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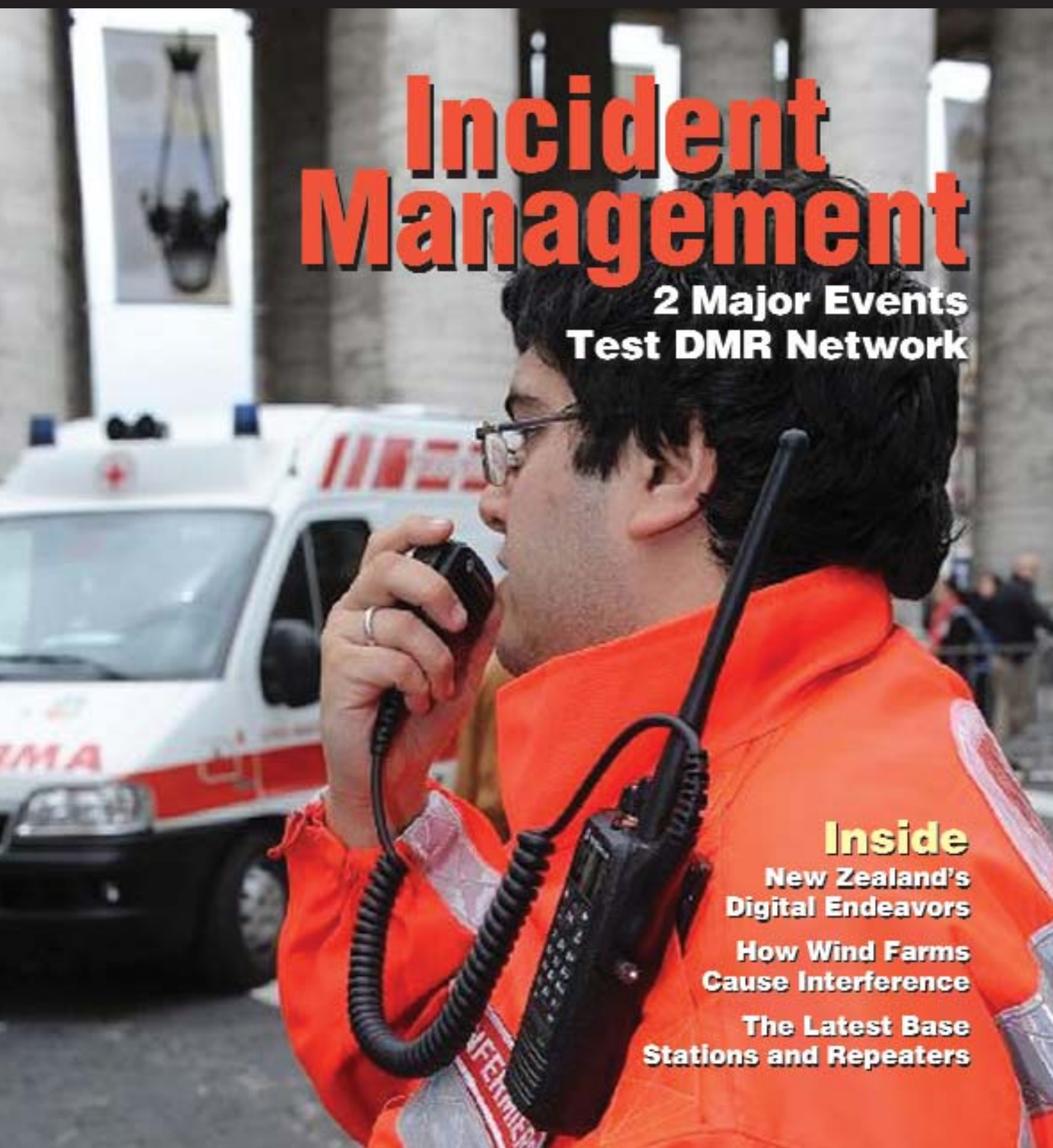

Incident Management

2 Major Events Test DMR Network

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How Wind Farms Cause Interference

The Latest Base Stations and Repeaters

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RadioResource INTERNATIONAL

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Top-Notch Data

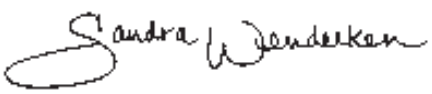
Each year our staff conducts an extensive process to update our editorial database. In addition to company contact and target market information, our database includes a comprehensive list of industry product categories and services. Each mobile communications supplier completes a detailed form that we use to populate the database so we have a complete picture of the industry's products and corresponding vendors.

Because we are constantly updating our information and contacting suppliers by email, phone, direct mail and at trade shows, we are confident we have the industry's most up-to-date, comprehensive database of mobile communications suppliers. We then use the database for our various print buyers guides — including our recently published Worldwide Buyers Guide — and online SuperGUIDE at RRImag.com. If you're in the market for new public-safety communications gear, these resources can be useful sources of information with manufacturers and software companies for everything from antennas to CAD software to digital radios and infrastructure to broadband gear.

This issue specifically highlights the latest base stations and repeaters from professional mobile radio (PMR) companies. Take a look at "Product Expo" on Page 30 if your system is in need of new infrastructure equipment.

Social networking is becoming a larger part of people's lives. *RadioResource International* has a Facebook page, and if you "like" the magazine on Facebook, you'll be the first to know about breaking news and top articles from our website and the print magazine. The Facebook site is a great way to offer feedback and stay current on industry news and information. We welcome your comments and input through traditional email or telephone calls too.

We value your opinions! Please email your feedback to me at swendelken@RRMediaGroup.com.



Sandra Wendelken, Editor
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RadioResource INTERNATIONAL

RadioResource International delivers wireless voice and data information for mobile and remote mission-critical operations for professionals who reside or do business outside the United States and Canada. The magazine covers private and trunked mobile radio, wireless data, location technologies, public safety communications, microwave radio, satellite, paging/messaging, remote monitoring, and other wireless applications. Editorial content is international in scope and encompasses emerging technologies, industry reports and trends, innovative applications, product information and comparisons, news, standards, and troubleshooting tips.

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ASIA/PACIFIC

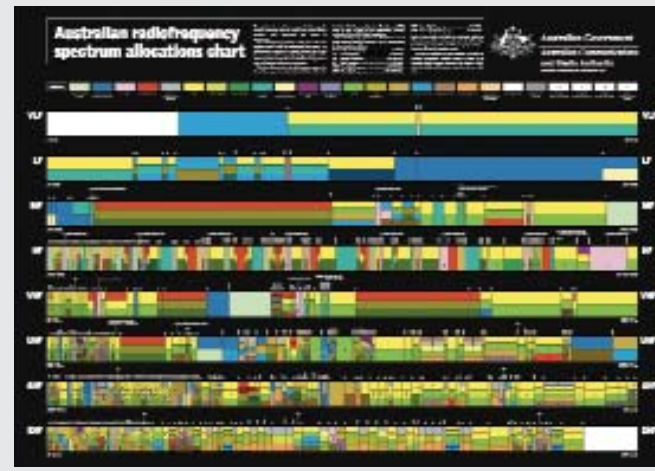
Australian Groups Support 800 MHz for Public-Safety Broadband Network

APCO Australasia supports the latest proposal put forward by the Australian government for emergency service organizations (ESOs) to be allocated spectrum in the 800 MHz band to build a stand-alone national public-safety mobile broadband network.

"If the reported properties of 800 MHz spectrum meet the public-safety agencies' requirements as a reliable and resilient mobile broadband capability, it will benefit ESOs in the form of reduced equipment costs through economies of scale and increased interoperability within other countries in our region," said Des Bahr, APCO Australasia CEO.

ESOs originally pushed the federal government for 20 megahertz of the digital dividend 700 MHz spectrum to build their own network, which could cost up to $1 billion.

"The telecommunications industry is very concerned that recent ESO calls for some of the digital dividend spectrum would result in a lose-lose outcome because it would isolate Australian emergency services from the Asia/Pacific region and impede the mobile telecommunications industry's ability to roll out the new 4G mobile broadband networks," said Chris Althaus, CEO of Australian Mobile Telecommunications Association (AMTA).



Australia's spectrum allocation chart

AMTA officials said the International Telecommunication Union (ITU) designated 806 – 824 MHz and 851 – 869 MHz for public protection and disaster relief in Asia/Pacific. A steering committee will look further into the matter, with a report planned for the next Standing Council on Police and Emergency Services meeting.

DERBY, United Kingdom — The affiliate of one of the world's largest oil and gas companies, Total E&P Indonesie, selected Xfin technology from **Team Simoco** — deployed in conjunction with local systems integrator PT Alssa. Xfin delivers voice communications over an IP backbone.

