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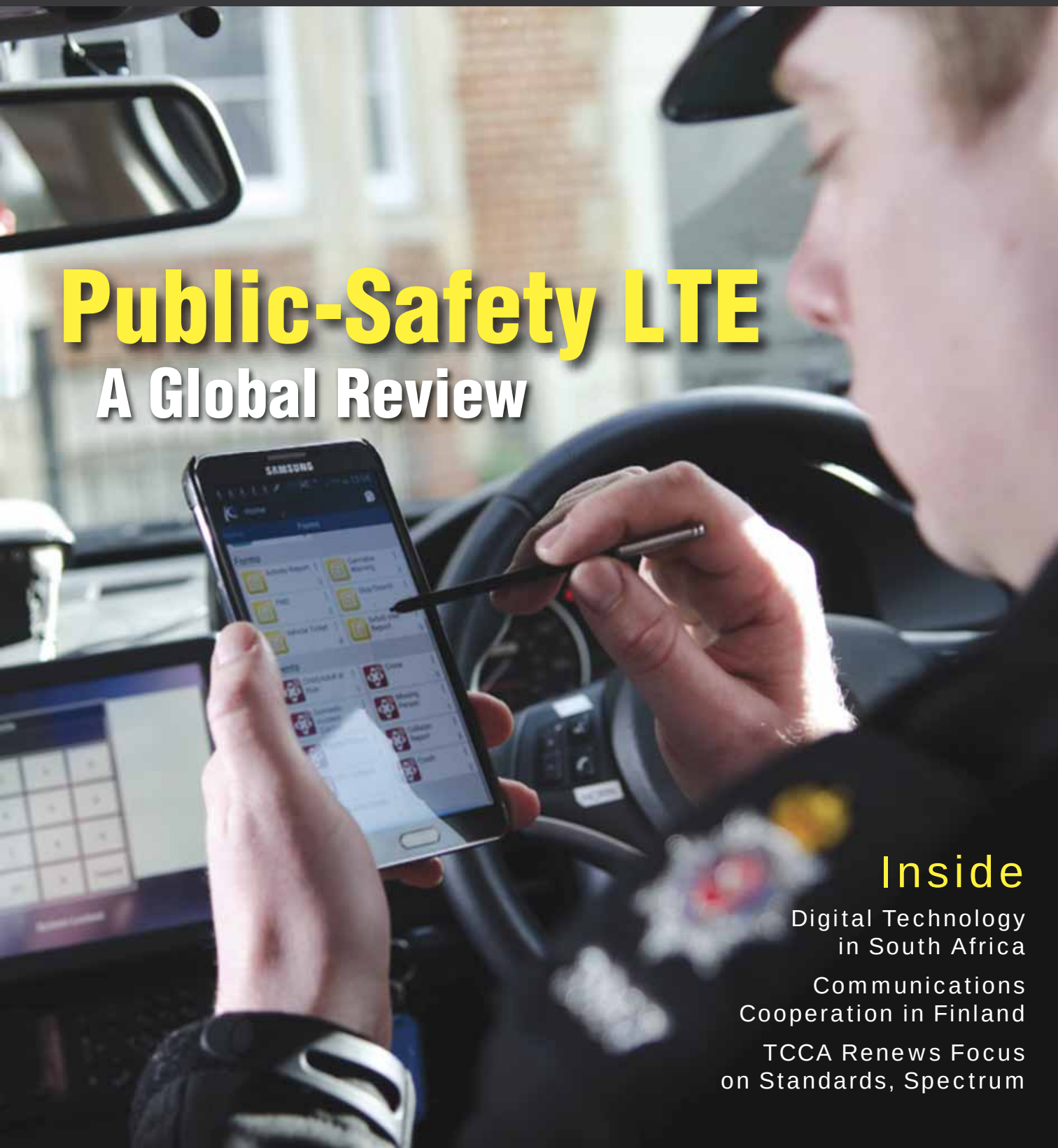

Public-Safety LTE

A Global Review

Inside

KENWOOD

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With new hand-portables and mobiles joining the existing Kenwood DMR line-up of portables and repeaters, you now have the breadth of choice you need to build a voice and data communications system that's precisely right for your operation; whether it's mission, operations or commercial critical.

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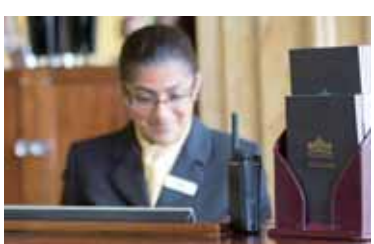

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RadioResource INTERNATIONAL

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Cover photo courtesy Airwave

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Zetron's Integrated Communications Enhance Your Situational Awareness

Zetron optimizes communication workflows by providing the right information to those who need it —when they need it. This improves situational awareness, leading to more efficient emergency response and decision making. Here's how:

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The Importance of PMR/LTE Interworking

Our cover story takes a global view of public-safety Long Term Evolution (LTE) deployments around the world. As readers can see, plans and implementations are different in every country, depending on many factors. The variables for each network include spectrum, budgets, relationships with mobile operators and regulatory environments.

It is clear by the varied stages of deployment around the world — most countries haven't even begun public-safety LTE plans or implementations — that professional mobile radio (PMR) networks will be around for quite some time. Interworking between PMR and LTE technology was set on the back burner the past few years while the industry focused on implementing public-safety features into the Third Generation Partnership Project (3GPP) LTE standards process.

However, with the completion of mission-critical voice over LTE standards in March, industry leaders are moving forward to ensure PMR and LTE interworking is now standardized. More details on the work underway among 3GPP SA6, the Alliance for Telecommunications Industry Solutions (ATIS) and the European Telecommunications Standards Institute (ETSI) are covered on Page 8.

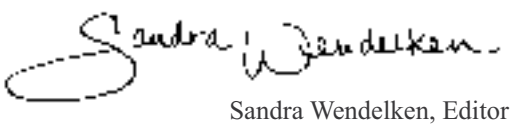
In addition, the U.S. federal Public Safety Communications Research (PSCR) program, which has US$300 million in funding from the U.S. government for public-safety communications research, identified PMR and LTE interoperability as one of its five main research and development (R&D) areas.

PSCR holds roundtables to receive input from public-safety professionals and other stakeholders and then outlines a research road map. The program is also leveraging cooperative agreements, grants, prize challenges and other contemporary contract mechanisms to spur innovation in public-safety technologies.

With several efforts underway globally, PMR/LTE interworking standards are on the horizon. That is a positive development for the industry because both technologies will be part of the mission-critical communications industry for years to come. And having standards to interconnect those technologies will be essential to mission-critical communications suppliers and users.

Please email your feedback to swendelken@RRMediaGroup.com.

In addition, we are running portable radio specification charts, Specs Survey, for the first time in this magazine. Product comparisons for 52 radios from 24 suppliers begin on Page 32. We welcome your input.



Sandra Wendelken, Editor
swendelken@RRMediaGroup.com

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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Study Item to Standardize PMR to LTE Interworking Moves to 3GPP SA6

An industry group is working to standardize two-way radio and Long Term Evolution (LTE) interworking capabilities and submitted a study item to the Third Generation Partnership Project (3GPP) SA6 for potential inclusion in LTE Release 14 or 15.

The study item is the first step in pushing the issue of interworking professional mobile radio (PMR) and LTE networks higher on the priority list for 3GPP LTE public-safety requirements.

An Alliance for Telecommunications Industry Solutions (ATIS) ad hoc LMR/LTE interworking group, which submitted the study item, was formed last October and is discussing the transition of Project 25 (P25) and TETRA networks to LTE technology. The work on TETRA updates interworking requirements outlined in a European Telecommunications Standards Institute (ETSI) work item, said Malcolm Quelch, chairman of the ETSI working group on requirements for TETRA and critical communications evolution (TC TCCE).

In addition to the study item, the group will submit a terminology document and a gap analysis providing insight into what interworking between the technologies is needed, in addition to the 3GPP SA1 requirements already captured. The terminology document addresses differences among P25, TETRA and 3GPP mission-critical push to talk (MC PTT) "so when we talk about emergency calls and user IDs, we're all on the same page," Quelch said.

