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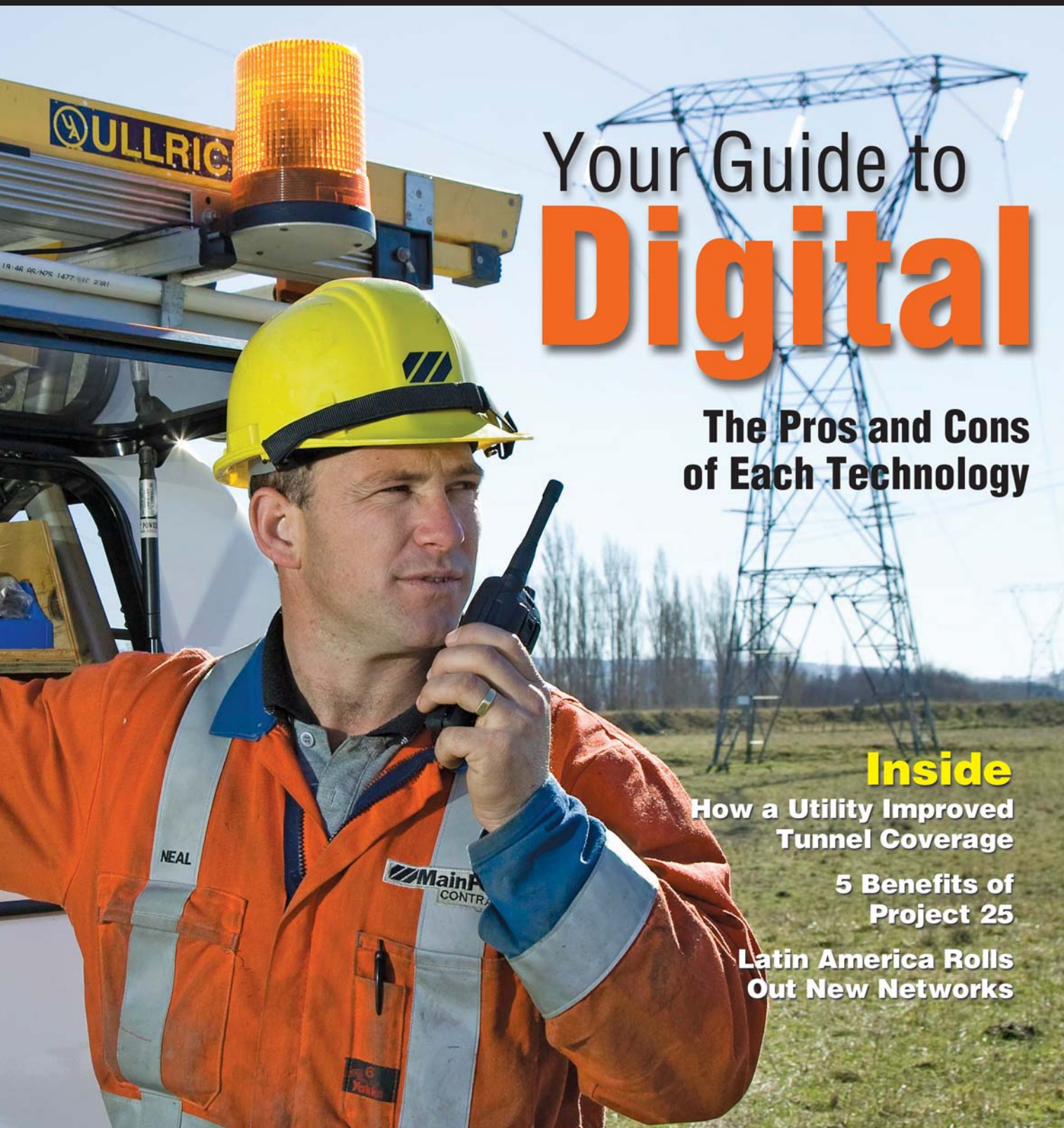

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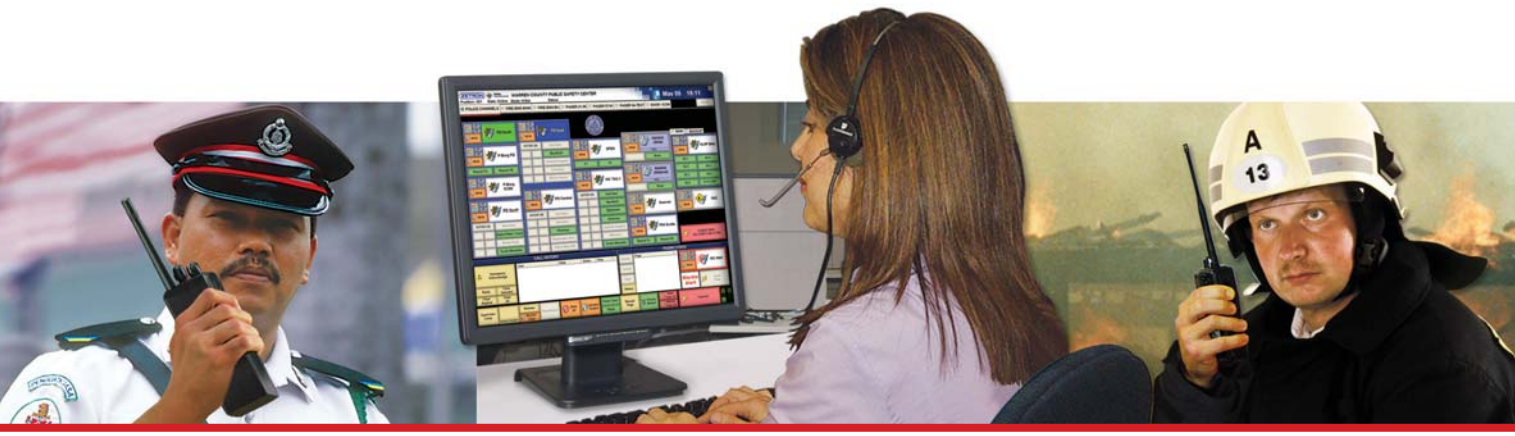

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The Essentials: Spectrum and Funding

Spectrum and funding continue to affect our industry, often determining what technology is deployed and when. If you don't have both, your network likely won't get far.

As broadband technology continues to push forward in standards bodies, finding spectrum and money for new networks is a hot topic for telecom regulators, end users and others. Finding spectrum for public-safety-specific broadband applications is an even larger challenge. Although public safety user numbers are smaller than commercial users, the need for dedicated spectrum is critical to public-safety communications networks.

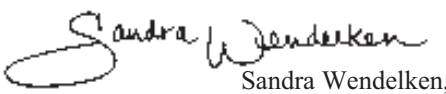
In the United States, public safety has 10 megahertz of dedicated broadband spectrum, but public-safety leaders say it isn't enough. They're asking for an additional 10 megahertz — for a total of 20 megahertz of public-safety broadband spectrum. In Europe, it's been difficult to find spectrum for public-safety high-speed data technology, let alone broadband. But a working group within the European Telecommunications Standards Institute (ETSI) recently formed with a goal of identifying a 2 by 10 megahertz block of spectrum for broadband. The group's members are exploring Europe's Digital Dividend UHF spectrum freed by the transition from analog to digital TV.

The Australian Communications and Media Authority (ACMA) likely will change the 450 – 470 MHz band to make it available as harmonized government spectrum within five years. In Asia, each country has different spectrum plans and needs. Some countries are reallocating spectrum and moving users to accommodate broadband and other technologies.

The budget for a network often dictates the technology deployed. Many users would appreciate the benefits of high-end digital networks, but cost is a stumbling block for most. Without an upfront and recurring funding mechanism, some agencies choose to stay with analog networks. Some low-cost digital technologies newly on the market are making great strides because they allow users with limited budgets to enjoy the features of digital cost effectively. Learn more about your digital options on Page 24.

We value your opinions! Please e-mail your feedback to me at swendelken@RRMediaGroup.com.

As we continue down the broadband migration path, spectrum and funding will continue to advance or inhibit industry growth. Let us know how we can help educate decision makers about the continued importance for mission-critical mobile communications networks.



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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INTERNATIONAL

World Cup Security Relies on TETRA Network

The 2010 FIFA World Cup, the world's premier football tournament held once every four years, is being supported by mission-critical communications networks supplied by several TETRA vendors. Matches are being played across the country at 10 stadiums in nine cities, and EADS radio communications are helping the South African Police Services (SAPS) oversee the tournament's safety and security.

EADS and local partners Integcomm and Saab Grintek Technologies supplied, tested, commissioned and operated a large TETRA network to provide secure communications in the Eastern Cape, with coverage of Port Elizabeth, including the match venues. The network, comprising more than 200 base stations and 10,000 EADS terminals, provides communications for 16,000 provincial officers across a region with about 7 million citizens. SAPS is one of the first customers that purchased TETRA Enhanced Data Service (TEDS), which will provide high-capacity data services for advanced command, control and dispatching communications, including mobile video transmission.

SAPS chose a Panorama Antennas antenna to provide communications in the Royal Bafokeng Stadium. Fitted throughout the stadium, the low-profile antenna is used for in-building applications. "The soccer officials could not spot the dome antennas," said Col. Chris Jonck, commanding officer of SAPS. "They blend in with the surrounding structure and are just what they wanted."

Durban Stadium in South Africa

The SAPS network will complement another EADS TETRA network at South Africa's Cape Town International Airport, also ordered in preparation for the football contest. This system, delivered through Integcomm, will include a TB3 base station and will be used by about 100 Airports Company South Africa (ACSA) staff.

IRVING, Texas, USA — A private equity fund agreed to acquire **EF Johnson Technologies** under a deal unanimously approved by EF Johnson's board of directors. Stockholders will receive $1.50 per share in cash at closing from Francisco Partners, a global technology-focused private equity fund. EF Johnson manufactures Project 25 (P25) and other mobile radio equipment.

"The board considered a range of potential alternatives, including continuing to operate as an independent entity, the possibility of the sale of certain assets, and the returns and dilution associated with issuing additional equity in a private offering," said Michael E. Jalbert, CEO of EF Johnson Technologies. "After this thorough review process, our board of directors unanimously concluded that this transaction with Francisco Partners is in the best interest of our stockholders."

GENEVA — A new **International Telecommunication Union** (ITU) group is tasked with identifying standards needs for the world's new smart grid deployments, which will bring the

Management Buys Team Simoco Parent in US$50 Million Deal

Team Telecom Group (TTG) announced a £32.8 million (US$49.7 million) management buyout of TTG from parent company Spice, a publicly listed company. TTG CEO Mike Norfield and Chairman Peter Burridge will lead the new company. The deal was backed by Gresham Private Equity and HSBC.

