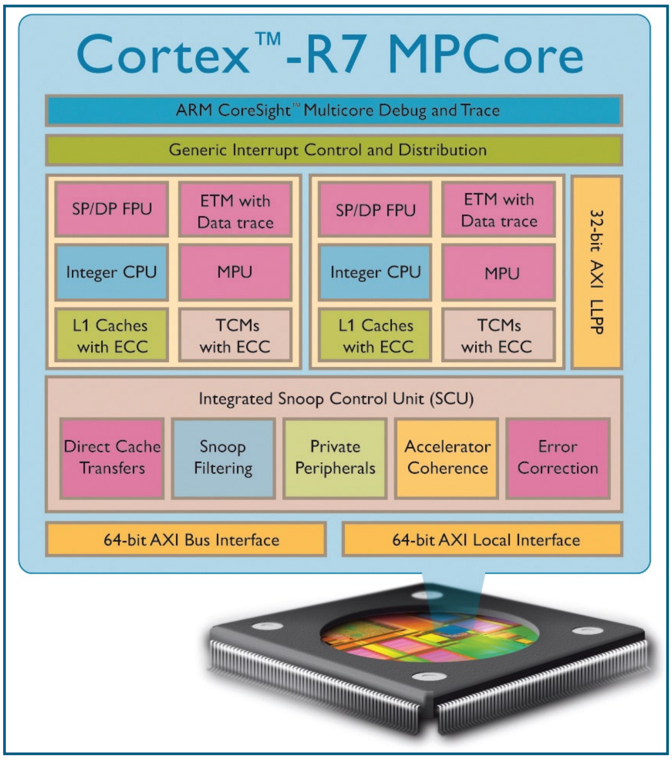
The SCU in Cortex-R7 processor has features to support AMP that are not found in a Symmetric Multi-Processing (SMP) core system. SMP is normally scalable from one, to two, to four and so on processors. Each processor can access the single flat memory map in the system and the software operating system will issue tasks to ensure that processor loading is balanced evenly. Therefore a central part of the SCU will normally be an access queue for any of the processors to address any memory location because there is no way to predict which processor will do what. This means that in a traditional SMP system the activity from one processor can always temporarily block another processor's access.

Quality of service configuration

In the Cortex-R7 real-time processor there is additional configuration in the SCU to prioritize a processor's access to a specified memory region or peripheral. ARM calls this 'Quality of Service' (QoS) configuration. This means that an asymmetric system can, for example, prioritize one processor's access to the fast Low-Latency RAM and control modem hardware over the Low-Latency Peripheral Port, while the other processor has priority access to main memory. Neither processor will be blocked by the other while accessing its prioritized memory and peripherals, but each can access the others memory and peripherals when required. Clearly this is a valuable feature for the baseband system illustrated above where one processor is more concerned with fast hardware management and the other is processing larger chunks of data.Each processor can still communicate to the other when required and data can easily be passed between them. Of course, a conventional and fully balanced SMP capability is possible when the two processors' SCU priorities are configured identically.

In the Cortex-R7 processor architecture there are two high performance, low latency ports for peripherals and RAM access. These provide fast paths to memory and I/O that are not blocked by queued accesses on the main AMBA® AXI™ bus when it is moving larger chunks of data in and out of memory. Most likely, both processors will fetch the majority of their instructions over the main AMBA AXI bus, but fast Interrupt Service Routines (ISR) and key data structures and tables should be stored in the LLRAM.

The Cortex -R7 processor core.



Deterministic responsiveness

A key feature of all Cortex-R series processors provides for the deterministic responsiveness that is required in real-time systems such as LTE baseband. The Cortex-R series processors all offer a special memory that is tightly coupled to the processor and used to store code and data for an ISR that is always available for immediate access. Other processors without this feature will run all code and data from cached memory and may take many 100's of cycles to enter an ISR whilst waiting for AMBA AXI bus transactions to complete before fetching the ISR into cache if it is not already present. Thus all Cortex-R series processors have a bounded and deterministic interrupt response time of around 20 cycles, which is essential when so many high frequency interrupts must be serviced promptly.

The Cortex-R7 processor provides two memory areas for this purpose; the shared LLRAM external to the processor and a smaller Tightly-Coupled Memory (TCM) within each processor that can be accessed even more quickly. TCM size has to be limited to 128 Kbytes for code and 128 Kbytes for data so that it does not inhibit the maximum operating clock frequency.

LTE baseband processor designers will design their interrupt frequency plan very carefully to take full advantage of both processors whilst operating at the lowest clock frequency they can afford. Minimizing dynamic energy consumption is a major part of the design challenge and this is strongly linked to the operating clock speed. Most likely the designers will distribute a small number of high frequency interrupts onto one processor and a larger number of more sporadic interrupts requiring more processing time to the other. This will most certainly result in a lower energy system than would be achieved with a single processor servicing all the interrupts and running at very high frequency. In fact, such a single processor system might spend so much time entering and exiting ISRs that it would struggle to do much useful work.

Data coherency

Another key feature of the Cortex-R7 processor is its provision for data coherency. As data from the modem or the processors is written to memory it could leave any copies held in processor cache in an incoherent state, i.e. the processor would be working on old data until the cache is updated. The Cortex-R7 SCU addresses this by automatically invalidating any cache lines whose content is being updated in main memory. Moreover, any data in cache that is waiting to be written back to memory is also managed automatically. The SCU does this by snooping into the processors' data cache while data is transferring to see if the memory being written to is also present in cache. This process is accelerated by the SCU maintaining its own private copy of the cache tag RAMs, which saves the snooping from impacting on cache performance.