"In the United States and Europe, the need was recorded, but essential MC PTT functionality came first; now that is being addressed, and we wanted to push this up in priority," Quelch said.

The specifications for MC PTT were finalized during 3GPP meetings in March and will be included in LTE Release 13.

The terminology document includes identity translation and call-routing scenarios. The TETRA + Critical Communications Association (TCCA) encouraged ETSI to include TETRA technology in the work.

"We can put in place a common terminology so that we understand what it means in each technology," Quelch said. "There is good overlap between TETRA and P25, but slight differences in how things are named, and more differences in MC PTT."

Interworking details were included in the requirements written in 3GPP SA1 some time ago, but they hadn't found their way into standards released in SA6, the working group within 3GPP that defines specifications for critical communications. The gap analysis tracks updated requirements since the original SA1 document was developed. The document specifically highlights the need for short data service (SDS) interworking for TETRA.

A solicitation letter was sent to eight European organizations requesting updates on interworking requirements, and six groups responded. Quelch said there is debate in the public-safety communications industry about whether interworking standards are necessary. Some organizations, such as the U.K. Home Office, plan a "big bang change" with plans to switch directly from TETRA to LTE.

"Most other organizations think that's really too risky," he said. "Many users expect to have TETRA alongside LTE for quite some time. We do need some interworking."

He cited the Scandinavian countries, which plan to have TETRA and LTE working together for some time, and there will likely be scenarios involving different groups with different technologies operating at emergency scenes.

"There's a view that legacy systems will stay in place for some time," Quelch said. "That would be sensible because putting a new technology in place isn't just about whether the technology is there and available — and it isn't there yet — but changing the working practices to use the new technology will take some time. It makes sense to standardize the interworking with as much functionality as we can put into 3GPP."

Quelch said there is an outside chance LMR/LTE interworking will be included in LTE Release 14, but it's more likely to be part of Release 15. He said even with a 3GPP standard, there will likely be local adaption for either TETRA or P25 standards.

INTERNATIONAL

CHRISTCHURCH, New Zealand — Suppliers made two separate Digital Mobile Radio (DMR) product integration announcements. **Zetron** partnered with **Tait Communications** to develop a DMR Tier 3-based location services solution. The seamless integration with Zetron's MAX Dispatch system allows users to track vehicles and workforces through their radio networks and MAX Dispatch.

The combined solution offers a range of enriched features and functionality. The MAX Dispatch user interface uses the location services technology to display a built-in, single-layer map that supports map data from Bing, Open Street or ArcGIS Online. It also offers road and aerial views, depending on the map data used. Resources with GPS-equipped DMR mobile or portable radios can appear

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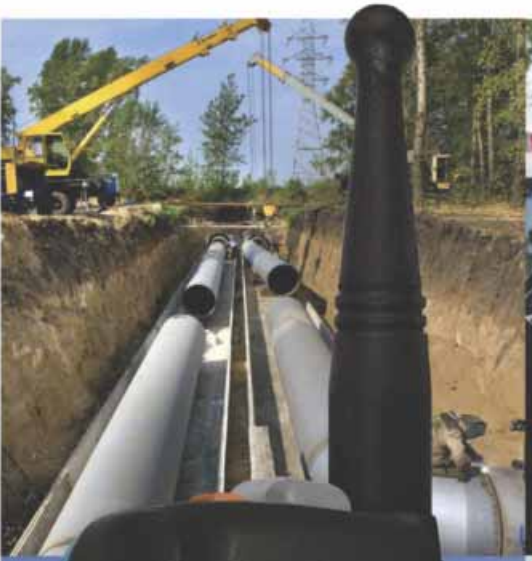

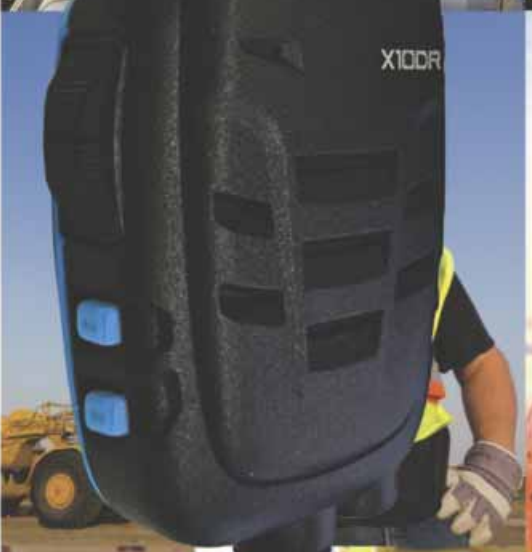

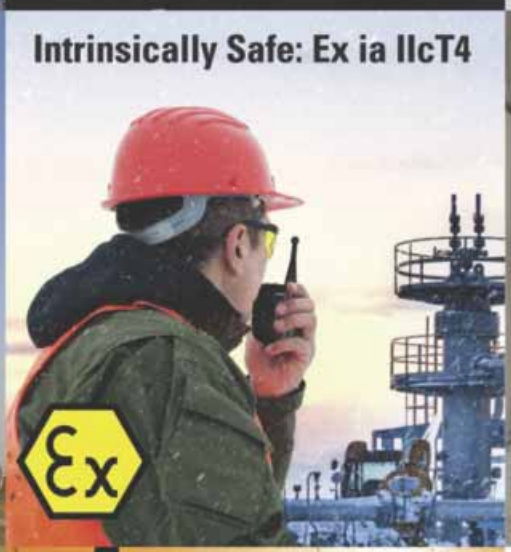

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International Forum to Collaborate on First Responder Technology

The International Forum to Advance First Responder Innovation is a collaboration among countries around the world to help enhance and expand the development of affordable and innovative technology for first responders. Phil Waters, forum program manager for the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T), discussed the forum and its goals.

Current members of the international forum are Australia, Canada, the European Commission, Finland, Germany, Israel, Japan, Mexico, New Zealand, Singapore, Spain, Sweden, the Netherlands, the United Kingdom and the United States.

Waters shared a chart that highlighted the objectives of the forum, including:

■ Defining a list of common global capability gaps,

■ Characterizing global first responder markets,

■ Working with the research and development (R&D) community to promote innovative and affordable technology for first responders,

■ Educating first responders about available technology,

■ Improving the safety and security of first responders and citizens around the world.

One key part of that work will be partnerships between first responders and industry, Waters said. The forum, which launched near the end of last year, has had initial meetings with industry members in Europe and North America and plans to continue outreach efforts this year. Those outreach efforts will include the launch of a stakeholder committee, conferences and individual meetings, Waters said.

Waters said the forum plans to include small businesses on the stakeholder committee. "We see small business as key to providing innovative solutions and will include them in the stakeholder committee," Waters said.

Waters shared some preliminary statistics the forum had from analyzing the first responder market in the current member countries. In those countries, the forum identified 7 million first responders and overall operating expenditures of about US$426 billion.

International Forum to Advance FIRST RESPONDER INNOVATION

The forum plans to have a full market overview available by the end of June. The market overview will look at the purchasing power of first responders around the world, as well as the overall size of the global first responder community. The forum will use this information to identify technology gaps to help guide technology development efforts, according to its website.

Waters asked first responders about obstacles they face and concerns they have. Responses included vendors struggling to understand how and what specific technology applies to certain operations and a lack of communications and collaboration among first responders outside their regions.

The forum hopes to eliminate isolation among first responders by giving them a platform to share technology obstacles and work together on solutions for overcoming those obstacles, Waters said.

on the map as icons. Indications of incoming individual calls, emergency alerts and location data accuracy can also be displayed.

The solution also improves dispatchers' ability to monitor and manage events. They can simply click a mapped resource to answer an incoming call or initiate an outgoing individual call. A "bread-crumb" feature using recent location data allows dispatchers to view where a resource has been.

Separately, **Simoco** and **Catalyst Communications Technologies** integrated Catalyst's dispatch consoles with Simoco's Digital Mobile Radio (DMR) Tier 3 radio system using the Application Interface Specification (AIS).