"We needed a right-minded investor for our business," Norfield said. "We are looking to grow in the mobile sector. We are looking at like-minded companies that have other professional mobile radio (PMR) technologies in geographic regions and key areas where we operate now."

TTG comprises four businesses — Team Simoco in Derby, United Kingdom; ComGroup in Victoria, Australia; AirRadio in West Drayton, Middlesex, United Kingdom; and Indigo Telecom Group in Monmouthshire, Wales, United Kingdom.

Norfield said the new firm will have continued investment in research and development (R&D), particularly the advancement of the company's Project 25 (P25) and Digital Mobile Radio (DMR) roadmaps. TETRA technology will continue to be an area of focus for the company as well. "With Gresham's support, we intend to continue this investment and increase our international presence, both organically and by acquisition," Norfield said.

Team Telecom Group executives

Team Simoco bought ComGroup in July 2009 for $11 million. The acquisition provided TTG with a terminal manufacturer in addition to Team Simoco's infrastructure products.

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benefits of digital technology to the existing electricity network.

According to a study by ABI Research, the number of smart electric meters deployed worldwide will increase from 76 million in 2009 to about 212 million in 2014. Many governments have earmarked significant portions of their stimulus packages for smart grids.

The group will survey existing national standards initiatives to see whether these can be adopted at an international level and will also perform a gap analysis to identify new standardization requirements that will then be taken forward by relevant ITU-T study groups. Then work will begin on the development of the standards necessary to support the global rollout of smart grid technologies.

LAS VEGAS, USA — Three new members — **Connect Systems**, **Hoag Electronics** and **Pyramid Communications** — joined the NXDN Forum during the general meeting in March. The forum now has 16 member companies.

The NXDN Forum was established in July 2008 with eight founding members to promote the NXDN digital air protocol for use with 6.25- and 12.5-kilohertz narrowband technology.

SINGAPORE — Peter Clemons, director of communications at **Teltronic** and editorial advisor at *RadioResource International*, was voted onto the board of the TETRA Association. Other board members who were re-elected are Roger Dowling, Sepura; Daniel Hache, ASTRID; and Hans Borgonjen, vts Police Netherlands. A casual vacancy on the board was filled by Dr. Gabriele Knoll, BDBOS.

Peter Clemons

The members join board representatives from Motorola, EADS Defence & Security and Selex Communications, who were not up for re-election this year.

EUROPE

STOCKHOLM, Sweden — Swedish Civil Contingencies Agency (MSB) and the Federal Agency for Digital Radio of Security Authorities and Organizations (BDBOS) signed an agreement to launch a cooperative project with **EADS Defence & Security** to implement and trial cross-border communications.

The trial, planned for November and December, will involve frontline authorities from Sweden and Germany. The operational trial will center on an exercise in international incident

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management and will use TETRA for cross-border communications. The aim is to study how TETRA functionalities can improve communications and cooperation between two countries' authorities. It will also demonstrate the usability of the standard in managing an international incident.

"This trial goes to show that authorities involved in a cross-border incident in another country can communicate with each other and with their international counterparts as securely and seamlessly as in their everyday operations in their home country," said Dr. Gabriele Knoll, head of directorate-general for BDBOS.

EADS was the first to prove in independent tests that its TETRA networks can interconnect according to the Inter System Interface (ISI) standard, and this project is a direct continuation of a strategy to ensure interoperability between networks, EADS officials said.

Selex, Tetrasvyaz to Deploy Network for the 2014 Olympic Games

Selex Communications and Tetrasvyaz will present the TETRA network for the Winter Olympic Games 2014 in Sochi, Russian Federation. The project will be developed within the framework of the 2009 agreements signed by the Italian and Russian governments.

The Olympic Games network will cover a significant part of Krasnodar, the region where Sochi is located, including the area of the Olympic facilities, settlements, airports and transport means of the Black Sea coast of Russia.

The network comprises 90 base stations and two switching and control nodes. Tetrasvyaz and the Russian state corporation Olympstroy will perform construction work, while Italian firm Selex Communications will provide the infrastructure equipment.

The network will include a communications control center, a dispatching center, antenna feeders, commutation units, base stations and subscriber equipment; connection to the telephone network will also be provided. The network will provide data transfer from GLONASS satellites and monitoring services for mobile facilities to state and commercial users.

Officials discuss the 2014 Olympics communications network at a press conference.

The first stage of construction — 10 TETRA base stations — has been completed. The second stage of network construction — erection of 35 telecommunications facilities — will be completed in 2012.

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World News

BRUSSELS, Belgium — The European Commission (EC) adopted a decision establishing harmonized technical rules for member states on the allocation of 800 MHz frequencies for the deployment of high-speed wireless Internet services by avoiding harmful interference. In several member states, 800 MHz spectrum is being freed as part of the Digital Dividend resulting from the switchover from analog to digital TV broadcasting.

HOOGEVEEN, The Netherlands — Rohill Technologies joined the European-funded project Heterogeneous Networks for Public Safety (HNPS) within the CELTIC program, with the objective to develop solutions enabling cooperation of public-safety agencies across organizations and national borders.

Existing members of the HNPS consortium include Alcatel-Lucent, EADS, Thales and Telefonica, and a number of research institutes. The goal of HNPS is to develop a heterogeneous network concept for future European public-safety communications. The project focuses on integrating private mobile radio systems and broadband technologies such as Wi-Fi, WiMAX and Long Term Evolution (LTE).

BUCKINGHAMSHIRE, United Kingdom — Microbus appointed Bob Schimmelman sales manager. Schimmelman previously worked with Motorola in the United States and Europe, followed by international sales management roles with Futronics and Data 911.

BAD MUENDER, Germany — Rohde & Schwarz Professional Mobile Radio installed a TETRA digital radio system in the new Donbass Arena in Donetsk, Ukraine. The system will provide stable and jam-resistant communications for security staff and rescue teams during large-scale events.

The digital radio network covers the stadium and its surroundings. In 2012, the Donbass Arena will be one site of the European soccer championship.

CAMBRIDGE, United Kingdom — Sepura was awarded a contract to supply TETRA radios to the Futian District's Police Force in Shenzhen, China. The 350 MHz radios feature 1.8-watt output power, and the gateway and repeater feature 10 watts RF transmitting power.

Separately, ComGroup, Sepura's Australian partner, won the tender for a TETRA digital system to the remote Gorgon liquefied natural gas (LNG) facility in Western Australia. The project will develop the greater Gorgon area gas fields.

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TETRA Association Forms Broadband Group

By Sandra Wendelken

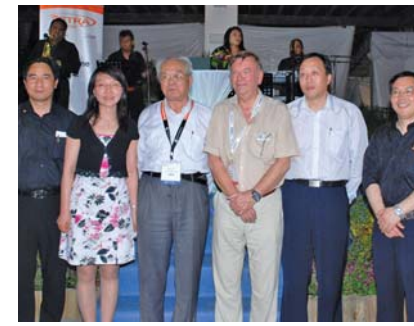
The TETRA Association announced a new mobile broadband working group within the European Telecommunications Standards Institute (ETSI) to establish user requirements for broadband public-safety communications systems. The news follows the launch of the first commercial TETRA Enhanced Data Service (TEDS) products at the TETRA World Congress 24 – 27 May in Singapore.

ETSI working group WG4 will investigate expanding TETRA for broadband with a five-year schedule to complete the work and identify appropriate spectrum, said Motorola's David Chater-Lea, WG4 chair.

He said the group will investigate Long Term Evolution (LTE), WiMAX and other technologies, noting cognitive radio and reconfigurable radio systems will be explored as well.

The group will also look to help solve public-safety spectrum issues in Europe for high-speed data and broadband. Europe doesn't have dedicated high-speed data or broadband spectrum for public safety. The TETRA Association is working with Europe's Public Safety Communications (PSC) to address the issue.

In addition, Jolly Wong, telecommunications engineer for the Hong Kong Police Force (HKPF), was named the TETRA Association's ambassador for Asia. "There was a need for a local expert with technical, regulatory and political experience," said Phil Godfrey, TETRA Association chairman. Wong is an editorial advisor to *RadioResource International*.



Members of the China Trunking Forum

Godfrey presented the outstanding contribution to TETRA award to the China Trunking Forum. Professor Zheng Zuhui accepted the award. The award is presented each year to an individual or group who furthers TETRA technology.

The 2011 TETRA World Congress will be held in Budapest, Hungary, 24 – 26 May. ■

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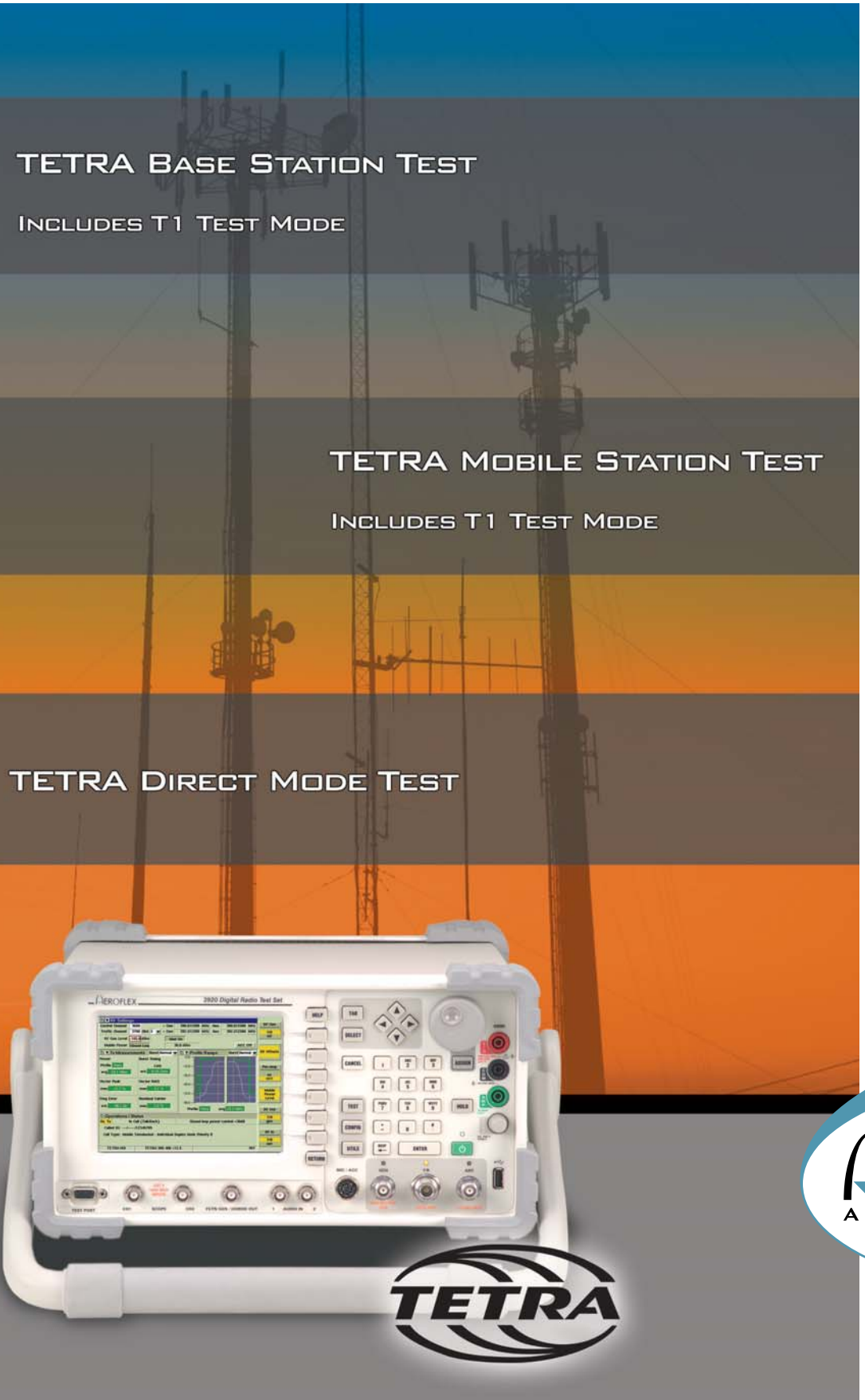

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Repeaters Improve Coverage

Helsingin Energia ensures TETRA communications in underground energy production tunnels.