Replacing an existing analog trunking system, the Team Simoco system enables a secure and reliable multichannel communications network across nine transmission sites in the Indonesian region of East Kalimantan.

Team Simoco will provide more than 300 mobiles and 1,250 intrinsically safe (IS) trunked portables. The new network supports calls between these radios, used by Total operational staff across the region.

VICTORIA, Australia — Zetron is participating with **Airwave Solutions Australia** and other radio equipment vendors in Airwave's new Project 25 (P25) solution center. Customers can use the center to test selected P25-compatible solutions to see how they work together.

This allows customers to observe firsthand the compatibility, interoperability and flexibility offered by P25-compliant products. Zetron is the only participating console vendor whose products use the P25 Console Subsystem Interface (CSSI) and Digital Fixed Station Interface (DFSI). Radio infrastructure vendors taking part in the center include **Harris**, **Tait Radio Communications**, **Auria Wireless**, **ComGroup**, **RFI** and **Icom**.

The center, hosted by Airwave Solutions, opened 5 May to allow potential customers of Telecommunications Industry Association (TIA) P25-compliant products to get a no-risk, hands-on experience before making a major investment.

"With their CSSI, Zetron is at the forefront of P25-compatible console development," said Airwave Solutions Australia CEO Malcolm Keys. "We look forward to working with them and the other participating vendors to demonstrate the innovative solutions that are available in the local Australian marketplace."

BANGKOK, Thailand — The Thai state-owned Metropolitan Electricity Authority (MEA) signed a contract in Bangkok with systems integrator Digital Research and Consulting Co. (DRC) for a digital trunked radio system (DTRS). The contract includes a TETRA radio system from **Cassidian** as the core.

The DTRS project aims to improve secure communications at MEA. The new system will interface to other systems, such as the private automatic branch exchange (PABX) system, the

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Hytera Goes Public on China's Shenzhen Stock Exchange

On May 27, Hytera completed its initial public offering (IPO) on the Shenzhen Stock Exchange of China. About 70 million shares, out of 278 million shares of total capital, were traded publicly with an initial price of CNY19.90 (US$3.06) per share to total gross proceeds of CNY1.4 billion (US$214.2 million), bringing Hytera to a market value of CNY 5.5 billion (US$851 million).

The capital collected from the IPO is preliminarily going to the research of digital technologies, such as the TETRA, Digital Mobile Radio (DMR) and China's Police Digital Trunking (PDT) standards; extension of the current digital portfolios; and expansion of the global marketing and service network to enhance Hytera's competitiveness worldwide.

As one of the few professional mobile radio (PMR) manufacturers listed on the stock market, this move is significant for Hytera to further enhance its research and development (R&D) capability, strengthen its sales and service network, and reinforce the core competitiveness, company officials said in a statement.

MEA IT system and other networks. The TETRA system will provide voice and data services throughout MEA's operating area in the provinces of Bangkok, Nonthaburi and Samut Prakarn.

Under the contract, Cassidian will supply one switch, 17 base stations, 13 dispatcher workstations, 500 handheld radios and 1,250 mobile radios. A server will allow integration of value-added applications, including AVL, into the radio system.

EUROPE

ZARAGOZA, Spain — The Biscay Transport Consortium (CTB) signed an agreement with Basque operator, ITELAZPI, to deploy its **Teltronic** TETRA network in Bilbao Metro.

The agreement will allow Bilbao Metro to change its existing TETRA system to Teltronic's latest-generation infrastructure, with coverage across the whole Basque country. A further extension during 2011 will include the railway's underground sections.

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Airwave helped ensure emergency services during the 29 April royal wedding in London. On the wedding day, 6,000 users were connected to the network, with 3,800 users in a 1-mile radius of Westminster Abbey and the Mall. The network operated and remained stable throughout the day, Airwave officials said.

Stockholm City Transport Selects TETRA Network

Stockholm's city transport authority will use TETRA radio communications technology from Sepura to update the voice and data communications for its tram and lightrail operations. The contract comprises around 1,000 radio units.

The contract was awarded by Storstockholms Lokaltrafik (SL), the public transport authority for the greater Stockholm area and involves the supply and installation of 250 units on trams and 750 units on trains, all serving the 1.1 million people who use the Stockholm public transport network daily.

The units will be used to transmit both voice and data traffic across SL's TETRA network. The data transmitted will consist primarily of AVL information to help deal with any incidents. Installation began in May and is scheduled for completion by June 2012.

The network infrastructure is shared among a range of public services. The infrastructure comprises 137 base stations deployed across Basque, expanding to 161 base stations by the end of 2011.

PARIS — Cassidian helped ensure the success of the security system at the recent G8 summit held in Deauville, France. The forces used high-security mobile communications systems.

TETRAPOL secured radio network technology was installed in the fixed Infrastructure Nationale Partageable des Transmissions (INPT), RUBIS and OPERA networks and in the TOPAZE deployable tactical network. Together, these technologies formed a cornerstone of the demanding system, with a primary objective to ensure the protection of eight heads of state and government and of 17 delegations comprising more than 7,300 invited guests.

During the G8 summit, 10,000 users — including forces from the police, the gendarmerie, the French Armed Forces and various civil security bodies — were on the system. Cassidian installed a variety of redundant components to increase the density of the INPT network, guaranteeing greater stability of the communications system in the event of a crisis.

BUDAPEST, Hungary — Motorola Solutions provided interoperable TETRA digital radio systems for police and emergency services in the English Channel islands of Jersey and Guernsey. The new systems will allow Jersey and Guernsey to collaborate more effectively in public-safety provision and emergency situations.

Motorola Solutions installed Dimetra 7.1 TETRA infrastructure for both Jersey and Guernsey, allowing both to operate independent secured TETRA networks with push-button interoperability between both islands' public-safety systems. The communications networks were launched during the first week of April.

By uniting the two systems, Motorola Solutions will help emergency services personnel in Jersey and Guernsey to more efficiently safeguard public safety by expanding the networks' coverage and improving the tracking of seagoing vessels and craft. Coverage was also expanded.

BRUSSELS, Belgium — RWE Deutschland, a German utility, joined the European Utilities Telecom Council (EUTC) as a new member. Dr. Andreas Breuer, vice president of new technologies and projects, will represent RWE Deutschland at the EUTC board of directors. RWE Deutschland is based in Essen and is the operating company for electricity grids, gas and water supplies, sales and energy efficiency in the RWE Group.

SOPHIA ANTIPOLIS, France — European Telecommunications Standards Institute (ETSI) members elected Luis Jorge Romero Saro as director general of the institute for a five-year term. With more than 20 years of experience, Romero held director positions in Spain, Morocco and Mexico, predominantly with Telefonica.

LATIN AMERICA

BUDAPEST, Hungary — Thales was selected to provide TETRA systems for two new metro lines, one in Santo Domingo, Dominican Republic, and one in Panama City.

The technology will be deployed in Santo Domingo's metro line 2, which will be operational in 2012. OPRET, the operator, previously deployed Thales' TETRA technology in line 1.

Panama City's first metro line, about 14 kilometers long and set to open in 2013, will be equipped with 11 TETRA radio sites.

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Broadband Dominates Discussion at TETRA World Congress

By Sandra Wendelken

The migration to broadband was a main theme at this year's TETRA World Congress in Budapest, Hungary. While emphasizing that mission-critical voice communications will continue via TETRA networks for years to come, several TETRA suppliers had announcements specific to broadband technology.

Cassidian Communications and Alcatel-Lucent announced a joint development agreement under which the two companies will provide a mobile broadband solution for emergency response and security communications systems operating in the 400 MHz spectrum band. Using Long Term Evolution (LTE) technology, the joint Alcatel-Lucent and Cassidian offering will support broadband data services such as mobile video security, location-based video services, and smart vehicle integration of devices and applications to complement voice and data systems.

The announcement is important for markets such as Europe and Hong Kong where TETRA networks operate in the 400 MHz bands. In addition, the technology could be deployed in countries that have commercial CDMA 450 networks, Cassidian executives said.

Eric Davalo, chief technology officer (CTO) for Cassidian, said the technology will operate in 1.4-megahertz channels. Cassidian will supply 400 MHz LTE chipsets for terminals, high-power base stations, and LTE terminals and applications for the public-safety market. The LTE technology will allow the reuse of TETRA sites operating in the same 400 MHz spectrum.

U.S. public-safety officials are planning to deploy a public-safety broadband network at 700 MHz using 5-megahertz channels. Cassidian and Alcatel-Lucent also have an agreement to develop 700 MHz LTE equipment for public safety.

"Broadband capacity is becoming a critical ingredient of public-safety communications, delivering new mission-driven applications such as video-based situational awareness that were impossible before," said Tom Burns, president, enterprise and strategic industries, Alcatel-Lucent.