Catalyst's IP|AIS gateway routes digital audio and advanced control messages to the Simoco Tier 3 DMR radio system through a single Ethernet connection. The interface supports unit ID, console pre-emption, group calling and emergency group calls.

For interoperability, other radio systems, such as Project 25 (P25), SmartNet, EDACS and MDC 1200, as well as Long Term Evolution (LTE) push to talk (PTT), can be patched to the Simoco DMR Tier 3 system through the Catalyst gateway with or without the Catalyst console. Existing Catalyst customers can upgrade dispatch consoles and interoperability solutions to include the AIS gateway.

SOPHIA-ANTIPOLIS, France — The European Telecommunications Standards Institute (ETSI) published the set of complete updated oneM2M Release 1 technical specifications. ETSI is a founding partner of oneM2M, which recently issued updated editions of its Release 1 global specifications.

Each oneM2M partner standards body publishes the complete set of oneM2M specifications as its own local specifications, thereby ensuring there is one global set of specifications recognized in each region.

The specifications enable Internet of things (IoT) interworking and provide a foundation to interconnect IoT devices and applications. The standards cover requirements, architecture, application programming interface (API) specifications, security solutions and mapping to common industry protocols. The updated specifications, released a year after initial publication, incorporated improvements from early implementation experience and feedback from oneM2M's first Interop event last year.

EUROPE

BRUSSELS — Public Safety Communication Europe (PSCE) released its

HELPING THE WORLD CELEBRATE IN SAFETY

Huawei eLTE Public Safety Solution, makes complicated situations clear at a glance

As cities get larger and more complex, citizen safety becomes an increasing headache for city managers especially during big gatherings and festive events. Fortunately Huawei's eLTE Public Safety Solution solves the problem. By combining multiple technologies including voice trunking, video and data with multiple communication interfaces, Huawei enables city managers to enjoy visual command of events on the ground, assess situations, and share information instantly with security personnel to allocate resources and ensure citizens can celebrate in safety.

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HUAWEI

ASTRID Withstands Brussels Terror Attacks

The ASTRID TETRA-based radio communications systems were stressed as a result of the exceptional mobilization of emergency and security services following the 22 March terrorist attacks in Brussels. In consultation with its users, ASTRID seeks to further optimize emergency communications.

Following an initial thorough analysis, ASTRID called a meeting with all of the user organizations to take a close look at the communications processes, both from technical and operational perspectives. Concrete points of action and recommendations were defined in this context.

Several ASTRID systems were used during the emergency situation. The radio network did not suffer a general outage. Following the attacks in the metro station, the communications masts in the area surrounding the attacks became saturated.

Because of the unprecedented nature of the emergency, which involved successive heavy attacks at several locations, at certain hours and within a limited radius, some radio base stations had to process an unprecedented volume of communications. Emergency and security services from all over the country were mobilized to provide assistance, which led to exceptional radio traffic.

Photo courtesy ASTRID

At the request of the organizations, ASTRID connected hundreds of additional radio terminals to the network on the day of the attacks. The failure of commercial mobile phone networks also led to a considerable surge in radio traffic on the ASTRID network.

The radio network did not experience a nationwide outage; however, it did suffer serious capacity problems, particularly in the Brussels region. Shortly after the attacks, the ASTRID base stations close by reached maximum capacity, affecting communications during a few crucial hours. A number of users did not have access to group calls.

"ASTRID did not suffer an outage; the radio, paging and control room systems remained functional at all times," said Marc De Buyser, ASTRID CEO, in a newsletter. "However, the massive mobilization of emergency services, as well as the hundreds of simultaneous group calls did affect the performance of radio communications in Brussels. Shortly after the attacks, the ASTRID base stations in the vicinity of the Maalbeek metro station reached maximum capacity, which made communications difficult from time to time. A number of users experienced delays or did not get access to group calls. Challenging and stressful moments like these inevitably lead to a higher number of push to talks."

The police and emergency control rooms in Brussels and Flemish-Brabant (emergency calls to 1-0-1 and 1-0-0/1-1-2) experienced heavy communications loads, but continued to function properly. The paging system for mobilizing firefighting volunteers was also placed under exceptional stress, but continued without problems. ASTRID's mobile base station (lorry) was set up to increase the capacity of the radio network in the center of Brussels.

ASTRID met with the ASTRID User Advisory Committee in March. The meeting resulted in points of action and recommendations regarding radio usage and training. Further technological optimization of the network is already included in the ASTRID business plan approved by the board of directors.

fourth white paper. The document covers security architecture, end-to-end security, privacy mechanisms and intrusion detection approach.

The document is based on the findings of the SALUS project. It describes the components and interfaces for the interim SALUS security and privacy architecture considering possible road maps for the evolution of public protection and disaster recovery (PPDR) networks.

SALUS is a European project to design, implement and evaluate a next-generation communications network concept for agencies, supported by PPDR network operators and industry. The project will provide security, privacy, seamless mobility, quality of service (QoS) and reliability for mission-critical professional mobile radio (PMR) voice and broadband services.

The white paper is based on SALUS deliverable D5.2 and describes interim solutions for security services, such as security extensions for seamless mobility, end-to-end security and privacy support for interoperable PPDR communications systems, techniques for flow-based intrusion detection — including forensics — wireless sensor network security and localization privacy. Because SALUS also deals with security at the physical layer, this deliverable also describes the current achievements on propagation modeling for wireless communications channels.

The paper is available on the PSCE website.

BRUSSELS — Two groups launched the first next-generation 1-1-2 (NG 1-1-2) Emergency Communications Plugtests in Europe 14 – 18 March. The European Telecommunications Standards Institute (ETSI) Emergency Telecommunications (EMTEL) special committee and the European Emergency Number Association (EENA) organized the event, which independently and jointly trialed all components of the 1-1-2 communications chain based on next-generation networks.

Companies from Asia, Europe and North America, connected their equipment to the test infrastructure and tested their solutions on-site from the ETSI headquarters in Sophia Antipolis, France, as well as from their own labs. Several topics, including location-based emergency call routing, policy-based emergency call routing and next-generation media types, were addressed.

"In emergency communications, interoperability is key, and this is a great opportunity for solution

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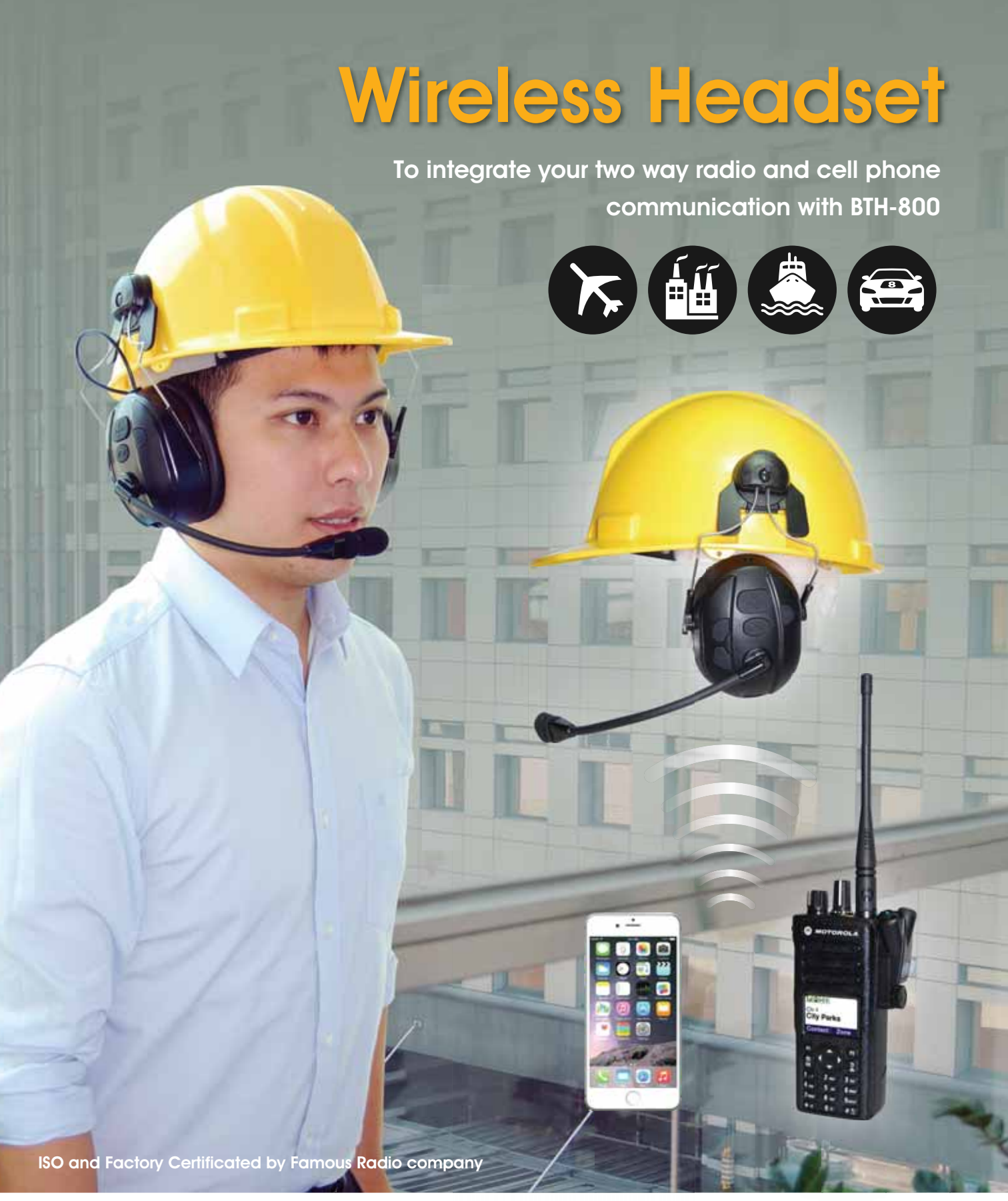

