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comms critical

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ON THE COVER

The Rohde & Schwarz TSME ultra-compact drive test scanner enables advanced quality analysis and benchmarking, is small and lightweight, flexibly configurable for standard as well as sophisticated measurement tasks, and fit for future requirements.

The TSME scanner measures up to eight wireless communications technologies simultaneously and seamlessly. It is possible to cascade multiple scanners — for instance, for LTE applications, four scanners can be combined for 4x4 MIMO measurements.

The TSME boasts very fast signal processing and incorporates the RF core competency of Rohde & Schwarz in an ultra-compact RF receiver. As a result, it can perform measurements in a user-configurable frequency range between 350 MHz and 4.4 GHz, making it possible to measure all current and future bands of any supported technology in this range. Its measurement bandwidth of 20 MHz allows all wireless communications standards to be measured, including LTE, LTE Advanced and WiMAX. Since the TSME can simultaneously measure any combination of bands, it supports measurements in networks with LTE-Advanced carrier aggregation. It is possible to use multiple bands in parallel and to measure multiple technologies simultaneously. For each technology, it is possible to define multiple frequencies in different bands.

With its light weight of only 650 g and low power consumption of maximum 15 W, the TSME meets all the requirements placed on a drive test scanner.

Rohde & Schwarz (Australia) Pty Ltd
www.rohde-schwarz.com.au

Transmit

Do you erect, maintain equipment on or otherwise need to climb communications towers for a living? If so, you'll be very interested to read of the new US standard for safe tower working, reported in this issue. A10.48, Criteria for Safety Practices with the Construction, Demolition, Modification and Maintenance of Communications Structures, is the US's first voluntary national consensus standard strictly dedicated to protecting workers in the communications tower industry. Eleven tower workers were killed in the US in 2014, most of them the result of falls from heights. Safety at work should be the paramount concern for all of us, so we should all take note of the new safety standard to see what we can learn from it.

Also from North America, in this issue we report on a major interoperability exercise conducted along the US–Canada border, plus we look at trial mobile technology being used by FirstNet to connect multiple comms modes in a local area.

Comms Connect Melbourne is rapidly approaching (22–24 November), and it is attracting some big-name participants, including Bill Schrier, a senior FirstNet advisor, who will speak about progress with the public safety mobile broadband network. This year will be Comms Connect's 10th anniversary, so it's a big congratulations to Paul Davis and all the members of his team for the stellar work they do in organising and conducting such a well-run and vital industry event. This year's event will be bigger and better than ever, so make sure you book your registration to the conference, exhibition and workshops to guarantee that you don't miss out. See you there!

Jonathan Nally, Editor
cc@wfmedia.com.au

Calendar

September 2016

Comms Connect Adelaide 2016
23 September
National Wine Centre, Adelaide
adelaide.comms-connect.com.au

LTE Asia 2016
26–28 September
Marina Bay Sands, Singapore
asia.lteconference.com

October 2016

ITS World Congress 2016
10–14 October
Melbourne Convention & Exhibition Centre
itsworldcongress2016.com

November 2016

Critical Communications Middle East 2016
7–9 November
Jumeirah Beach Hotel, Dubai
criticalcommunications-me.com

MilCIS 2016
8-10 November
National Convention Centre, Canberra
milcis.com.au

ITU Telecom World 2016
14–17 November
IMPACT Arena, Thailand
telecomworld.itu.int

Comms Connect Melbourne
22–24 November
Melbourne Convention & Exhibition Centre
melbourne.comms-connect.com.au

For a full list of dozens of industry events, see criticalcomms.com.au/events.

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If you have any queries regarding our privacy policy please email privacy@wfmedia.com.au
Subscriptions: For unregistered readers, price on application

Audited Media Association of Australia
cab
September 2015 total CAB Audited Circulation 3,654 (84% personally requested)

Print Post Approved PP100007393
ISSN No. 2202-882X
Printed and bound by SOS Print + Media
+61 2 9549 2119

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SYDNEY'S LIGHT RAIL

Jonathan Nally

Safety and security are front and centre in the Sepura TETRA communications strategy for Sydney's new tram network.

The ALTRAC consortium, which comprises Alstom Transport Australia, Transdev Sydney, ACCIONA and Capella Capital, is hard at work on construction of Sydney's new CBD and South East Light Rail lines, in a $2.1 billion public-private partnership with the NSW Government.

The contract was awarded on 17 December 2014 and commercial services are expected to begin in early 2019.

As part of the contract, the consortium will also take over the operations and full maintenance of the existing Inner West Light Rail (IWLR) system, which includes 12 trams and connects Sydney's inner west with Pyrmont, Darling Harbour and the southern CBD.

For the new 12-kilometre-long line, Alstom is responsible for the integrated tramway system which includes the design, delivery and commissioning of 30 coupled Citadis X05 trams, power supply equipment, including APS (ground power supply) over two kilometres, communications and signalling systems, the energy recovery system HESOP, depot equipment and maintenance.

"Alstom is very committed to Sydney's transport network and is pleased to bring with Citadis X05 a new passenger experience, high-capacity, sustainable, full fluidity and optimum system services. Sydney will benefit from Alstom's worldwide experience and latest evolution of its tram range," said Dominique Pouliquen, senior VP of Alstom Transport Asia Pacific.

"This project will transform Sydney and provide a step change in the city's public transport capability and reliability while protecting the aesthetic appeal of the central business district."

The Citadis X05 integrates new technologies such as permanent magnet motors to reduce energy consumption and easier subsystem integration and maintenance to decrease lifecycle costs. Citadis X05 will have constant CCTV monitoring, emergency intercoms and the latest way-finding aids for real-time passenger information.

ACCIONA will be responsible for the design, construction and integration of the civil works including track, 19 stops, a bridge over the Eastern Distributor toll road, a tunnel under Moore Park, control centre facilities, housing for the light rail vehicles, a maintenance depot, and substations and other service buildings along the route.

The CBD and South East Light Rail will run every four minutes in peak hours in the CBD and every eight minutes to and from Randwick and Kingsford. Each service will carry up to 450 passengers, equivalent to nine standard buses. As a result, the network will carry up to 15% more passengers during peak hour and provide 33% more seats across the day. The project also includes wire-free infrastructure to protect the aesthetic appeal of the CBD.

Rail communications

In July 2016, Alstom announced that it had selected Spanish firm Teltronic to supply the communications system design for the new Light Rail line. Teltronic is now part of the Sepura group, having been acquired in 2015.

The Sepura TETRA system will provide communications between all staff on the line — including drivers, maintenance and security staff, inspectors and the control centre — and will be integrated with an intelligent transport system application, responsible for fleet management, traffic regulation, passenger information management and train-to-ground information exchange.

Terence Ledger, head of the Asia Pacific region for Sepura Group, told *Critical Comms* that the communications network design will be done by Sepura. Some of the equipment will be standard, off-the-shelf Sepura gear, such as SRG3900 mobiles, and STP 9000 handhelds, but other elements, such as the RTP-300 onboard equipment, will be specifically adapted to the requirements of the 30 tram units.The other major rail project in Sydney at the

Images courtesy Alstom and Sepura

Images courtesy Alstom and Sepura

moment, the North West Rail Link, also will use Sepura infrastructure and terminals.

"On that project, it's going to be the new SC20 as the handheld radio, the RTP-300 onboard equipment and our SRG3900 mobile radios," said Ledger, "along with our Nebula TETRA system infrastructure."

According to Ledger, Teltronic is known for its public safety-grade TETRA infrastructure, and is renowned for its onboard transport solutions, while Sepura terminals have long enjoyed a reputation for functionality and reliability.

"Since Teltronic and Sepura have come together, it has given us extra strength in the marketplace in Australia," said Ledger. "We'd already had success with our solutions, but Teltronic's expertise in the transport sector is really important for us, and it's helping us win business all around the region."

Sepura's NEBULA TETRA infrastructure is a key element of many rail operations.

> "TELTRONIC'S EXPERTISE IN THE TRANSPORT SECTOR IS REALLY IMPORTANT FOR US, AND IT'S HELPING US WIN BUSINESS ALL AROUND THE REGION." — TERENCE LEDGER, SEPURA

Why is TETRA so successful in the transportation communications sector? "It's proven and reliable. With transport projects, people don't want to use experimental technology because there's too much at risk, and they're too high profile to not work," said Ledger.

"Basically all the engineering companies, and transport integrators, want it because it is already compliant with rail guidelines," he added. "There are certain testing and standards you have to comply with to make sure you get through vibration, shock, temperature and so on. We've done all that testing. We're one of the few manufacturers that can supply this kind of onboard equipment."

Sepura's portfolio of onboard mission-critical communication products also complies with the new European standard EN 45545, published by CENELEC, the European Committee for Electrotechnical Standardisation. The standard, which was adopted by all EU countries in April 2016, regulates fire safety in railway rolling stock. The Sepura portfolio is compliant with both part 1 (EN 45545-1) — the 'principal terms and definitions and general regulations governing the classification of rail vehicles in operational and design categories, as well as fire safety objectives' — and part 2 (EN 45545-2), which describes the requirements for the fire behaviour of materials and components.

According to Ledger, another reason for TETRA's success is its price point. "If you're spending millions of dollars on a metro line, [the cost of] TETRA is just a drop in the ocean," said Ledger, particularly compared with P25. "The cost of the networks, handhelds and equipment is a lot lower, and you get more functionality as well. P25 is quite limited with what you can do."

And yet, both TETRA and P25 can work hand in hand, with Ledger citing the example of a major US city bus system, the communications contract for which was won by PowerTrunk, another Sepura subsidiary. "That's probably the biggest contract we've ever signed so it's quite a big project that's going to be rolled out over the next few years," said Ledger.

Technological innovation

In the Basque Country, Spain, Bilbao Metro is taking part in a pilot communications project using LTE technology. The network

continued over page »

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> THE LTE SYSTEM PROVIDES UNINTERRUPTED, HIGHLY AVAILABLE, REAL-TIME VIDEO MONITORING AND, IN COMBINATION WITH THE EXISTING TETRA NETWORK, CAN SIGNIFICANTLY BOOST SECURITY.

is deployed in conjunction with ITELAZPI, operators of the Basque Country's regional communications network.

The project integrates LTE with the existing TETRA network, which is based on Sepura's eNebula solution. The LTE system provides uninterrupted, highly available, real-time video monitoring and, in combination with the existing TETRA network, can significantly boost security in the Metro, and help facilitate a coordinated response in an emergency situation.

The integrated TETRA-LTE system provides real-time video transmission between trains, stations and the Command and Control Centre in Bilbao, as well as from portable devices used by the security staff onboard or in the station. Real-time video from cameras at stations can also be displayed.

ITELAZPI's security infrastructure is also used by public safety agencies and transportation entities such as Euskotren and ETS.

"This is an excellent platform on which we can easily build our professional broadband services. It is also a cost-effective solution, since we are able to layer LTE technology onto the existing network, alongside existing PMR voice and narrowband data services," said Ricardo Lizundia, TETRA systems manager at ITELAZPI.

"This opens up a range of interesting possibilities for the network and promises significant improvements in the public service communications within the Basque Country."

According to Ledger, a unique feature of Sepura's systems is that they use a single network management system, so all provisioning is done through one network management system. "With most of the competition you need to have network management for the LTE component and one for the TETRA component," he said. "We've cut it down and made one network management system, which makes it really, really easy — basically it becomes one network."

Sepura is also working on rail signalling. "We're working on a couple of projects in Asia that use signalling over TETRA, which require TETRA services to be used in a highly efficient manner, closely integrated with the signalling application," said Ledger.

"This is just one way in which TETRA is evolving to meet the ever-changing needs of the market."

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Industry Talking

July saw Queensland shine as we gathered to attend a one-day Comms Connect and then ARCIA networking dinner. The event was held at Rydges South Bank, and both the daytime Comms Connect and networking dinner were well attended. Comms Connect included an excellent presentation from the Queensland Government Wireless Network, including presentations from the police, fire and ambulance services.

We learned about the huge difference new and reliable radio technology is making to public safety personnel using the GWN. It was interesting to hear that while the network is a unified trunk radio network, each key agency had been able to adapt their operational procedures because of the availability of new coverage and features. We often take for granted features such as duress functionality and multiple working groups, plus extended coverage for portable users, which can make a big difference. This was borne out by the presentation from the Queensland Ambulance Service, which showed how medical staff are able to maintain the critical connection to the coordination centre even when leaving the ambulance. The GWN has not only improved officer safety but is also providing better patient outcomes.

During the panel debate, questions were raised about the need and effectiveness of interagency communications, which is often cited as one of the major reasons to build one public safety network. The agencies all agreed that their first priority had been to ensure that the new network provided the maximum benefit for each agency, with at least replication of existing service and coverage levels. However, it was clear that the success of the project has led to a new level of collaboration between agencies. Common talk groups are being used where appropriate; however, the potential for the new network to do more over time is seen very positively.

The lesson I learnt from listening to the GWN panel at Comms Connect is that when people work together with the aim to improve the service levels for all public safety, great outcomes are possible. The GWN is a giant leap forward for public safety communications in Queensland, but even more impressive is how the agencies and government are working together to ensure that the investment in new digital radio technology provides dividends for the community overall. With the present considerations regarding public safety mobile broadband, there are lessons for other jurisdictions in how the individual agencies worked towards a common goal and outcomes, and with this in mind individual concerns were addressed as part of a common solution.

The next ARCIA event will be in Adelaide in September at the prestigious National Wine Centre; we look forward to seeing you there. Don't forget Comms Connect and the annual ARCIA gala dinner in Melbourne — November will be here before you know it, so it's time to think about your nominations for the industry awards and begin to book your tickets for the Melbourne industry dinner and Comms Connect.

Hamish Duff, President
Australian Radio Communications Industry Association

LED light source and power meter

The Kingfisher KI-28010 is a singlemode, handheld LED laser light source that comes with a KI-2600 power meter, available to rent from TechRentals.