In addition to maintaining data cache coherency between the processors there is also provision for maintaining coherency with an external data source, such as the modem. This data is fed to the SCU through the Cortex-R7 processor's Accelerator Coherency Port (ACP) which maintains coherency in both processors' data caches. Automated cache coherency is an extremely valuable feature that saves the system from what would otherwise be very considerable software overhead. This feature is essential for implementing an energy-efficient LTE modem with adequate performance for LTE and LTE-Advanced communications.

Flexibility design and operation of baseband protocol stack software

These QoS and coherency features provide valuable flexibility in the design and operation of baseband protocol stack software. A dual core Cortex-R7 processor-based system is easily able to rebalance the work load between processors as differing wireless communication protocols are called into play when the mobile device moves between cells, operators or roams internationally. Network capabilities can vary dramatically when roaming from cell to cell, causing the mobile device to switch between various 3G and new 4G standards. This can trigger a rebalancing of the load to further minimize the system energy consumption.

Overall performance of the Cortex-R7 processor is very high with a Dhrystone benchmark exceeding 2.5 DMIPS/MHz. This is achieved using a sophisticated 11-stage pipelined architecture with instruction pre-fetch, branch prediction and superscalar execution through parallel processing paths. Register renaming and out-of-order instruction execution all add to performance capability and there is a fast hardware divider and optional floating point unit for applications that need it. The processor's load-store unit also has a four-slot memory read-write queue allowing execution to continue while waiting for outstanding load-store operations to complete.

Interrupts are routed to either processor using the integrated Generic Interrupt controller (GIC), which also facilitates the passing of rapid interrupts between the processors. The Cortex-R7 also offers a choice of interrupt modes for either normal or low latency. Normal mode offers the maximum processing performance, but interrupt latency can be reduced by switching to low latency mode when the interrupt can be taken in fewer cycles at the expense of having to repeat some of the processing activity that started just prior to the interrupt.

Migration Path for LTE and LTE Advanced

These and other features of the Cortex-R7 real-time processor make it perfectly designed for use in high data rate LTE and LTE-Advanced modem systems that will be capable of multi-standard operation and give designers the opportunity to optimize the energy efficiency of their products. Previous generations of modem for HSPA and first generation LTE have used the Cortex-R4 real-time processor to good effect and the new Cortex-R7 processor will allow existing software to be easily migrated onto the new platform. There is also a new Cortex-R5 processor available with performance similar to the Cortex-R4 processor and incorporating some of the coherency and low latency access features described above. Other system engineering features such as the ARM CoreLink™ interconnect (AMBA 3 AXI) and CoreSight™ debug infrastructure allows design teams to easily evolve their work from one product to the next.

Single-chip reconfigurable digital radio front-end

Imec has presented a digital front-end component for low-cost and low-power spectrum sensing, paving the way to power-efficient cognitive radios and networks.

The accelerated deployment of broadband personal communication coupled with the continuously increasing demand for large data rates results in an increasing spectrum scarcity. A dynamic access to the available spectrum would increase the throughput efficiency significantly. In licensed bands scenarios, dynamic spectrum access would for example allow personal mobile terminals to seamlessly set-up and maintain a reliable wireless connection. In unlicensed bands (such as the crowded 2.4 GHz band), it would bring great added value to products for which interruptions in the connectivity cannot be tolerated, for safety reasons in a control system (for example in surveillance cameras), or for comfort reasons in real-time applications (wireless conferencing, hearing aids,…) as it would improve connectivity even in the presence of many competing and interfering networks.

However, current radio architectures are focused on the reception of a predefined channel, and cannot proceed to a frequency scan operation in a timely, cost- and energy-effective way. Imec's cognitive reconfigurable radio solutions hold the solution for such next-generation flexible radios, as they enable multi-mode communication and spectrum sensing.

This latest spectrum sensing component was designed as a versatile digital engine to meet a wide variety of use cases, at low cost and low power overhead. The chip, which hosts a dedicated application-specific integrated processor, can perform both flexible synchronization and spectrum sensing for high-throughput WLAN (802.11a-n), cellular standards (including the recent 3GPP-LTE), and digital broadcasting standards.

The spectrum sensing component connects to imec's in-house designed analog reconfigurable radio chip (SCALDIO) and its programmable digital baseband platform conceived for 4G seamless connectivity (COBRA). Consequently, imec's complete reconfigurable radio solutions enable multimode communication with efficient use of the spectrum.

"Several companies are already investigating the use of these spectrum sensing solutions to increase the quality and reliability of a wide variety of wireless applications;" said Liesbet Van der Perre, director green radio programs at imec.

www.imec.be

Networks will have a major headache in 2011 and tablets will only make it worse — however wireless Ethernet microwave can ease the pain

By DragonWave Inc., www.dragonwaveinc.com

The shift in the mobile network traffic profile from voice towards data is now indisputable. Even more significant is the fact that the largest proportion of this data is not just best-effort traffic such as web browsing or file downloads, but video streaming – which has high-bandwidth demands and is sensitive to network latency (or more precisely, variations in network latency). With large screen, high performance connected devices emerging in 2010, this trend is likely to increase. 2010 has been the year of the tablet – the iPad tablet – and this is only one of many high performance connected devices we will see in 2011, with a multitude of Android, Linux, Microsoft and Blackberry devices already announced.

With the dramatic growth in mobile data, the divergence of traffic and revenue in mobile networks is well known, but let's quantify the problem.

Looking at the problem in terms of 'revenue per MByte' demonstrates the true scale as shown in Table 1.

The other significant factor in this equation is the capacity of each service. Whilst SMS and voice only require low capacities, mobile data (particularly mobile broadband for laptop & tablet computers) require data rates that approach fixed broadband. Expectations are in the region of at least 1Mbps per user.

Measured in terms of revenue per bit delivered, SMS is hugely profitable; voice is moderately profitable; mobile data is an expensive drain on resources.