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Ericsson, Motorola, Telstra Partner on PTT for LTE

Ericsson and Motorola Solutions, together with Telstra in Australia, will trial next-generation mobile broadband push-to-talk (PTT) communications technology and collaborate on standards development. The companies said the new PTT technology will create a way for traditional radio communications to integrate and extend via Long Term Evolution (LTE) networks.

The three companies will progress the technology through concept testing in Australia and collaborate in standards forums globally to develop an industry solution to meet the requirements of public-safety users.

The partnership brings together Ericsson's network infrastructure, Motorola Solutions' experience in providing mission-critical communications, and Telstra's network resources and expertise in defining and deploying next-generation communications standards and capabilities.

Next-generation PTT is an important component of emerging LTE-based public-safety communications solutions. The technology will complement the mission-critical capabilities provided by professional mobile radio (PMR) networks that agencies depend on and extend those networks to a greater number of users carrying smartphones and other devices, a statement said.

"This project is part of our vision for smart public safety, Next-Generation

Mobile Intelligence, which is helping agencies deliver better community safety outcomes through a dynamic mix of technologies," said Bruce Brda, executive vice president products and services with Motorola Solutions. "Connecting a greater number of public-safety officials will help to increase situational awareness and efficiency among first responders in the field."

Telstra plans to reach LTE coverage across 99 percent of Australia by the end of June 2017 and offers a dedicated, partitioned LTE spectrum "lane" for exclusive use by mission-critical communications customers.

"Providing a leading LTE public-safety capability is a key objective for Telstra with its Telstra LTE Advanced Network for Emergency Services (LANES) advanced network solutions," said Mike Wright, Telstra Networks Group managing director. "A mission-critical PTT capability is part of our vision for public-safety communications via LANES and delivers our mission-critical customers a compelling solution to extend voice to more of their staff."

LATIN AMERICA

Mexico relied on Tetrapol communications technology from Airbus Defence and Space during the Pope's visit in February. The nationwide network provided support for Mexican security forces and various assistant organizations to ensure the safety of Holy Father Francis.

providers in the field to put their products to the test," said Cristina Lumbreras, EENA technical director. "The success of the event does not rely only on the individual performances, but on the lessons learned collectively, and the knowledge we will gain with the aim of improving emergency response for citizens."

The European Commission supported the event. The interoperability of NG 1-1-2 products and services had not been previously tested in Europe. The NG 1-1-2 Emergency Communications Plugtests event used a testing campaign based on use cases developed by ETSI and EENA.

PARIS — Thales and **SFR** formed a technology partnership to meet future network requirements of professional mobile radio (PMR) systems and bring the benefits of Long Term Evolution (LTE) technology to PMR users.

Under the agreement, the two partners will offer mission-critical services on the high-speed network operated by SFR. SFR and Thales will demonstrate how the next evolution of LTE technologies can provide user groups with the robust, high-performance communications capabilities they need, while making it easier to access and share data, imagery, video and other real-time information across a fast broadband network.

ASIA

NEW DELHI — India will adopt 1-1-2 as the national emergency number, similar to several European countries, with the interministerial telecom commission giving a go-ahead to the move, the *Times of India* reported.

The rollout of 1-1-2 may see a gradual phase out of existing emergency numbers.

Telecom Regulatory Authority of India (TRAI) suggested adopting 1-1-2 as the national emergency number in its recommendations submitted to the telecom department last April.

TAIT TOUGH

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Daniel Cole,
Director of Panola County Emergency Operations, Mississippi

After installing Tait mobile and portable radios, Panola County put the "Tait Tough" promise to the test when a Tait portable was accidently dropped into a fire. Although the casing suffered superficial damage, the radio turned on and continued working.

"Since we implemented the Tait radios, I've been 100% confident in them ... the Tait radios have never failed. We've had zero complaints, everybody loves them."

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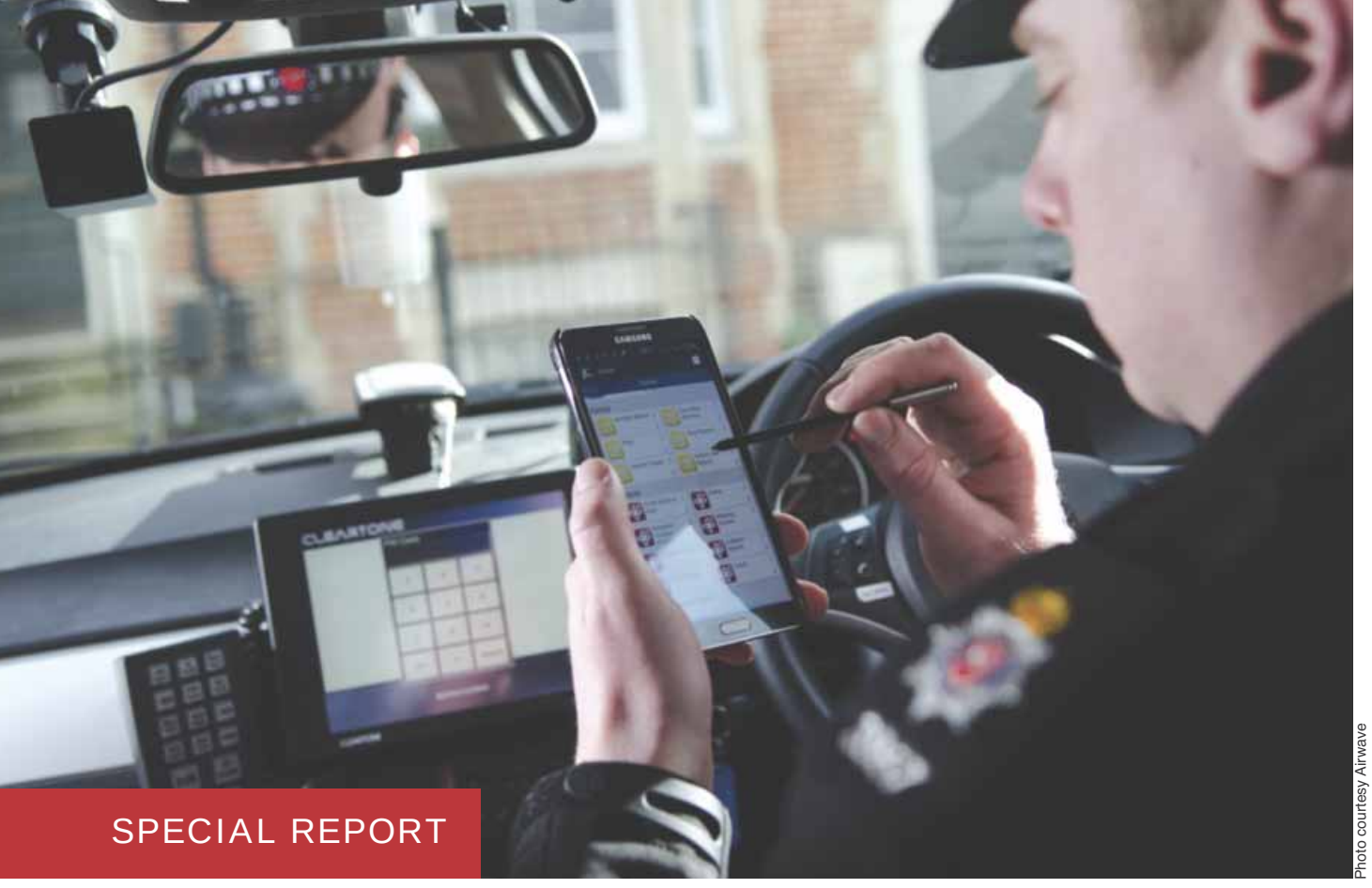