By Katja Lehtomaa and Tommi Matila

Modern metropolitan cities are filled with underground tunnels, which must have broadcasting services for personal and emergency communications. The capital of Finland, Helsinki, is no exception when it comes to a huge variety of underground tunnels. One of these tunnel networks belongs to Helsingin Energia, one of the largest energy production companies in Finland. The company supplies electric energy to about 400,000 customers in Finland and covers more than 90 percent of the heat demand of the capital city with district heat. Among the services provided by Helsingin Energia are the design, projecting and maintenance of energy production and distribution systems.

In 2009, Helsingin Energia started a project to enhance TETRA network coverage inside a service tunnel in the area of Helsinki. The service tunnel includes district heating pipes and is used by personnel of Helsingin Energia, as well as various service men. To be able to communicate in the kilometers-long underground tunnels, adequate network coverage needs to be assured.

"The district heat pipes are distributed in the tunnels, as well as the network of water supply," says Markus Weiström, who is responsible for the maintenance and installations of the TETRA network. "In these locations, personnel work regularly. The tunnel creates a challenging work environment; in addition, the district heat network can cause threatening situations if a leak occurs in the pipe or valve. In these situations, it is important that the communication works. The HelenNet TETRA network is built to every tunnel of Helsingin Energia to assure safety, as well as to help the communications of personnel in their everyday work."

The tunnels were built in three phases — two tunnels are completed, and the last one will be completed in the third quarter. In the beginning of the project, the tunnel lacked TETRA coverage, causing communications problems. The TETRA network used in the tunnels is called HelenNet, which is operated by Helsingin Energia. Helsingin Energia chose Creowave, a Finnish company specialized in RF and microwave solutions, to build the TETRA coverage to the final tunnel. Creowave has experience in providing solutions to enhance the TETRA network coverage. The company's professional mobile radio (PMR) business offers a variety of TETRA repeaters that allow a cost-effective enhancement of the network.

Network Design

After the quarrying of the tunnels, only a few driving ramps and the service clefts had adequate coverage from the 16 base stations surrounding the tunnels. TETRA coverage was needed to the whole tunnel and to the clefts. The network coverage was planned to a redundant status, which means that a power breakdown or breakdown of one base station won't compromise the entire radio coverage. "We wanted to build the network to redundant status by bringing the signals to the tunnels from different base stations. This increases the reliability of the network," Weiström says.

The requirement set for the power of the network in the tunnels was -85 dBm. The goal was to get the power of the network to exceed the required -85 dBm on 95 percent of the area, allowing the network power to be an average of -75 dBm. The tunnel to be

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> **"We wanted to build the network to redundant status by bringing the signals to the tunnels from different base stations. This increases the reliability of the network."**
>
> — Markus Weiström, Helsingin Energia

covered was about 10 meters in diameter. In addition to the tunnel itself, the coverage was required to 12 clefts upward from the tunnel and in certain open halls.

The coverage for the tunnels was built using five Creowave repeaters, leaky feeders and antennas. The tunnels required three band-selective indoor repeaters and two band- and/or channel-selective hybrid repeaters. The leaky feeders are a good choice for tunnels because in addition to the TETRA signal, GSM signals can be carried on the feeders.

The redundant nature of the network structure defines the positions of the repeaters; there has to be a repeater on the edges of the coverage area. Because of the complex structure of the tunnels, there has to be four edge repeaters. These edge repeaters feed just one leaky feeder to one direction. In addition to the edge repeaters, one repeater is needed for the middle of the coverage area. This repeater usually feeds two feeders heading to different directions. To provide coverage in the service clefts that rise upward from the tunnel, several couplers were used. Couplers "steal" a small amount of the repeater power, and with an antenna, the signal is carried to the clefts. In addition to couplers, splitters were used to split the signal into two different directions.

The five repeaters were installed in five different installation sites. Typically the sites were service clefts, enabling easy access for service and maintenance. In installation sites one, two and four, a good separation between base stations was achieved using directive antennas. This enabled the use of band-selective repeaters, the most cost-effective repeater type.

Installation sites three and five were more challenging. In installation site three, two strong base station signals were discovered. These were the same signals present in installation site two. These unwanted signals couldn't be separated using reasonable-sized directional antennas and acceptable height mast. Similarly, the site four base station signals were strong in installation site five. Additionally, the unwanted base station

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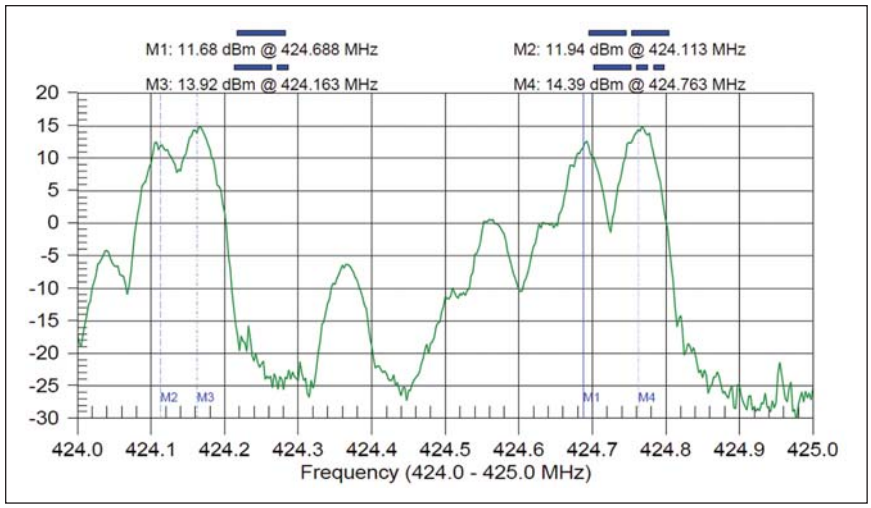

Figure 1: Downlink power spectrum in installation site two when the hybrid repeater is in band-selective mode. The standard 1-megahertz filter is used.

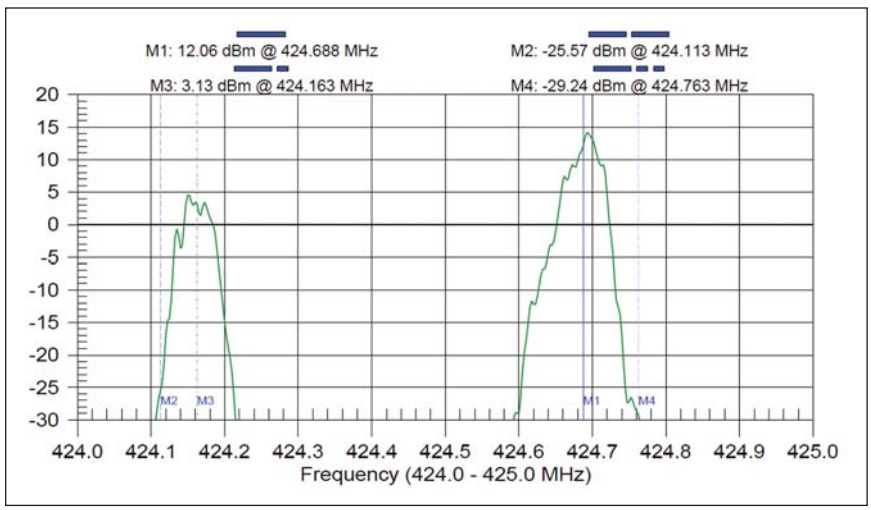

Figure 2: Downlink power spectrum in installation site two when the hybrid repeater is in channel selective mode. The standard 25-kilohertz filter is used to filter unwanted signals.

signals were close in frequency to the wanted signal, making the use of a channel-selective repeater mandatory. In installation site three, the frequency separation was as small as 50 kilohertz. For these reasons, the Creowave hybrid repeater was chosen for these locations.

Filtering Challenges

Because of its filtering challenges, installation site three is investigated in detail. As mentioned, the frequency separation between wanted and unwanted signals was as small as 50 kilohertz. Figures 1 and 2 present the downlink direction power spectrum, measured from the repeater port, normally connected to a leaky feeder network. Figure 1 presents the spectrum, when the hybrid is used in band-selective mode (1 megahertz bandwidth). The wanted channels are M1 and M2. All the other signals are unwanted signals, mainly from several surrounding base stations. In particular, the strong M3 and M4 channels are unwanted, because they are distributed in the tunnels by the installation site two repeater.

The hybrid repeater is equipped with a standard set of filters optimized for both indoor coverage and tunnel use. In a typical indoor, multifloor building, the filters must have relatively small delay to remove the problems in the overlapping areas where a direct signal from the base station and the repeater confront. In Figure 2, the standard 25-kilohertz filters are applied to both wanted carriers (M1 and M2). The figure demonstrates that despite the relatively narrow filters, the unwanted carrier M3 close to carrier M2 is still strong relative to wanted carrier M1.

When building tunnel coverage, however, the small filter delay of standard filters is of less importance because of the isolated structure of the underground tunnel where a direct signal from the base station does not penetrate into the tunnel. Therefore, custom filtering with additional notches on M3 and M4 were designed for this application. Application of this filter results in clean power spectrum; all the interfering signals and TETRA channels are separated by more than 30 dB relative to wanted base station channel M1.