Featuring a large LCD display that is both sunlight readable and backlit, the unit is rugged and lightweight, making it suitable for all field applications. It is compatible with APC and PC singlemode networks, while autotest functionality provides fast, easy and automatic multiwavelength loss testing. It can also be used for encircled flux compliant testing and as a tone source for fibre identifiers.

Other features include: good optical power stability and reconnection repeatability; memory with text, timestamp and USB dump; real-time PC reporting software; and wavelengths 1310, 1550 and 1625 nm.

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PIM detection on spectrum analyser

Anritsu has launched a PIM Alert application that uses a built-in spectrum analyser to check the Uplink Band of mobile carriers for the possibility of PIM (passive intermodulation).

While there are many causes of PIM, internal PIM is typically caused by loose or corroded RF connectors, dirt or metal shavings contaminating the connectors during installation. Damaged antennas can also result in internal PIM. External PIM by comparison will occur when the antenna radiates into any device that can act as a diode, introducing high RF noise directly into the antenna's receive path; typically corroded or dissimilar metallic surfaces such as street furniture or corrugated roofing sheets.

The presence of PIM at a cell site will result in degraded performance of the network, reduced receiver sensitivity and more frequent customer complaints. The cell boundary will be smaller, data throughput of the site will be reduced and calls may be dropped. The PIM alert application is a free tool that runs on standard BTS Master and Spectrum Master as well as Site Master instruments with the spectrum analyser option.

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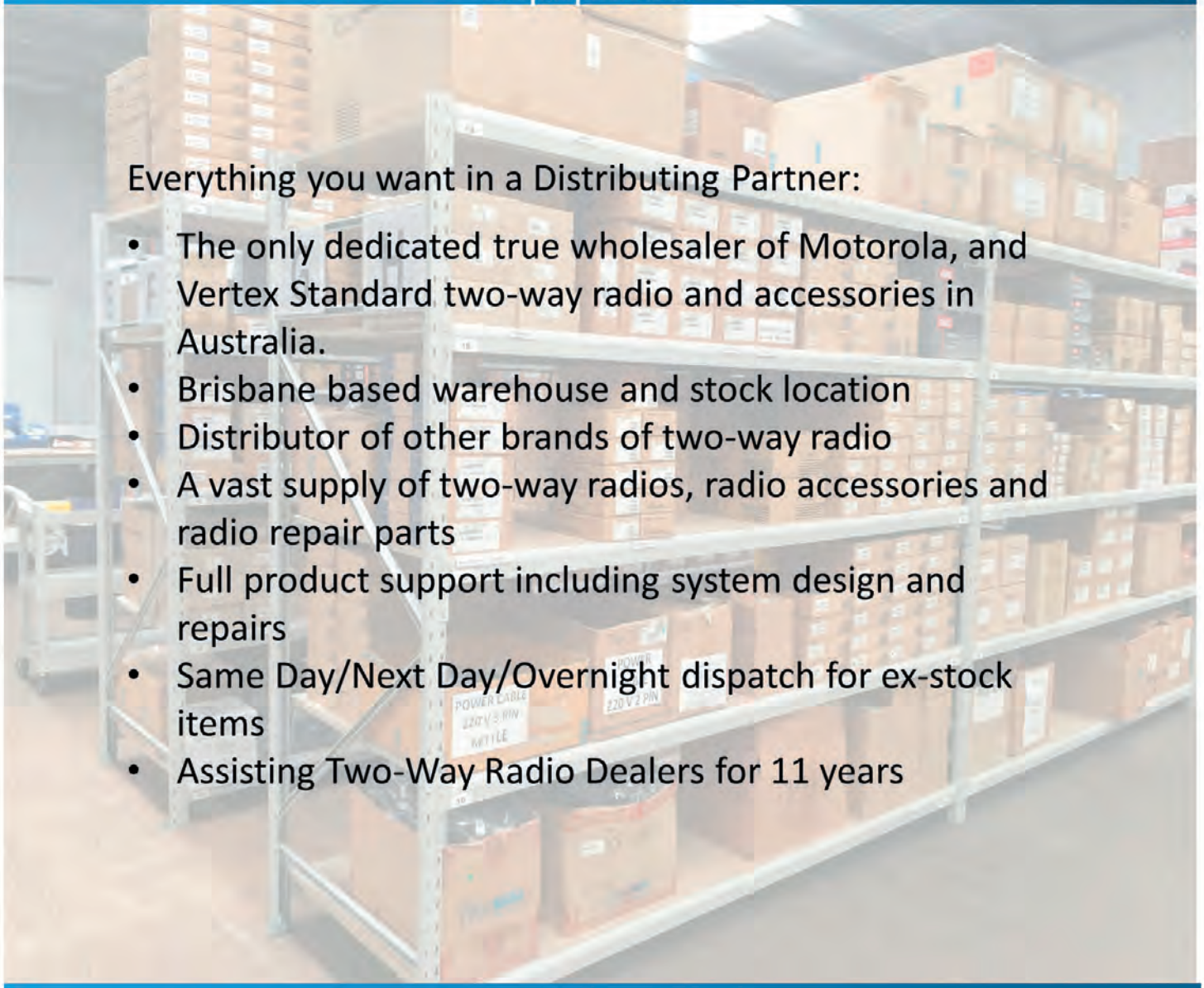

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COMMS CONNECT MELBOURNE

Jonathan Nally

22–24 NOV 2016

COMMS 2016 CONNECT

Don't miss this world-class line-up of speakers, workshops and exhibitors.

The international Comms Connect conference and exhibition is on again in Melbourne, from 22 to 24 November 2016. Now in its 10th year, it is expected to draw more than 1400 attendees from a broad range of industry sectors, including utilities, public safety, government (local, state and federal), transport, mining, oil and gas, security, defence, IT, backhaul and telemetry, and the wider commercial environment.

The conference will feature individual presentations, panel sessions, keynotes and workshops covering a myriad of topics of interest to everyone in the critical communications field: latest technologies, regulation and government policy, case studies, security, the Internet of Things and many more.

This year, all exhibits and presentations will be in the same place — the Exhibition Halls at Melbourne's Convention and Exhibition Centre. And with 90+ exhibitors, 80+ speakers and delegates from 20 countries taking part, Melbourne will be the place to be in November.

Training workshops

The event will begin with a series of industry workshops on Tuesday, 22 November, the day before the main conference program commences. This year there will be eight workshops (last year there were six), and the topics and presenters/moderators will be:

- Voice and data applications over IP — presented by Daniel Oliphant, Product Manager, Zetron Australasia
- 400 MHz band changes and achieving compliance: the things you need to know — presented by representatives of ARCIA and the ACMA
- Implementation of location services within a radio dispatch environment — presented by Kor Snyman, Engineering Manager, Omnitronics
- Fleet management cradle to grave utilising OTAP — presented by Andrew Smith, Engineering Solutions Manager, Tait Communications
- Mission-critical communications redundancy: the future looks bright — presented by Ryan Lovett, Australian and New Zealand College of Paramedicine, and Inspector (Ret.) Lance Valcour O.O.M.
- Integrated operations: beyond IT/OT convergence — presented by Stuart Zerbe, Director, Marketing & Strategy, Harris
- Critical communications: where to from here — presented by members of the Australasian TETRA + Critical Communications Forum and the International TETRA and Critical Communications Forum
- Building a private LMR network from the ground up: an independent workshop — presented by Chris Stevens, Lifesaving Communications Advisor, Surf Life Saving Australia

These workshops tend to fill up quickly, so make sure you get your registration in as soon as possible. And keep checking the Comms Connect website (comms-connect.com.au) for information on additional presenters and panellists as it comes to hand.

Conference program

The organisers always secure very high-profile keynote speakers to begin the first day of the event, and this year will be no exception.

First up will be Dr Kevin Vinsen of the International Centre for Radio Astronomy Research in Perth. Dr Vinsen is heavily involved

At A GLANCE
Where: Melbourne Convention & Exhibition Centre
When: 22 November (preconference workshops), 23–24 November (conference and exhibition)
Web: comms-connect.com.au

in the development of the Square Kilometre Array (SKA), a pioneering radio telescope system being built in remote Western Australia and southern Africa.

The SKA will incorporate groundbreaking Australian radio technology and produce copious amounts of data that will require supercomputers to process. In this presentation, Dr Vinsen — who previously spent almost 10 years as chief software engineer for leading defence contractor Thales — will demonstrate how terrestrial communications and cutting-edge radioastronomy share so many things in common… the latest radio and electronics technology, remote operations in harsh environments, high-speed data links, big data analysis, spectrum protection and more.

He will be followed by Bill Shrier, Senior Advisor to the US First Responder Network Authority (FirstNet), who will give a presentation on the progress being made towards implementing the world's largest and most complex public safety mobile broadband (PSMB) communications network. Considering that Australia will one day soon move towards having a PSMB network of its own, this will be an invaluable opportunity for delegates to hear directly from one of the leading experts involved in the FirstNet project.

Following the keynotes, the conference will split into three streams — Public Safety & Emergency Management, Industry and Technology — with two dozen presentations spread over the remainder of the first day. There are too many speakers to list them all here (the full range can be seen on the Comms Connect website), but here is selection that covers a range of topics:

- From pre-hospital to out of hospital, the past, present and future of mission-critical communications (Ryan Lovett, Zone Manager, Lead Operational Digital Engagement Strategy, NSW Ambulance)
- Evolving DMR standards deliver new customer benefits (John Graham, DMR Association Marketing Working Group Chairman, Tait Communications)
- Cyber warfare in the utilities — the art of protecting critical infrastructure (Dr Suresh Hungenahally, CISO and Cyber Security Lead, CommTel Network Solutions)
- 2017 and beyond: what do customers want from a communications solution? (Daniel Leppos, Channel Manager, Motorola Solutions)
- Tackling interference issues in the field with real-time spectrum analysis (Steve Karandais, General Manager, Keysight Technologies)
- Digitising policing services to the community (Inspector Trevor Gould, Business Manager, Policelink, Queensland Police Service)
- Spectrum for private LTE networks — picking over the bones (Andrew May, Licensing Manager, Spectrum Engineering Australia)
- Electrical equipment for hazardous areas (EEHA) — just what is 'intrinsically safe'? (Ian Miller, Executive Officer, ARCIA)
- Delivering electronics and communication training using a 'Blended Model' approach (Dr Kenneth Meyer, Head Teacher: Systems Engineering Design, TAFE Riverina)

ARCIA Gala Dinner and awards ceremony

All attendees are encouraged to register for the Annual Gala Dinner of the Australian Radio Communications Industry Association (ARCIA), which will be held on the evening of Wednesday, 23 November. This festive occasion will include presentation of the national industry awards.

The dinner is always a fun and enjoyable event… a chance to let your hair down after a busy first day at the conference/exhibition, and to network with colleagues in a relaxed and friendly atmosphere. Full registration details are available on the ARCIA website (www.arcia.org.au).

Conference, day two

The second day will begin with a special keynote address from Station Officer Graham Tait — Systems Officer, Operational Communications, Fire & Rescue NSW — who will give delegates a first-hand view into what happens when disasters occur and emergency responders converge to help the trapped and injured.

Next up will be a keynote presentation from Crispin Blackall, Director, Global Enterprise Product Engineering at Telstra, who will speak of how Telstra's network evolution from high-speed LTE to LANES and 5G is bringing a wealth of new ways to connect and collaborate. From mission-critical, highly resilient solutions to high-coverage, low-powered sensor networks for IoT, technological change is driving numerous opportunities, from automation to public safety.

This will be followed by another 20 presentations on a wide variety of subjects — here are just a few:

- Big data: gearing up from what's next in digital policing and investigation (John Rennie, General Manager, NICE)
- Cyber resilience — addressing the changing communications landscape of wide area industrial communications (Bradley Yager, Solutions Manager, and Peter Clissold, Schneider Electric)
- Defending critical communications network infrastructure against cyber-attacks (Hansen Chan, Product Marketing Manager, Nokia)
- Building carrier-class FWB networks to support ITS applications — a regional Australia focus (Roy Wittert, Regional Sales Director, Cambium Networks)
- Improving the visibility and reliability of bus services within the public transport sector using digital two-way radio (Glen Norris, National Business Development Manager, The Orion Network; Robert Glover, Solutions Specialist, Mastercom; and Nicholas Yap, General Manager, ComfortDelGro Cabcharge)

Comms Connect will conclude on the Thursday afternoon with a not-to-be-missed panel session of interest to everyone in the Australian critical communications sector — 'Public safety mobile broadband — the way forward for critical communications in Australia'. This session will bring together experts to discuss progress with achieving PSMB in Australia, an issue that has been at the forefront of deliberations for a number of years.

Panel members and delegates will discuss, in a facilitated session, various options and points of view on how to develop a national strategy to move PSMB forward. This discussion will be invaluable to agencies as they begin to prepare the operational guidelines and inter-relationships between agencies and jurisdictions that will be needed for this critical communications development.

So there you have it — a very impressive line-up of local and international experts, exhibitors and activities for Comms Connect's 10th year. Make sure you take advantage of this once-per-year opportunity to take part in Australasia's leading critical communications conference and exhibition, an opportunity to mingle with a who's who of experts from industry, government and academia.

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Understanding interference hunting

As wireless services grow, interference, once uncommon, becomes a fact of life for wireless and broadcast services. A metropolitan area of two million people may have 2000 licensed two way radios, 1,500 cell sites and 100 broadcasters. To this mix, add military, aeronautical, and emergency services. And then there are all the lower powered unlicensed signals such as Wi-Fi or wireless video cameras. If you consider that many of these services are expanding, being modified, ageing, or failing, it becomes evident that interference will be an issue.