Photo courtesy Airwave

SPECIAL REPORT

A Global Review of Public-Safety LTE

Countries have different plans and timetables for spectrum and deployments of public-safety LTE networks.

By Sandra Wendelken

Professional mobile radio (PMR) networks continue to keep first responders and citizens safe globally. A transition to Long Term Evolution (LTE) networks is underway, although PMR systems will be in place for years to come and may never be entirely replaced. But numerous countries are establishing spectrum, governance and funding for public-safety LTE networks to meet data needs. Some countries are still debating which spectrum to use, while others are beginning deployments. The willingness to partner with mobile operators also varies by country.

Following is a roundup of the initiatives underway in various countries.

France and European Spectrum

France allocated 2 by 5 megahertz and 2 by 3 megahertz in the 700 MHz band for a broadband public protection and disaster relief (PPDR) dedicated network, said a French Ministry of Interior (MoI) official. The decision for the 698 – 703/753 – 758 MHz and 733 – 736/788 – 791 MHz allocations was incorporated into the legal corpus but will not be enacted until July 2019.

The prime minister's decision will seek solutions to accommodate other state ministries, such as justice, finance/customs, defense, health and several critical infrastructure operators that contribute to PPDR missions. During the transition period to 2019, France plans to receive exemptions from the country's broadcasting services to develop tactical networks — called "bubbles" — or small experimental networks in some geographical areas.

"There are currently lots of discussions to define the legal, economic and

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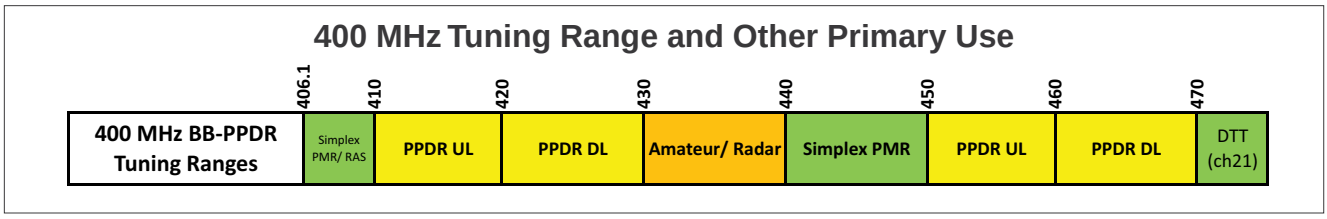
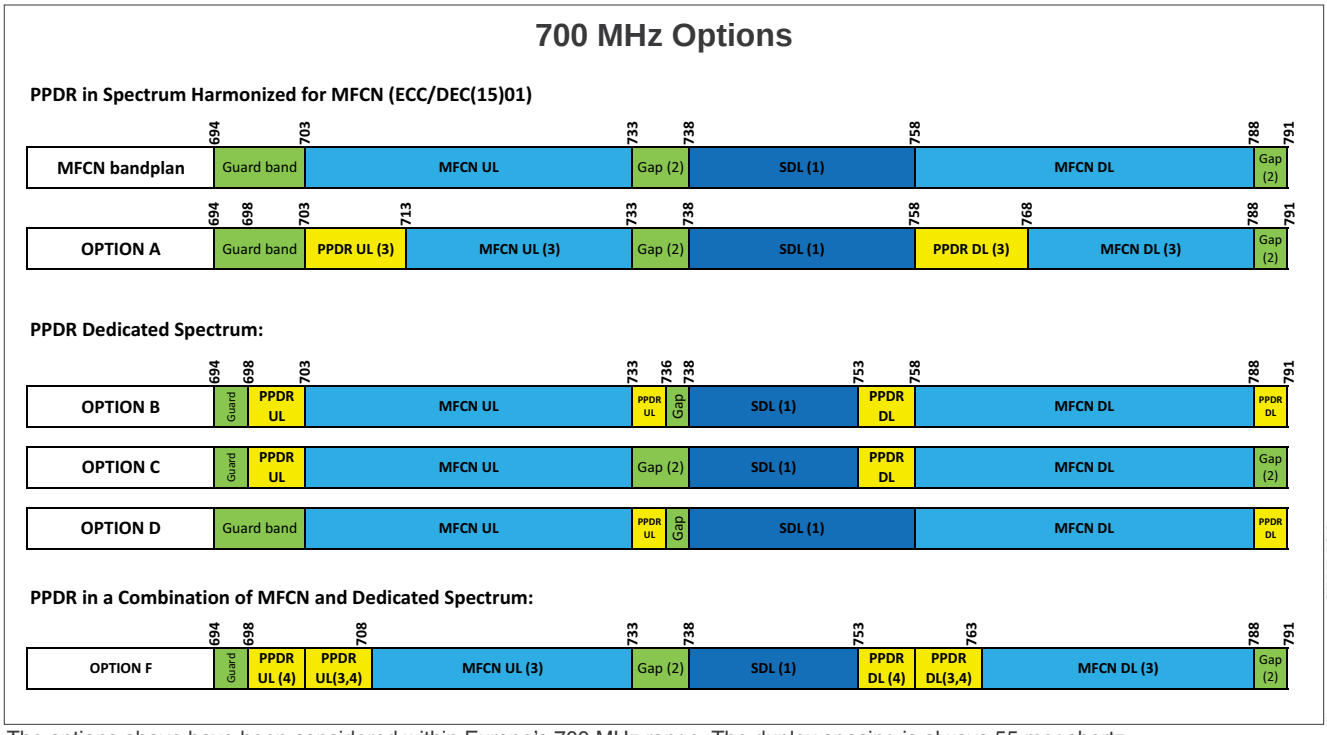


The 400 MHz bands for European broadband PPDR uplinks (UL) and downlinks (DL) with 10-megahertz duplex spacing.



Figures courtesy CEPT ECO

The options above have been considered within Europe's 700 MHz range. The duplex spacing is always 55 megahertz.

technical models of the future network," said the French MoI. "However, the basic principle is to take benefits from the commercial LTE ecosystem. To this end, we intend to build our network on LTE technology adapted to the specific needs of broadband PPDR."

The MoI will request input from the communications industry to provide relevant information about the technical strategy for the short and medium term. For example, a recent request for information (RFI) launched on tactical network bubbles highlighted the enthusiasm of potential suppliers in strict compliance with the standards of the Third Generation Partnership Project (3GPP) and identified matters that require further research and development (R&D).

The R&D areas include isolated evolved universal terrestrial access network (E-UTRAN) operation for public safety (IOPS) and direct mode operation (DMO). IOPS allows an LTE eNodeB to operate with limited to no backhaul and still support mission-critical push to talk (MC PTT). DMO allows two devices to communicate without network radio infrastructure. These are areas where France still expects short-term progress in terms of functional scope covered by the 3GPP standards.