Even with variations in usage, profile and traffic, the trend is clear. The revenue generated per Mb of network capacity has declined with the widespread adoption of mobile data usage, yet the total network cost is increasing rapidly to cope with the demand (Figure 1).

With the current thirst in mobile data showing no sign of diminishing, the implication is clear: the necessary exponential increase in network capacity cannot be delivered using traditional technologies, without either a dramatic reduction in profitability, or imposing a severe limit on capacity which is not a viable long-term strategy. The one certain outcome would be high subscriber churn and a resulting rapidly declining revenue. A step change in data delivery is essential as things will only get worse in 2011 and beyond.

Table 1: Revenue per MByte for vfarious services.

Service	Quantity of data	Revenue	Revenue per MByte
SMS	160 bytes	$0.10	$625.00
Voice	2 min voice call	$0.20	$0.83
Mobile broadband	5GB data/month	$25.00	$0.005

However this problem can also be seen as an opportunity. The opportunity is to embrace the change that is essential and get ahead of the competition.

On the face of it, the obvious solution for delivering high capacity for packet data is a rapid move away from the voice-centric model of the 1990's – the traditional circuit-switch TDM backhaul – towards a more efficient, internet-centric packet-based Radio Access Network (RAN) and backhaul. An all-IP network has long been seen as the ultimate architecture for an efficient network, but getting to that architecture from today's hierarchical networks is a very big step. A recent survey[1] of mobile operators by Infonetics Research revealed that all were deploying IP/Ethernet backhaul in their network, some in conjunction with TDM backhaul but the majority as a complete replacement for TDM.

In mobile networks, the necessary capacity increase is primarily felt in two parts of the network: the RAN and the backhaul network.

The move towards packet RAN has already taken place with High-Speed Packet Access (HSPA) rolled-out across most European Mobile Networks. The move towards packet backhaul, on the other hand, is lagging far behind.

The reason for this lag in the backhaul network is simple. Whilst high capacity data requirements readily move from traditional circuit-switched TDM (e.g. E1 for GSM/GPRS and ATM over E1 for UMTS) backhaul to cost-efficient packet-based Ethernet backhaul, the migration for voice traffic to a packet Ethernet backhaul is not so clear. This is due to the fact that voice traffic is highly reliant on the accurate and stable network synchronisation delivered by the traditional synchronous TDM backhaul network.

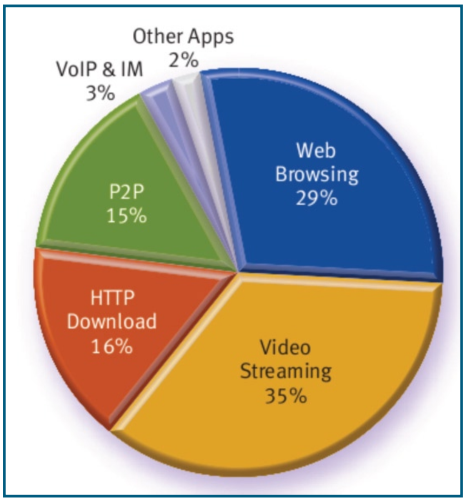


Figure 1.

Source: www.theregister.co.uk/2010/09/29/allot_mobile_data.

The challenge is therefore to cater to the very high capacity demands of mobile broadband packet data whilst also supporting the synchronous requirements necessary for voice. There are a number of possible solutions, each with their own pros and cons:

- Dual backhaul networks: Keep the existing TDM network and adding a second packet network;

- Migrate to hybrid network: carrying a mix of TDM traffic and packet-traffic over the same network;
- Migrate to all-packet RAN: converting all existing TDM RAN to have an IP interface;
- Migrate to packet backhaul, with TDM delivery capability: carrying TDM traffic as packets over a packet network.

Looking at each of these possible solutions in turn, it is clear that whilst some at first glance might be attractive, in the long term, only some make practical and economic sense.

Dual backhaul networks

This immediately solves some of the problems: it maintains a reliable network for voice – one that quite likely has already been optimised, and adds a second network for the high-capacity data without impacting the original backhaul network. But the cost penalties cannot be overlooked. The cost and complexity of running two networks, in terms of network management, equipment, spectrum, site rental, fibre rental etc, means that the original problem, how to reduce the cost of delivering the required network capacity, had not been solved.

Hybrid network

For each hop of the backhaul network, the existing TDM link could be replaced by a hybrid link that combines the TDM and packet traffic then separates it at the other end. This preserves the timing information of the TDM traffic, and goes some way to offering the capacity for packet traffic, but it requires the duplication of switching and cross-connect equipment at each nodal point in the network – driving significant costs and complexities. In addition, this in effect creates separately managed and protected network layers, adding significant operations costs.

It also means there is no statistical aggregation of voice traffic towards the core of the network – one of the key cost benefits of all-IP networks. This solution may achieve the goal of delivering both types of services, but will not achieve the cost per bit economics required to be profitable when delivering high bandwidth services.

Migrate to all-IP network

An all-IP network might seem to be the ideal solution, but the steps to getting there, can be substantial. There is a huge number of TDM-based GSM & UMTS/HSPA basestations already deployed, and the cost of replacing these with packet-based RAN equipment is too high to take in a single step. Therefore all-IP networks might be the goal, particularly with LTE networks now already being rolled-out, but from a cost and management consideration, intermediate steps are likely to prove more financially viable, unless a greenfield network is being deployed.

Migrate to packet backhaul, with TDM delivery capability

Considering the impact in moving to an all-IP network, an intermediate step is very attractive. Having a packet backhaul network delivers the benefits of statistical multiplexing offered by aggregated IP traffic and yet through the use of complementary technologies allows time-sensitive voice traffic to also benefit from such an efficient backhaul. A suitable technology is Pseudowire End-to-End Emulation, which allows TDM traffic to be transported over packet. With pseudowire, the backhaul operator can deploy a single end-end packet network, eliminating costly TDM connections and equipment at intermediate sites. This provides a CAPEX benefit, but more importantly, a significant operations benefit too. But can pseudowire meet the stringent timing requirements of TDM?