The first indicators of interference are noisy links, for analogue systems. Legacy AM and FM systems indicate interference problems by various noises. Hiss, hum, or even voices from other transmissions can be heard. For digital transmissions, such as HDTV, cellular, or P25, interference shows up as limited range, dropped calls, or low data rate. A second indicator of interference is a high noise floor in the receive channel. Interference naturally affects reception first, where the signal levels are normally small. Once a high receive noise floor has been identified and located, it's time to get a spectrum analyser out and take a look. The first and best place to start looking is at the input to the receiver. If the receiver has a pre-filter, it's best to measure the signal after the pre-filter. This will allow you to see what the receiver and the receiver's antenna sees. It is important to get a 'visual ID' on the signal at this point so you can be sure you are on the same signal later.

If you are working a cellular issue and the base station has a high noise floor, you need to be looking on the uplink channels, not the downlink. If the issue is instead poor mobile reception in a given area, then you would look on the downlink frequencies, since that is what the phone receives. Two way radio and other push-to-talk systems often use the same frequency for both the uplink and the downlink, so this distinction becomes less important for them.

A key point is that an interfering signal does not need to be on the receive channel to cause interference. It only needs to be within the receiver bandwidth, which normally means that it only needs to get past the receive pre-filter. Once an interfering signal is present at the input of a receiver, it affects the receiver's front end, causing a reduction in sensitivity. This will cause the effective carrier-to-interference ratio (C/I) to be lower and result in all the symptoms of a weak signal, except that the received signal strength measurements will be strong due to the high noise floor. It's as if you were at a noisy party, trying to hear a soft-spoken person while the band was playing. Plenty of information is reaching your ears, but much of it is preventing you from hearing the conversation.

Once the interfering signal is spotted, it's important to characterise the signal before disconnecting from the receiver's signal. To characterise the signal, adjust the spectrum analyser to best view the signal by using the pre-amp, reference level, span and resolution bandwidth controls. Observe the signal's shape, bandwidth, and behaviour. Look for frequency drift, amplitude changes, and frequency hopping. If the signal is intermittent, or turns on and off, use Max-Hold to create an envelope. For signals that are intermittent with a long time between appearances, it can be helpful to use a 'save on event' capability. A Spectrogram display is also useful to show how signals change over time. Locating the source is best done with a handheld GPS enabled mapping spectrum analyser. This helps resolve the most complex cases in the quickest possible manner.

For further information or to request a free 30 page guide to Interference Hunting please call Anritsu on 1800-689-685.

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RADIO GAMES

Equipment from multiple vendors was used by federal and state agencies to ensure continuity of critical communications during the Rio Games.

Teltronic, Airbus Defence and Space and Motorola Solutions communications systems were in operation during the recent Olympic and Paralympic Games in Rio de Janeiro in Brazil.

A total of 30,000 users, making more than 300,000 calls per day, were successfully supported by Teltronic's end-to-end solution, which comprises Nebula TETRA infrastructure, a CeCoCo control centre utilised by over 100 dispatch operators, four transportable high-traffic base stations and thousands of fixed, mobile and portable terminals.

A team of 20 systems engineers and technicians provided round-the-clock maintenance and operational support, including resource planning and real-time optimisation of coverage and traffic on an event-by-event basis.

The usage extended the extant Nebula network used by Rio police, originally provided for the Pan American Games in 2007, to cover four venues (Barra da Tijuca, Copacabana, Deodoro and Maracanã), two airports (Rio de Janeiro/Galeão - Antônio Carlos Jobim International and Santos Dumont) and several key transport routes in the Olympic area.

Significant upgrades were made to meet the coverage and traffic requirements of the Olympic event, enabling the system to provide critical communications for Rio's State Police and Emergency Services, as well as 14,000 members of the Olympics organisation workforce.

"We have a strong background in events of this scale, having supported communications for the FIFA World Cup 2014 and the Pan-American Games — both huge events in the sporting calendar of Brazil and, indeed, the world," said Gordon Watling, CEO of Sepura, Teltronic's parent company.

Meanwhile, the Federal Police of Brazil relied on Tetrapol technology from Airbus Defence and Space to guard the Olympic Games 2016.

The existing network in Rio de Janeiro implemented by the company gave complete coverage in all crucial locations, including the main venues, such as Maracanã and the Olympic Village, the airports and the main routes of the city. In addition, radiocommunication for public protection agencies was available within the venues and the basement of Maracanã.

The network also covered stadiums in the cities of Brasília, São Paulo, Salvador, Belo Horizonte and Manaus where football matches took place as part of the Olympics. Federal Police officers based there were interconnected with the central Federal Police coordination unit of the Games in Rio de Janeiro.

Images courtesy Olympic Games, and André Gustavo Stumpf under CC BY 2.0

The Maracanã arena.

> THE SYSTEM PROVIDED CRITICAL COMMUNICATIONS FOR RIO'S STATE POLICE AND EMERGENCY SERVICES AS WELL AS 14,000 MEMBERS OF THE OLYMPICS ORGANISATION WORKFORCE.

The Federal Police also cooperated with more than 50 foreign security forces to ensure the safety of the athletes and visitors. The Tetrapol system was integrated with the radio networks of other forces, with the Command and Control Unit of the Rio de Janeiro Public Safety Secretary managing all communications between the various agencies involved.

Motorola Solutions was involved, too, providing more than 16,000 portable, in-vehicle mobile and fixed station radios used to address critical communications needs of public safety personnel, Brazilian Army and other first responders.

Military forces used a variety of mission-critical communications technology from Motorola Solutions, and public safety forces from the State of Rio de Janeiro used Motorola Solutions TETRA radios.

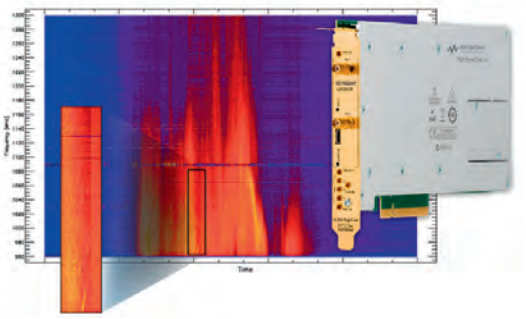
Rio de Janeiro's Command and Control Centre and the Army Operations Center (COp) worked together, making it possible to gather intelligence to carry out joint actions, such as delegation protection, protest management, incident prevention and routine activities. In addition to radiocommunications, the COp had full visibility of the real-time location of the officers in the field.

"Thanks to the expansion of the system that was in use in Rio de Janeiro, we will have optimal mission-critical communication technology available for our military, GPS location and the capability to work seamlessly with unified groups, which will help speed up and improve incident prevention and response," Lieutenant Colonel Felipe Drumond Moraes of the Brazilian Army said ahead of the Games.

"We have had excellent experiences during major events in the past where we used this communications technology, and we rely on the ability of the system for the upcoming challenges."

The radio system in Rio comprised 11 Tetrapol base stations with eight channels supporting more than 2000 TPH700 terminals from Airbus Defence and Space, used simultaneously in more than 40 conversation groups. There was additional infrastructure of core equipment and communication links in order to have good network capacity.

"Tetrapol is the official means of communication for all Federal Police staff involved in the operation. All our officers will be coordinated through Tetrapol, including the assault and intelligence team. Helicopters, boats and tactical vehicles also are equipped with mobile Tetrapol terminals. Therefore, Tetrapol has met our expectations," said Aluisio Sardinha, coordinator of Federal Police Tetrapol operations in Rio de Janeiro, prior to the events.



Bench instrumentation software

Keysight Technologies has released its latest bench instrumentation software, BenchVue 3.5, an intuitive, easy-to-use platform for PCs. Designed for bench-instrument users, the software provides multiple-instrument measurement applications, data capture and solution applications without the need for instrument programming.

By using BenchVue's Test Flow app, users can quickly create automated test sequences without traditional instrument programming. The app combines BenchVue's data capture and analysis tools with the power of a sequencer. The product also supports variables, math and, for users requiring instrument programming, the integration of Command Expert Sequences for increased flexibility. New apps additionally support signal generators, universal counters and Keysight's FieldFox Series of handheld analysers.

The software changes the way engineers interact with their instruments and their entire bench, from initial connection to analysis completion. By plugging an instrument into a PC over LAN, GPIB or USB, the instrument is automatically configured for use in BenchVue. No programming or separate instrument drivers are required, greatly accelerating common testing tasks. Data capture and export are also accomplished with just a few clicks.

Other key features include: expandable apps that provide instrument control with plug-and-play functionality; data logging for instruments, such as digital multimeters, oscilloscopes, power supplies and FieldFox analysers; rapid test automation development and analysis; three-click exporting to common data formats, such as .csv, MATLAB, Microsoft Word and Excel.

Keysight Technologies Australia Pty Ltd
www.keysight.com

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Multitest platform

The JDSU MTS-2000 Multi Test Platform with FiberComplete module is available for rent from TechRentals. The product is suitable for field technicians looking to perform traditional fibre qualification tests such as bidirectional insertion loss (IL), acceptance testing, and general maintenance on metro and PON-based FTTx networks.

The system comes with a power meter, fibre inspection probe and optical time domain reflectometer (OTDR) module. The MTS-2000 will measure optical return loss (ORL), simplifies troubleshooting in FaultFinder mode and has onboard automated NBN test sequences.

For more information, click here.

TechRentals

www.techrentals.com.au

NB-IoT solution

Huawei has launched an end-to-end narrowband IoT (NB-IoT) solution to help operators expand their IoT services into new markets.

The end-to-end NB-IoT Solution includes: Smart Device Solution enabled by Huawei's LiteOS and NB-IoT Chipset; eNodeB base stations that can smoothly evolve to NB-IoT; the IoT Packet Core that supports flexible deployment of Core in a Box and network functions virtualisation (NFV); and a cloud-based IoT Connection Management Platform with big data capabilities.

The solution is designed to meet operators' requirements for IoT services with low-power and wide-area (LPWA) coverage. Developed based on 3GPP standards, the solution underpins flexible networking under various industry and use scenarios. In addition, the solution's devices and platform can be made easily accessible to NB-IoT device and application partners, which makes it possible to rapidly achieve business innovation and scenario-based customisation.

Huawei Technologies Australia P/L

www.enterprise.huawei.com

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Images courtesy ACMA and nbn

SATELLITE TAX STUDY

The ACMA is considering reducing taxes for satellite services to encourage more efficient use of the spectrum.

The Australian Communications and Media Authority (ACMA) is conducting a review of apparatus licence taxes for satellite and space-based services. The review focuses mostly on the Ka band.

There are a number of definitions of the Ka band but for the purposes of this review the ACMA defines it as 17.3 to 51.4 GHz. As part of this review, some licence tax issues relating to services outside the Ka band have also been identified for consideration.

Ka band reform proposals

The consultation paper presents the ACMA's preliminary views on a number of reform proposals for satellite services in the Ka band. The regulator is inviting interested parties to respond to and comment on the proposals.

The ACMA engaged economic and engineering consultants Plum Consulting to review taxes for the band using opportunity cost pricing principles and investigate how taxation arrangements could be improved to better reflect the peculiar spectrum denial properties of satellite systems.

After considering Plum's analysis, the ACMA's preliminary view is that some of the taxes are high compared with international standards and should generally be reduced to encourage more efficient use of the spectrum.

The ACMA said that it considers these proposed taxation reductions are appropriate because there is some evidence of unutilised spectrum and no evidence of likely congestion in the near future.

Further, the ACMA anticipates that the proposed price reductions will encourage new satellite and space-based services in the Ka band and are likely to add to the more than $4 billion of GDP that is already derived from Australian space capabilities.

The main tax reform proposal involves the following tax reductions for satellite services in the 17.3 to 51.4 GHz band:

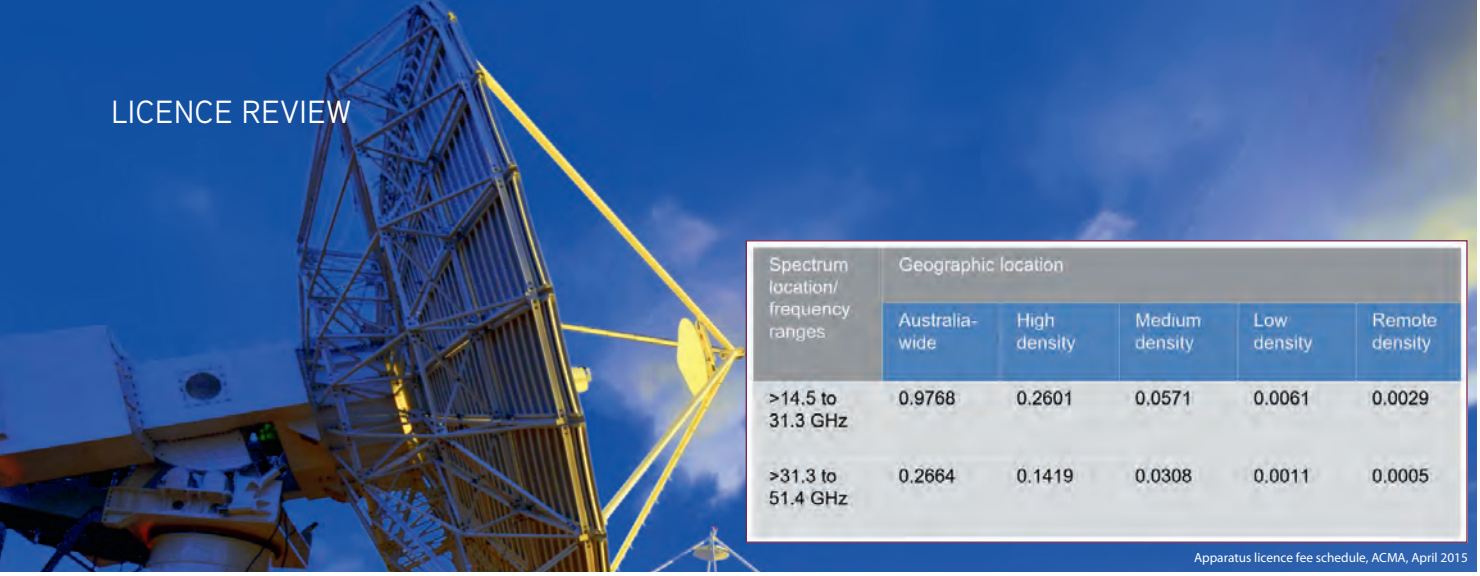
- 30% for Australia-wide and high density area (HDA) licences.
- 50% for medium density area (MDA) and low density area (LDA) licences.
- $0 tax for remote density area (RDA) licences (subject to cost recovery fees and the minimum tax of $39.18).