Enhancing the TETRA network coverage in the service tunnels of Helsingin Energia has proceeded as planned. Four of five repeaters are now installed, and the final one will be installed when the tunnel is finished later in 2010. According to the measurements operated in April, the coverage for the finished areas is accomplished according to plan, and the customer is satisfied with the results. The workers of Helsingin Energia and other service men can now communicate in underground tunnels in the challenging environment. “During the tests made in April, we discovered that the coverage enhancement solutions provided by Creowave have succeeded as planned,” Weiström says. ■

Katja Lehtomaa is the marketing assistant of Creowave. She is responsible for the company’s media relations and marketing communications.

Tommi Matila is the chief scientist of Creowave. He received his doctorate degree in 2001 from the University of Oulu. His current research interests include mobile communications systems, digital signal processing (DSP) and radio wave propagation. E-mail comments to katja.lehtomaa@creowave.com.

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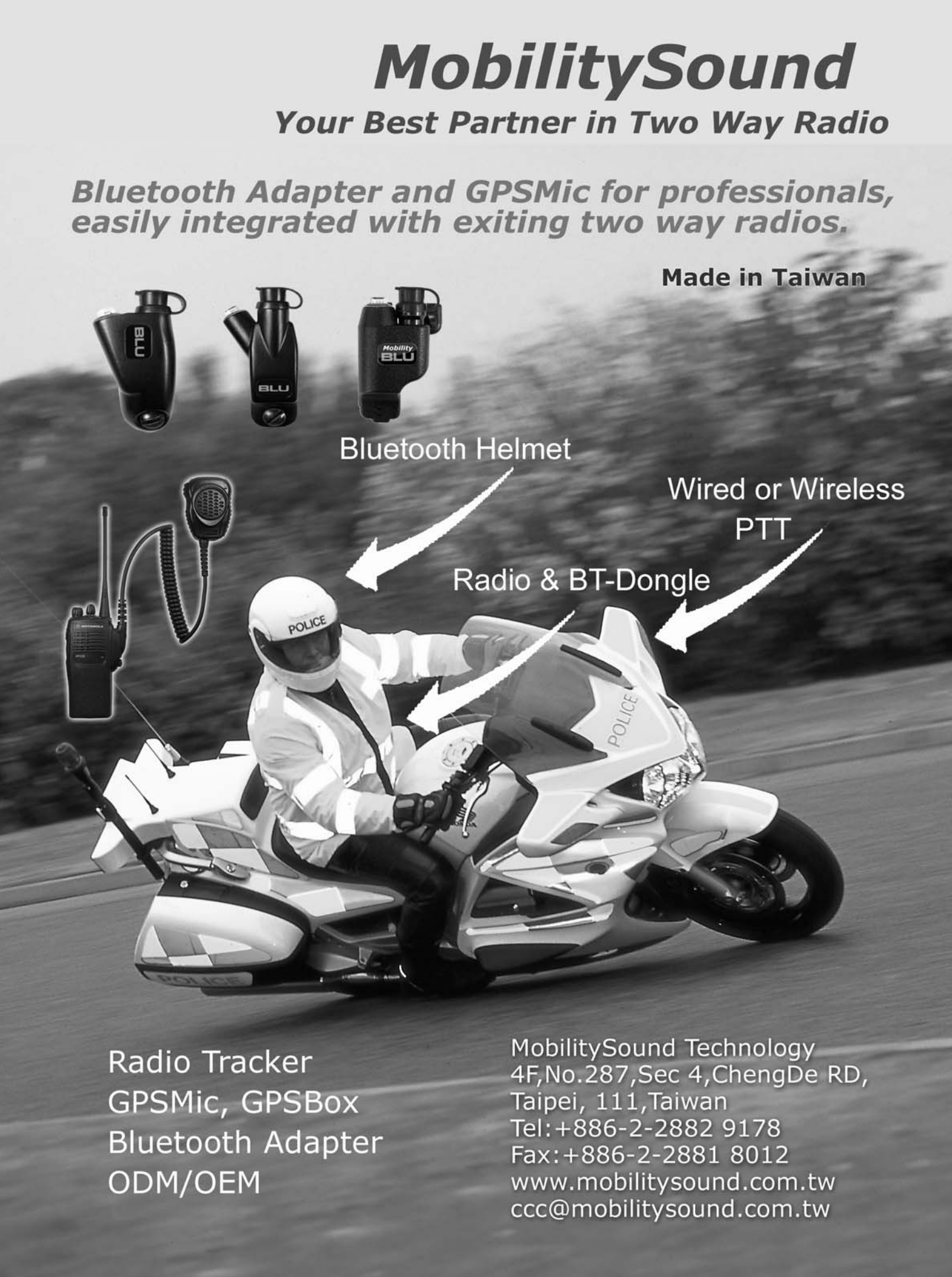

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Photo courtesy Tait Electronics

Your Guide to **Digital**

Before you purchase your next radio system, know the advantages and disadvantages of each technology.

By Tom Mockridge

You have most likely noticed a standards competition in the professional mobile radio (PMR) industry. As different technologies and industry players vie for their share of the digital market, there has been a proliferation of groups promoting different digital technologies and a deluge of marketing material giving the virtues of different approaches. It can be hard to get clarity through the haze created by all this activity, so it is important to have a guide to help you understand the key areas of debate.

There are four widely promoted digital standards, three of which originate from the European Telecommunications Standards Institute (ETSI) in Europe, TETRA, Digital Mobile Radio (DMR) and digital Private Mobile Radio (dPMR), and one standard, Project 25 (P25), developed by the Telecommunications Industry Association (TIA) in the United States. There is also NXDN, a proprietary technology owned by Kenwood and Icom. Each technology is backed by its own trade association. All the protocols have strengths and weaknesses and different market positions. Anyone considering the purchase of a radio system would be wise to understand the advantages and disadvantages of each solution with respect to their short- and long-term needs.

What is clear are the benefits of digital. Compared with analog, digital delivers clarity of voice and better performance at the edge of coverage areas through error correction and signal processing, easier integration with IP-based data applications or external tools such as GPS, and the availability of novel features because of the possibility to manipulate bit streams in innovative ways. Of the five technologies, TETRA and P25 can be considered in a separate category because of their maturity and dominance of the public-safety market segments, and they won't be the focus of the following information.

DMR Details

Outside of the high-tier trunked market segments, the DMR community claims it is the most widely adopted digital standard with deployments in more than 100 countries and more than 450,000 radios sold. The DMR Association announced in May the successful completion of the first formal interoperability testing session between vendors. Until recently, there were only three radio manufacturers — Selex Communications, Radio Activity and Motorola — with DMR products in the market, but this is changing rapidly.

Hytera launched DMR-compliant products at the International Wireless Communications Expo (IWCE) in Las Vegas in March, and Tait, Team Simoco, Sepura and Vertex Standard have all announced upcoming DMR models in a mixture of conventional and trunked formats. German rail radio specialist Funkwerk Koelleda is committed to DMR, and Chinese maker Kirisun Electronics has publicly discussed launching a DMR radio in 2010.

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DMR is plug and play with respect to existing 12.5-kilohertz licenses while at the same time doubling the capacity of existing systems.

DMR's main advantages are that it is plug and play with respect to existing 12.5-kilohertz licenses while at the same time doubling the capacity of existing systems through the use of two-slot TDMA technology. This effectively splits a license holder's existing channels into two communications paths while maintaining the same channel profile as a legacy 12.5-kilohertz analog system. Maintaining the channel profile also enables a smooth migration path and happy co-existence of legacy analog and new digital radios because the spectrum needs of the two types of radios are identical. Of the other digital standards, only P25 can claim a similar feature.

DMR is also plug and play with respect to infrastructure; old analog repeaters are removed and new digital ones installed. Doubling the capacity of a system is particularly helpful because user needs are increasingly driven by capacity-hungry data applications as well as traditional voice services.

When only one channel is needed, DMR is less spectrally efficient than a 6.25-kilohertz FDMA-based system, and this can be a disadvantage in a low-end system, depending on the licensing regime. Two DMR manufacturers are supplying simulcast DMR solutions, which can deliver spectral efficiency in multi-site implementations. Another criticism of DMR is that repeaters are needed to coordinate time slots to give two communications paths in a channel. This means in direct mode operation, when there is no repeater for coordination, a 12.5-kilohertz channel can only give one path — less efficient than 6.25-kilohertz FDMA. However, DMR is being deployed in more sophisticated systems, and the repeaters needed for time slot coordination are in place.

DMR manufacturers also state that TDMA delivers longer battery life. Many factors, such as power management wizardry in radio software, impact battery life but for a given power of transmission, DMR radios transmit for 50 percent of the time of an FDMA radio for a given transmission of bits. The best advice is to make sure you read the product

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literature and carefully compare the battery capacity of the devices.

FDMA-Based Digital Options

dPMR and NXDN both use 6.25-kilohertz FDMA as the underlying technology, but the protocols are not the same or interoperable. These ultra-narrowband technologies both have their origins in a Japanese standard, digital Kan-i, which also uses FDMA in 6.25-kilohertz channels. Digital Kan-i is a low-tier technology optimized for use without infrastructure in a spectrum-scarce environment. The strengths and weaknesses of dPMR and NXDN as technologies can be traced back to these origins.

Using 6.25-kilohertz channels provides efficient use of spectrum where a user does not have any infrastructure or only needs one channel. In these cases, a user needs only 6.25-kilohertz of bandwidth to set up a communications path. Also, the narrow channel width means less noise in the channel, which can provide greater range for a given transmit power because there is less background noise for the signal to contend with. These are useful characteristics for simple, low-power communications systems. Extending 6.25-kilohertz FDMA into high-power systems can bring drawbacks, however.

When 6.25-kilohertz FDMA systems are used with high power and in multichannel systems, separate infrastructure (repeaters/base stations) is required for each channel, and the problem of oscillator drift needs to be overcome. Drift is the phenomenon whereby all oscillators move from the desired center frequency over time. In ultra-narrowband high-power systems, this can lead to link degradation without the use of specialist equipment. Such equipment is available but adds cost to a system.

Critics of 6.25-kilohertz FDMA systems also argue that licensing regimes around the world are not always 6.25-kilohertz friendly. The licensing picture is certainly variable from country to country. Some jurisdictions have dedicated 6.25-kilohertz channels available, but many do not, and some countries allow two 6.25-kilohertz channels in an existing 12.5-kilohertz license, but some regulators do not. Buyers should make sure they have a detailed understanding of what is possible in their territories.

Photo courtesy Selex Communications

Narrow channel widths offer less noise, providing greater range for a given transmit power.

Turning to the availability of 6.25-kilohertz FDMA equipment itself, dPMR and to a lesser extent NXDN are impacted because they are the most recently developed protocols. There are no vendors of high-power dPMR and, to date, there is only one vendor of low-power dPMR for unlicensed use, Icom. So in market terms, the standard is not deployed yet. NXDN products are available around the world, and Kenwood and Icom are the significant global vendors. No other major vendors have chosen to support NXDN, and it remains outside the standardization process. This proprietary nature of NXDN may influence some buyers' choices.