Tetrapol technology is used for the mission-critical voice networks in France. There are two different networks: Rubis is the dedicated Gendarmerie network in the 80 MHz band, and Infrastructure Nationale Partageable des Transmissions (INPT) is a shared national radio infrastructure that serves police forces and firefighters in the 400 MHz band. The two networks share some architecture elements.

The French government expects the 700 MHz allocation to be insufficient to cover all the country's broadband PPDR needs. "Our current strategic goal is to obtain additional resources at 400 MHz to mitigate significantly higher deployment costs" of building a 700 MHz network to obtain the same coverage as the Tetrapol networks and to cover difficult coverage areas, the French MoI said.

"Obviously, the same LTE technology will be kept to implement services on the 400 MHz band," the MoI said.

Last October, the European Conference of Postal and Telecommunications Administrations (CEPT) Electronics Communications Committee (ECC) Report 218 addressed spectrum options for implementing broadband PPDR services in CEPT countries in the 400 and 700 MHz frequency ranges. The report proposed the concept of "flexible harmonization" to

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The French R&D areas include isolated evolved universal terrestrial access network (E-UTRAN) operation for public safety (IOPS) and direct mode operation (DMO).

enable an efficient implementation of PPDR LTE within CEPT and did not designate a single frequency band for PPDR LTE in Europe.

The CEPT ECC Decision (16)02 is going to address broadband PPDR spectrum in the 450 – 470 and 700 MHz ranges. At press time the draft of the decision was on public consultation, after which it will go through comment resolution and the approval procedure in the Working Group Frequency Management (WGFM) in May. Final approval for publication by the CEPT ECC plenary is scheduled for June. On 29 September, there will be a joint European Telecommunications Standards Institute (ETSI)-CEPT ECC Workshop on broadband PPDR in Sophia Antipolis, France. A main target is to link the standardization work to the CEPT harmonization approach, said Thomas Weber with the European Communications Office (ECO) of CEPT — Spectrum Management.

"We are delighted with the ECC (16)02, and we are working with the French spectrum regulator ANFR to assess the possibilities in the 450 – 470 MHz band," the French MoI said.

United Kingdom

At the annual British APCO (B-APCO) event held in Telford, United Kingdom, in March, the Emergency Services Mobile Communications Programme (ESMCP) team explained the program. Representatives from the Home Office and three services providers — EE as the 4G Long Term Evolution (LTE) mobile services provider, Motorola Solutions as the user services provider, and the delivery partner KBR with support from Arup and Mason Advisory — also provided details about the Emergency Services Network (ESN).

ESN will cover Great Britain and is the replacement for the current Airwave TETRA-based network. The network will incorporate the EE LTE radio access network (RAN) with a separate core network for ESN, using the public-safety quality of service (QoS) class identifiers provided through 3GPP Release 12 to ensure ESN bearers are allocated a grade of service commensurate with mission-critical communications. The separate core will also differentiate ESN from EE's commercial traffic, and resilience and security will be built into the overall solution from the outset.

Motorola Solutions is delivering public-safety features based on the Wave7000 product, offering a pre-standard capability optimized for public safety. Development of the detailed design is underway. The Home Office anticipated receipt of the suite of documents that comprise the detailed design at the end of March.

The program remains on track with the goal to transition to the ESN "without a single diminution of functionality," according to Rees Ward, KBR project director. The transition will commence in 2017 once the ESN is stood up as a proven solution — with the comprehensive program of testing and operational trials being key to the user community having the confidence that all is ready. The objective is to have the ESN fully adopted and in use by all three emergency services by the end of 2019.

Mansoor Hanif with EE and Steve Whatson from the Home Office drew out myriad coverage enablers that will ensure ESN coverage is at least as good as the Airwave network. The ESN will have core vehicle coverage to 96 percent of major roads and support transport solutions — London Underground and Crossrail — marine operations, air to ground and rural areas of Great Britain.

EE officials said they have about 19,000 macro LTE sites that will underpin coverage and up to 100 megahertz of spectrum for capacity loading. EE executives were keen to stress the level of innovation being brought to bear to ensure the ESN is successful. The operator switched on voice over LTE (VoLTE) in central London in March. The underpinning connections to the core network have diverse routing and geographic redundancy. Flooding scenarios have been studied to look at flood plains and ensure vulnerable sites are protected. Service level agreements (SLAs) with maintenance providers were uplifted to be smarter and more effective.

"4G LTE is a stable technology that is truly a catalyst for innovation," Hanif said.

Nordic Region

The owners of the public-safety mobile radio networks in Sweden, Norway and Finland emphasized the importance of dedicated frequencies in the 700 MHz band for emergency communications in a joint white paper released earlier this year. Broadband data is the key phrase in the white paper signed by the Swedish Civil Contingencies Agency, Finnish State Security Networks and Norwegian Directorate for Emergency Communication.

The three Nordic critical communications network owners recommend that part of the 700 MHz frequency band should be dedicated for use by PPDR organizations. Without dedicated frequencies, the next-generation emergency communications systems must be built exclusively on commercial operators' networks. The paper questioned whether commercial networks can offer functionality and sufficient technical quality, robustness and security for PPDR use. In addition, there is no guarantee that commercial operators will be willing to meet the needs of PPDR organizations, the paper said.

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Most countries are just beginning or still considering options for transitioning to public-safety Long Term Evolution (LTE) networks.

"Dedicated networks will undoubtedly provide the best security and data safety and greater possibilities for sending large volumes of important and mission-critical data," a statement from the groups said. "The 700 MHz band is pointed to as the only realistic alternative to achieve a harmonized solution for future emergency communications systems in Europe. This band is well suited for achieving high percentage area coverage and good indoor coverage without having to invest in unrealistic, extensive and expensive infrastructures."

In the Finnish five-step plan to convert VIRVE from TETRA to an LTE platform, stage two was reached when the mini LTE core was implemented. Ownership of subscriber and addressing data is essential not only for control, but also for security, because core networks become more cloud based and might soon reside anywhere.

The next phase, in which the dedicated LTE radio access is integrated, will be tricky. The debate over frequencies is still ongoing, and regardless of how or if frequencies are shared between commercial and PPDR operators, the most cost-efficient ratio of dedicated and outsourced service must be found, while maintaining the level of availability that TETRA users are used to.

South Korea

Commercial carriers KT and SK Telecom (SKT) are building a pilot public-safety LTE network in South Korea after being selected by the government last October. The operators plan to build the pilot network by the end of April, and testing and validation is set to begin in May and continue through mid-June. The government's target date to endorse the pilot project is 17 June, said Dujeong Choi, project manager, public-safety communications testing and certification, South Korea's Telecommunications Technology Association (TTA).

KT is building the network in Pyeonchang, and SKT is building the network in the city of Gangneung, as well as Jeongsun. The US$40 million pilot network will include 205 base stations and 2,496 handsets. Users on the pilot network include four organizations — police, fire, coast guard and the local administration office. The pilot will offer testing and validation of the country's planned nationwide public-safety LTE network.

South Korea plans to launch a nationwide LTE network by 2017. There are eight total mandatory user organizations for the nationwide public-safety network, including police, fire, EMS, coast guard, military, local administration office, electricity and gas. There will be a separate request for proposals (RFP) for the nationwide network deployment.

Australia

Commercial carriers are the most cost-effective option for delivering a public-safety mobile broadband capability to public-safety agencies, according to an Australian Productivity Commission report released at the end of 2015.

Mobile broadband technology represents a significant opportunity to save lives and property, improve officer safety and drive productivity gains in the delivery of public safety. However, mobile broadband use is unlikely to increase significantly until a public-safety-grade service — superior to services offered by commercial carriers — is available.

The report evaluates a range of options for delivering a public-safety mobile broadband capability to Australian public-safety agencies, including use of a dedicated network, an existing commercial network and combinations or hybrids of the two.

The commission found that the commercial option would be significantly lower cost than a dedicated or hybrid option. "A commercial option is substantially lower cost because considerable existing infrastructure could be used or shared, meaning significantly less new investment is required," said Commissioner Jonathan Coppel.