The ACMA also proposes amendments to:

- the Ka band tax frequency ranges — to better delineate the Ku band and the Ka band from a tax perspective;
- the tax treatment of non-geostationary orbit (NGSO) systems — to provide more consistency with geostationary orbit (GSO) systems. This proposal includes applying a 50% tax premium to NGSO services in frequencies between 17.3 and 51.4 GHz (compared with GSO services).

In terms of general reform proposals and reform proposals outside of the Ka band, the ACMA also proposes:

- the introduction of a tax incentive for earth station spectrum sharing (in all parts of the radio spectrum spectrum). This incentive offers a 30% tax reduction for co-frequency terminals (where frequencies are congruent or overlap) that are located within a radius of 500 metres;



Spectrum location/ frequency ranges	Geographic location				
	Australia-wide	High density	Medium density	Low density	Remote density
>14.5 to 31.3 GHz	0.9768	0.2601	0.0571	0.0061	0.0029
>31.3 to 51.4 GHz	0.2664	0.1419	0.0308	0.0011	0.0005

Apparatus licence fee schedule, ACMA, April 2015

- the removal of bespoke tax treatment for code division multiple access (CDMA) satellite systems in the UHF band (300–3000 MHz).

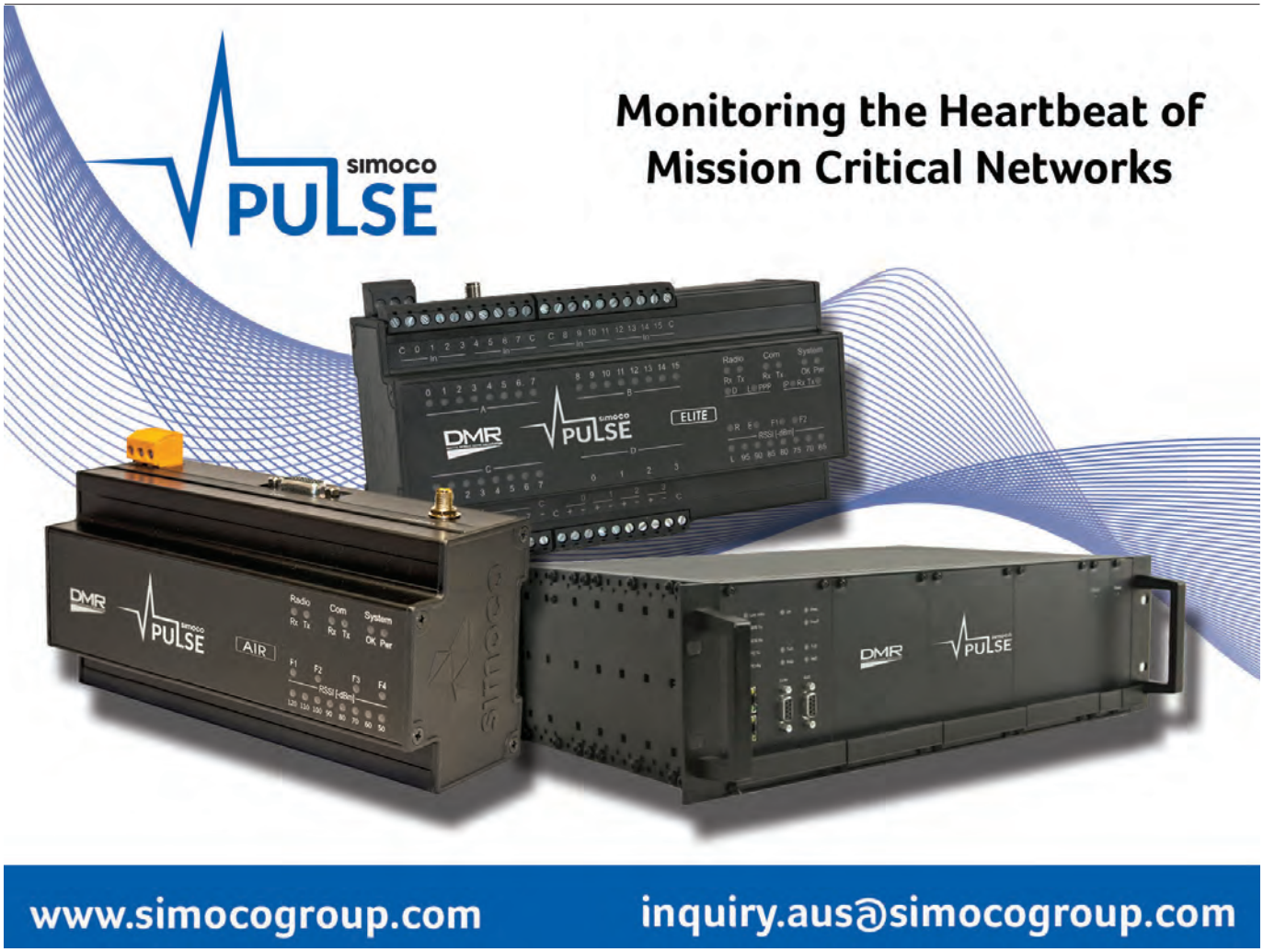
Issues for comment

The ACMA has invited comments on the issues set out in the consultation paper:

- Do you have other evidence about demand and/or congestion in the Ka band that could improve the ACMA's views about the Ka band tax rates for satellite services?
- Do you have any evidence of more appropriate taxation frequency ranges (tax brackets) for the Ka band that would better support opportunity cost pricing principles?
- The proposed 50% tax premium for NGSO services is based on spectrum denial analysis of a number of scenarios in the 18 and 50 GHz bands using various elevation assumptions. Would spectrum denial analysis in other bands between 18 and 50 GHz produce results that are materially different to the analysis already undertaken?
- Do you agree with the eligibility criteria for the proposed earth station spectrum sharing incentive of a reduction in taxes of 30%?
- Do you have any evidence that would improve the ACMA's understanding of the application of opportunity cost pricing to CDMA satellite systems in the UHF band and the proposed tax reform?
- If the ACMA proceeds with the tax reform proposals presented in this paper, are there any implementation and/or transitional issues that the ACMA should be aware of?

You can make your submission via the ACMA website.

Australian Communications and Media Authority
www.acma.gov.au



Intrinsically safe two-way radio

Hytera has released the PT790Ex, an intrinsically safe two-way radio that also complies with the highest explosion-proof standard 'ia'. This device has passed ATEX, FM, IECEX certifications and complies with IP67 rating as well as MILSTD 810 C/D/E.

The two-way TETRA radio is operable in places that contain explosive gases, including mine methane, such as coalmines, gas stations, oil platforms, chemical plants, airports and other inflammable or explosive conditions. It can also be used in Zone 0/1/2 and complies with M1.

The rugged device features an antistatic shell made of light metal to avoid mechanical spark and reduce the possibility of static discharge. The 1.8″ LCD screen is also crack-proof and provides users a clear display even under bright sunlight. Separated by the antenna, the radio's channel knob and volume knob stand apart from each other, while large textured keys provide good tactile feeling. These features combined are designed to help offer ease of use and accuracy when users wear gloves or operate the device in dark environments. The product supports GNSS positioning, man down and lone worker functions for worker safety. It also provides a 1800/2400 mAh large capacity Li-ion battery, which lasts over 20 h under 5-5-90 duty cycle. A strict overcharge and over-discharge protection design ensures the battery against instability caused by overheating.

Hytera Communications Co. Ltd
www.hytera.com.au

Thermal power sensors

The R&S NRPxxT(N) thermal power sensors feature linearity of 0.007 dB (0.16%) up to 67 GHz and 0.010 dB (0.23%) between 67 GHz and 110 GHz, making them suitable for performing relative measurements.

The thermal power sensors are used for complex measurement tasks where high accuracy is critical. They also tolerate any type of modulation. To improve measurement accuracy, the hardware is designed to reduce measurement noise to a minimum and to make the sensor immune to thermal environmental effects. To achieve stable measurement results, the temperature in the thermal test cell must correspond to the applied power. When the power is increased, the measurement cell of the thermal power sensors quickly attains a stable temperature.

When the power level is decreased, the excess heat is dissipated extremely quickly. The company claims its thermal power sensors are able to measure with accuracy three times faster than comparable solutions with triggered measurements and >500 measurements in buffered mode.

The power sensors are designed to operate with the power meter base unit or a PC/laptop. They also offer USB capability and can be additionally controlled via LAN.

Rohde & Schwarz (Australia) Pty Ltd
www.rohde-schwarz.com

NAVARINO, INMARSAT PARTNER

Navarino will bring more than 1200 vessels to the Fleet Xpress service over a six-year period, after entering into an agreement with Inmarsat. Fleet Xpress, the Global Xpress maritime solution, delivers high-speed broadband connectivity across oceans around the world. It also facilitates 'Connected Ship' applications. Navarino provides satellite communications products and services for the maritime industry, covering all types of merchant vessels. It has an established and steadily growing international resellers' network, and offers installation capability at major ports around the world. "This is a significant agreement for Inmarsat and our new Fleet Xpress service," said Ronald Spithout, president of Inmarsat Maritime.
More info: bit.ly/2b9j6k9

LTE FOR RAIL COMMS, CONTROL

Bombardier Transportation has successfully completed tests to operate its range of mass transit and mainline rail control solutions with the latest LTE standard for wireless data communications. The tests were carried out with Ericsson, Huawei, Nokia and ZTE. The technical assessments were conducted in line with the rail signalling industry's quality of service (QoS) requirements for the transmission of critical signalling information alongside other wireless communication with the train. Operators using LTE will be able to integrate the transfer of safety-critical signalling, closed-circuit television, passenger information systems as well as on board internet services onto one network.
More info: bit.ly/2bLCuoN

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THE IMPORTANCE OF BEING AUTHORISED

Jonathan Nally

What can be done about the importation and operation of unauthorised and unsafe radio devices?

"The ACMA band plan is shot to bits because of illegal radios being imported at will and in great numbers and on illegal unlicensed frequencies," said Bob Selby-Wood, group CEO and founder of Radio Industries International.

That's the problem summed up in a nutshell. A flood of radio equipment, often of poor quality, not compliant with local regulations and requirements, and having the potential to cause all sorts of problems, from interference to electrical hazards.

"In general the equipment is not certified to Australian standards, which means there could be problems with poor quality and interference generated for other spectrum users. It also usually means that the radio programming is second rate (or non-existent), which means interference problems again," said Ian Miller, ARCIA executive officer and proprietor of Orange Horizons communications consultancy.

"One of the main issues is lack of warranty or any form of proper maintenance facilities; plus, if there is electrical equipment such as battery chargers, they are most likely also not approved and could present a safety risk."

The problem is exacerbated by the capacity for businesses and individuals to access products through the global market but which are designed for overseas jurisdictions and do not operate on Australian frequency bands. The emergence of online supply models has meant that there is greater scope for businesses and individuals to purchase products directly from overseas suppliers, or via local online markets or sales agents.

The regulator, the Australian Communications and Media Authority (ACMA), does not, however, maintain official statistical records regarding the number or quality of imported devices.

Regulatory requirements

According to an ACMA spokesperson, under equipment supply arrangements, Australian suppliers (ie, importers or manufacturers) are required to apply a compliance label to devices, including radios, before supplying the device to the Australian market.

Suppliers are also obliged to hold records that provide evidence of compliance with ACMA-mandated standards. It is an offence under the *Radiocommunications Act 1992* for suppliers to supply such devices without labels or to label devices without holding the required technical test reports for the devices. In this regard, the spokesperson said, the labelling requirement is the regulatory lynch pin upon which the compliance regime rests.

While it is not illegal to import non-compliant products, it is illegal to supply or operate non-compliant products. The operation of non-compliant equipment contravenes radiocommunications licensing requirements.

"If done legally, these devices must be approved by a government-approved testing laboratory and these devices must meet the specifications as laid down by the government," said Selby-Wood. "At this point it seems that the only people that do this legally are the true radiocommunications importers and distributors who do everything by the book. If they did not the ACMA would put them out of business.

"But the private individual and the companies that want cheap radios just bring them in via eBay without any checks being done on either the importation or usage of these illegal devices on illegal unlicensed frequencies," he added.

The ACMA spokesperson told *Critical Comms* that Australian regulatory arrangements do not prohibit importation of 'grey' product provided the supplier has met its compliance obligations, ie, to label the product. The regulatory arrangements are not designed to address intellectual property issues that may be associated with grey importing.

Practically, the greatest risk is interference to licensed services from devices which are not intended or designed to

continued on next page »

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operate in Australian frequency bands. This could result in an end user transmitting on an unlicensed frequency causing interference to a licensed service, operating unlawfully or paying for a product that they cannot legally use.

So what is the solution?

"It really needs a concerted effort to bring in an education campaign to get people to realise that it is not good for our economy or the spectrum," said Miller. "Something we should do is try to get to the IT industry, especially the smaller suppliers and 'computer shops' who try to solve communications problems outside of their knowledge area.

"Apparently the ACMA has recently stumbled across a couple of these types of organisations who were buying radios off the web and selling them to their customers," added Miller. "But they thought it was like Wi-Fi and you just plugged it in and it worked — they had no idea about the need for actual licensed channels, or the risks involved for other users like public safety agencies through interference."