The debate about the relative range of 12.5-kilohertz TDMA and 6.25-kilohertz FDMA systems has an interesting historical precedent. TETRA is now clearly dominant in European public-safety applications, but a competing technology, Tetrapol, is also used in some countries. Tetrapol is a 12.5-kilohertz FDMA system, and in the early days of digital European public-safety radios, there were arguments that Tetrapol delivered better range than TETRA because it used narrower bandwidth channels and therefore had a lower noise floor. In the end, TETRA has prevailed in the market as the benefits of the TETRA TDMA approach outweighed any coverage benefits of Tetrapol. The fact that TETRA was standards based and offered the market a range of devices and interoperability between manufacturers also had a significant impact.

Buyer Needs

So what does all this diversity mean? Those who seek a unified digital radio standard — similar to those who search for a theory of everything in physics — may be disappointed for some time. But in the world of PMR, perhaps this is not a bad thing. Users have the choice and will determine the future direction of the technology rather than having one imposed upon them. A trick for the buyer will be not to get left behind in an evolutionary cul-de-sac when the final technical direction, or directions, of the industry become clear.

So, as usual, define what you need: What is essential and mandatory; what would be nice to have and what is irrelevant? Balance your nice-to-haves against each other and create a scoring table. Your needs definition should be broad — it should cover functions and features, level of competition, need for many different terminals or a need to have one supplier responsible for all. ■

Tom Mockridge is chairman of the DMR Association technical working group and currently DMR industry relations director at Motorola. Mockridge has also held roles in Motorola networks and mobile devices businesses since joining the company in 2004. Prior to Motorola, he worked for multinational telecommunications service providers, iPass and Global One and in U.K. telecommunications regulation. E-mail comments to tom.mockridge@dmrassociation.org.

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5 Benefits of P25

Agencies worldwide are deploying the U.S.-based public-safety communications standard because of these features. **By John Muench**

The Project 25 (P25) standard has traditionally been associated with the North American region, but during the past several years there has been significant growth in its adoption internationally, and continued growth is expected into the future. This international growth can be attributed to the flexibility of the standard in the areas of coverage, conventional and trunked operation, and interoperability. The attributes are in addition to the spectral efficiency and multivendor sourcing that the P25 standard enables.

1. Coverage vs. Cost

Coverage that is cost effective is a key factor driving international agencies to P25 networks. Many international agencies require large geographic coverage areas to which P25 is well suited. High-power operation allows large areas to be covered with fewer transmitter sites than other technologies, making P25 technology an economical and efficient choice for these environments. Additionally, simulcast operation allows agencies in more urban, dense environments to reuse scarce frequencies and increase coverage penetration within a given area.

2. Conventional and Trunked Operation

P25 offers the flexibility of both trunked and conventional operation. Some international users have needs for smaller, cost-effective or large, low-density communications systems that conventional operation satisfies, while other international users need the efficiencies of trunked systems.

3. Interoperability

The most widely deployed P25 interface in the industry is the Common Air Interface (CAI), which specifies the type and content of signals transmitted between radios or between a radio and infrastructure over the air. The CAI is the foundation of the P25 standard and allows multiple manufacturers' equipment to interoperate. In addition, manufacturers across the industry have demonstrated interoperability through interoperability events focused on testing one supplier's infrastructure with other subscriber manufacturers' subscriber products.

Many international customers have an increased need to communicate across borders or organizations within a city, county or country. The Inter Subsystem Interface (ISSI) is a wireline interface specified by the P25 standard. The ISSI allows users to roam from one network to another network, have encrypted communications across the networks, and permits roamers to talk back with their home users. This interface is commercially available in the industry. Multiple manufacturers have demonstrated this capability at numerous trade shows. Interoperability testing was conducted most recently in March; the tests demonstrated successful interoperable communications between the Motorola ISSI.1 network gateway and ISSI gateways from PlantCML-EADS, Etherstack, Harris Public Safety and Professional Communications, PowerTrunk and Raytheon.

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P25 Leads the Market in Australia

Australia is an extremely large land mass; it is the sixth-largest country in the world with more than 7.6 million square kilometers and an estimated 22.4 million population, equating to a density of about 2.8 people per square kilometer. The majority of the population lives along the coastal areas of Australia, making the need for communications large in those urban areas. Trunked technology lends itself well in this case. However, state governments also have responsibility across many other parts of the state that are sparsely populated, so conventional radio technology is the most economical choice for cash-strapped state treasuries.

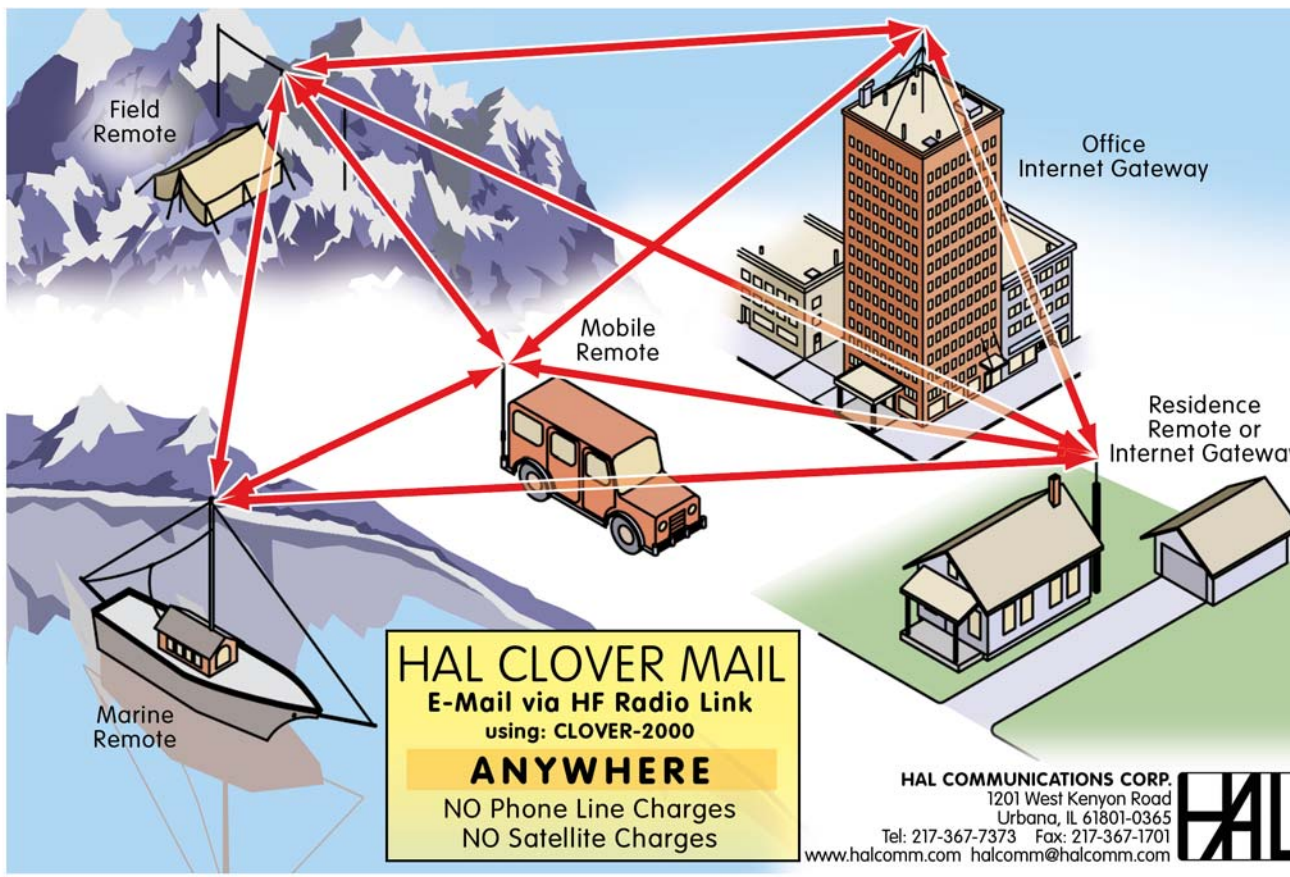
Project 25 (P25) is the most dominant digital technology used in Australia and is now widely deployed by both federal and state agencies. An ever-increasing demand for voice and data services is pushing other users to consider upgrading their services. State-based emergency services, defense, utilities, mining companies and couriers are still the main P25 users, however, some users are not able to migrate to new technologies because of the lack of spectrum.

Sydney Airport in Australia

In 2009, Frequentis delivered a P25 communications system for the Department of Parliamentary Services (DPS) in the Australian capital, Canberra. Fujitsu is the prime contractor to DPS, which supports the work of the Federal Parliament in Canberra. With a staff of about 800, DPS is the principal support agency for Parliament House, a building where more than 3,500 people work and that counts 1 million visitors every year. Failsafe communications is crucial to guarantee the security of staff and visitors.

Other P25 systems currently deployed include:

- Australian Customs Service
- Air Services Australia (airport fire upgrades)
- Melbourne Metropolitan radio (a recent upgrade for emergency services)
- New South Wales (NSW) government radio network (for emergency and other services)
- NSW Police Force
- WA Police (a new system under construction)
- Northern Territory Police (a new system)



More Information

Project P25 Interest Group
www.project25.org

efficiency with P25 Phase 1 FDMA technology for many countries that are narrowbanding — moving from 25- to 12.5-kilohertz channels — and Phase 2 TDMA that adds greater value while operating in a 12.5-kilohertz bandwidth. P25 Phase 2 TDMA provides two time slots in a 12.5-kilohertz channel, which now means that P25 is spectrally equivalent to four times slots in a 25-kilohertz channel.

However, because the channels are split — one 25-kilohertz channel into two 12.5-kilohertz channels —more frequencies can be deployed as well, which is a benefit to the overall mobile user base. Additionally, P25 Phase 1, P25 Phase 2 and analog all use 12.5-kilohertz bandwidth, enabling users to keep existing bandwidth and frequencies as they migrate from one of these technologies to another.

5. Multivendor Sourcing

The ability to procure P25 equipment from multiple vendors is critical to many government agencies and businesses around the world. More than 25 equipment manufacturers and service providers offer a wide portfolio of P25 products and services. The diverse portfolio of equipment is available in multiple frequency bands — VHF, UHF and 700/800 MHz — offering users around the world choices in system design. In addition, multiband radios, enhancing interoperability, recently became available.