Pseudowire is often deployed at the base station using a cell-site router, which interfaces both TDM and Ethernet traffic with IP backhaul. According to research by Infonetics, operator spending on cell-site routers increased by 136% in 2009. It is important to note that TDM E1 links are not only used to deliver raw information, but also to deliver timing information to the base-station - an essential requirement for GSM and UMTS/HSPA networks. In an IP-based network, the ability to deliver TDM data and synchronisation imposes these network requirements:

- Need for minimum end-to-end latency and effective QoS management;
- Optimised bandwidth utilization (minimising the overhead to carry TDM traffic);
- Managed jitter and a variation in packet delay within predefined limits;
- Maintain clock synchronisation between the two ends;
- Maintain packet order.

Defining these criteria quantitatively, and ensuring each is met, is part of the network engineering function but let's expand them a little further to ensure that a high capacity packet network is going to be suitable for existing TDM-based networks.

Ensuring QoS

In a packet network, delays occur when multiple packets contend for the use of links and other resources. When this occurs, it is important that the time-sensitive packets are given the highest priority and therefore sent first. If there is insufficient capacity, then the lowest priority packets should be discarded. If this occurs too often, then the network isn't dimensioned correctly and it does not have sufficient capacity. Applying QoS to the IP packet network is essential to overcome problems of contention and suitable QoS mechanisms would be through the use of priority bits in VLAN tagging, 802.1q Ethernet priority tagging, DSCP or MPLS, for example. To ensure consistency throughout the network, end-to-end management of the packetized TDM traffic simplifies network management.

Tagging and managing TDM traffic as high priority in this way not only minimises the latency through the network, it also minimises the variation in latency. If the variation in latency were to become excessive, this would lead to a loss of synchronisation for the TDM traffic.

Table 2.

Network requirements	Microwave requirement
High capacity - Typically 20-40Mbps per base station, 40-400Mbps on aggregated links	Packet microwave are typical scalable from 10M to 400 per link, with over 1G links possible for core backhaul
Low Latency - Sub 20mS end-to-end delay for LTE & voice traffic	Typically sub 120µS per hop, so multiple hops still sub 1mS latency
Flexible QoS management - Able to route TDM traffic ahead of 'background' traffic	A variety of QoS management is possible, including: VLAN tagging 802.1q Ethernet priority tagging DSCP MPLS
Whatever the expected interference conditions, the minimum bandwidth must guarantee delivery of high priority 'synchronous' traffic.	Hitless Automatic Adaptation to interference – allowing lower priority traffic to be dropped in cases of temporary link bandwidth reductions. As IP traffic is inherently tolerant to lost packets this is acceptable and allows for higher link capacities, while maintaining high availability for high priority services.
Inherent network resilience and tolerance to equipment outage (whether planned or unplanned)	Rings and mesh architectures are often used in packet networks to provide cost-effective equipment rain fade protection. The ability to rapidly shut down links that are obstructed or during equipment outages does not impact the network as a whole.
Low cost & rapid deployment	In contrast fibre, a major benefit of packet microwave links is their speed of deployment and low spectrum licensing costs per Mb of capacity.
Low OpEx - Fit and forget network management	Automatic adaption to environmental conditions, such as hitless automatic adaptive modulation and automatic transmit power management ensure that links can adapt to their local environment.

Avoiding excessive packet delay variation

Whilst effective management with QoS can minimise the variations in latency in a network, there will inevitably be some, leading to jitter at the receiving end. This jitter makes it difficult to deliver the constant bit rate TDM traffic, but is easily managed through the use of jitter buffers – in the same way that streaming media players buffer data before playing it. However buffers introduce end-to-end delay, so there is a trade-off between size of buffer and overall latency: the larger the buffer, the greater the tolerance to jitter, but the greater the latency. This trade-off is an important engineering optimization.

Maintaining clock synchronisation

E1 links deliver TDM traffic at a constant bit rate, delivering not only the data but also a clock that is in sync at the two ends of the link. Because an IP network is not clocked in a synchronous way, the clock from the TDM traffic is lost. However, pseudowire employs clock recovery mechanisms to reconstruct the original clock from the data, thereby effectively delivering a constant bit rate stream over an asynchronous network. Timing recovery with pseudowire can deliver accuracy up to ±0.016 ppm and meet industry standards for jitter and wander masks, easily meeting 2G/3G basestation requirements.

Applying TDM transport requirements to Ethernet microwave

Wireless Ethernet-based backhaul is an attractive technology choice due to its flexibility in deployment, its efficient high capacity data-transport capability, its low cost and rapid deployment and its resilience in backhaul environments. Having defined a mechanism for carrying synchronous TDM circuits over a packet network, it is then important to look at the features and capabilities of an Ethernet microwave system to see how they map onto a pseudowire backhaul network (Table 2).

Ethernet microwave systems have proven their worth in packet backhaul environments; pseudowire technology is now mature enough to meet the demands of synchronous 2G & 3G mobile networks, and it is now possible to combine the two technologies and deliver the step change in mobile network backhaul costs. This in turn will help ensure mobile operators remain profitable whilst also delivering exponential growth in mobile data that has been seen in recent years and shows no sign of declining.

Reference

[1]www.infonetics.com/pr/2010/Mobile-Backhaul-and-Microwave-Market-Highlights.asp

Low profile end launch connectors
deliver low VSWR and insertion loss

Southwest Microwave has announced a family of low profile, PCB-mount End Launch connectors. Requiring no soldering for mounting or use, they provide the same high electrical and mechanical performance as Southwest Microwave's standard height End Launch connectors.