The ACMA agrees, the spokesperson saying that it has developed information encouraging consumers to seek information before purchasing a product. Last year it produced an infographic for the public: acma.gov.au/Citizen/Consumer-info/All-about-spectrum/High-risk-devices/the-real-deal-or-a-dodgy-device. "The radio industry can educate its customers about the need to obtain apparatus licences for certain types of radios and the importance of buying labelled goods that comply with Australian regulations," said the ACMA spokesperson.

Selby-Wood, and many others, would like more action. "The whole importation of illegal radios on illegal frequencies is out of control," he said. "The government must make importation of radiocommunications equipment illegal unless you are an authorised importer of these products."

"Without government intervention by putting import restrictions in place (you will probably win Lotto before that happens) there isn't much else; education is probably the only thing that might help," added Miller. "I think bodies such as eBay and some of the other selling websites do have warnings about illegal use of equipment and tell people they must have a licence, but without any real attempts to police the issue it is going to continue and probably get worse."

According to the ACMA spokesperson, the regulator takes a risk-based approach to compliance. In addition to its standing policy of taking compliance and enforcement action against certain high-risk devices, such as those which cause interference to broadcast signals or mobile telephone networks, the ACMA focuses on several risk-assessed areas each financial year. For a list of current 'priority compliance areas', see acma.gov.au/Industry/Suppliers/Product-supply-and-compliance/Supplier-resources/priority-compliance-areas.

News

NZ FIREYS ADOPT MOTOROLA, SPARK

A two-way radio system by Motorola Solutions and Spark has been implemented at the New Zealand Fire Service. It will enable the service's 10,000 career and volunteer firefighters to remain connected to their colleagues in the field. The organisation will receive more than 4500 new radios designed for use in the most severe fire ground environments. The radio system contains a remote speaker microphone that fully integrates within the breathing apparatus worn by firefighters. This is combined with the radio's push-to-talk button. The radios are part of a five-year contract, which also provides access provisions for related government agencies wanting to take advantage of the technology.

More info: bit.ly/2buugSC

PLB AIDS BIRDSVILLE TRACK RESCUE

Image courtesy RFDS

While riding on the Birdsville Track north of Mungerannie, South Australia, in early July, a motorcyclist was involved in a high-speed accident, suffering extensive injuries. The normally quiet track was heavy with traffic with festival-goers to the 'Big Red Bash'. Thankfully, three nurses were quickly on the scene and administered first aid, while another passer-by contacted the Royal Flying Doctor Service (RFDS) to request assistance. The RFDS asked for an EPIRB or PLB to be activated in order to pinpoint the location of the crash site and identify the nearest RFDS-capable airstrip to commence the rescue operation. Fortunately, another traveller produced his GME brand MT410G PLB and activated it.

More info: bit.ly/2b9i5Zm

LTE M2M device

Vodafone has launched the Vodafone MachineLink 4G, an LTE M2M device developed by NetComm Wireless to strengthen coverage, capacity and remote connectivity.

The product integrates the Vodafone Global SIM to provide an out-of-the-box solution that can be deployed virtually anywhere. The device combines edge processing capabilities with the ability to manage a myriad of mobile and bandwidth-intensive applications that transmit large volumes of mission-critical data in real time in areas such as smart buildings, health care, security, transport and retail. The device features high-speed Wi-Fi, two Gigabit Ethernet ports, a USB 2.0 port and a built-in GPS.

Vodafone

www.vodafone.com.au

Uninterruptible power supply

Schneider Electric has announced the availability of Gutor PXC, a standardised, fully industrial uninterruptible power supply (UPS) for harsh environments.

Suitable for rugged and outdoor settings such as oil and gas exploration and production sites, marine and offshore environments and climates with extreme temperatures, the Gutor PXC protects critical equipment and industrial applications from damage due to power outages, surges and spikes while providing short-term battery power during an outage. Due to the solution's standardised and flexible design, users including facility managers, engineers and contractors now have the ability to deploy a reliable and turnkey solution in a dramatically shorter time frame and at a lower cost.

Features include: operating temperature up to 55°C, all-steel enclosures to meet vibrations up to 1G, embedded dust filter reinforcement of ambience protection (native IP42), small footprint (600 mm width for 10 to 80 kVA without transformers) and lifetime management of 20+ years.

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Marine portable radio

The Cobham SATCOM SAILOR 3965 UHF Fire Fighter is a marine portable radio that specifically fulfils the requirements of SOLAS Chapter II-2, Regulation 10.10.4 – 'Fire Fighters Communication'. The standards require that approximately 65,000 existing SOLAS vessels worldwide carry intrinsically safe portable radios within the regulated 'fire fighter outfits' on board, prior to a vessel's first survey after July 2018.

The radio is based on Cobham SATCOM's series of SAILOR portable, GMDSS and ATEX radios. It features an easy-to-read display for channel and battery information; large, tactile buttons; audio confirmations (eg, channel changes) in the operator's headset; and is compatible with a wide range of established third-party accessories from SAVOX and Peltor. Its bright red colour signals to crew members that the radio should not be used for daily operations and must stay as part of the fire fighter outfit.

As standard, the radio has an ATEX 1.800 mAh rechargeable Li-Ion Battery, IP67 battery pack; however, Cobham SATCOM also offers ATEX approved non-rechargeable emergency batteries. Plus it features the Tone Coded Squelch System (CTCSS) to avoid interference from other nearby vessels and Trunked Mode Operation (TMO) for vessels with a repeater system.

Cobham Satcom

www.cobham.com/satcom

Signal spectrum analyser

RS Components has introduced the Tektronix USB RSA306B real-time spectrum analyser. The product offers improved functionality to electronics design engineers working with RF signals and is suitable for field, factory or academic use.

The analyser's wide frequency range from 9 kHz to 6.2 GHz covers the bandwidth from conducted EMI to the latest wireless LAN standard, allowing analysers to view data over the entire working spectrum.

Key features of the tool include minimum signal event duration of 100 μs for 100% probability of intercept and a real-time spectrum/spectrogram display over a 40 MHz bandwidth. This minimises the time spent on transient discovery and interference hunting. Measurement options include mapping, modulation analysis, standards support and pulse measurements. Other specifications include a +20 to -160 dBm measurement range and spurious-free dynamic range (SFDR) of 60 dBc.

RS Components Pty Ltd
www.rsaustralia.com

Vector signal transceiver

NI has released a second-generation vector signal transceiver (VST). The NI PXIe-5840 module has 1 GHz bandwidth VST and is designed to solve challenging RF design and test applications.

The product combines a 6.5 GHz RF vector signal generator, 6.5 GHz vector signal analyser, user-programmable FPGA and high-speed serial and parallel digital interfaces into a single two-slot PXI express module. It is suitable for a wide range of applications, including 802.11ac/ax device testing, mobile and Internet of Things device testing, 5G design and testing, RFIC testing and radar prototyping.

National Instruments
singapore.ni.com

Exterior view of the Smart Ambulance, produced by Australian firm Byron Group in collaboration with emergency care solutions provider Ferno

SMART AMBULANCE TO SAVE LIVES

An Australian-designed 'smart ambulance' is set to revolutionise on-scene communications with hospital emergency departments.

A cutting-edge ambulance that will transmit real-time information about patients to hospital emergency departments has been demonstrated to ambulance authorities from Australia and New Zealand.

Known as the Smart Ambulance, it is the result of an alliance between Byron Group, an Australian ambulance manufacturer and exporter, and Ferno, a provider of emergency care solutions.

The new ambulance, revealed at a technology forum at Byron's Smithfield plant in Sydney, promises to provide a safer working environment for paramedics, more efficient fleet management for ambulance services and improved communications about patient conditions with hospitals.

Glen Walker, Byron's CEO, said the innovations in ambulance engineering and technology represent a revolution in ambulance design and manufacturing in Australia.

"Ferno's world-leading products in patient transport, safety and vehicle intelligence systems will transform the medical vehicles we build and supply to ambulance and emergency services," said Walker.

"Hospital emergency departments will be able to track changes in the patient's condition in real time like never before. The ambulance will transmit the patient's vital information, such as ECG readings, and cameras inside the ambulance will enable the hospital to view the patient while in transit.

"When the ambulance arrives at the hospital, they will already know the patient's condition. The improved data flow between the ambulance in transit and the hospital will save valuable time in the triage process, where seconds are critical."

Walker said the wellbeing of paramedics is paramount in the design of the Smart Ambulance.

"The Smart Ambulance will have a duress system activation accessible from anywhere in the vehicle or by the paramedic's personal device that activates 360° digital video recording, in-car voice warnings and distress texts to multiple agencies with vehicle identification and location."

Ferno's ACETECH cloud-based vehicle intelligence system will provide fleet managers with a stream of real-time data about the ambulance's operations, deployment, driving behaviour, fuel costs, systems status and maintenance schedule.

The ACETECH Integrated Vehicle Intelligence System provides a fully integrated vehicle performance monitoring and control system to ensure fuel efficiency savings, protect assets and capture real-time and ongoing data to assist fleet management decisions. The ACETECH iNtelligent camera monitoring solutions enable emergency departments to see the patient as well as hear the paramedic's commentary.

The addition of a roaming personal duress system means the vehicle can also act as a hotspot for officers out of the vehicle. A personal duress signal instigated by an officer, from outside, can be transmitted back to base, including GPS location, via the ambulance hotspot. If the paramedic and the incident are close to the ambulance, the external ambulance cameras can be used by the command centre to create a type of 'remote eye on the situation', which can further help in advising other emergency personnel, such as police, of the status of the scene. The Smart Ambulance doesn't just have a single duress button, but also two strategically

placed 'emergency duress strips' that are accessible from all seating positions in the vehicle. One touch of these ceiling-mounted strips will not only send a signal back to base but will also activate the in-vehicle voice commands system, alerting occupants that a duress has been activated and that recording is in progress. It will also simultaneously capture the recording of both vision and audio of the activity aboard the ambulance via the internal cameras.

Onboard ACETECH Wi-Fi provides in-vehicle connectivity with Wi-Fi-enabled devices and provides excellent bandwidth for wired failover connections or internet connectivity in remote locations. Rugged housing and industrial-class hardware ensure operability in the harshest application environments and external antennas enable installation in hardened locations and enclosures.

Joe Bourgraf, US-based president and CEO at Ferno, said in Sydney that the system was the result of five years of research and development and worldwide consultation with medical practitioners, first responders and ambulance services.

"The Smart Ambulance is at the cutting edge globally of onboard vehicle intelligence, patient care and safety standards for paramedics, and communication," he said. Representatives of ambulance services from NSW, Victoria, Queensland, the ACT, WA, SA, NT, Tasmania, Vietnam, Canada, the UK, New Zealand, the United Arab Emirates and Ireland have seen the new Smart Ambulance demonstrated at Byron's plant in Smithfield.

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TOWER SAFETY STANDARDS

The US has finalised new safety standards for those who build and maintain communications towers.

A new standard aimed at protecting workers who install, alter or maintain communication towers offers the first comprehensive approach to reducing injuries and saving lives in the industry that has rapidly expanded in recent years, according to the American Society of Safety Engineers (ASSE).

On 3 August 2016, the American National Standards Institute (ANSI) approved A10.48, Criteria for Safety Practices with the Construction, Demolition, Modification and Maintenance of Communications Structures, the first voluntary national consensus standard strictly dedicated to protecting workers in the communications tower industry.

According to the US Department of Labor, 13 communication tower workers were killed in 2013 and another 11 were killed in 2014, leading to efforts by the Occupational Safety and Health Administration to focus inspection resources on the industry and to work with the communications tower industry to address the risks.

Most of the fatalities were the result of falls from heights.

The new standard establishes minimum criteria for safe work practices and training for personnel performing work on communication structures including antenna and antenna supporting structures, broadcast and other similar structures supporting communication-related equipment.

"A10.48 is the culmination of 13 years of work by ASSE and hundreds of other industry volunteers who identified safety best practices in putting this standard together," said Richard King, chairman of the A-10 committee that developed the standard and saw its approval by ANSI.

"A10.48 brought some of the best minds in the industry to tackle a serious problem for the telecommunications industry," he added.

"We broke down each activity related to working on a communications tower and provided safety measures that we hope will reduce injuries and fatalities."

"The final version of the A10.48 Standard is a by-product of over six years of hard work and diligence by a group of dedicated organisations and subject matter experts," said National Association of Tower Erectors (NATE) A10.48 Subcommittee member Don Doty, Regulatory Compliance Advisor with FDH Velocitel.

"The release of the A10.48 Standard is one of the most significant developments to have occurred in my 43 years working in the industry," added Doty.

"The A10.48 Standard will provide the ultimate road map for companies and workers to adhere to in order to raise the bar on safety and quality in the industry," said NATE A10.48 Subcommittee member Kathy Stieler from ERI Installations.

"This transformative standard will fill a huge void that currently exists right now in the industry," added Stieler.

"NATE is proud to have played a crucial role in establishing the standard and helping get this valuable resource across the goal line," said NATE Executive Director Todd Schlekeway.

The new standard will go into effect in January 2017. For more information on A10.48, see http://www.asse.org/publications/standards/.

ANSI is a private non-profit organisation that oversees the development of voluntary standards for United States industry through a process that allows all stakeholders to participate in a carefully followed process that builds consensus towards standards that can govern products, services and industry processes like the protection of workers from safety and health risks.

ASSE is a Standards Development Organisation managing voluntary standards developed through ANSI to help industry manage workplace risks.

NATE is a non-profit trade association in the wireless infrastructure industry providing a unified voice for tower erection, service and maintenance companies. Today the association boasts over 805 member companies in 15 countries, including Australia.

Information and image courtesy of NIST

ROLLING WIRELESS NET

Plug in NIST's Rapidly Deployable Public Safety Research Platform, switch it on and start making calls within minutes.

First responders often have trouble communicating with each other in emergencies. They may use different types of radios, or they may work in rural areas lacking wireless coverage, or they may be deep inside large buildings that block connections.