The flexibility of P25 continues to drive worldwide growth of the standard by meeting the diverse needs of a multitude of users from small towns to countrywide systems and urban cities to rural wide areas. With a variety of equipment in the major land mobile frequency bands, P25 is an attractive choice for organizations around the world. ■

Countries with P25 Systems

Angola	Kenya
Argentina	Kurdistan
Australia	Kuwait
Bahamas	Latvia
Brazil	Malaysia
Canada	Mexico
Chile	Nigeria
Colombia	Russia
Costa Rica	Trinidad y Tobago
Ecuador	United States
India	Venezuela

Source: Motorola

John Muench is the director of business development as it relates to worldwide standards activities associated with government, public-safety and mission-critical products developed within the enterprise mobility solutions group for Motorola. E-mail comments to editor@RRMediaGroup.com.

Product Expo: Base Stations and Repeaters

Alligator Communications

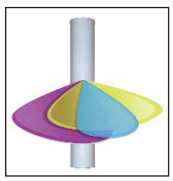
Alligator's Common-Time-Base feature, GatorTrac, ensures zero frequency offset to a radio network, providing a consistent

optimum bit error rate (BER) performance. A single adjustment of the master radio's frequency module collectively calibrates the complete master station radio and all associated remote station radios, company officials said. Global calibration is automatically performed while the supervisory control and data acquisition (SCADA) system is polling without imposing system down time, officials said.

www.alligatorcom.com

Andrew Solutions

Andrew Solutions offers three types of SmartBeam base station antennas, providing enhanced optimization options as well



as capacity efficiency through load balancing, company officials said. The antennas increase capacity efficiency of existing sites and equipment by redirecting the beam based on predictable customer traffic load, officials said. Dynamic load balancing covers traffic peaks. Adjustments include remote tilting, panning and fanning.

www.commscope.com/andrew

Axell Wireless

Channel selective digital repeater CSR438 features patented software defined radio (SDR) technology that allows standard

surface acoustic wave (SAW) filters to be replaced by digital ones. The concept offers higher performance and flexibility, making it possible to add enhanced functionality by downloading new software to the product, Axell executives said. The repeater offers remote channel and filter configuration and alarm monitoring, allowing a choice between low delay and high selectivity. The product expands a base station's area by filling in coverage holes caused by terrain, buildings or tunnels.

www.axellwireless.com

CalAmp

The Sentry 4G-900 pico base station is a secure long-range wireless platform based

on IEEE 802.16e-2005 (mobile WiMAX) technology. The single-sector, lightweight base station features a ruggedized enclosure ideal for all-outdoor installations, and provides connectivity to fixed and mobile endpoints. Connected via a single Power over Ethernet (PoE) connection, the base station reduces operational cost and complexity, CalAmp executives said. With orthogonal frequency division multiple access (OFDMA) radio technology, it's robust in adverse channel conditions and enables non-line-of-sight (NLOS) operation, executives said. Leveraging link adaptation algorithms, modulation and coding are continuously adjusted to prevailing link conditions.

www.calamp.com

Comsystems

The MICOM-Z HF-SSB base station features automatic selection of multiple signaling standards. Other features include up to

1,000 automatic link establishment (ALE) nets or channels with phonebook index style calling and digital signal processing (DSP) for audio clarity. The base station is simple to use and easy to maintain, making it a cost-effective radio package with flexible field mounting capabilities, Comsystems officials said.

www.comsystems.com

Creowave

Creowave provides band and channel-selective repeaters for indoor/outdoor areas

as well for hazardous areas with ATEX-certified TETRA repeaters. The newest addition is TETRA Highpower Repeater, which features a high RF output, enabling the handling of more challenging coverage cases, company officials said. Typical installation sites for the TETRA repeater are large, open indoor and outdoor areas.

www.creowave.com

Damm Cellular Systems

BS421 outdoor base station can be installed with up to four carriers at one site, and BS41x indoor base station can be installed with up to 16 carriers. Designed

for a fully distributed IP solution, scalable from single- to large-multisite networks, the base station is integrated with LogServer, dispatcher and network management, and with internal GPS receiver. BS421 can be mounted direct in the mast close to the antennas, providing full, dual receive (RX) diversity, and features a built-in duplex filter with an output power to the antenna up to 10 watts.

www.damm.dk

Daniels Electronics

Daniels Electronics analog and Project 25 (P25) base stations and repeaters are available with power output levels from 2 to 200

watts in the following bands: analog low band (29 – 50 MHz), VHF (136 – 174 MHz), UHF (380 – 520 MHz) and 700/800 MHz. The base stations and repeaters can operate in analog, P25 or mixed mode, with mixed mode retransmitting in whatever mode it is received. In P25 digital mode, the repeater will pass clear and secure (encrypted) P25 digital information; the base station will pass the P25 information digitally to a console via the P25 fixed station interface.

www.danelec.com

Decibel Engineering

Decibel Engineering introduced a new COFDM portable transmitter and receiver for covert surveillance. COFDM provides performance in difficult multipath propagation environments encountered in urban areas and over water, Decibel officials said. The TPX transmitter may be carried in a pocket or in a purpose-designed

harness. The RMP receiver features an air interface based on digital video broadcasting-terrestrial (DVB-T). The product range is designed for mobile, airborne and maritime deployments, which may also provide repeater facilities.
www.decibelengineering.com

EADS Defence & Security

The TB3 series TETRA base stations are ready for TETRA Enhanced Data Services (TEDS) and available in the 350, 380, 410, 450 and 800 MHz bands. In addition to coverage, the line helps reduce operating costs with remote operation and maintenance, EADS executives said. Also included is readiness for IP-based transmission, which allows for advanced and flexible redundancy and disaster recovery schemes. The base stations are about 20 percent less power hungry than previous base stations, executives said.

www.eads.com

Fiplex Communications

Fiplex Compact Repeaters for TETRA and Project 25 (P25) applications increase indoor/outdoor coverage of systems, providing extended coverage with minimum infrastructure investment. Typical applications include tunnels, subways, stadiums and airports. Over-the-air and fiber feed versions are available. Low- and high-output power, band selective and channel selective with out-of-band rejection meet all FCC and ETSI regulations. A compact repeater line is also available for numberous frequencies and applications.

www.fiplex.com

Harris Public Safety and Professional Communications (PSPC)

The VRS7010 cross-band vehicular

repeater is an all-in-one mobile radio and vehicular repeater that ensures law enforcement officials have operational flexibility and reliable communications while traveling through areas with different radio frequencies, Harris executives said. The repeater retransmits and extends weak or low-level signals to reduce signal degradation in

areas where coverage is spotty or the terrain varies. When operating as a mobile radio, the repeater communicates on Project 25 (P25) trunked and conventional radio systems in the 700 and 800 MHz bands. In addition to the P25 standard, the repeater complies with several national and international technical standards, executives said.
www.pspc.harris.com

Hytera Communications

The RD982 digital repeater can operate in analog or digital modes. The repeater can support 100 percent duty cycle at 50

watts. The heat sink and cooler fan ensure stable operation at high power. The product is ideal for mounting in a rack, bracket or cabinet, and can be placed on a desktop. Full LED indicators and a large high-definition color display provide visibility for vital radio information.
www.hytera.us

Icom Japan

Icom's IC-FR5000 series is a 50-watt FM and IDAS digital dual-mode repeater for VHF/UHF bands with 25-watt versions also available. The repeater has an IDAS conventional IP networking capability that links up to 16 IDAS repeaters via an IP network and a single-site IDAS trunking

capability. The unit comes in a two-unit height 19-inch rack mount design. In addition, the RC-FS10 remote communicator creates an IP-based virtual radio on a PC and can use the repeater series as an IDAS conventional base station from a remote location via an IP network.
www.icom.co.jp/world/idas

Kenwood Communications

Two NEXEDGE digital base/repeaters, the VHF NXR-710 and UHF NXR-810, offer distinct benefits over analog, including

increased coverage, advanced voice audio, secure calling features, GPS location and a soft migration path from analog systems, Kenwood executives said. The NXR-710 (25/50 watt) and NXR-810 (25/40 watt) operate multimode in digital NXDN 6.25 kilohertz or analog 12.5 kilohertz.
http://nexedge.kenwood.com

Midian Electronics

Midian Electronics released the IS-1 interoperability switch and cross-band repeater maker. The IS-1 features two ports to interoperate two different radio systems. For example, a VHF Project 25 (P25) radio system can interoperate with a conventional UHF system, or a high frequency (HF) SSB radio system can interoperate with a conventional VHF radio system. The switch features an enable/disable option for disabling the switch when interoperability isn't desired using DTMF, five-, two- or pulse-tone signaling. The switch can operate off an internal battery power or external power from a radio or a wall adaptor. Preconfigured cables for some radios are also available.

www.midians.com

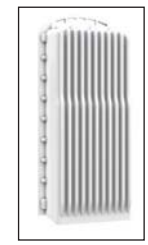
Midland Radio

Midland's 700 and 800 base stations/repeaters are 100 percent continuous duty (up to 100 watts transmit output power) and provide a remote site operation reliability rate greater than 0.991 percent, company officials said. The stations offer a 500-channel capacity, are programmable by channel for digital, conventional modulation or mix mode, and are programmable by channel for base station or repeater operation. Options include Digital Fixed Station

Interface (DFSI), channel steering and remote site monitoring. IP phone, tone remote interface and data encryption standard/advanced encryption standard (DES/AES) encryption are available. Midland also offers conventional Base Tech II analog-only low band and VHF/UHF models from 50 to 110 watts continuous duty transmit power.
www.midlandradio.com

Motorola

The MTS1 TETRA Enhanced Data Services (TEDS)-ready base station is ideal for indoor and outdoor coverage applications



that feature IP66 water resistance and wall- and pole-mounting installation options. The MTS4E is a multiband TETRA base station that can support TEDS and was designed to maximize network capacity for operators with access to multiple frequency bands. The product provides support for E1, IP-over-Ethernet and multiprotocol label switching (MPLS) and includes eTETRA functionality, allowing support for base radios operating in multiple frequency bands using the same control channel.
www.motorola.com

Niros Communications

The BSX3000 outdoor base station and repeater is designed for ease of deployment, Niros executives said. The IP-rated enclosure houses the duplex radio equipment, duplexer and power supplies. In addi-

tion to wall mounting, the die-cast painted enclosure is molded to allow the unit to be mounted directly to an antenna pole or structure. With all the usual tone signaling options, the base station version can be further enhanced with VoIP functionality.
www.niros.com

Powerwave Technologies

Powerwave's Nexus FT repeaters for

distributed antenna systems (DAS) were designed for subways, airports, commercial and government buildings, shopping malls, stadiums, and other large indoor/outdoor venues. The units support all frequencies, are easy to install, and support multicarrier and multiband operation. The repeaters offer high-capacity and long-reach fiber-optic distribution and support deployment up to 24 kilometers from an existing base station hotel, extending the coverage area of that station while eliminating the need to install additional macro cell sites to cover larger geographic regions.