The commission assessed the risks of each option. While the nature and magnitude of risks varied across options, no option was clearly preferred on the basis of risk factors alone. Because the benefits of each option were not expected to vary markedly, the commission considered that its cost evaluation provided the best guide to net community benefit. The estimated cost differential was about A$4 billion (US$3.1 billion).

"Small-scale pilots would provide an opportunity for jurisdictions to gain confidence in a commercial approach, gauge the costs and benefits of the capability more precisely, and develop a business case for a wider scale rollout," Coppel said. "With mobile broadband technology, the potential to achieve interoperability within and across jurisdictions is within reach and would bring significant additional benefits. However, this will depend on jurisdictions agreeing to common interoperability protocols and making arrangements for sharing information and network capacity among agencies."

Middle East

The specifics about public-safety LTE projects in the Middle East are

few, but both Motorola Solutions and Nokia executives said they have significant projects underway in the region.

Last September, Motorola Solutions Chairman and CEO Greg Brown said the company is implementing public-safety LTE networks in two separate countries in the Middle East, "which are a few hundred million dollars in total award value."

In February, Brown said Motorola's LTE revenue was about US$130 million in 2015, a little higher than projected. With four LTE contracts — the U.S. Los Angeles Regional Interoperable Communications System (LA-RICS), two in the Middle East and the U.K. ESN — 2016 LTE revenue is expected to be comparable to 2015.

"The growth in public-safety LTE in the near term will be outside the United States," he said last September.

Last October, Nokia re-entered the public-safety communications market after a 10-year hiatus with LTE products that include added public-safety features and functionality. The Middle East is a target region for the new offerings, said Hermann Rodler, Nokia global head of public safety.

EE officials said they have about 19,000 macro LTE sites that will underpin coverage and up to 100 megahertz of spectrum for capacity loading in Great Britain.

Nokia has a public-safety LTE contract in Qatar and several other agreements in the region that it has not yet publicly announced, he said. In March, Nokia was commissioned to deploy a smart city solution based on a 5G-ready next-generation network that will enable high-bandwidth voice, video and other data applications for mission-critical services and Internet of things (IoT) applications in Dubai, United Arab Emirates (UAE).

Spectrum is the starting point for most public-safety LTE network deployments and plans. Because of its scarcity, spectrum allocations and potential commercial network use are often the most difficult decisions. PMR networks will continue to operate for years to come. LTE has many challenges to overcome to meet the needs of the mission-critical communications community, and parallel networks are the likely scenarios for the countries first out of the gate. ■

Sandra Wendelken is editor of *Radio-Resource International* magazine. *Radio-Resource International* correspondents contributed to this report. Contact her at swendelken@RRMediaGroup.com.

Digital Technology in South Africa

Photos courtesy ESS

As many critical infrastructure sectors upgrade to digital, energy company Sasol expands its TETRA network and features.

By Johan Hoolsema

The critical communications market in South and Southern Africa is continuously developing with an increasing awareness of the need and value of safe and secure wireless communications in key industries across the economy. Contributing factors include the planned migration from analog to digital wireless communications and stricter regulations from government on the safety and security of employees and business operations. An increasing awareness, by relevant industries, of the value of safe and secure wireless communications is also present.

During the past year, new professional mobile radio (PMR) systems and upgrades to current systems have been put in operation in Southern Africa in the mining, safety and security, and oil and gas sectors of the economy. A commodities price slump had a significant impact on capital projects and expansion in the region, mainly in the mining sector. However, Expert System Solutions' (ESS) experience has been that PMR system requirements in the different industrial/business sectors are mainly driven by strict government regulation of safety, health and security requirements. The requirements contribute to PMR projects being scaled down or extended across longer implementation timescales rather than canceling or postponing such projects.

ESS has played a key development role within South Africa in the PMR industry by providing consulting, system engineering and system integration services to a wide spectrum of key installations within South Africa. The number of solution-driven applications to unlock the true value of the infrastructure expenditure on critical communications systems is also increasing.

Energy Deployment

In the early 2000s, ESS proposed TETRA technology for Sasol to replace its legacy MPT 1327 radio network that could not handle its increasing capacity requirements. Sasol, an international integrated energy and chemicals company, has more than 32,000 employees worldwide, and its turnover is 4 percent of

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South Africa's gross domestic product (GDP). The firm has two locations in South Africa, Secunda and Sasolburg, that use TETRA technology for voice and supervisory control and data acquisition (SCADA) monitoring and control applications.

The 410 – 430 MHz system was engineered by ESS together with the Sasol Electronic and Communications team. Following a rigorous research and evaluation process, Sasol determined the Hytera Accessnet-T system (previously Rhode & Schwartz) was best suited for its operational and user requirements. The system was put into operation in 2008. The initial system comprised 13 TETRA base stations and about 3,500 intrinsically safe handheld TETRA radio terminals.

The limitation on capacity caused problems with health and safety standards required for the firm's plant operations. The network was designed and built with a high degree of geographical separated redundancy. This made the network extremely reliable with an uptime better than 99.999 percent.

The robustness of the installed system has been proven through growth since its inception, with the system at times operating at more than double its initial designed capacity. To accommodate the growth and maintain the capability of the system, a "subscriber classes" functionality was added in 2014 to distribute the TETRA subscribers across the four high-capacity TETRA base stations. In 2015, the network's capacity was expanded by upgrading the IP infrastructure and equipping each TETRA base station in the plant area with eight carriers. The handheld terminal capacity increased to 12,000 subscribers. The current Sasol TETRA network in Secunda is one of the highest traffic-loaded systems in the world.

The success of the TETRA system at Sasol can be contributed to the sound and detailed process that was followed over an extended period of time in the design and engineering of the system requirements based on the company's operational and user specifications. From the start of the process, the Sasol Electronics and Communications team's active involvement helped support the success of the system's implementation and commission and ensured a well-trained and motivated team to support and maintain system operations. The operation of the Electronics and Communications section as a business unit has been an added value contributor. This initiative is a motivator for the team to unlock the full value of operational capabilities and features of the system to service any communications system driven requirements identified within the Sasol plant operations.

The transportable Health & Safety Announcement System is primarily used for temporary offices that require gas, fire and public-safety announcements.

Telemetry Services

With its involvement in the TETRA system developments at Sasol and other installations, ESS identified that providing solutions and value-added services linked to installed critical communications networks offered opportunities for a specialist communications enterprise. This formed a sound foundation for the development of its South African designed and manufactured TETRA remote terminal unit (RTU) to support telemetry/telecontrol services to its identified market.

The ESS TETRA-RTU was nominated by the TETRA + Critical Communications Association (TCCA) in the best TETRA innovation 2014 category. Having this in-house capability and expertise has positioned ESS well to benefit from a growing trend of expanding on available communications systems capabilities and unlocking value for the owners of the system. The ESS RTU is a valuable tool for providing operational monitoring and control solutions and optimizing system, safety and security features offered by the available communications system. A typical example is the increase in demand for automation, monitoring and control over PMR networks.

Typical ESS TETRA telemetry/telecontrol systems supplied to Sasol include pipeline monitoring, railway track monitoring and control, environmental monitoring and public address systems for indoor and outdoor applications. The public address system provides gas and fire alarms, as well as voice notifications in the case of incident and accident handling.

The RTU can operate on various wireless technologies such as TETRA, Digital Mobile Radio (DMR), digital Private Mobile Radio (dPMR), GSM and legacy MPT 1327. A built-in Linux microprocessor simplifies programming and allows the product to be adapted to client-specific requirements. The unit falls in line with ESS' development focus on providing solutions to meet the growing demand for wireless applications and data efficiency in the telemetry industry.

South and Southern Africa is expected to experience relatively good growth for 2016 and 2017 in

the trunked radio communications market. Various requests for information (RFIs) for digital wireless communications solutions that cover the transport, safety and security and mining sectors have been issued during the past couple of months. The South African RFIs issued indicate an increasing awareness of Long Term Evolution (LTE) for wide bandwidth applications in conjunction with mission-critical TETRA narrowband communications technology. A current constraint on LTE in South Africa, similar to experiences internationally, is the unavailability of sufficient spectrum for private communications networks. To address this, international suppliers provide a TETRA/LTE gateway to public LTE networks.