The lower profile design permits use where vertical headroom is critical, such as in board-to-board stacking, and low profile packaging. They have the same mounting footprint as standard End Launch connectors and can be used interchangeably with the same board designs.

The End Launch connectors are designed for single and multi-layer printed circuit boards where the microwave layer is on top. They provide industry typical lowest VSWR and insertion loss for broadband applications in SMA (27 GHz), 2.92-mm (40 GHz), or 2.4-mm (50 GHz). Multiple launch options help optimize circuit match. A unique clamping feature accommodates board thicknesses up to 0.110 inch.

www.southwestmicrowave.com

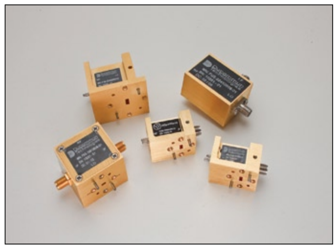
Ultra-low energy radio IC
draws less than 3 mW, for wireless sensor networks

Toumaz has launched the TZ1053 Telran, an ultra-low energy (ULE) radio for wireless sensor networks, remote controls, green energy solutions, smart meters, and environmental monitoring. Built on the company's proprietary AM Mixed Signal technology, the sub-1 GHz radio SoC offers 1 V operation using a single button cell battery and consumes under 3 mW continuous use.

The TZ1053 Telran contains an enhanced 8051 running Toumaz's Nanopower Sensor Protocol (NSP) allowing developers to program and control the device easily with high level commands either over a standard interface such as UART or "over the air". The IC supports networking and communication modes including P2P, star network and basestation-to-basestation communication. The chip sustains data rates of 50 kbps with a range greater than 100 m line of sight using a high gain antenna, or 20 m from a PCB or chip antenna in a body-worn environment.

www.toumaz.com

Millimeter wave guide balanced mixers
cover from 26.5 to 110 GHz in six waveguide bands



Ducommun Technologies offers balanced mixers that come in 6 waveguide bands to cover the frequency spectrum from 26.5 to 110 GHz.

These mixers employ high power performance GaAs Schottky beamlead diodes and balanced configuration to produce superior performance and a moderate LO pumping level. The mixers are designed for full RF waveguide band operation with extremely wide IF bandwidth. Typical conversion loss for these mixers is 5 to 10 dB. Ducommun mixers can be used for test equipment, communication systems and radar receivers where frequency down conversion is required.

www.ducommun.com

Low-power 40-nm LTE Advanced baseband SoC
delivers multi-sector performance

DesignArt Networks takes the wrapper of its ground-breaking 40-nm 4G SoC platform family with the launch of five distinct SoC solutions. The DAN3800 baseband SoC is the 4G performance flagship, targeting next-generation distributed macro base station equipment. It draws new lines in the sand in terms of performance, system integration, and extremely low power consumption.

The SoC features a scalable 4G baseband pipeline, consisting of optimized multi-core DSP and RISC processing layers, augmented with a software-programmable high-capacity multi-core hardware acceleration layer, all dimensioned to achieve true multi-gigabit ITU Advanced performance. Consuming only 8 W, it delivers multiples in performance of currently available silicon solutions – powering an entire 4-sector LTE Advanced Macro BTS for the delivery of up to 1.2 Gbps of raw 4G data capacity – all with just one single DAN3800.

LTE Advanced foresees the use of advanced features and signal processing capabilities, such as successive interference cancellation (SIC), beam forming (BF), multi-user MIMO (MU-MIMO), LTE relay, and multi-carrier spectrum aggregation, to create the necessary multi-gigabit capacity for 4G data services. Simultaneously, the DAN3800 SoC supports all of these processing intensive technologies, while operating a 4-sector LTE R10 baseband across up to 80 MHz of aggregated spectrum capacity, driving up to 16 transmit and 16 receive paths, far beyond the scalability and performance of existing silicon solutions.

www.designartnetworks.com

Multi-core processor
for LTE eNodeB / base stations

The XLP316L multi-core, multi-threaded processor designed by NetLogic Microsystems integrates sixteen NXCPUs, and features a breakthrough quad-issue, quad-threaded and superscalar out-of-order processor architecture capable of operating at up to 2.0 GHz.

Manufactured in an advanced 40-nm process, the processor is targeted to offer performance of 20 Gbps and 30 million packets-per-second (Mpps) for converged data plane and control plane processing in LTE and LTE-Advanced base stations.

In addition, the sixteen NXCPUs are fully cache and memory coherent for software applications to seamlessly run in Symmetric Multi Processing (SMP) or Asymmetric Multi Processing (AMP) modes.

The processor features NetLogic Microsystems' high-speed, low-latency Enhanced Fast Messaging Network to enable efficient, high-bandwidth communication among the sixteen NXCPUs and to support billions of in-flight messages and packet descriptors between all on-chip elements.

The multi-core processor offers a tri-level cache architecture with over 6 Mbytes of fully coherent on-chip cache, which delivers 40 Tbps of extremely high-speed on-chip memory bandwidth. It also incorporates one channel of 72-bit DDR3 interconnect that yields over 100 Gbps of off-chip memory bandwidth.

To complement the sixteen NXCPUs, the XLP316L processor offers fully-autonomous processing engines that provide independent and complete offload of certain network functions from the NXCPUs, including 10 Gbps of encryption/decryption/authentication including support for Kasumi and SNOW3G protocols.

www.netlogicmicro.com

Digital mini repeaters
ideal for cost-effective in-building coverage

Axell Wireless has launched its first family of digital mini repeaters providing 2G, 3G and 4G coverage in all cellular frequency bands based on its patented DSP technology. The dual band DIGI mini targets mobile operators wanting to provide indoor coverage to business customers, whether an SME or a major enterprise.