Giovanni Guidotti, Selex Communications deputy CTO and vice president of technology and product planning, said broadband will likely be an extension of TETRA networks with shared services. He said the technology will be deployed in a phased approach with broadband overlays on TETRA Enhanced Data Services (TEDS) dedicated private systems.

Guidotti cited broadband requirements detailed by the U.S. National Public Safety Telecommunications Council (NPSTC), noting that 80 kilobits per second (kbps) data speeds are sufficient for most public-safety applications. NPSTC is a federation of U.S. public-safety associations.

"I'm not convinced everyone needs broadband, but data use will increase," said Airwave CTO Euros Evans. "Voice and data will converge." Evans noted several operational challenges for broadband deployment, along with costs and spectrum harmonization in Europe. Airwave operates the U.K. nationwide public-safety TETRA network.

Tom Quirk, Motorola Solutions vice president and general manager for TETRA products, said the only public-safety application that wouldn't be available on a TEDS network is streaming video. Quirk said Motorola's latest TETRA infrastructure products, which are LTE compliant and will be available later this year, will use 60 percent less power and require a 30 percent smaller footprint than current products.

Andrew Seybold, a U.S. consultant for the public-safety communications market, offered suggestions for securing spectrum for broadband deployments. He said public safety must speak as one voice and plan for enough spectrum for daily communications needs. He also gave details of public-safety LTE tests in the Washington, D.C. area.

Thales launched Every Talk, what it called the first ruggedized push-to-talk (PTT) terminal with broadband capabilities for LTE or WiMAX systems. ■

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AT THE SPEED OF IDEAS™

Incident Management with DMR

A digital simulcast system was implemented in Rome to handle emergency communications during two major events on the same day.

By Flavia Negretti

Photos courtesy Selex Elsag

In January, Pope Benedict XVI approved a miracle credited to Pope John Paul II, setting the ground for the beatification of his predecessor. The Vatican then announced that the ceremony of beatification would take place in Rome 1 May.

On the same day, the Eternal City hosts a huge annual concert dedicated to the Labor Day with an average participation of around 500,000 people. More than 2 million pilgrims and tourists were expected in the city, the most populated in Italy and home to around 3 million people covering an area of almost 1.3 million square meters.

ARES 118, the Italian emergency service, gave Selex Elsag, a Finmeccanica company, the task of creating a network infrastructure to cope with the increased volume of emergency communications from 28 April to 5 May. Developed using simulcast Digital Mobile Radio (DMR) technology and based on seven repeater sites inside and outside the city, the new network doubled the traffic capability of the conventional analog radio system used by 118, enabling radio links across the entire city area. In St. Peters Basilica, St. Angel Castle, Risorgimento Square, Circus Maximus, Termini Railway Station, Cavour Square and in other areas particularly involved in the events, coverage was intensified and base camps set to support medical first-aid services.

Distributed across the territory were more than 200 operators, equipped with dual-mode DMR handheld terminals, one for first aid and the other for coordination and logistical support. Some of these terminals used GPS for radiolocation from the operations room. Moreover, 20 hospitals were radio linked. During 1 and 2 May, more than 10,000 radio communications events took

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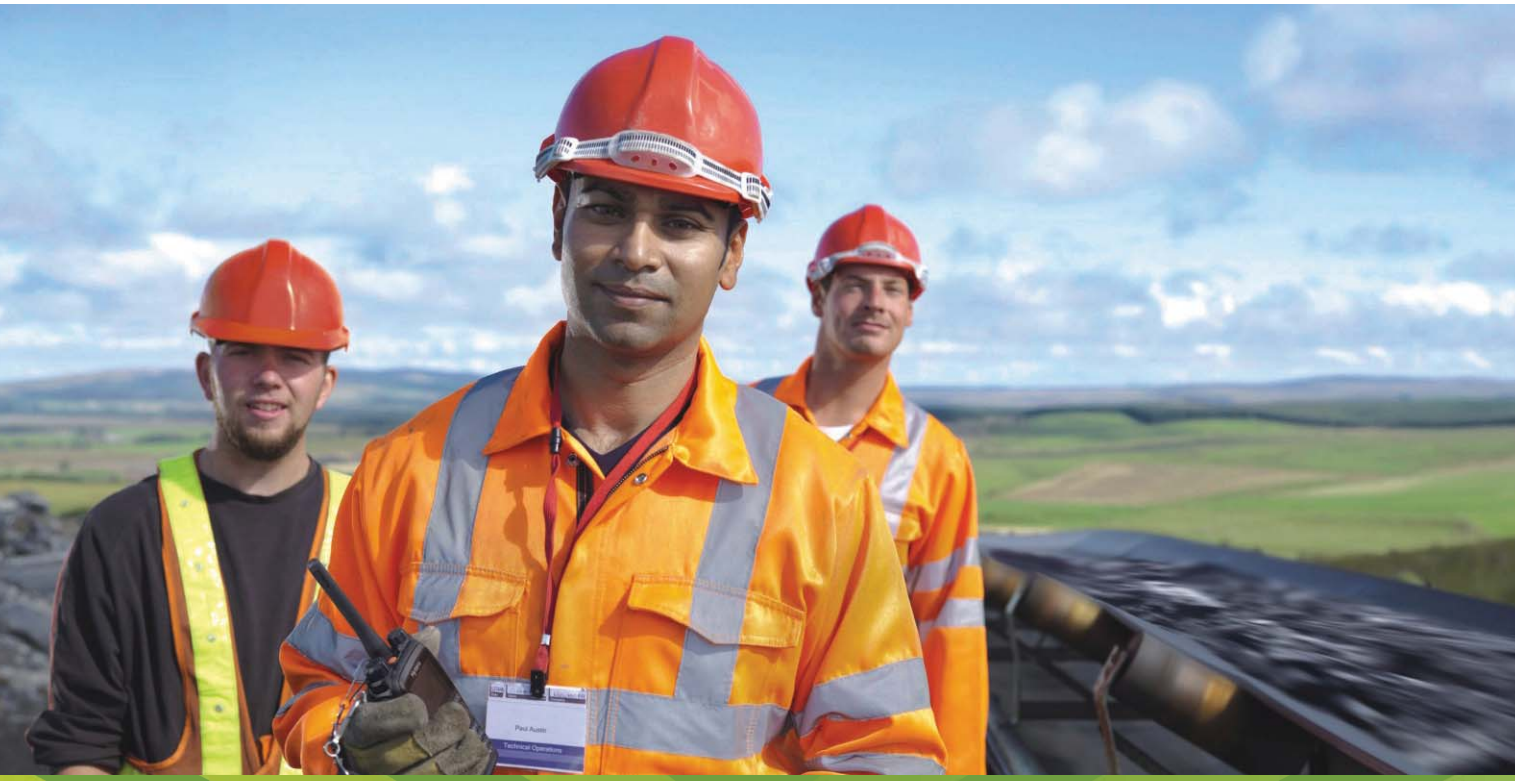

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The Italian emergency service used a DMR network for the Wojtyla beatification ceremony in Rome 1 May. An annual concert was held the same day.

place. About 3,000 first-aid activities in the city center, compared with an average of around 1,000 daily interventions in the entire city, occurred but with less then 150 hospitalizations. One camp hospital, 25 advanced medical devices, more than 100 ambulances and 500 stretcher-bearer teams were established for a total of around 3,000 people during 48 hours.

"Selex Communications support was very effective," said Giancarlo Mosiello, ARES 118 regional operations room director and sanitary director of the event. "We communicated constantly and everywhere, even in the most difficult areas and in the smallest streets of the city. We've strived hard to have a system that worked properly because we were aware that inadequate communications would have caused problems. As a result, the technological devices were a point of strength, allowing us to manage the event." ■

"We communicated constantly, even in the most difficult areas and in the smallest streets of the city."

— Giancarlo Mosiello, ARES 118

Flavia Negretti is responsible for media relations at Selex Elsag. Email comments to editor@RRMediaGroup.com.

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Photos courtesy TeamTalk

Top: Antennas on top of 25-meter high Leaning Rock on a 1,647-meter peak in the Dunstan Mountains. Middle: Mid Dome, Southland near Lumsden. Bottom: Mt. Mary, Mackenzie Basin, 996 meters above Lake Pukaki

New Zealand's Digital Endeavors

Project 25 (P25) technology has been adopted by emergency services, but the overall digital market is still shaking out.

By David Ware

New Zealand; it's that little country south of Australia. You probably know it as the backdrop for the "Lord of the Rings" movies, or more recently, because of the Christchurch earthquake. The February earthquake decimated the second-largest city's central business district and much of its residential housing.