To demonstrate improvements to emergency communications and foster research on systems that can be quickly placed in strategic locations, the US National Institute of Standards and Technology (NIST) has worked with industry partners to integrate commercial technologies into a mobile wireless communications system. About the size of a filing cabinet, the platform offers more capabilities and faster set-up than typical 'cell on wheels' systems.

NIST's Rapidly Deployable Public Safety Research Platform enables more than 200 local users of broadband smartphones, Wi-Fi, data terminals and two-way radios to communicate with each other using voice, text, instant messages, video and data. The range is about 4 kilometres in a rural environment.

Crucially, the system interconnects LTE with the public safety community's traditional LMR systems. The USA's estimated 5 million public safety personnel are expected to use a mix of both systems. LTE data transmission rates are 30 to 1000 times higher than LMR.

"The portable system was built to enable research in diverse environments," said Tracy McElvaney, an engineering supervisor in NIST's Public Safety Communications Research (PSCR) Division. "But it is modelled after FirstNet's image of a vehicle-borne network system and the public safety community's vision of a rapidly deployable system to be used when the nationwide network is not available.

"Our role at NIST is not to develop the technology itself, but to integrate the state-of-the-art pieces into a conceptual

continued on next page »

NIST engineer Ben Posthuma demonstrating the use of NIST's Rapidly Deployable Public Safety Research Platform, a mobile array of commercial technologies that can be set up in strategic locations to enable over 200 local users of broadband smartphones, Wi-Fi, data terminals and older walkie-talkie radios to all communicate with each other.

platform that will help drive the industry to meet public safety needs — that is, to make portable systems smaller, more robust and with more capabilities," McElvaney said.

NIST's research and demonstration platform was developed through PSCR's Broadband Consortium, in which more than 70 vendors provide equipment and support. PSCR staff use the system for research projects such as evaluating how to improve audio intelligibility amid crowds and background noise and the development of a database of communications in high-stress, loud-noise environments.

The platform enables research into factors considered critical to the public safety mission, such as how to establish push-to-talk capabilities over broadband systems.

PSCR staff recently tested the system at a convention centre and a stadium in Harris County, Texas, an early adopter of LTE technology for public safety.

"Typically, it takes on the order of hours to deploy a 'cell on wheels' system to provide coverage at an event, and multiple deployable systems are needed to enable both LTE and LMR," McElvaney said. "Our system provides LTE, LMR, video and data. We rolled the system from the vehicle into the building, and once connected to an AC power outlet, we were making calls in less than five minutes." The mobile system can also be connected to the internet, satellite or a commercial cellular network to link users to a broader community. PSCR staff are currently exploring integrating sensor data and analytics into the system and developing requirements for linking up with both personal area networks that are already in place as well as temporary Incident Area Networks, which are created as needed and can expand as an incident grows in size and complexity.

NIST has Cooperative Research and Development Agreements (CRADAs) with the partners contributing to the mobile platform. CRADAs are the principal mechanism used by US federal labs to engage in collaborative efforts with non-federal organisations and allow the exchange of resources with private industry to advance technologies that can then be commercialised.

The mobile net is just one of a number of deployable systems PSCR plans to evaluate and leverage for research. Others include backpack systems that can rapidly serve a small team of users, vehicle-mounted systems and perhaps airborne systems.

The work was funded, in part, by the US Department of Homeland Security's First Responder Group.

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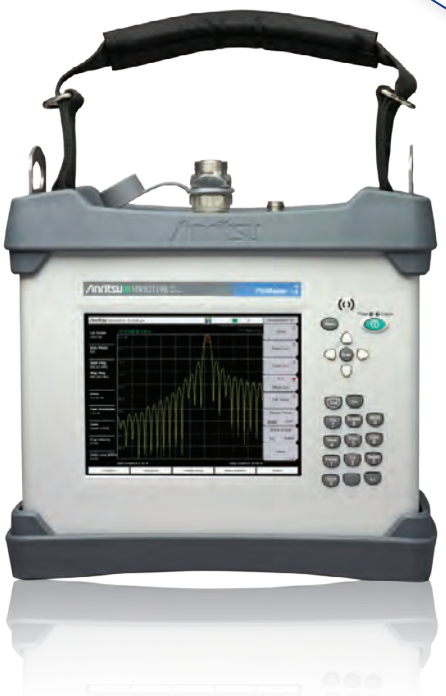

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Camera probe

The Viavi/JDSU camera probe with LCD display and USB adapter is a lightweight and versatile device, providing fibre end-face image analysis and capture. The product is available for rent from TechRentals.

The microscope inspects both bulkhead (female) and patch cord (male) sides of fibre interconnect. Additional features include a patch cord microscope and a visual fault locator to detect damaged fibres.

Precautionary fibre inspection and cleaning can prevent weak signal performance, damage to equipment and network downtime. This fibre inspection kit includes software and various probe tips. According to the company it can cut inspection times by more than 50%.

The product has high-resolution 3.5″ TFT LCD display that can detect 1 μm particles and scratches; the probe has 200/400x quick dual magnification with the focus control conveniently located on the probe; compatibility with over 250 FBPT precision tips and adapters; includes FiberChek software with a PC/laptop for one-button capture and easy analysis of fibre end faces.

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Multiservice network analyser

The Greenlee DataScout 10G multiservice network analyser combines a fully featured Android tablet with a flexible combination of test interfaces. These are capable of testing from legacy DSO TIMS up to 10G Ethernet. The product is rugged with a boot time of 20s and the intuitive interface is suitable for field technicians. Test interfaces can be configured in virtually any combination, depending on user needs.

Applications include metro Ethernet, wireless validation, business services, mobile backhaul, PRI-ISDN, ATM and utility substation SCADA testing. The test set uses a plug-and-stay architecture, which eliminates removing, damaging or losing modules. Plug-and-stay also enables testing multiple services at the same time without powering off the device to change modules.

The standard 4 GB memory is expandable to 16 GB of internal storage, which can hold numerous test reports, procedures and training videos. Email client supports sending/receiving files and reports. The preloaded Mobi Office suite enables viewing of Word, Excel, PDF and other documents.

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Yagi antenna

The ZCG Scalar Y415-DD-RSB split round boom Yagi antenna is designed and manufactured for optimum performance at UHF 470 and 610 MHz frequencies.

The split round boom design allows for a 15-element Yagi to be packaged and stored in a smaller volume, meaning savings on courier fees and storage space. Mounting clamps, a coaxial feeder cable, connectors and other installation accessories are all available separately. Features include: 12 dBd nominal gain; 50 W maximum power, 50Ω impedance; 20 dB front-to-back ratio; and <1.5:1 VSWR at both frequencies.

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SHIPSHAPE GPS

Researchers are investigating how to prevent ships' GPSs being jammed in cyber attacks that may cause vessels to collide or run aground.

Big, modern ships are highly automated with networked navigational systems, including differential GPS (DGPS), which offers more accurate positioning (to 1 m) than conventional GPS.

However, previous research has found that these highly sensitive maritime DGPS receivers are easy to disrupt using widely available, inexpensive jamming devices.

DGPS signal disruption, particularly when ships are navigating through narrow inshore waters, could result in inaccurate positional information, leading to more maritime accidents.

Academics from the University of Nottingham's Nottingham Geospatial Institute (NGI) and the Royal Norwegian Naval Academy's (RNoNA) Navigation Centre tested DGPS disruption in the busy shipping lanes of the Norwegian straits, where navigational errors account for half of all accidents.

The "main factors behind maritime accidents in this part of Norway are an influx of foreign vessels, coupled with quickly changing weather conditions and the dangerous nature of the narrow inshore waters", said Dr Lukasz Bonenberg, senior technical officer at the NGI.

"In these difficult conditions, with a need for high-accuracy navigation, there tends to be an overdependence on DGPS technology, which can lead to a false feeling of security. These errors have increased significantly since the introduction of DGPS on most ships.

"DGPS jamming from nearby cliffs, for instance, could seriously affect shipping traffic going through the narrow straits and fjord networks. Affected vessels could take a long time to correct their journey or physically stop, which may cause the maritime equivalent of a motorway pile-up," Dr Bonenberg added.

The trial was conducted with a high-end, surveying-grade receiver and antenna placed on the shore, with the jammer moving towards or away from the receiver on a small boat.

The aim of the trial was to quantify the jamming effect, simulating a vessel's approach to a narrow inshore strait. The researchers found that the DGPS receiver didn't stop functioning altogether. Instead, it gave false readings, with positional data moving more than 10 m.

"Observed discrepancies of up to 10 m are very hazardous, considering the narrow nature of the Norwegian straits, which are frequently affected by poor visibility," said Lieutenant Commander Oeystein Glomsvoll at RNoNA Navigation Centre.

"GPS jamming is a worldwide growing problem. The technology for jamming is readily available, resulting in many cases of intentional jamming in recent years, and the attention given to this problem has increased."

The research team looked at a solution that would fix and maintain a transporter ship's position more accurately and quickly using additional GPS signal frequencies instead of upgrading navigational systems onboard.

Currently, the majority of maritime receivers are DGPS L1 ones. The authors suggest that combining this system with a multifrequency GLONASS receiver would be advantageous.

This is because the frequency band of GPS + GLONASS signals together is much wider than dual L1 and L2 frequency GPS or GLONASS alone, increasing positional precision.

This is due not only to the increased number of satellites used, but also to the higher elevation and better coverage of the GLONASS satellites operated by the Russian Aerospace Defence Forces.

"The use of multiconstellation receivers and an increase in the frequencies received offers better jamming resilience for close-to-shore navigation," said Dr Bonenberg.

GPS signalling is currently undergoing modernisation, which includes an additional frequency (L5) and an open L2C code on an L2 frequency. Currently, only a limited number of satellites offer these signals.

Data observed during the experiment suggests that the use of this modernised signal will offer advantages similar to the multi-frequency GLONASS option.

The research was published in the latest edition of *Journal of Navigation*.

Handheld field analysers

Anritsu Site Master, Spectrum Master and Cell Master handheld field analysers now have a CPRI RF measurement option. This allows wireless technicians and contractors to identify interference sources by testing at ground level, which reduces the requirement for costly tower climbs.

The analyser provides users with a number of advantages when installing, maintaining and optimising wireless networks. Its sweep speed allows users to capture all interfering signals, including intermittent interferers. A spectrum/spectrogram tune and zoom function allows users to zoom into an area of interest on a displayed signal to more closely examine interfering signals and better identify their origin.

An auto-detect function automatically configures the CPRI link to minimise set-up time and potential errors. This feature, supported by preconfigured radio set-ups, simplifies the previously difficult task of ensuring that the test instrument matches the CPRI link.

Anritsu Pty Ltd

www.anritsu.com

Radio transceiver

The Barrett 2050 HF SDR transceiver provides secure voice, email and data transfer. Covering a transmit frequency range of 1.6 to 30 MHz and a receive range of 250 kHz to 30 MHz, the product is intended as a static base station or as a vehicle-borne radio. It is aimed at a broad cross-section of the market, including peacekeeping or humanitarian assistance tasks, non-government organisations (NGO), security organisations and civil security, and commercial businesses such as oil exploration. The product has been designed to be used by those who are not trained radio operators but nonetheless need the long range and flexibility that HF radio provides. The detachable remote control head incorporates a 24-bit colour touch screen which closely resembles a modern smartphone in look and feel, utilising the same type of touch and swipe interface. The interface is multilanguage, which can be easily changed. Installed standard language libraries include English, French, Spanish, Russian, Arabic and Chinese, but others can be added as required. Functionality is directly available through easily identifiable icons rather than step-through menus. As a result, the inexperienced user is operating within a familiar environment.

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CROSS-BORDER COMMS

LESSONS LEARNED FROM THE U.S./CANADA CAUSE IV EXPERIMENT

A fictional tornado set the scene for a cross-border test of public safety broadband communications and social media.

A tornado has just devastated a community on the border between the United States and Canada. Paramedics scramble to bring patients from overcrowded hospitals across the border. Communication blackouts and downed trees force ambulances to weave their way through blowing debris, fallen electrical lines and car wrecks. The time for a routine trip from the injury site to the hospital has now tripled.

While this event didn't really happen, the potential for it to occur was the focus in April when the US Department of Homeland Security Science and Technology Directorate (S&T), the Defence Research and Development Canada's Centre for Security Science (DRDC CSS) and Public Safety Canada collaborated on a cross-border experiment with the aim of preparing emergency responders for this type of scenario.

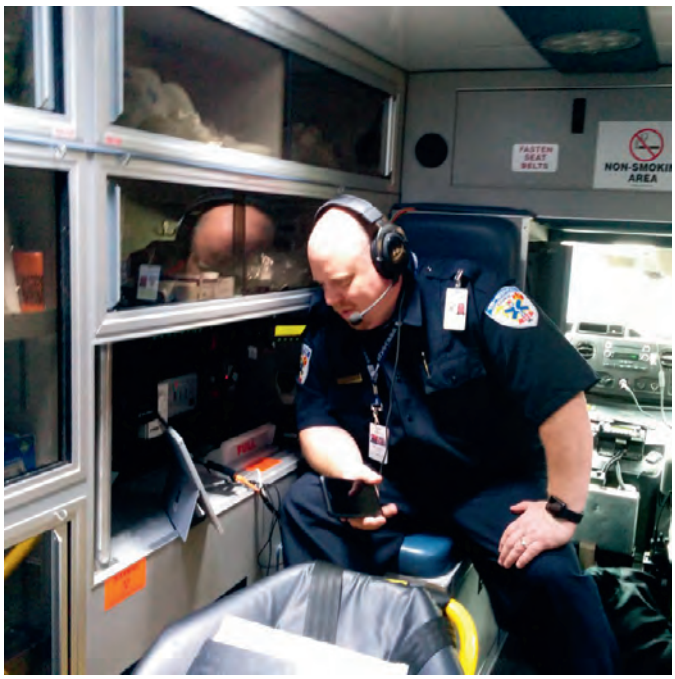
The fourth instalment of the Canada–US Enhanced Resiliency Experiment (CAUSE IV) unfolded in the aftermath of a fictional tornado along the Michigan–Ontario border. It involved real first responders using real gear, vehicles and standard operating procedures to ensure that citizens and communities remained safe and received necessary care during and after the 'storm'.