Available in dual-band and single-band variants, the units can provide a 'tri' and 'quad' band combination if required. European frequency bands available include 900 MHz, 1800 MHz, 2100 MHz, and 2600 MHz but any combination of 2G, 3G or 4G services can be run on any band.

The company claims that, with further spectrum allocation at a premium, many operators are now looking to 're-farm' existing frequency bands, running different services within one band (for example GSM and UMTS in the 900 MHz band). The DIGI mini fully supports this application without the cost associated with deploying multiple repeaters.

www.axellwireless.com

Renesas Mobile makes its mark with LTE modem platform

The first product launch following the acquisition of Nokia's Wireless Modem Team by Renesas Electronics, which coincided with the creation of Renesas Mobile, has been announced. The LTE triple-mode modem platform integrates a single-chip baseband processor that supports LTE/HSPA+/GSM, RF transceiver ICs, high power amplifiers, power management devices and related software. The platform supports major mobile OS's including Android, MeeGo and Symbian as well as Linux and Windows Mobile on PCs. This will allow easy integration as an embedded modem, including standalone, or as a companion to an applications processor.

It also supports TD-LTE and FDD-LTE cat 3 (100 Mbps downlink (DL) / 50 Mbps uplink (UL)) along with HSPA+ features such as DC-HSDPA cat 24 and HSUPA cat 7 giving 3G data rates of 42 Mbps (DL) /11.5 Mbps (UL) respectively.

www.renesasmobile.com

OMAP 5 platform

boasts multiple cores

Texas Instruments' believes its OMAP 5 platform is expected to change the concept of 'mobile' by driving disruptive mobile computing experiences providing stereoscopic 3D, gesture recognition and computational photography based on multi-core processing, including ARM Cortex-A15 MPCore processors.

The 28-nm OMAP 5 applications processors offer up to 3x processing performance and five-fold 3D graphics improvement, and a nearly 60% average power reduction compared to a sample user experience on the OMAP 4 platform.

The OMAP 5 processor uses two ARM Cortex-A15 MPCores capable of speeds of up to 2 GHz per core in the OMAP 5 implementation. The 50 percent boost in performance over the Cortex-A9 core (at the same clock frequency), is combined with up to 8 GB of dynamic memory access and hardware virtualization support.

In addition to the two Cortex-A15 cores, the OMAP 5 processor includes individual, dedicated engines for: video, imaging and vision, DSP, 3D graphics, 2D graphics, display and security.

The OMAP 5 processor can support up to four cameras in parallel, as well as record and play back S3D video in 1080p quality, and perform real-time conversion of 2D content to S3D at 1080p resolution. The processor can also deliver advanced short- and long-range gesturing applications, as well as full-body and multi-body interactive gestures.

The OMAP 5, coupled with a TI DLP Pico projector and a camera, can also enable interactive projection where the user can actually "touch and drag" projected images on both a table top or wall.

www.ti.com

E-field probe

handles from 100 kHz to 6 GHz

Now available from Link Microtek is a probe that can detect the electric fields emanating from equipment operating at frequencies from 100 kHz to 6 GHz, suitable for safety measurements at mobile-phone, WLAN and WiMAX base stations, as well as TV and radio transmitters. Designed for use with the Narda NBM series of wideband field strength meters, the EF0691 probe provides a cost-effective means of complying with the requirements of BS EN 50492, which calls for safety evaluations of all permanently installed RF sources up to 6 GHz in the vicinity of base stations.

As an isotropic probe, the EF0691 measures three spatial components of an electric field, and the resultant value of the field strength is automatically calculated by the NBM meter. Safety measurements can therefore be made quickly and accurately without needing to take readings in three orthogonal directions.

Individual calibration data is stored in an EPROM within the probe, with the necessary correction factor also automatically applied by the meter. The EF0691 probe features a high sensitivity of 0.35 V/m, and its wide dynamic range of 65 dB means that there is no need to switch measurement ranges on the NBM meter itself.

www.linkmicrotek.com

Voltage variable attenuator and VGA

target high linearity applications to 6 GHz

Hittite Microwave has introduced an SMT packaged wideband Voltage Variable Attenuator (VVA) and an SMT wideband analog Variable Gain Amplifier (VGA) targeting high linearity broadband, cellular/3G, WiMAX/4G and military EW applications from 400 MHz to 6 GHz.

The HMC973LP3E is an absorptive VVA, which operates from 0.5 to 6 GHz and is ideal for applications that require a continuously variable attenuation setting. It accepts a single analog control signal between 0 and +5 V, and provides up to 26 dB of attenuation range. This high range VVA features a monolithic shunt-type topology which is non-reflective and well matched at all control voltage settings; furthermore, unlike other GaAs FET based VVAs, it exhibits excellent linearity of +35 dBm input IP3 throughout its control range.

The HMC973LP3E analog controlled VGA is comprised of two high linearity VVAs and a high linearity amplifier. This wide range analog VGA operates from 0.5 to 6 GHz, and can be set to provide between 35 dB of attenuation, and 15 dB of gain. The device accepts a single control voltage between 0 and +5 V, to achieve up to 50 dB of gain/attenuation variation. This high linearity analog VGA also delivers noise figure of only 7.5 dB in its maximum gain state, and exhibits a high output IP3 of up to +28 dBm.

www.hittite.com

Tiny receiver sees both GPS and GLONASS

claims to be the smallest available

ST-Ericsson has launched a tiny receiver (which claims to be the smallest available) that is able to see both GPS and GLONASS positioning satellites, enabling mobile devices to deliver much faster and much more reliable location-based services.

Requiring just two external components, the CG1950 is built in 45 nanometer silicon, enabling manufacturers to produce sleek, low-cost devices capable of supporting highly-accurate navigation, mobile social networking, augmented reality and other location-based services. The combination of GPS and GLONASS, will enable devices to retrieve positioning data from more than 50 satellites by the end of 2011.