In fact, there is one more thing you should know about New Zealand: We're big users of mobile radio down here. What makes the New Zealand market interesting is that it's similar to a laboratory at the end of the world where mobile radio technologies of every size and shape are all put to the test. If they fail, the rest of the world won't even notice.

New Zealand happily adopts both European and U.S.-based radio standards. Furthermore it's a challenging environment for mobile radio — remember all those mountains in the 'Rings movies? And with only 4 million people, it's hardly the most populated place on the planet, so the financials are never easy.

A History Lesson

During the 1990s through the early part of this decade, the market for wide-area mobile radio was dominated by either linked conventional systems or networks based on the British-developed MPT 1327 standard. New Zealand's emergency services all used linked conventional, and most commercial customers signed up for MPT 1327-based services provided by a commercial mobile radio provider, TeamTalk.

EDACS and other wide-area technologies were introduced, but failed to achieve critical mass, and many of the networks slowly died. Single-site services tended to be either conventional services or Motorola Solutions' SmartNet systems, although other technologies were used.

By the mid-2000s, commercial network operators and emergency services were starting to look toward digital technology. The challenge was making a business case stack up to justify the investment. Because of the country's small population, there isn't much pressure on radio spectrum. Only the advanced feature sets of the digital technologies can be used to justify the increased cost of digital deployments.

The first truly digital services introduced were single-site Project 25 (P25) networks in the large cities. The P25 networks were all targeted at commercial users, and it would be fair to say that all of these networks — including the

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The manufacturer that gets to market first with a reliable, wide-area trunked product will probably set the de facto standard for New Zealand.

TeamTalk network my company owns — have become commercial failures. The problem isn't the technology, the standard works, and it's as solid as a rock. The problem that all the network operators have discovered is that commercial users aren't prepared to pay high enough premiums compared with their existing analog service fees to sufficiently fund a P25 network.

Next out of the blocks with a digital network was the New Zealand Police, which deployed a P25 network in the major cities. For the police, the P25 path has been a bit of a rocky road with all sorts of technology issues. However, by most accounts, the technology has settled, and the network is working well. The costs appear to have well exceeded the original budget.

The commercial operators have picked themselves up after their brush with P25 and have begun installing other digital solutions. One company has installed a wide-area TETRA network across the four main cities. Patchy coverage and the relatively high cost of TETRA equipment and handsets are the main reasons that this network has been a commercial failure. Indeed, the jury is still out in regard to TETRA's long-term viability in New Zealand.

Digital Mobile Radio (DMR), including Motorola Solutions' MOTOTRBO, and digital Private Mobile Radio (dPMR) are starting to appear mostly as single-site networks. The main limitation to the broader adoption of these

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The government is exploring the option of a public/private partnership whereby a private organization would fund the initial deployment and operate the network.

technologies is the lack of wide-area trunked products.

However, the rapid adoption of these single-site services proves there is a large pent-up demand for modern, cost effective, digital services. So whichever manufacturer gets to the market first with a reliable, wide-area trunked product will probably set the de facto standard for New Zealand. Unfortunately, P25 likely doesn't make the cut for commercial mobile radio services because the standard is too expensive and cumbersome.

So where does this leave P25 in New Zealand? It looks like the standard is at a crossroads. The New Zealand Police are keen to push on with P25 and have expressed a desire to roll out a nationwide service. New Zealand's Fire and Ambulance services have also expressed an interest in the technology, possibly jumping onboard with the police.

The government, however, doesn't appear to share the police's enthusiasm for P25, and federal officials are showing reluctance to fund an expanded P25 network. To reduce the financial burden, the government is exploring the option of a public/private partnership whereby a private organization would fund the initial deployment and operate the network. Of course, the challenge for any private operator will be to build a long-term business model given that DMR and dPMR are imminent and will meet the needs of all but the most demanding users at a significantly lower price point.

Perhaps in a year or so we will know if P25 has carved out a successful niche as the network of choice for New Zealand's emergency services and how the next generation of digital services will fit into the New Zealand market. ■

David Ware is the managing director of TeamTalk, which he founded in 1994. His career spans 30 years in the telecommunications industry and includes engineering, consulting and marketing roles. Ware has provided strategic consulting services to Asian mobile radio companies and managed the Brazilian mobile radio operator Via-1. Email comments to dware@teamtalk.co.nz.

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Wind Farm Interference

The remote locations of turbines can unpredictably affect the reflections and diffractions of utilities' radio waves.

By John Wittams

Given governmental interest in promoting green energy, there has been a focus on wind farms in the United Kingdom and around the world. However, wind turbines can potentially cause considerable interference to radio communications. Wind turbines are often sited in sparsely populated areas on high ground to take best advantage of the prevailing wind. Unfortunately, these are the same locations that utility companies choose as microwave sites and scanning telemetry radio sites, and so turbines and radio sites are often close to one another.

Although wind turbine blades are largely made of nonconductive plastics and similar composite materials, they are large constructions, and the latest designs still contain metal reinforcements and conductors for lightning protection. The main rotating blade structures are sometimes more than 90 meters in diameter. A single turbine presents a significant but geometrically variable radar cross section that has the potential to reflect or diffract radio propagation waves and cause a delayed multipath component that may interfere with the original radio link signal. The more turbines a wind farm has, the more unpredictable the reflections and diffractions of radio waves become with potentially a far greater impact than may otherwise be expected.

Problems for Utilities

The potential for interference is of particular concern for the utilities industry, which makes extensive use of scanning telemetry systems and supervisory control and data acquisition (SCADA) systems to monitor and control its infrastructure. These systems are often fail-safe so that operations are automatically suspended if, for example, the SCADA system fails. Interference from wind turbines could potentially result in the shutdown of power and water supplies if serious interference is detected.

The 460 MHz band is often selected for SCADA links because the link path profile is non-line-of-sight, and this band permits the deployment of a diffracted path route between each link end as a design parameter. In these cases, the link path loss is significantly greater than the nominal free-path loss that would otherwise exist for the line-of-sight case, and different interference design rules must be applied. This can make SCADA links particularly prone to wind farm interference.

Further Study Required

A key analytical study examining the potential for wind turbine interference on radio links was published in 2002 by David F. Bacon and set the baseline for interference studies. However, the study only considered the limited case of a single turbine with direct line of sight to the nearby radio links, making no reference to the case where a link is diffracted. Telecom regulator Ofcom recognized these limitations of the Bacon study, and in 2008, Ofcom commissioned ERA

Solution for Air Traffic Control Radar Interference

Cassidian developed a technical solution to largely eliminate interference to air traffic control radars caused by wind turbines. Wind turbines generate radar interference signals, primarily through their rotors, which overlap with the echoes from aircraft, or which can easily be confused with them. Because of this interference, radar systems may no longer detect aircraft, which makes the control of air traffic much more difficult.

As a result of a multiyear research project carried out in cooperation with the German Federal Ministry for the Environment, Cassidian developed technology based on changes to the radar antenna, as well as to the signal and data processing. Using a controllable antenna diagram, a large part of the interfering radar echoes from wind turbines can be masked out. Using pattern recognition algorithms, the radar system can distinguish aircraft echoes from interference

signals, even in the immediate vicinity of wind turbines.

The effectiveness of these procedures has been proved in extensive flight tests at Büchel Air Base in Germany. This new technology will facilitate the extension of wind parks in the vicinity of airports while taking account flight safety. The detailed results were presented at the beginning of this year and will be made generally accessible at the conclusion of the study. The technology is expected to be commercially available within two years.

Technology and Aegis Systems to undertake field trials to measure the effects of wind farms on fixed-link and scanning telemetry systems.

A significant conclusion of these trials was that, under certain conditions, wind farms could generate more interference than predicted by the previous Bacon model, with fades as large as 15 or 20 dB for links where the path loss is greater than the free-path loss — that is, where the path is diffracted. Such fades would significantly impact radio link performance because of degradation of the designed link protection ratio. The report on the field trials recommended that because wind farms present a complex radio propagation model, further work was required to assess, understand and better quantify the interference mechanisms that prevail in these circumstances.

Joint Radio published an example of such interference where a wind turbine was built close to a diffracted link path. In Northern Ireland, the Tappanghan wind turbine is close to a link path and has resulted in considerable interference, because the turbine's intermittent reflected path results in a much higher, but variable, signal strength compared with the original design levels of a diffracted path.

Across the United Kingdom, there are a number of similar links at 460 MHz where the path profile relies on a terrain-diffracted path, rather than direct line of sight. From a system design perspective, this is often why 460 MHz has been selected, because the comparatively low frequency enables the use of a diffracted path.