www.powerwave.com

RF Neulink

The NL6000 digital radio modem operates at 12 kilobits per second (kbps) and is configurable to operate wireless telemetry and mobile data. Transmit power adjustability from 1 to 6 watts allows for mobile and fixed operations. Power requirements are from 11 to 16 VDC. The product can be programmed as a base (host), remote or a repeater. A remote may function as both remote/repeater as needed.

www.rfneulink.com

Rohill Engineering

The Rohill Base Station System (BSS4) is a compact base station solution for up to four TETRA transceivers. The modular system can be deployed for any base station application. The RF performance and robust protection against high signal interference offers unmatched coverage and quality of service, Rohill executives said. The highly power-efficient design reduces power consumption, heat dissipation and system costs, executives said. The system is available for frequencies ranging from 350 to 470 MHz, as well as 800 MHz, and is supplied as an optimized 19-inch rack enclosure with passive cooling for highest system reliability.

www.rohill.com

Sonik Messaging Systems

Sonik's PTX-150 base station and Wireless Messaging Base Station (WMBS) are designed for continuous duty simulcast applications and offer 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. Sonik uses Zetron controllers and paging terminals in turnkey systems.

www.sonik.com

Spectra Engineering

The MX800 repeater includes a new data repeat capability (option T83), which is compliant with the Project 25 (P25) standard. Data transmitted from P25 mobiles and portables can be transparently repeated over the air without any additional external hardware. The T83 option will auto detect mixed modes of data packets, digital voice or analog voice signals. RF capabilities of the transmitter have been expanded with 100 watts of power now available in bands from 30 to 900 MHz while still using the original 2 rack unit (2RU) size case.

www.spectraeng.com.au

Swissphone Telecom

The ITC2100 is a paging base station that transmits and receives digital POCSAG messages in a radio network system, and can be used to set up a synchronous radio paging network. The base station receives the POCSAG message from another base station either via satellite, IP cable or radio. Multiple base stations can transmit synchronous paging messages, allowing rapid coverage of large areas, company officials said. The base stations can also be monitored and configured remotely.

www.swissphone.com

Tait Electronics

Tait's Project 25 (P25) simulcast solution is now available with P25 Compliance Assessment Program (CAP)-tested TB9100 base stations. The licensable software features simulcast controller, centralized voting and IP functionality built into the base station, eliminating the need for additional external equipment or a prime site. The built-in functionality reduces capital costs because less equipment is required from the outset and upgrades can be managed without visiting the site. With Tait's P25 simulcast solution, several sites can be used as a central voter to reduce the risk of network failure.

www.taitworld.com

3T Communications

The eXTRAS release is a TETRA radio infrastructure with full IP-backbone capability. Features include scalable redundancy, full VoIP capability and easy interfacing to existing systems, company officials said. A distributed database enables fast call setup and features fallback mode. Subscriber management allows multiple agencies to manage their terminals in the network, so the administrator can grant air interface resources to user groups exclusively (virtual private networks). Interoperability with all major TETRA terminals is granted, officials said.

www.3t-ag.com

Vertex Standard

The BSC-5000 base station is specifically designed for use with the VX-5500 or VX-600 mobile radios to provide users more options in bands and power ranges. The base station features 30 amperes DC power suppler, 12-watt speaker for clear audio sound and 25-pin accessory port connector.

www.vertexstandard.com

New Products

TEDS Radio and TETRA Enhancements

EADS Defence & Security introduced a TETRA Enhanced Data Service (TEDS) data radio designed for vehicle, office or integrated use. The data radio provides connectivity with direct IP via Ethernet and standard USB; and for traditional use, input and output lines and serial port

connections are available. The radio offers integrated GPS with high-speed location-based services such as transmission of maps with real-time updated position information. The radio was designed for easy connection between a vehicle computer or IP camera directly to the TETRA radio.

EADS also enhanced the DXT3 switch and TB3 base station. The switch supports both IP and E1 connections, and a DXT3-based network can feature simultaneous IP and E1 connectivity. The base station features a dual homing capability that can be connected to two switches at the same time.

The company also presented a compact, mobile secure high-speed Tetrapol radio communications prototype, which is part of the Milicor mobile military IP radio communications line. The network combines Tetrapol and high-speed technologies to provide voice and data communications in temporary fields of operation and to connect high-speed data transfer applications.

www.eads.com/pmr

TEDS Radio and Software

Motorola's MTM5400 is a next-generation TETRA radio that includes TETRA Enhanced Data Service (TEDS) and

advanced local networking capabilities, and enables over-the-air programming. The radio provides extended coverage, improved audio performance and high-speed data connectivity, with an increase in data throughput of at least 20 times to back-office systems and remote databases, Motorola executives said. The radio includes an integrated repeater/gateway function and a 10-watt transmission power capability.

Motorola also launched the Dimetra 7.1 software platform that provides simplified, high-speed access to data, improved network security with end-to-end encrypted logging and playback, and flexible network capacity and coverage. The software supports TEDS wide-scale deployments of data applications and secure, high-speed connectivity for existing data applications.

www.motorola.com

Portable Radio

The new Blackbox+ Series professional two-way radio from **Klein Electronics** features a compact design with all-metal

chassis. The UHF/VHF 16-channel radio features scan, priority scan, IP54 water resistance, two-tone encode/decode, software-enabled voice operated transmit (VOX), voice enunciation for each channel and a Li-ion battery. The radio now features louder sound and noise cancellation, Klein executives said.

www.blackboxradios.com

Portable Satellite System

VT iDirect launched ReadyConnect, a portable emergency response satellite communications system for deployment in the Pacific region. The system is an off-the-shelf, fully mobile communications system designed to provide immediate, reliable access to VoIP, broadband Internet and other applications during natural disasters. The system supports operation of multiple bandwidth-intensive applications and includes all necessary hardware, bandwidth, support and training. The kit includes an iDirect satellite modem, telephony interface, VoIP Ethernet switch, backup power supply/conditioners, built-in wireless access point and quick-deploy antenna.

www.idirect.net

TETRA Radio, Gateway

The STP8200 hand-portable TETRA

radio from **Sepura** combines essential TETRA and private mobile radio (PMR) features with a simple, rugged and high-performance design for the public-safety market. The radio features a streamlined user interface and a monochrome display visible under all lighting conditions. The radio is available with blue, yellow and red bezels, offers high standards of water and dust resistance, and features 1.8 watts RF power for extended coverage.

Sepura also introduced the SRG3900 TETRA gateway repeater radio that includes dual console support and 10 watts RF power. The Sepura Colour Console (SCC) complements the radio and features a large high-resolution color screen. The company also expanded its portfolio of STP hand-portable audio accessories and motorcycle kits.

www.sepura.com

Data Radio Modem

The ME-D200 data radio modem from **Mobile Expertise** features 1 – 5 watts RF output power in the 146 – 174 and 400 – 480 MHz bands. The small, flexible

radio transceiver is CE approved and can operate over a wide temperature range. With a solid die-cast aluminum construction, the transceiver is fit for mobile and static environments. PC programming enables squelch control, transmit and receive only, and new power-saving modes, company officials said. The transceiver is ideal for telemetry systems, remote monitoring and repeaters. The product can support 1.2 to 9.6 kilobits per second (kbps) data rates via optional modules.

www.mobile-expertise.co.uk

UHF/VHF Transceivers

The RG-450ST series UHF/VHF transceivers from **The Regal Group** are designed to be compatible with the SmarTrunk II digital trunking protocol.

With up to eight zones and 196-channel capability, the feature-rich transceivers are optimized for trunking and conventional operation, company officials said. The transceivers are available in full keypad and nonkeypad models.
www.szrg2003.com

Data and Telemetry Interface

KonekTel, a MOTOTRBO application partner of Motorola, developed the IFMI1 transparent data and telemetry interface

that can be used for a number of data applications in any MOTOTRBO radio network. The modem provides the following interfaces and general purpose input/outputs (GPIOs): two RS-232 interfaces, Ethernet 10/100 M interface, one digital output, two digital inputs and diagnostic LEDs.
www.konektel.cz

Audio Network Interface

MiMOMax Wireless released the 4 Wire Audio Network Interface Box (4WA NIB) that provides six channels of four wire VF with ear and mouth signaling on a 25-kilohertz channel. The interface supports

site monitoring and intersite communications via an RS-232 async serial connection with a maximum raw data rate of 192 kilobits per second (kbps). The product uses a G726 32 kbps ADPCM vocoder that provides low latency, toll quality and tone transparent audio paths.
www.mimomax.com

Data QAM Modem

CML Microcircuits launched the CMX7163 wireless data quadrature amplitude modulation (QAM) modem IC. The modem provides 4/16/64-QAM baseband modem functions in a single chip and features high dynamic range analog signal capturing, digital baseband filters, auxiliary codecs, clock generator and input/output (I/O) functions. Designed for narrowband applications, the chip works with machine-to-machine systems over dedicated channels, digital software-defined radio (SDR), high-speed wireless data, and supervisory control and data acquisition (SCADA). The half-duplex device is suitable for 6.25-, 12.5- and 25-kilohertz bandwidths and features channel estimation and equalization.

www.cmlmicro.com

Radio Semiconductors

Mitsubishi Electric announced two 12.5-volt high-power metal oxide semicon-

Midian's **NEW** Voice Scrambler

Midian's new VS-1200 is a DSP based FFT Frequency Domain voice scrambler offering a high level of voice security. This technology is comparable in security to rolling code scrambling, but doesn't require synchronization.

This type of encryption and the lack of synchronization result in excellent audio quality, high security and enable the VS-1200 to be used in virtually any type of radio system. These systems include Conventional two-way, HF SSB, Trunking, and Voting.

The VS-1000 (inversion scrambler) and VS-1050 (inversion scrambler with ANI) are also available.