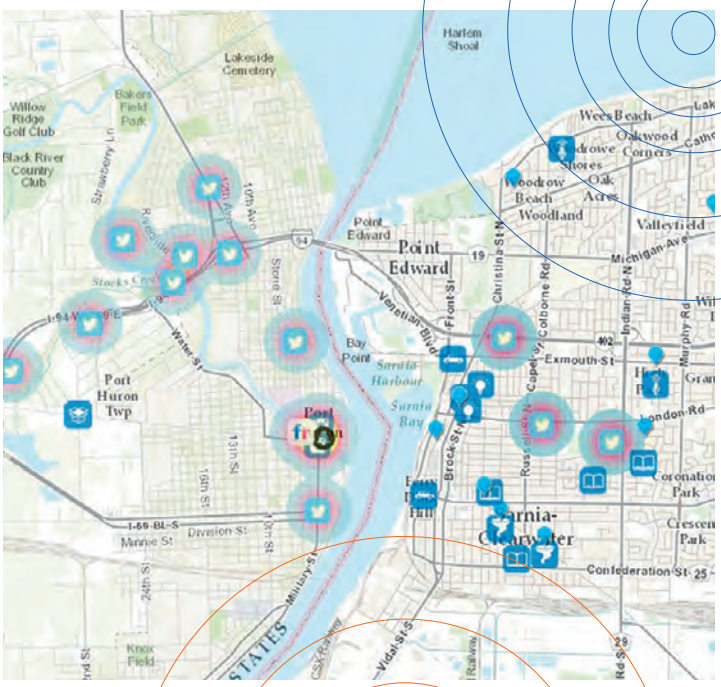
CAUSE IV was designed to highlight critical aspects of an emergency of this magnitude — overarching situational awareness, reliable communications tools, public alerts and warning, and access to real-time data for decision-making and resource allocation. The program comprised two vignettes. The first, led by DRDC CSS, focused on establishing a public safety broadband network (PSBN) for emergency responders crossing the US–Canada border. The second vignette, led by S&T's First Responders Group (FRG), examined the full disaster life cycle, from resource planning to mutual aid, and tested how information from social media and 211 (an emergency telephone number) could provide situational awareness that could integrate with other data and be used to effectively manage post-disaster response. For example, during the experiment, information about a road obstruction was identified by digital volunteers on social media and a new route was relayed to the paramedics transporting a patient across the border.

S&T Program Manager Denis Gusty explained how two vignettes were both critical components to achieving interoperability during the experiment. "You really couldn't have one without the other. In the event of a large-scale natural disaster — in this case, a simulated tornado — cross-border communication between hospitals, dispatchers and paramedics would be a central part of post-disaster management."

The first vignette established a constant broadband connection between emergency responders as they shuttled 'patients' across the border. Ambulances from St Clair County (Michigan) and Lambton County (Ontario) tested voice, video and data applications and services.

"[The PSBN is] so critical for border towns, especially because we're so close. If there is a disaster and we can't communicate to each other — especially with our first responders and our am-





Information and image courtesy DHS and ISR

> "THEY'RE IN A DEAD ZONE. ONCE [THE AMBULANCES] CROSS THE BORDERS THEY HAVE NO COMMUNICATION WHATSOEVER WITH US. IF WE CAN ESTABLISH THAT OPERABILITY, WE CAN BECOME ONE." — BETTY FALECKI

bulances — that can cause a detriment to our health care," said Betty Falecki, Lake Huron's director of emergency services and preparedness.

When American ambulances cross over into Canada, the receiving Canadian hospitals are unable to communicate with them because each country currently operates on separate networks. Falecki explained, "They're in a dead zone. Once [the ambulances] cross the borders, they have no communication whatsoever with us. If we can establish that operability, we can become one."

"CAUSE IV is really the first time we've built a stand-alone bridge between those two networks," said Jeff Brooks, deputy manager of the County of Lambton EMS Department.

The public safety broadband network technology that was tested during the experiment operated in the 700 MHz Band 14, which enabled operators to seamlessly transmit data such as patient vital signs, electrocardiograms and live video in real time from hospital to hospital and ambulance to hospital.

The experiment comprised two temporary public safety broadband networks. In order to accurately emulate both FirstNet in the United States and the future PSBN in Canada, the base stations were located in Port Huron, Michigan and Sarnia, Ontario, but the evolved packed core networks (EPC) for both countries were located at the Communications Research Centre (CRC) in Ottawa, Canada. The entire first vignette system was designed and implemented by DRDC CSS, the Communications Research Centre Canada (CRC) and Texas A&M University.

"With this technology we'll be able to maintain communication in the event that the patient deteriorates, there's a problem with the vehicle or the crew needs directions," Brooks added. "Video conferencing with the physician that's receiving the patient could potentially provide better managed patient care. Doctors will have more information and will be ready for the patients when they arrive."

"Having all key stakeholders able to communicate via voice, data or other situational awareness tools helped paramedics to perform time-critical medical interventions, which increased patient care," said Doug Socha, DRDC CSS's paramedic portfolio manager.

The other element of CAUSE IV was the work S&T carried out in the second vignette — testing the use of social media and digital volunteers for enhanced situational awareness. This data was analysed in real time to permit emergency operations centres (EOC) to detect, evaluate and plan improved response.

"Incident data collected from social media could inform the safest and fastest route for an ambulance crossing the border to take, saving time and, ultimately, the lives of victims," Gusty said.

This included various methods to utilise the 'citizen as a sensor' concept, including having trained weather spotters report current weather conditions using a GeoForm in the field and digital volunteers submitting information to the EOC related to road

continued on next page »

blocks, downed trees and flash floods observed via social media (on Twitter accounts created just for the CAUSE IV experiment).

The data gained from the field reports was automatically generated into a base map that included critical infrastructure and key information. EOC personnel could then make decisions on how to plan response efforts based on what the weather spotters reported in real time.

Jeff Friedland, director of Homeland Security Emergency Management for St Clair County, Michigan, noted how the experiment's use of public participation digital volunteers could be essential for first responders moving forward. "CAUSE IV showed us how to mine social media and extract what is critical or what really pertains to us and apply it instantly to our maps," he said. Another problem examined during vignette two was the struggle to allocate precious resources during post-disaster damage assessment.

"We're also automating damage assessment that citizens fill out electronically. It tells us where we need to send our damage assessment personnel," said Friedland. "It prioritises all the damage in the county and records on a continuous basis, keeps track of the number of homes destroyed, along with major and minor damage."

Illustrating what's ahead for 211 call centres across Canada and the United States, Jennifer Tanner, project manager for 211 in Southwest Ontario, said, "We have all this information from callers that we're able to share with municipalities and hopefully that information can help inform the decisions that are made in an EOC during an emergency."

Experiment findings and lessons learned will be published in a CAUSE IV after-action report that will be posted later this year at www.dhs.gov/science-and-technology/first-responders.

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ACMA'S ANALYSIS PLAN

Jonathan Nally

In 2016–17, the ACMA will continue to consider a wide range of matters, including spectrum management and market forces.

The ACMA recently released its 2016–17 research update, outlining its areas of interest and concern as a function of government legislation, and the study efforts it is pursuing in those areas.

According to the update, the research focus "is consistent with the ACMA fulfilling its regulatory functions outlined in the *Australian Communications and Media Authority Act 2005* (the ACMA Act) and legislation related to the ACMA's telecommunications, radiocommunications and broadcasting and internet functions".

Those functions require the ACMA to:

- report to and advise the minister in relation to the telecommunications industry and on matters affecting consumers or proposed consumers of carriage services;
- make available to the public information about matters relating to the telecommunications industry;
- monitor and report to the minister each year on significant matters relating to the performance of telecommunications carriers and carriage service providers;
- report to and advise the minister in relation to the radiocommunications community;
- make available to the public information about matters relating to the radiocommunications community.

The update notes that many current technology, content and service developments, both in Australia and around the world, indicate a more highly connected and internet-enabled environment.

"The communications and media sectors have already seen the mass connection of individuals, businesses and other service providers, with the rapid development of digital technologies and services driving an increasing fragmentation across industry sectoral boundaries and consumer and citizen behaviours," the update says.

The update further notes that these developments "continue to place considerable pressure on existing regulatory interventions that were designed as solutions for a different environment".

Occurring in parallel to these internet-enabled developments are a range of complex regulatory transitional issues. In telecommunications, as the National Broadband Network (NBN) rollout proceeds, there remains significant transitional work to rationalise telecommunications regulatory structures, particularly the heavy emphasis on fixed-line consumer regulation.

The update comments that there are also technical standards issues requiring industry standards development or underpinning regulatory determinations. "Research will assist the ACMA in understanding the impact of technology upgrade and migration issues on industry and consumers, including where regulation needs updating to support innovative services." As far as spectrum matters go, the update explains: "In spectrum management, the increased demand pressures for spectrum allocations to support the needs of every sector of the economy will need to be managed at the same time as the Spectrum Review recommendations are implemented, itself an extensive body of work. Research and analysis will inform the development of new licensing, allocation and pricing models for reformed spectrum management arrangements."

In terms of the ongoing implementation of the Spectrum Review recommendations, the update says: "Research and analysis will support the development of more market-orientated allocation and pricing models and draw on international better practice regulatory models, as well as continuing to anticipate spectrum demand arising from technology developments."

It further notes: "The intensifying pace of connectivity fostered by the Internet of Things (IoT) that connects devices, people and data [is] influencing demand for public resources like spectrum as well as the development of standards to support network and personal information integrity."

Areas of research focus

The ACMA's research areas include market developments, social and economic participation, media content and culture, and citizen and consumer safeguards. But the area of most interest to the critical communications field is the one concerned with regulatory best practice and fulfilling the ACMA's functions as an effective and efficient regulator. This involves:

- advice to government about the operation and costs of regulation;
- regulatory and program design, including the development of non-regulatory solutions to emerging issues in communications and media;
- analysis of whether to regulate, influence through communication and facilitation, or initiate discussion about regulatory reform to accommodate innovation occurring in the sector.

In the area of market developments, the ACMA's research focus looks at "conditions in contemporary communications and media. It has an emphasis on market developments, regulatory policy settings, the interventions needed to support efficient use of public resources (such as spectrum and telephone numbers), and the quality of service experienced by Australia's digital citizens."

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It also "continues the ACMA's priority work to support spectrum initiatives, in particular the implementation of spectrum reforms".

Specific strategic questions explored through individual ACMA research projects include:

1. How can regulatory decision-making support market-based approaches to spectrum management?
2. What are the key approaches to the valuation and pricing of spectrum?
3. What are the consequences of changes in market structures and business models for planning and resource allocation and regulatory settings?

Spectrum matters

One of the ACMA's chief areas of research is that of determining the highest value use of spectrum. The update says that "Consistent with the ACMA's Mobile broadband strategy, this research will estimate the highest value of use for spectrum bands that are identified as being under consideration for mobile broadband use. It is expected that in 2016–17 the ACMA will release preliminary and comprehensive determinations of the highest value use for the 1.5 GHz band. This research has previously been identified in the ACMA's Five-year spectrum outlook 2015–19."

The ACMA is also charged with considering the reform of pricing and licensing arrangements associated with the Spectrum Review. The update notes that the regulator's "research will develop a framework for considering when private band management arrangements could be optimally used".

The project will "undertake research to inform the licence renewal process framework (that is, whether to renew administratively and approaches and processes for determining price, or to reallocate via competitive auction), taking account of international best practice regulatory models".

The update notes that, having taken into account the recommendations of the Pricing Review and refreshed the principles for spectrum pricing, the ACMA will:

- apply these to refresh the general formulas for setting spectrum access charges for all spectrum bands and services;
- consider the framework to allow licensees to self-select licence duration and the incentives needed to encourage efficient use of spectrum.

The research will include analysis of best practice auction methods and updates to section 60 auction rules.

Regulatory best practice and development

Finally, as noted above, a major focus for the ACMA is a continuing analysis of the "effectiveness, costs and benefits of current regulation. It includes identification of emerging issues and problems that may require regulatory or non-regulatory solutions, and where regulation may be adapted to address contemporary communications and media issues."

Key questions the regulator is exploring are:

4. What are the costs and benefits of specific regulatory and non-regulatory interventions?
5. What are the best practice design solutions for communications and media regulatory settings?

The ACMA is also investigating specific approaches to risk, whereby it "will consider a range of scenarios where a different range of regulatory approaches (from direct to 'hands-off') could be required. This research will support the ACMA's ongoing evaluation of its role as regulator, identifying potential improvements to regulatory decision-making processes and desirable intervention levels for direct regulation."

This research has previously been identified in the ACMA's Five-year spectrum outlook 2015–19 and "supports the ACMA's role in implementing the reforms outlined in the Spectrum Review".

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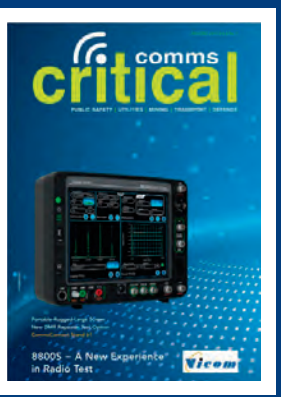

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OFF-THE-SHELF 5G TESTING

EXECUTING 5G AND IOT RF SYSTEMS

How-Siang Yap, Product Manager and Planner

Designing 5G and IoT RF systems through accurate simulation with OTS components and fast multistage impedance matching synthesis on a PCB.

5G, the upcoming 5th-generation wireless mobile network, will operate from 24 GHz and up to 95 GHz. It promises extremely high data rate wireless connection for applications such as 4K/8K ultra high definition TV streaming.

The Internet of Things (IoT) is another fast-growing application of wireless technology that is all around us — from personal gadgets to industrial sensors and freight tracking around the world. By 2020, over 50 billion IoT objects are forecasted to be in operation.