Assessment of the impact of wind turbines and farms needs more field measurements and study to quantify the interference mechanisms, particularly in situations where the basic path is diffracted. As a result of Bacon's work, the simple case of a single line-of-sight link with a single turbine is understood, but using this theory to predict effects with the more complex, but more common, cases involving multiple wind turbines in close proximity to diffracted link paths can produce misleading conclusions, with the potential to cause interference and even prompt the closure of utility operations. ■

John Wittams is a chartered engineer and a member of the Institution of Engineering and Technology. He is a lead consultant within Analysys Mason and has worked in the radio communications industry for more than 25 years, gaining valuable experience in taking lead roles in the design and implementation of mobile radio solutions and the associated control room applications across the public safety, utilities and transport environments. Prior to joining Analysys Mason in 2002, Wittam held various product development, technical and system engineering management roles within Simoco Digital Systems, formally Philips Radio Communications Systems. Email comments to enquiries@analysysmason.com.

Product Expo

3T Communications

The FR400 TETRA base station can host up to eight carriers with 40-watt output each. Connectivity to the networks is IP based, but other line types are also supported. The base station offers low power consumption, typically 240 watts with two carriers. The base station can be used stand alone and in large networks. In fallback mode (no network connectivity), the full set of TETRA features — group/individual calls, half/full duplex, short data service (SDS), packet data, local database for subscriber management and encryption — is available.

www.3t-ag.com

Alligator Communications

The Alligator Model 1800 frequency synthesized, redundant base station/repeater is available in the 400 and 900 MHz and 1.4 GHz bands. The Common Time Base technology provides zero frequency offset between four internal RF modules. A single adjustment of the transmit frequency calibrates the entire unit. Built-in intelligence performs automatic checking of a warm standby transmit module and schedule rotation of the transmit modules.

www.alligatorcom.com

Axell Wireless

The BSR438 digital band-selective TETRA repeater is based on digital filtering technology and can be remotely configured using software updates. The repeater can extend the range of a TETRA base station by up to 57 kilometers. The repeater operates from 380 – 470 MHz in up to 20-megahertz bandwidth. The repeater is well suited for applications that require more than eight channels to be amplified. Band-shifting technology allows the repeater to be deployed in remote or rural applications.

www.axellwireless.com

Creowave

Creowave offers TETRA indoor, outdoor, hybrid, ATEX, high-power and optical fiber repeaters to correct coverage problems. The TETRA ATEX repeater is suitable for hazardous environments that have stringent requirements for equipment and can be placed up to zone 1. Offering ATEX certification, the repeater can be configured on site or remotely though the company's repeater manager software.

www.creowave.com

Damm Cellular Systems

Damm offers an outdoor base station, BS421, which can be installed with up to four carriers at one site, and an indoor base station, BS41x, with up to 16 carriers. Designed for a fully distributed IP solution, scalable from single to large, multisite networks, the base stations come integrated with LogServer, dispatcher and network management, and an internal GPS receiver. The BS421 can be mounted directly in the mast close to the antennas, providing full-dual receive (RX) diversity for optimal sensitivity and a built-in duplex filter with an output power to the antenna of up to 10 watts.

www.damm.dk

Daniels Electronics

Daniels Electronics supports narrowband and wideband paging for base station, simulcast and remote paging applications. Optional high-power power amplifiers are available to extend a coverage area. A third-party paging encoder generates the paging format for analog (tone and voice) or digital display (numeric/alphanumeric output) pages. A variety of transmission standards are supported.

www.danelec.com

Detracom

Duplex base stations from the RPND series use three-slot digital TDMA technology. The highly spectrum-efficient duplex base stations provide two audio communications and one data communication at the same time in 12.5-kilohertz channel spacing between digital terminals. In networks where analog and digital terminals coexist, the duplex stations can handle communications between analog terminals. The company's mobile terminals also support dual-mode analog/digital operation.

www.detracom.net

Fiplex Communications

Fiplex introduced a way to wirelessly link various bidirectional amplifier (BDA) repeaters by proprietary software known as FOMS. The software, when combined with remote control cards inside each BDA, allows users to manage the repeaters via wireless links. The Windows-based utility allows real-time monitoring and operations of the BDA network for cellular, TETRA and public-safety 700/800 MHz. As an administrative application, FOMS allows for dynamic reconfigurations.

www.fiplex.com

Harris Public Safety and Professional Communications

The MASTR V base station provides secure digital trunked IP

communications for mission-critical applications in the 700/800 MHz frequency bands. Supporting the Project 25 (P25) interface, the base station enables integration of off-the-shelf IP data applications, offers easy interconnection of peripherals and equipment, and provides coverage and spectrum efficiency with linear simulcast capabilities over digital voice and data networks. The base station is fully upgradeable to P25 Phase 2 and features compact, integrated hardware that allows up to eight channels per cabinet.

www.harrispublicsafety.com

Hytera Communications

The RD982 digital repeater can operate in analog or digital modes and supports 100-percent duty cycle at 50 watts. The heat sink and cooler fan ensure stable operation at high power. Full LED indicators and a large high-definition color display provide visibility for vital radio information, company officials said. These features enable users to save time and resources, officials said.

www.hytera.us

Icom

Icom's IC-FR5000/FR6000 is a 50-watt, 32-channel VHF/UHF repeater/base station combining analog FM and IDAS digital modes. The IDAS digital mode uses 6.25-kilohertz narrowband FDMA technology and offers a flexible choice of the NXDN or digital Private Mobile Radio (dPMR) digital protocols with common hardware. The unit receives both digital and analog modes and switches the transmitting mode accordingly. The optional network/trunking controller provides IDAS trunking capability and IP connectivity.

www.icom.co.jp/world

Innovative Circuit Technology (ICT)

ICT provides mission-critical power for base station repeaters and trunked radio systems. The N+1 redundant power series features a high reliability modular design that provides true N+1 redundancy with active load sharing. For additional functionality battery back-up terminals and system monitoring, outputs are provided as standard features. Every distribution series panel features 12 fused DC outputs. IP enabled models are available for remote monitoring and remote power control.

www.ict-power.com

Kenwood

NEXEDGE VHF/UHF digital and FM base units, NXR-710/810, can offer a soft migration path from analog systems because

they can operate in both digital conventional at 6.25 and 12.5 kilohertz and FM conventional/trunked modes at 25 and 12.5 kilohertz. Mixed FM/digital operation is available, and users can replace handheld or mobile subscribers one by one depending on budget. The unit can operate in digital conventional IP networks with its optional KTI-3 network interface unit.

http://nexedge/kenwood.com

Midian Electronics

The IS-2 cross-band repeater and interoperability switch features two ports to interoperate two different radio systems. For example, a VHF Project 25 (P25) radio system can interoperate with a trunked UHF radio system or a Motorola MOTOTRBO radio system can interoperate with a Kenwood NEXEDGE radio system. For trunking systems, the device offers channel acquisition inputs and an audio buffer to store the incoming audio until the channel is acquired. There is a four-wire option for use with satellite or microwave systems. Preconfigured cables for some radios are also available.

www.midians.com

Mobat USA

Software-based, high frequency (HF) base stations are available in 125- and 500-watt and 1-kilowatt (Kw) output power levels. The radios operate in the 1.6 to 30 MHz range. Automatic link establishment (ALE) is a standard feature. IP control, embedded advanced encryption standard (AES) encryption, digital voice, internal data modem and HF email are optional features. The units are easy to operate, and the high mean time between failure (MTBF) makes them ideal for military and disaster relief agencies.

www.mobat-usa.com

Polycom

The Kirk IP base station controls the traffic channels in the air and works as the link between the Kirk handset and the Kirk wireless server 6000. The wireless server operates the base stations through standard power over Ethernet (PoE) LAN cables (CAT5 or better). Each base station covers a circular area between 50 and 600 meters, depending on location specifics.

www.polycom.com

RFI Antennas

RFI's DSPbR rebroadcast repeaters are designed for deployment as coverage in-fill or network enhancement, such as sites where full builds are not cost-effective, restricted by zoning,

solar powered or where traditional backhaul is not feasible. The repeaters use an advanced digital signal processor (DSP) implementation to provide a channelized architecture capable of up to 135 dB of gain and provide translating or nontranslating operation within the same band or cross-bands. RF transparent operation provides simultaneous analog and digital compatibility (conventional or trunked), including all subaudible, in-band signaling or encryption schemes.

www.rfi.com.au

RF Neulink

The NL6000 radio modem can be programmed as a base station

(host), remote or a repeater. The device operates at 12 kilobits per second (kbps) on narrowband channels and 22 kbps on wideband channels. The digital product is configurable to wireless telemetry and mobile data. Transmit power is adjustable from 1 to 6 watts allowing mobile, fixed and solar operations. Power requirements are from 11 to 16 VDC.