Benefits of the VS-1200 include:

- 3 user-programmable levels of security
- No synchronization
- Programmable gain controls for audio levels
- ANI in Motorola's MDC-1200, Kenwood's FleetSync, DTMF, 5-Tone & Harris' G-Star
- Plug-in versions for Kenwood, Motorola & Vertex Versions for HYT, Icom, & Tait are coming soon

email: sales@midians.com • website: www.midians.com • phone: 1-800-643-4267 • 520.884.7981

ductor field effect transistor (MOSFET) models. The products are designed for high-frequency power amplifier devices in commercial two-way radios for 25- and 50-watt grade power transmission applications. Both models are available in VHF and UHF bands, and conform to surface mount technology requirements.
http://global.mitsubishielectric.com

Receiver Antenna

The radio clock antenna RCA-ROD series from **PREMO** is an antenna for synchronized clocks and ripple control such as traffic switching, public lighting control and smart metering that consists into a parallel resonant tank. The ferrite core standard dimensions are 10 by 40 millimeters, with other dimensions available on request. The antenna can be set and tuned in different frequencies from 40 to 139 kilohertz for clock applications and power control and management applications. The long-wave transmitters use frequency shift keying (FSK) modulation with frequency precision of ±107 hertz and signal speed of 200 Bd.

www.grupopremo.com

Electrical Switch Knobs

Elma Electronic offers bell-shaped knobs for electronic switches in the 3, 6, 9 and 12 o'clock indicating positions. The bell-shaped design comes in hard or soft touch finishes and employs a two-shot injection design. The knobs accept standard pan-European D-shape for 6-millimeter shafts with a 4.5-millimeter flat. Regardless of the orientation of the D-shaped end, the indicator lines or dots come in the four position options and are available in blue, white or custom colors.

www.elma.com

Filter

Temwell's Four Tuning Helical Band-Pass Filter satisfies high attenuation, broadband needs with an insertion loss of less than 2 dB and group delay of less than 20 – 40 nano-seconds. The filter is ideal for digital-mixer RF/IF conversions, multipoint distribution system (MDS), mine communications, Project 25 (P25) and data applications of two-way radios. The company can install the filter into module filter, and offers SMA, N and F connectors.

www.temwell.com.tw

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www.PMRExpo.com

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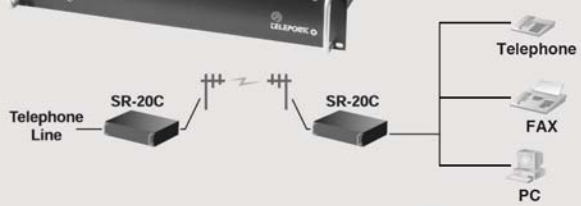

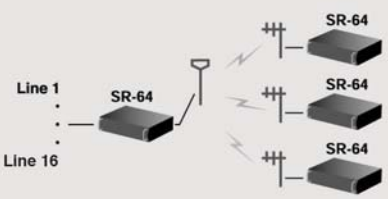

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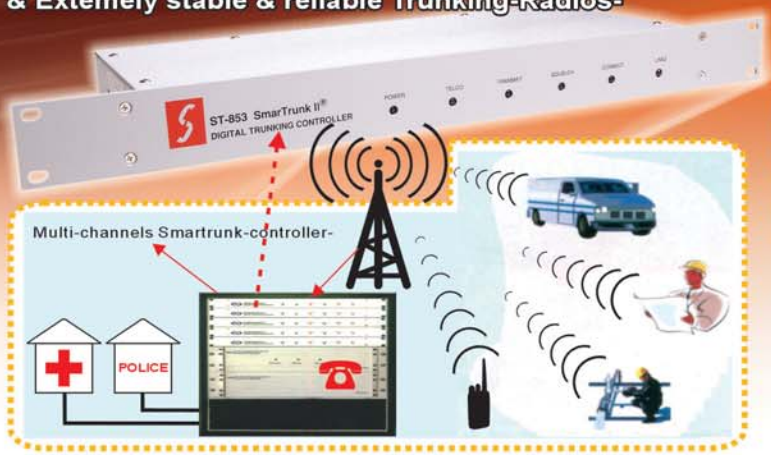

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2. Which of the following best describes your organization?
❑ A Mobile Communications Dealer/Reseller
❑ B Distributor, Agent, Importer, Exporter, Rep
❑ C Commercial Trunked Radio and Other Wireless Service Providers
❑ D Government/Public Safety/Military
❑ 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 radio communications equipment or services?
❑ A Yes ❑ B No

5. Is there any servicing of radio 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 _____

Q310

Latin America Rolls Out New Networks

By Peter Clemons

TETRA has had a presence in Latin America since the 1990s. More than a decade later, the European Telecommunications Standards Institute (ETSI) standard has more than 40 systems deployed from Mexico to Argentina, via Central America, Venezuela, Colombia, Brazil and Chile for public safety, transportation, utilities, industry, oil and gas, and public access mobile radio (PAMR). A number of manufacturers quietly built support for the standard across the continent, creating a vibrant user community and developing features to enhance its functionality, resilience and coverage for the benefit of local customers.

Mexico City is one of the world's most populated cities with latest estimates showing as many as 20 million inhabitants, who all need to move around freely to carry out their daily activities. One of the city's principal modes of transport, Mexico Metro, has been operating continuously for more than 40 years, with some 360 trains running over 200 kilometers of track serving 175 stations across 11 lines. It's the largest mass transit system in Latin America and ranks fourth worldwide in numbers of passengers after Moscow, Tokyo and New York with as many as 7 million trips daily.

Mexico Metro Line B was inaugurated in two stages in 1999 and 2000, and now carries more than 400,000 passengers each working day along elevated, ground level and underground track through 21 stations. The original communications system was suffering from obsolescence when Teltronic was asked to upgrade the network. Line B now boasts new, specialized onboard equipment in train cabins, a radio management system combined with an integrated control and communications center, handheld radios for operations and maintenance, and integration with underground radiant cables. Increased driver and passenger security has been guaranteed with the implementation of an emergency call facility. TETRA is at the heart of Line B's integrated communications, improving security and efficiency throughout the transport network and satisfying the metro's requirements for many years to come.

Neuquen Province is different than Mexico City. Located in western Argentina, under the shadow of the Andes and at the northern tip of Patagonia, the province is home to barely half a million people. The same underlying radio communications technology plays the same important role here as it does in densely populated Mexico City. The forward-looking Neuquen Regional Government created a vision of a professional public-safety agency using state-of-the-art technology based on open standards integrated into a solution including a full range of voice, data, video and multimedia services. This new system — Public Safety and Emergency Answering Integrated System (SISPAE) — has been fully deployed across the province and features an Ethernet/IP-based TETRA system as its core running over an IP integrated backbone.

A number of the 33 radio sites spread across the province are deployed at altitude in freezing conditions in the Andes, requiring high levels of resilience and remote maintenance to keep critical communications working through the harshest winters. A modern call-taking and dispatching emergency center attends to the public. The fully integrated system also includes fast, mobile deployment units equipped with digital mobile technology, video surveillance and the latest automated fingerprint identification system (AFIS) solutions connected via TETRA to databases for real-time identification.

The results from SISPAE have been dramatic, with an overall reduction in crime across Neuquen, a larger proportion of crimes solved, improved response times and increased satisfaction in the police force by the population.

Mexico Metro and Neuquen Regional Government are examples of a larger phenomenon that has spread across the Latin American continent. Whether it be civil protection and public safety in Venezuela; transportation in Colombia; public safety, transportation, utilities, industry and PAMR in Brazil; oil and gas in Argentina; or transportation in Chile, TETRA and other mission-critical communications technologies can be used in the harshest environments to provide security, privacy and connectivity to users. ■

A number of the 33 radio sites spread across the province are deployed at altitude in freezing conditions in the Andes, requiring high levels of resilience and remote maintenance.

Peter Clemons is the director of communications for Teltronic, a board member of the TETRA Association and an editorial advisor for *RadioResource International*. E-mail comments to pclemons@teltronic.es.

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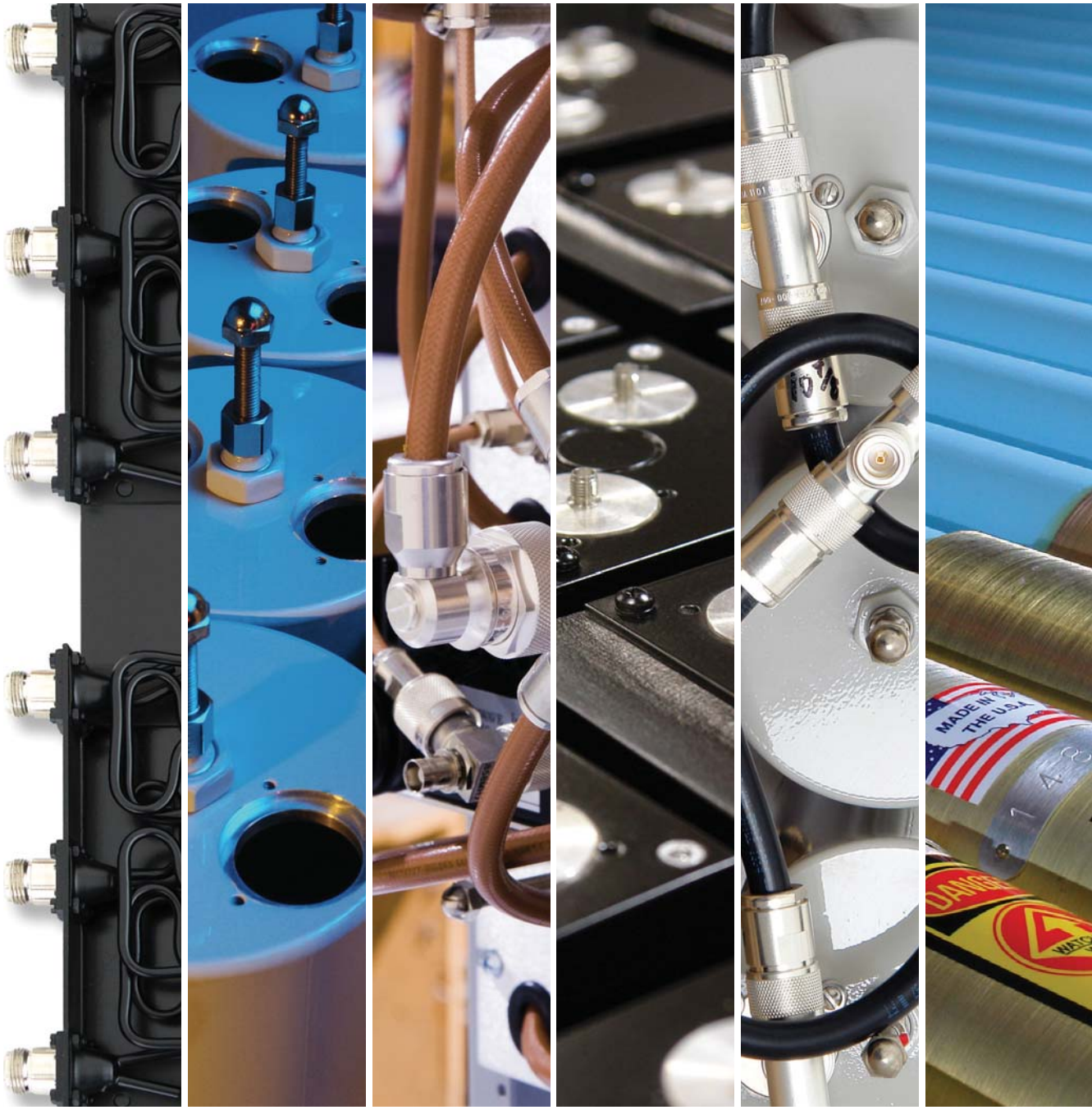

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