This means tremendous work and pressure for RF and microwave engineers to design and build 5G and IoT products quickly to compete for a share of the market.

5G 28 GHz RF system simulation

Designing and building RF systems to operate at 24 GHz and above is challenging due to the parasitics of interconnects, peripheral biasing and passive components, and the absence of simulation models of available system components.

Calculating with spreadsheets and then breadboarding with actual hardware is very costly in terms of time, instrumentation and effort for every ensuing iteration.

A more efficient approach in designing, prototyping, and realising RF systems in one pass is now possible and is validated in Figure 1, which shows the block diagram of a 5G system with 28 GHz RF input and two down conversion LOs at 22 GHz and 7 GHz to a 1 GHz IF. The block diagram is simulated in the Keysight Genesys Spectrasys system simulator with system blocks modelled as:

- X-Parameter for nonlinear circuit data;
- Sys-Parameter for system datasheet behavioural data with frequency, bias and temperature dependence;
- S-Parameter for linear circuit data;
- behavioural equation-based models.

RF system simulation technology has come a long way since the use of spreadsheets. Improvements in accuracy and diagnostic capabilities are significant. An example of these improvements includes identifying the component origin and frequency equation of nonlinear intermods; and which system blocks and their specs in the system line-up are contributing to performance degradation such as error vector magnitude (EVM), BER and ACPR under digital-modulated RF stimulus.

Figure 2 shows the budget analysis of EVM error versus system component line-up, which instantly identifies the major contributors of EVM degradation as LO phase noise and linearity of mixer and amplifiers. Clicking on the culprit components enables their offending specs to be adjusted in order to improve the system performance. This enables proper selection of system component line-up without over or under spec'ing

Image courtesy Richard Smith (via Flickr) under CC BY 2.0

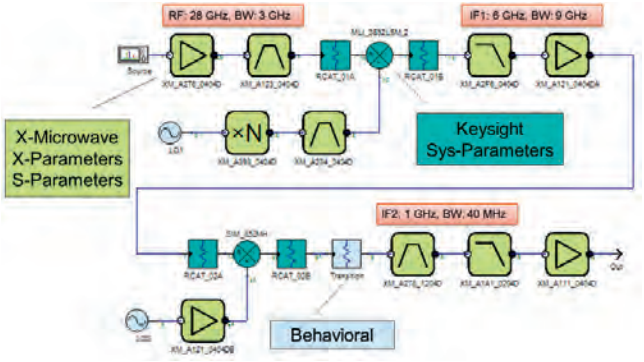

Figure 1. 28GHz 5th-generation RF receiver system with dual down conversion to 1GHz IF. Simulated with Keysight Genesys RF system simulator.

them, to achieve the best performance with minimum cost. Specifying the behavioural specs during design and then trying to find real components that have such specs during realisation is a common but inefficient approach, which inevitably results in multiple iterations.

Sys-parameters representing simulatable datasheets of real off-the-shelf components or X-parameters of measured nonlinear components can be used directly in RF system simulation, so that when the design is complete, parts have also been already specified and verified to work in the system chain.

The system is now ready for hardware implementation.

5G system realisation with OTS parts

Off-the-shelf parts from vendors such as Mini-circuits, Analog Devices, Qorvo, Marki and Avago implemented into modular tiles by X-Microwave were used in the realisation of the 28 GHz 5G RF receiver system as shown in Figure 3.

Each modular tile, called an X-Block, includes all the biasing and peripheral passive components for the active device such as LOs, mixers and amplifiers. They are characterised by measured X-parameters or Sys-parameters at their co-planar interconnect reference planes for simulation to accurately model how they are being used in the actual system hardware. They are connected together by a flipped, co-planar laminate that spans the small gap between the X-blocks and is held down by compression, without soldering, to work reliably up to 67 GHz.

The 1.9 mm test launchers are also held down by compression so that the X-blocks can be re-used with no damage. When the prototype is finalised, the same composite layout can be used directly for production, since they are all built on the same laminate material.

When the system was measured, the agreement with the simulated result was unexpectedly close, as shown in Figure 4, and within the uncertainty error of the vector signal analyser.

Designing for the IoT

Multiple standards are emerging for IoT radios based on range of coverage, data bandwidth and operating frequencies. The IoT frequencies can be broadly divided into two categories: sub 1 GHz, and those above, namely around the 2.4 GHz and 5.8 GHz ISM (industrial, scientific and medical) bands.

From the perspective of designing IoT physical radio links that work at these frequency bands, the main focus should be on impedance matching the IoT chipset to the antenna. For a longer range, amplifiers may be inserted in between the chipset and the antenna.

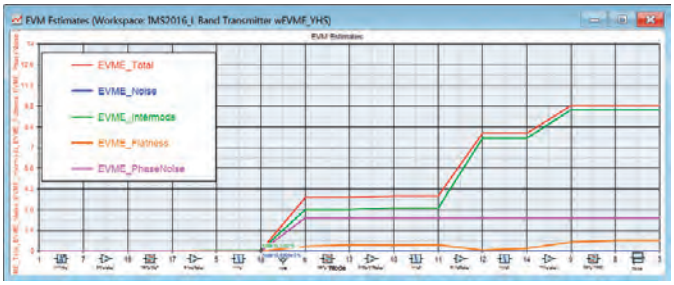

Figure 2. Breakthrough budget analysis of Error Vector Magnitude diagnoses which components in the RF system line-up are causing degradation to digital modulated RF signals in the system path, to prevent wasteful hardware prototype iterations.

> SPECIFYING BEHAVIOURAL SPECS DURING DESIGN AND THEN TRYING TO FIND REAL COMPONENTS THAT HAVE SUCH SPECS DURING REALISATION IS A COMMON BUT INEFFICIENT APPROACH.

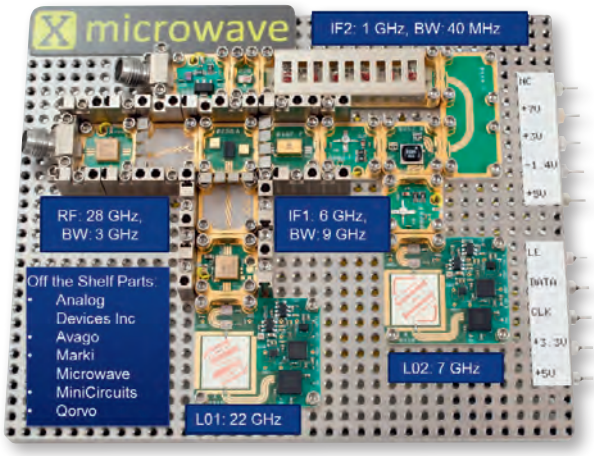

Figure 3. Hardware prototype of a 28 GHz receiver system using X-Blocks from X-microwave. What-You-Simulate-Is-What-You-Get without the discrepancies caused by interconnect parasitics or inaccurate system models.

Input Power (dBm)	Measured EVM (%rms)	Estimated EVM (%rms)
-50	1.8	2.2
-60	3.1	3.5
-70	9.3	9.3
-75	17.9	16.3
-78	20.0	22.9

Figure 4. Measured vs. simulated Error Vector Magnitude with different input RF power. Excellent correlation to within measurement uncertainty of test instruments.

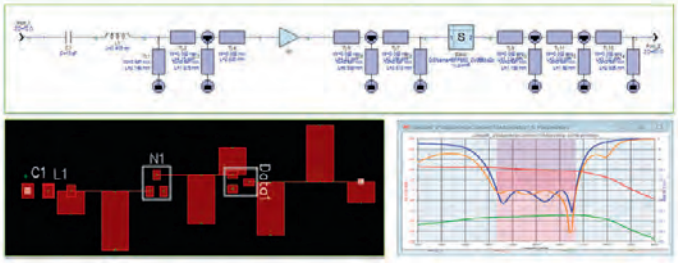

Figure 5. Impedance matching synthesis and microstrip layout of a three-stage matching network from 2 to 3GHz to achieve -20dB return loss and 35 dB gain, is done in less than 1 hour.

Ideally, the impedance matching network has to be compact and economical to build. Multistage impedance matching over a broad bandwidth (30% or more) to complex frequency-dependent impedances such as an antenna, measured S-parameters of an IoT chipset or an unstable non-unilateral discrete transistor amplifier is extremely difficult and tedious using traditional Smith chart or benchtop cut-and-try techniques.

A more efficient and optimal approach is the use of automatic impedance matching synthesis, which employs multiple algorithms from simple L-sections to the real frequency technique, for addressing the increasingly difficult above-mentioned impedance matching problems.

Because synthesis can accomplish difficult simultaneous multistage matching in seconds with distributed and/or lumped networks, the IoT radio designer can quickly experiment with multiple matching topologies to select one that is most economical to build.

Figure 5 shows the result of three-stage, simultaneous matching of an antenna to a low-noise stabilised transistor amplifier circuit, followed by the measured S-parameter of a chipset power amplifier to achieve -20 dB return loss match from 2 to 3 GHz and a gain of 35 dB.

The microstrip layout dimensions were also synthesised with the automatic insertion of discontinuities such as tees and open stubs. The entire process was completed within one hour.

RF systems for 5G and IoT applications can now be efficiently simulated, prototyped and produced with off-the-shelf system components thanks to breakthrough diagnostic capabilities which pinpoint wrongly spec'ed components in the system line-up.

Accurate X- and Sys-parameter simulation models of off-the-shelf RF system components enable what-you-simulate-is-what-you-get efficiency in going from design to prototype and production with no iterations.

Impedance matching synthesis replaces tedious manual design and optimisation with an instant selection of various suitable matching topologies for the most economical realisation.

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Backhaul

Backhaul takes you on a trip down memory lane as we look at what was happening in the comms field of yesteryear.

25 YEARS AGO. The cover of the October/November 1991 issue of *What's New in Radio Communications* featured the Philips PRP16 family of MPT 1327 trunked or conventional analog radio units. In this issue we reported on Tait Electronics winning a $3 million contract to supply Malaysia's state-owned telecommunications organisation, Telekom Malaysia, with a nationwide mobile radio network. We also reported on a proposal for the Radio Communications Products Division of the Australian Electrical and Electronic Manufacturers Association to establish a new membership category to enable dealers to participate in the Association's activities. And the first commercial MPT 1372 wide-area trunked mobile radio network in Australia — known as the Biscom Network — had begun operating in south-east Queensland as a result of a joint venture between Queensland Communications and Tait Electronics.

10 YEARS AGO. Sticking with the Tait theme, the cover of the September/October 2006 issue of *Radio Comms Asia-Pacific* featured that company's TM8260, TM8235 and TM8255 mobile radios. Elsewhere in the magazine, we published a case study on the implementation of what was billed as the first commercial radio over internet protocol system in Australia, for Country Energy in NSW. The company was able to retire two UHF systems as a result. We also had an interesting article on Hollywood actress Hedy Lamar, who co-invented the concept of spread spectrum communications, and a feature on the benefits of a then fairly new concept in radiocommunications, interoperability. Advertised in the magazine was the 2006 Annual Radio Communications Dinner, to be held in Glen Waverley, Melbourne, in November. The event was to see the launch of the "Australia Radio Industry Association". Finally, Mark Ward of Vertel contributed an opinion piece extolling the virtues of outsourcing in the industry, to avoid being locked in to sole providers, particularly as it applied to network providers.

Spectrum

The false (and dangerous) economy of commercialisation

It is now clear that globally we are entering an extended period of migration from traditional PMR/LMR solutions such as TETRA, P25 and DMR, and heading towards the next generation of public safety and critical communications systems, which will be based on 3GPP standard releases — beginning with Release 12. Users will soon gain access to new products, services and applications as we move towards a new generation of societies and economies based on new principles that are only now beginning to emerge.

For the past five years or so, the global critical communications community has become increasingly engaged in the global standards processes, developing common, unified platforms for a new generation of 'digital services' that require end-to-end, secure-by-design, private-by-design principles applied across the network. In this new environment where we are always connected and always open to the rest of the world, we require guaranteed levels of performance, availability and security. We have taken this for granted in private networks, but it now must be extended to all solutions in this new network-of-networks world, where no weak points can be permitted.

Governments and public safety agencies are now pondering their next moves as this switch to more advanced platforms begins. However, it appears that many authorities are focused more on the potential cost savings from unified platforms rather than the increased security and operational benefits. Public safety is a fundamental public service that all governments must provide for their citizens in order to guarantee law and order, and enable businesses and individuals to flourish in an open society. When it comes to public safety communications, there can be no short cuts.

Countries such as the United Kingdom and Australia are even contemplating handing over their entire public safety communications to commercial carriers such as EE and Telstra, who would be expected to provide essential communications services to all public safety agencies over existing spectrum using off-the-shelf equipment and standard contracts. Together with many other critical communications experts, I believe this is one dangerous step too far that will almost certainly need to be corrected in the short to medium term to reduce the risk of a future system failure with potentially catastrophic consequences.

Governments must strike a balance between maximising the economic value of valuable, prime spectrum in global LTE/5G bands by auctioning it off to the highest bidder, while at the same time reserving sufficient spectrum for future mission-critical services that provide enormous social value and insurance against natural and man-made disasters.

Governments must also maintain control over such critical public services at all costs by putting aside sufficient funds to make sure public safety and emergency services personnel have the necessary tools to keep us all safe. Handing such critical services over to the private sector without all the necessary checks and balances, and without making sure that all possible future scenarios are considered, simply to save some money in the short term is a false economy.

We most definitely need to move forward with new services and we definitely need to push the boundaries of what is possible and show ambition, but we also need to find the best possible long-term model for mission-critical communications. The debate will continue to rage within our industry for many years to come, but we must never allow private gain to take precedence over public good and public service.

Peter Clemons is founder and Managing Director of critical communications consultancy Quixoticity, and a frequent visitor to Australasia, where he regularly speaks at top-level conferences such as Comms Connect.

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