www.rfneulink.com

SmarTrunk Systems

The ST-858QR SmartXpress can operate as a stand-alone repeater tone panel or in computer-operated or IP network operation modes. The stand-alone repeater operation allows multiple groups to share a single repeater channel. In this mode, the

device must be connected to a repeater or two base stations. The device functionality can be upgraded by installing a desktop computer running SmarTrunk software applications to operate with the controller. Additional features in this mode include voice logging, time stamp and AVL tracking alarms. Multiple community repeater systems can be tied together by adding a media converter and an IP connection, creating a wide-area radio network. The number of repeaters is unlimited, and workers from one repeater site can communicate with workers from other remote repeater sites.

www.smartrunk.com

Base Stations and Repeaters

Sonik Messaging Systems

The PTX-150 and WMBS base stations are designed for continuous duty, simulcast applications, offering remote diagnostics and alarms. The base stations are compatible with utility paging telemetry protocols, such as SA206, and offer upgradeability for Motorola and Glenayre legacy paging systems. The base stations are custom designed to include filters, isolators, controllers, power supplies and GPS receivers for improved frequency stability and simulcast timing. The company uses Zetron controllers and paging terminals in the turnkey systems.

www.sonik.com

Spectra Engineering

The Project 25 (P25) Digital Linker connects multiple MX800 P25 radio base stations through a standard Ethernet connection to form a digitally linked wide-area conventional voice system. The linker can pass either the digital P25 Common Air Interface or analog G711 voice streams to other sites that are similarly equipped. The system will automatically vote and select the best receiver with the lowest bit error rate (BER) and pass the audio for subsequent transmitting. The unit communicates and resolves connections with other linked radios in the same network without micromanaging connections between individual P25 Linkers.

www.spectraeng.com.au

Tait Electronics

The TB9100 Project 25 (P25) base station/repeater offers reliable, continuous duty cycle operation at a range of temperatures and altitudes. A flexible, modular design combined with intuitive programming software make the product an ideal P25 solution for conventional, trunked and simulcast mission-critical networks. In addition, the TB9100 transportable repeater is ideal for use in emergency situations and for tactical operations from remote locations to urban environments. The base station is available in 50- and 100-watt configurations in a range of frequency bands.

www.taitworld.com

Teltronic

Nebula, Teltronic's TETRA infrastructure, provides coverage, security and reliability in a platform designed for efficient implementation and cost-effective scalability. The TETRA system is 100 percent IP, allowing a secure and reliable network with distributed switching, distributed intelligence and complete fault-tolerant redundancy. With 75 watts of RF output power from each repeater

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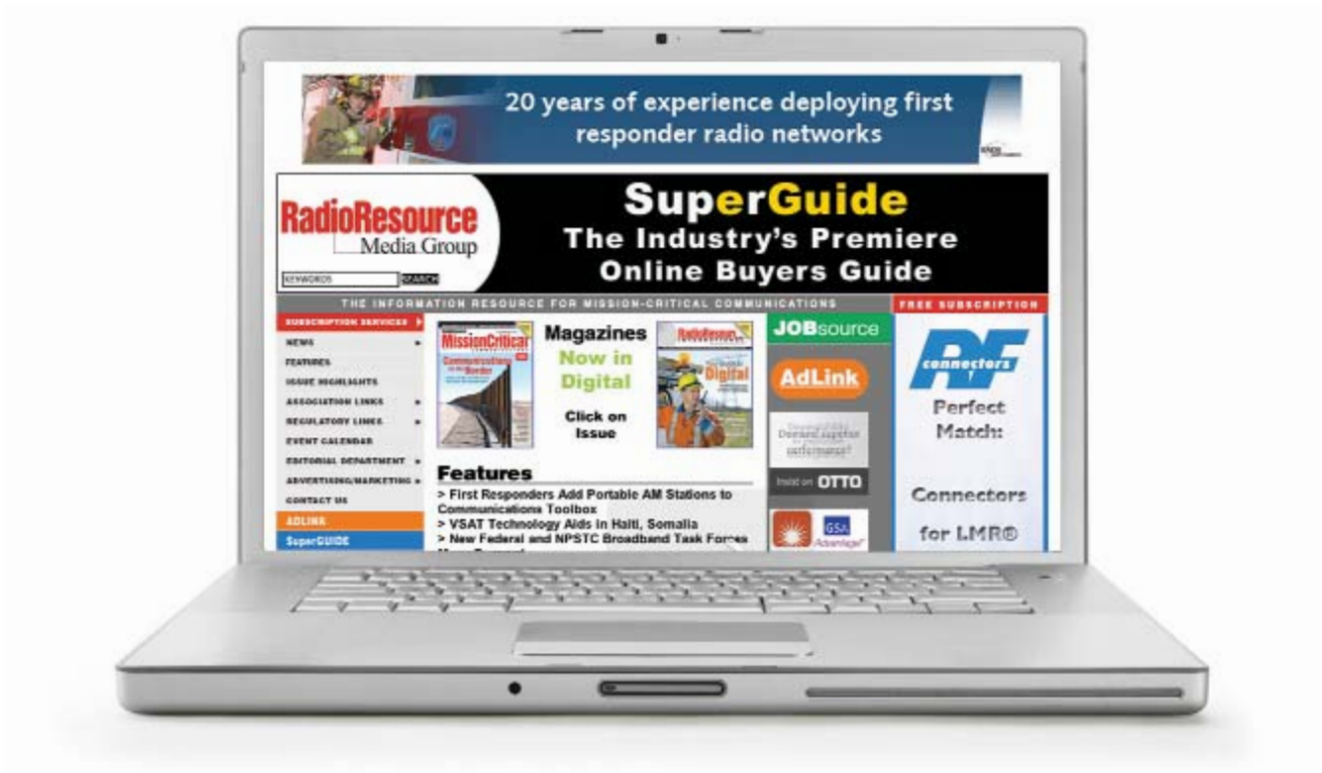

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and triple receiver diversity, the system is loaded with advanced capabilities such as multislot packet data up to 28.8 kilobits per second (kbps), simultaneous voice and data, FIPS Level 3-oriented E2EE management, real-time statistics of network performance and off-the-shelf solutions optimized for AVL, telemetry and transportation. The hardware is ready for migration to TETRA Enhanced Data Service (TEDS).
www.teltronic.es

Vertex Standard

The VXR-7000 base station is continuous-duty and cycle-rated to enhance productivity. Features includes DTMF

encode and decode for emergency and automatic number identification (ANI) functions. If an emergency alert is received from a mobile or portable radio, the base station will beep loudly and blink the LCD to notify the dispatcher. Other features include 16 channels, 47 CTCSS tones/108 DCS codes encode and decode, community repeater operation (up to 16 tones), multiple timer, D-Sub 25 pin accessory connector, line interface port and more.
www.vertexstandard.com/lmr

Westel Wireless Systems

Westel's Project 25 (P25) repeater products now support P25 GPS location services using the standard National Marine Electronics Association (NMEA)

message generated by either GPS microphones or vehicle-mounted GPS systems. The repeater/base can be interfaced directly to a PC running a mapping application, and the GPS positions of active mobiles can be presented to the dispatcher in real time. The repeaters support an extended form of messaging, whereby positions and waypoints can be exchanged between GPS units so all users and a dispatcher are aware of the locations of all other users.
www.westelwireless.com

Wireless Pacific

Wireless Pacific RDX Pico is a small self-contained analog and Project 25 (P25) suitcase repeater designed to allow instant deployment in most radio environments. A mode selector allows users to pre-define configurations. The 8.8 ampere hour (AH) inbuilt battery provides more than 12 hours of stand-alone operation at 10 percent duty cycle and can be recharged by any available 8 – 30 VDC

power source or alternatively AC mains power. RF output power is set to 5 watts to maximize battery life, as well as to ensure balanced talk-in/talk-out to field portable units.
www.wirelesspac.com

New Products

IS TETRA Radio

Sepura added the STP8X intrinsically safe (IS) radio to the company's TETRA line of products. The radio offers loud, clear audio, usability while wearing gloves and new levels of ruggedness, company officials said. The IP67 submersible radio also inherits the features normally found on the company's STP8000 hand-portable range, including missed event notification, a Micro-SD image viewer, extended battery life, man-down application and a display that is viewable in all conditions.

www.sepura-stp8x.com

Ruggedized Smart Phone

The Every Talk from **Thales Communications** is a ruggedized push-to-talk (PTT) terminal that adds broadband capabilities to existing professional mobile radio (PMR) networks. The future of PMR involves not only voice communications and text messaging, but also multimedia services such as data, images, video, live feeds, face recognition and database queries, Thales executives said. With the Every Talk smart phone, all of these services become available in one device. The device allows users to send real-time video, access remote databases (such as identity and stolen car), download situational information, and download and share pictures as well as GPS-based positions.

www.thalesgroup.com

Digital Covert Radios

Hytera Communications introduced the Hytera X1 covert radio, which is fully compliant with the Digital Mobile Radio (DMR) open standard. The radio offers an advanced encryption standard (AES) encryption algorithm and a 256-digit dynamic encryption key. The radio, 18 millimeters wide, features IP67 protection, is submersible up to 30 minutes and meets Mil-Std-810 C/D/E/F compliance. The radio is easy to use with professional wireless headsets or collar microphone, palm controller and flexible antenna, and offers full RF power of 4 watts for UHF and 5 watts for VHF, company executives said.

www.hytera.com

TETRA Coverage and Access Points

Motorola Solutions launched its TETRA RF Automated Coverage Evaluation System (TRACES), providing end-user administrators with the ability to automatically collect, visualize and evaluate data from across their mission-critical TETRA networks. Network administrators can gain access to data on network performance, irrespective of the network vendor, via their Motorola end-user radios.