The receiver features -163 dBm acquisition sensitivity and -165 dBm tracking sensitivity with embedded LNA (single-ended antenna), autonomous (cold start) TTFF of < 38 s, and A-GPS (hot start) TTFF of < 1 s. Its low power consumption enables continuous GNSS (Global Navigation Satellite System) tracking for more than 30 hours with a standard 850 mAh battery.

www.stericsson.com

Low noise GPS LNAs

in a space saving WLP package

Maxim Integrated Products has introduced the MAX2686/MAX2688, low-noise amplifiers (LNAs) designed for GPS-enabled applications operating in the 1575 MHz band. Packaged in a 0.86-mm x 0.86-mm, 0.4-mm-pitch wafer-level package (WLP) with only four pins, these LNAs minimize solution footprint for today's continually shrinking handheld designs.

The LNAs only require two external components to complete the board-level design (plus an optional resistor for logic-enabled shutdown) and are ideal for GPS L1, Galileo, and GLONASS applications.

The LNAs feature a low 0.75 dB noise figure that improves receive sensitivity over discrete and highly integrated CMOS solutions. A low 4 mA (typical) operating supply current ensures longer battery life.

www.maxim-ic.com

14-bit D/A converter

synthesises entire cable spectrum into a single RF port

Analog Devices has introduced a 14-bit D/A converter that enables cable television and broadband operators to synthesise the entire cable spectrum up to 1 GHz into a single RF port, while consuming a maximum of 1.1 W of power.

The AD9739A 14-bit, 2.5-GSPS D/A converter's wide bandwidth and dynamic range enables cable operators to increase the QAM (quadrature amplitude modulation) channel densities by 20 times over the densities found in today's cable modems. Competing D/A converter solutions require an additional 28 LVDS (low-voltage differential signaling) pairs for the data interface and consume nearly three times more power than the company's AD9739A D/A converter.

The D/A converter features a proprietary mix-mode function, which supports the high-fidelity digital synthesis of RF signals at up to 3.6 GHz. The combination of best-in-class, 2.5-GSPS bandwidth and 14-bit dynamic range with a direct-to-RF core allows broadband and next-generation wireless equipment designers to use a single-transmit D/A converter architecture that eliminates a low-pass filter and one mixer or modulator stage.

www.analog.com

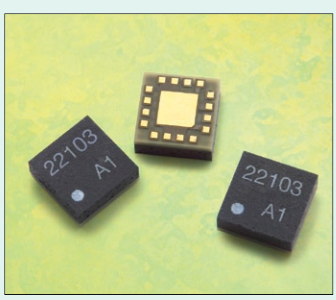
High-gain linear amplifier module

enables WiMAX to coexist with other radios

Avago Technologies has announced a linear power amplifier module for mobile and fixed wireless data WiMAX applications that include WiFi and other cellular radios. The MGA-22103 module features an aggressive gain shape that limits the noise injected into radio receivers co-located in the same device, enabling WiMAX to coexist with WiFi, GPS, PCS and other radios in handsets, tablets, USB dongles and other portable electronics.

The linear power amplifier is cost-effective and meets industry-standard Spectral Emission Mask (SEM) tests operating at 3.3 V. Covering a frequency range of 2.5 to 2.7 GHz, it includes fully integrated RF matching. These features are integrated in a 3- x 3- x 1-mm package.

The module meets the IEEE 802.16 WiMAX mask



at over 25 dBm power, with high gain of 35 dB across the band. Additionally, a low power mode allows operation at approximately 80 mA when only minimal power is required.

Additional features include integrated CMOS compatible pins for shutdown and low power mode, a +25 dBm linear output power, 2.5% error vector magnitude (EVM) 16 QAM WiMax modulation at +25 dBm, and operating temperature of -40 to +85°C.

Samples and production quantities are available now.

www.avagotechwireless.com

Cellular front end modules

target 3G/4G switch and signal conditioning applications

RF Micro Devices has announced the addition of four products to RFMD's expanding portfolio of front end modules for 3G/4G switch and signal conditioning applications.

The RF8889A and RF1291 single-pole 10 throw (SP10T) antenna switch modules (ASMs) deliver industry-leading linearity performance and excellent insertion loss for high-throw count applications and are compatible with reference designs from Qualcomm, Intel and ST-Ericsson. The RF8889A and RF1291 are specifically targeted at smartphone applications in which the coexistence requirements of multiple radio standards place critical importance on switch linearity and harmonic performance.

The RF1194A switch filter module (SFM) delivers the linearity and insertion loss performance of the RF8889A and RF1291 ASMs and expands upon their functionality by adding GSM Rx SAW filters. The RF1196 switch duplexer module (SDM) delivers the switch and filter capabilities of RFMD's ASMs and SFMs and expands upon their functionality by integrating a WCDMA band 1 duplexer. The RF1196 is first in a family of RFMD SDM products that significantly reduce total solution size by delivering complete front end integration of all switch and filter requirements in a single front end module.

www.rfmd.com

Low loss RF combiner

for high speed PXI measurements

The Aeroflex 3065A RF combiner addresses the need of RF test system engineers working in cellular handset or RFIC and component manufacturing when making measurements of RF transceivers. The RF combiner module is used in conjunction with signal generator and RF digitizer modules from the Aeroflex 3000 PXI range to enable development of high performance, low cost modular test systems for testing RF transceivers and components.

In addition to providing summed signal outputs, the two-input combiner module supports various combinations of input and output switched path configurations, to enable testing of single- and multi-port RF devices without the need to alter connections.

Operating over the frequency range 250 MHz to 6 GHz, the 3065A provides a combined low loss connection for a RF signal generator and RF digitizer to a mobile phone antenna, while offering high isolation between input ports and accepting input of power levels of up to +33 dBm for TDMA burst signals or +30 dBm for continuous CW.

www.aeroflex.com

CALENDAR

Satellite 2011
14th - 17th March 2011
Walter E. Washington Convention Center
Washington DC, USA
www.satellitetoday.com/satellite2011

EMV 2011
15th - 17th March 2011
International Congress Center
Stuttgart, Germany
www.mesago.de/en/EMV/home.htm

International CTIA Wireless
21st - 24th March 2011
Orange County Convention Center
Orlando, Florida, USA
www.ctiawireless.com/events/future.cfm

Smart Systems Integration 2011
22nd - 23rd March 2011
Hilton-Dresden, Germany
www.mesago.de/en/SSI/home.htm

ARMMS RF & Microwave Society Conference
4th - 5th April 2011
Milton Hill House
Oxfordshire, UK
www.armms.org

WAMICON 2011
18th - 19th April 2011
Hilton Clearwater Beach Resort
Clearwater, Florida, USA
www.wamicon.org

European Wireless 2011
27th - 29th April 2011
Vienna University of Technology
Austria
www.ew2011.org

LTE World Summit 2011
17th - 19th May 2011
Amsterdam RAI
The Netherlands
http://ws.lteconference.com

LIDAR & RADAR 2011
26th - 29th May 2011
Hohai University
Nanjing, China
www.lidar2011.org

DAC 2011
5th - 10th June 2011
San Diego Convention Center
San Diego, CA, USA
www.dac.com

Wireless Sensor Networks and RTLS Summit Europe 2011
21st - 22nd June 2011
Holiday Inn Munich City Centre
Munich, Germany
www.idtechex.com/wireless-rtls-europe-11

International Microwave Symposium 2011 (IMS 2011)
5th - 10th June 2011
Baltimore Convention Center
Baltimore, Maryland, USA
www.ims2011.org

Wireless Technologies 2011
27th - 28th September 2011
Schwabenlandhalle
Stuttgart-Fellbach
Germany
www.mesago.de/en/wireless/0

European Microwave Week 2011
9th - 14th October 2011
Manchester Central
Manchester, UK
www.eumweek.com

Wireless Congress 2011: Systems & Applications
9th - 10th November 2011
Konferenzzentrum München
Munich, Germany
www.wireless-congress.com

Cartes & IDentification 2011
15th - 17th November 2011
Villepinte Exhibition Center
Paris, France
www.cartes.com

Productronica 2011
15th - 18th November 2011
New Munich Trade Fair, Munich
Germany
http://productronica.com

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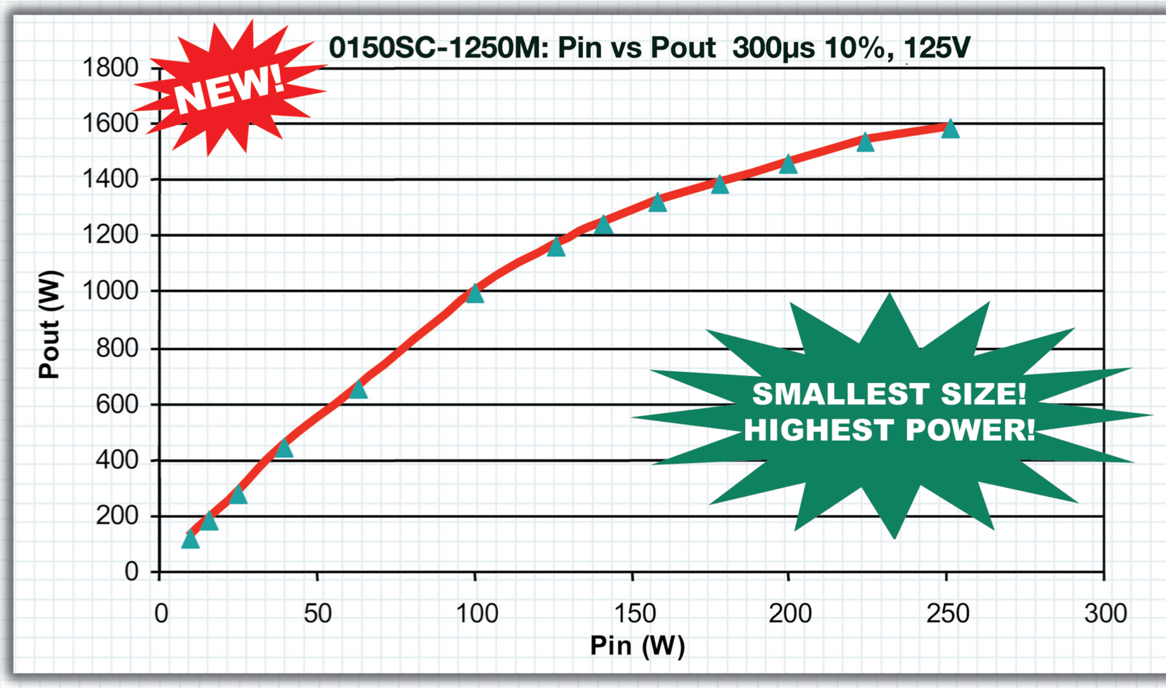
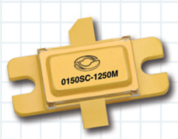
SILICON CARBIDE RF POWER DEVICES



Highest Peak Power In Smallest Package!



	0150SC-1250M	*0405SC-1000M*
Freq:	156 MHz	405-450 MHz
Power Out:	1400 typ	1100 typ
Power Gain:	9 dB	8 dB
Pulse Width:	300 µs	300 µs
Duty Cycle:	10%	10%
VSWR-T:	10:1	10:1
Efficiency:	60%	45%
Bias:	125V	125V
Package:	0.9”x0.4”	0.9”x0.4”
Metallization:	all AU	all AU

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