Motorola Solutions also expanded its WiNG 5 wireless LAN portfolio with single-, dual- and tri-radio 802.11n access points

(APs) and the NX 9000 integrated services controller. The controller was designed to help distributed organizations effectively manage thousands of APs from a network operations center for a continental or global deployment. The APs come in four models, AP 621, AP 6521, AP 6532 and AP 7161.

www.motorolasolutions.com

TETRA Testing

Aeroflex presented the Auto-Test II technology for testing TETRA mobile stations on the 3920 Digital Radio Test Set. The

new option allows testing of TETRA terminals, independent of the network and encryption settings. Performing regular maintenance testing is important, and with the TETRA Air Interface Encryption implementation on more TETRA networks, it has become an issue to maintain TETRA mobile stations on a base station simulator, company officials said. An intuitive user interface makes the device an easy-to-use test set in the field with low test uncertainty.

www.aeroflex.com

Multimode Wireless Router

The Harrier-900 multimode wireless router

from **CalAmp** is the first programmable digital communications device to combine both licensed and unlicensed 900 MHz range radio spectrum capability. The router is ideally suited for mission-critical operations in electric utilities, oil and gas, water/waste water, transportation, and public-safety markets. Operating in the 901 MHz licensed narrowband PCS (NPCS) band and the 902 – 928 MHz unlicensed Industrial, Scientific and Medical (ISM) band, the router provides high speeds and extended range coverage, giving users the ability to mix and match bands. Data throughput speeds of up to 512 kilobits per second (kbps) are available in the ISM band for shorter-range, higher-speed data applications. For greater range, hard-to-reach sites or extreme interference problems, users can operate in the 901 MHz band.

www.calamp.com

Meter Reading

Radiocrafts expanded its Wireless M-Bus product line with a new module using the 169 MHz band for long-range automatic

meter reading (AMR). Compliant with prEN 13757-4:2011 operating in the new harmonized frequency band for meter reading in Europe, the product features a typical range of 1.5 kilometers (km) in urban

areas and 20 – 40 km in open terrain with quarter-wave antennas. The instrument offers narrowband performance in the 12.5-kilohertz channel and up to 500-milliwatt (mW) output power, achieving a link budget of 150 dB. The module supports two-way communications at 2.4 and 4.8 kilobits per second (kbps) in six narrowband channels, and 38.4 kbps in a 50-kilohertz channel.

Radiocrafts and Kamstrup announced interoperability for the new C-mode in prEN 13757-4:2010. The C-mode (compact mode) reduces power consumption and increases the lifetime of battery-operated utility meters. The device offers a new physical layer with optimized data coding, giving an increased throughput and an optimized link layer and compression of data in the application layer. It also features an optimized encryption scheme.

www.radiocrafts.com

Programmable Frequency

MiMOMax Wireless now enables user programmable frequency functionality for all MiMOMax radios. Users can remotely, electronically tune the company's internal transmitter and receiver frequencies within the MiMOMax duplexer band range to match the desired requirements. Band ranges include 420 – 430, 440 – 450 and 450 – 470 MHz. The feature will increase user independence, flexibility and network control, company officials said.

www.mimomax.com

Spectrum Analyzers

Narda Safety Test Solutions introduced the Remote Spectrum Analyzer NRA, available in three versions. The NRA-2500 offers a frequency range of 5 MHz to 2.5 GHz; the NRA-3000 offers a frequency range from 9 kHz to 3 GHz; and the NRA-6000 wireless analyzer offers a range from 9 kHz to 3 GHz. All three are compact and one unit (1U) high. The analyzers feature low-power consumption and operate noiselessly without cooling fans. Powerful remote control via the 100Base-TX Ethernet interface allows seamless integration into users' own applications.

www.narda-sts.com

Intermodulation Products

Heuermann HF-Technik launched several new products. The Vector-PIM allows users to perform calibrated complex passive intermodulation (PIM) measurements that support accuracy, localization of intermodulation (IM) obstacles and exact modeling of IM defects. The NonLin-IM instrument performs error-correction IM measurements for magnitude and phase for different IM test sets. The 8 GHz vector network analyzer (VNA) calibration kit supports broadband VNA measurements of microwave devices up to 8 GHz, which is achieved with the SMA components for the four calibration measurements: short, open, load and through. The rapid automatic multipoint

calibration box, RapACal, allows for one- or multipoint calibration of VNA up to 18 GHz. The BCM40 broadband conical monopole antenna is a low-loss antenna that supports a monopole antenna characteristic and an ultra broad frequency band (1.2 – 40 GHz).
www.hhft.de

USB Microphone

The PS20-USB from **Peiker Acustic** is a USB-enabled desktop microphone for IP-based communications. The unit includes a high-quality dynamic mic and internal speaker, along with three programmable buttons and jacks for external push-to-talk (PTT) and headset. The metal housing and gooseneck withstand harsh environments. To operate, plug the unit into a standard USB slot and it is ready to communicate without additional drivers. The buttons can be assigned to nearly any keyboard command using the company's software applications or the developers' kit.
www.peiker.com

Radio Accessories

Imtradex unveiled a system where more headsets with push-to-talk (PTT) operation can be connected to the same computer using a USB interface. Each headset has its own serial number for the computer to recognize the headsets separately. Users can connect up to seven different devices to one computer.

The company also introduced the Aurelis series hand microphones. The basic equipment of the Aurelis-hand microphone is next to a transit button, microphone, high-quality speakers, an emergency call button, three-level volume control and a programmable LED (functions depending on the digital radio). The series features rugged plastic housing, water resistance, and protection from dust and temperature.
www.imtradex.com

ATEX TETRA Radio with Alarm Sensors

Funkwerk Security Communications presented the first ATEX TETRA radio with fully integrated alarm sensors, enabling rapid rescues and use in personal alarm systems. The FT4 series was designed and developed for use in prisons and chemical and petrochemical industries. The handsets are equipped with high-end sensors, providing personal security functionality including manual and automatic alarms. The TETRA devices possess an enclosure that makes it the first ATEX unit on the market with IP65 certification. The radios meet the toughest industrial requirements, with II 2G Ex ib IIC T4 Gb ATEX certification.
www.funkwerk-sc.com

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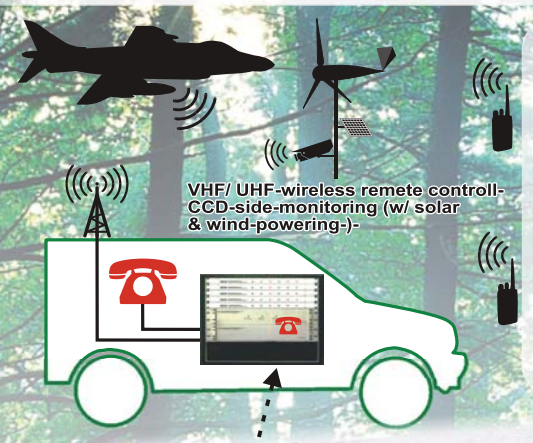

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2. Which of the following best describes your organization?
❑ A Mobile Communications Dealer/Reseller
❑ B Distributor, Agent, Importer, Exporter, Rep
❑ C Commercial Trunked Radio and Other Wireless Service Providers
❑ D Government/Public Safety/Military
❑ E Business/Industrial/Transportation User
❑ F Communications Manufacturer/OEM/Software Developer
❑ G Engineering and Consulting Firm
❑ Z Other—please specify _____

3. What is your function?
❑ A Corporate Management
❑ B Operations/Administration Management
❑ C Technical/Engineering Management
❑ D Sales/Marketing
❑ Z Others Allied to the Field—please specify _____

4. Do you recommend, specify or purchase mobile communications equipment or services?
❑ A Yes ❑ B No

5. Is there any servicing of mobile communications equipment at your location?
❑ A Yes ❑ B No

6. In what area of the world do you do most of your business? (mark only one)
❑ A Western Europe
❑ B Eastern Europe
❑ C Middle East
❑ D Asia
❑ E Australia/New Zealand
❑ F Africa
❑ G Mexico/Central and South America
❑ H United States/Canada
❑ Z Other _____

7. What wireless technologies does your organization plan to use/buy over the next 2 years? (check all that apply)
❑ A Conventional Two-Way
❑ B Cellular/Personal Communications
❑ C Paging/Messaging
❑ D Mobile Data
❑ E SCADA/Telemetry
❑ F Microwave radio
❑ G Trunking
❑ H Location Technologies
❑ I Tone Signaling (ANI, Encryption, etc.)
❑ J Interconnect
❑ K Satellite
❑ L CAD
❑ M Wireless Broadband
❑ Z Other _____

Q311

New Technology for Volcanic Monitoring

By Cristina Ramos

The Instituto Geofisico [Institute of Geophysics of Ecuador] has been responsible for seismic and volcanic monitoring throughout the country since 1983. Early warning of volcanic eruption is essential so that appropriate precautionary measures can be taken.

The institute's mission is to improve disaster preparedness and lessen the impact of seismic and volcanic phenomena throughout Ecuador via constant monitoring, scientific research and technology. The institute can issue early warnings based on risk maps produced by scientists. The dedication to seismic and volcanic monitoring warned thousands of people and saved countless lives in the recent eruptions of the Tungurahua Volcano in April and in 2006, 2008 and 2010.

The institute's monitoring network has increased because of new needs, technological advances and the involvement of international organizations that have donated equipment and trained personnel. However, with such rapid progress, new problems and challenges have surfaced.

The primary challenge was to build a real-time telemetry network capable of transmitting data. Previously, no adequate data collection equipment for seismic and volcanic monitoring, much less digital technology, had been installed in the country. The existing equipment could not transmit information and collected only local data. This meant time and money to visit remote sites to collect the data.

Digital telemetry was used for applications that didn't require continuous transmission in real time, and the data was transmitted in regular time intervals. With new technology in place, there were no interference problems, but the equipment was not robust enough for the climate conditions in which it needed to operate.

FreeWave Technologies' data radios transmitted data of the deformation of the Cotopaxi Volcano and the Galapagos Islands. The technology reduced maintenance of monitoring stations to zero. One of the institute's engineers set up a photographic camera with serial transmission using the units for the Reventador Volcano.

These changes took place around 2002, and the institute staff gained more experience in using the radios and became familiar with programming. The system's connections have proven reliable, as well as its performance in extreme conditions.

The institute added the radios to many of its monitoring networks and used them in various monitoring applications and implementation activities. Among the primary monitoring applications are real-time broadband seismic stations in the active volcanoes and tectonic faults, accelerometers located in the cities, meteorological stations, stations to monitor volcanic gases, deformation stations using GPS technology and borehole sensors, remote digital cameras and stations to quantify mud flow.

The institute has a challenge with implementing the geological and volcanic national survey in Ecuador. It plans to install 150 more stations with different applications and with many telecommunication solutions to get data in real time. The units connect two monitoring instruments allocated at the same site. The institute will soon use a high-throughput radio, useful when many signals are concentrated at the same node and after they are transmitted together to the other node.

During the past six years, the technology has met the institute's expectations. Performance in extreme conditions, as evidenced by a radio that transmits images from the top of the highest active volcano in the world, operating at below zero-degree temperatures from a height of 5,947 meters above sea level, has met its needs. For this application, a camera network was installed in the Tungurahua volcano for visualizing the volcano from four critical zones in real time.

For the latest models of deformation equipment, GPS technology with transmission using the TCP/IP protocol was used. The institute's network consists of five GPS receivers on the Cotopaxi, four on the Tungurahua, one on the Chimborazo, one on the Antizana volcanoes and seven around the country. This year, 50 additional GPS receivers will be installed.

Each piece of equipment is connected to the institute's internal network, allowing access to the equipment from any part of the network. Seismic broadband monitoring made it possible for the institute to give early warning about the eruptions, because the connected sensors allowed it to see signs that other sensors didn't see.

Engineers at the institute continue to consider this transmission equipment the best option for different applications and projects under way. The cost/benefit ratio is excellent, and the technology plays an important role in warning people at risk. ■

Cristina Ramos works at the Geophysics Institute of Polytechnic National School, and she has 10 years of telecommunications experience. She is a field engineer and has designed telemetry networks and solutions for data transmission for volcanoes and seismic monitoring. She is a professor at the Technology School of Telecommunications at Polytechnic National School. Email comments to editor@RRMediaGroup.com.

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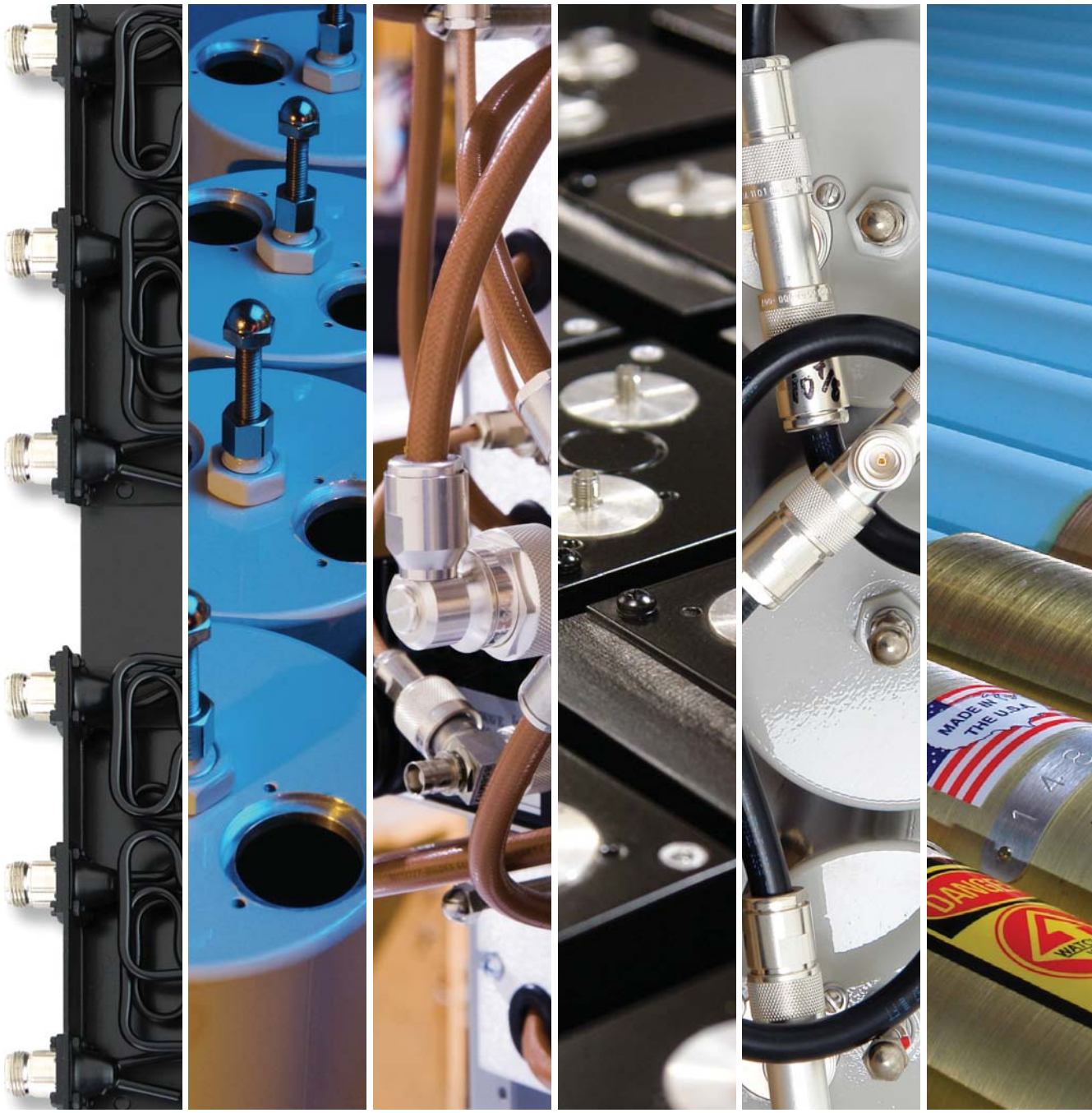

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