The debate on TETRA and LTE is ongoing internationally. In this regard, one can only reference the Netherlands' decision, which operated its C2000 TETRA network for 15 years. In 2015, Dutch safety users investigated the latest reliable mission-critical communications technologies and found that TETRA, as a proven and mature technology, was still the best option for at least another 15 years. ■

New professional mobile radio (PMR) systems and upgrades to current systems have been put in operation in Southern Africa in the mining, safety and security, and oil and gas sectors of the economy.

Johan Hoolsema is managing director of Expert System Solutions. He began his career as a design engineer for Philips Defense in the Netherlands. In South Africa, Hoolsema was involved in the system engineering and rollout of three national MPT 1327 radio trunking systems for Transnet, Fleetcall and One-2-One. He founded Expert System Solutions in 1999 with a focus on radio communications systems, as well as on the design and manufacture of wireless monitoring and control systems. Hoolsema has more than 34 years of experience in wireless communication systems. Email feedback to editor@RRMediaGroup.com.

Photo copyright Sami Hätönen

Communications Cooperation in Finland

A scarcity of resources has led to public-safety and mission-critical communications' social and technology innovation.

By Jarmo Vinkvist, Tero Pesonen, Heikki Riippa and Kari Junttila

Finland is a country where the TETRA-based national communications network is shared not only by public-safety agencies, but also by public transport and energy utilities. It is also a country where a 24/7 situational overview is common to all organizations and companies critical to national operations. In this article we drill into the fundaments that drove Finland to where it is and then look toward its future.

Resource Scarcity

In the 1980s, Finland was similar to many other countries in that each public-safety agency had its own dedicated analog — mostly unencrypted — radio system. It was evident that systems were nearing their end of lives. The era of mobile telephony had just begun with Nordic Mobile Telephony (NMT), and GSM digital cellular technology was under development. These developments pushed the understanding of technical boundaries for future digital public-safety communications solutions. It became evident that, because of limited resources, the only way for the agencies to have access to new technology was to do it together. From that realization, came the concept for a national shared public-safety network. The first call on the TETRA-based VIRVE network took place in the late 1990s, and the network reached full national coverage by the end of 2002.

To build trust, it was decided that each organization in the digital TETRA network was equally important but operationally would have its own private virtual radio network (PVRN). Seamless nationwide mobility and the capability to send messages to anyone in the network were enabled. Multiagency cooperation was established via designated common talk groups. The new common

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Photo courtesy Airbus

Firefighters and paramedics in Finland collaborate through multiagency operations for better efficiency during emergencies.

communications with increased trust enabled and required renewal and rationalization of the 1-1-2 emergency response center structure.

The Emergency Response Center Administration (ERCA) was established at the end of 2005. The agency handles call-taking and dispatching for all incidents and all agencies in the country. In parallel, the Finnish model of field command, where the commander leads remotely from the road, required greater situational awareness. To achieve this, police implemented a GPS-based AVL system to use with a computerized field command solution. The solution turned out to be very efficient, so the police made it available to other public-safety agencies free of charge. With a few agency-specific modifications, a public-safety official receives assignments from common dispatching and can share the same situational picture through common tools.

A Hybrid System

VIRVE has enjoyed wide support among the agencies. VIRVE's use has ranged from military to communal environmental protection and everything in between. As trust and cooperation between the users deepened and the technology proved its capabilities, a more comprehensive risk management view was taken. Critical infrastructure — in particular power — was identified as vital for the society to function. Utilities and their 24/7 control centers are now part of the cooperation scheme and common situational overview.

The national railway communications network recently migrated to the same high-availability VIRVE network because its dedicated railway voice system reached end of life. The next sphere of cooperation is to connect the Finnish public-safety network with the Norwegian and Swedish networks to enable seamless cross-border cooperation in the Nordic countries.

When VIRVE was built, site and transmission sharing were the norm because of resource scarcity. In this sense, it has been a hybrid network of a sort from the beginning. Following Finland's path to Long Term Evolution (LTE) (see "Finland's 5 Steps to Critical Broadband" in Quarter 4 2014 of *RadioResource International*), the public-safety operator now offers complementary secure data access through two national commercial cellular operators via a dedicated public-safety LTE core network. The drive is toward full mission-critical LTE service that can eventually replace TETRA, but interworking between TETRA and LTE will be required for many years until LTE networks' functionality, availability and coverage are sufficient and the organizations have made the transition from TETRA to the LTE-based service. This is the case even with the radio access hybrid plan where dedicated critical broadband service is in the major cities, and the radio access is shared with the commercial operators in the rural areas.

Next Generation

It is expected that different segments of critical communications will come together. Machines will cooperate, analyze incidents and take action on the data — be it Internet of things (IoT), sensors, self-driving cars or flood estimation. Field operations will be more information centric. With urbanization, aging, climate change, cyber and political threats, protection of the society and citizens will increase in priority. The final cooperation boundaries stemming from the paper process era will be dismantled.

The Finnish experience shows that trust in many layers is the key to success. Proper tools that provide security and safety enable parties to come together. They provide the means to share information, find new ways to work and move forward. The success is in cooperation. ■

Jarmo Vinkvist is the CEO at VIRVE operator Suomen Virveverkko. He was previously chief operating officer (COO) in the group's parent company, State Security Networks.

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SPECS SURVEY: PORTABLE RADIOS

MANUFACTURER→	Alinco, Electronics div.	Codan Radio Communications	Connect Systems	Connect Systems	EF Johnson Technologies	EF Johnson Technologies	EF Johnson Technologies
PRODUCT NAME→	**DJ-NX40T**	**Envoy**	**CS610**	**CS710**	**TK-5x30**	**Viking VP600**	**Viking VP900**
↓SPECS							
Suggested list price	--	--	US$270	US$280	--	--	--
For what protocols	NXDN	High-frequency SSB	DMR, CTCSS, DCS	DMR, CTCSS, DCS	P25, SmartNet/ SmartZone	P25, SmartNet/ SmartZone	P25, SmartNet/ SmartZone
Frequency type	Single	--	Single	Single	Single	Single	Dual
Frequency ranges	450-512 MHz	TX: 1.6-30 MHz; RX: 250 kHz to 30 MHz	400-470 MHz	400-470 MHz	136-174, 380-470, 762-806, 806-870 MHz	136-174, 380-470, 762-806, 806-870 MHz	136-174, 763-805, 806-869 MHz
Conventional/trunked	Conventional	N/A	Conventional	Conventional	Both	Both	Both
Analog/digital	Digital	Both	Both	Both	Both	Both	Both
Dimensions (HWD)	5.7 x 9.9 x 4.8 cm	RF unit: 21 x 26.9 x 6.6 cm; handset: 15 x 3.3 x 7.6 cm	11.3 x 5.5 x 3.5 cm	11.3 x 5.5 x 3.5 cm	13.9 x 5.8 x 4.8 cm	19 x 6.7 x 4.4 cm	19 x 6.7 x 4.4 cm
Weight	313 g w/ 2.65 Ah battery pack & antenna	RF unit: 2.8 kg; handset: 19.8 g	275 g	275 g	448 g	346 g	346 g
Housing material	Polycarbonate & die-cast metal	Die-cast aluminum	Plastic, metal	Plastic, metal	Polycarbonate	Polycarbonate	Polycarbonate
Channel capacity	260	1,000	32	1,000	1,024; 4,000 (opt.)	1,024	2,048
Channel spacing	6.25 kHz	N/A	12.5 kHz	12.5 kHz	6.25, 12.5, 25 kHz	12.5, 25 kHz	12.5, 25 kHz
Types of scans	N/A	Selective, voice, digital	Dual priority	Dual priority	System, group, priority, radiowide	System, group, priority, radiowide	System, group, priority, radiowide
Types of displays	Dot matrix LCD	Full color, QVGA	None	LCD	Multiline, alphanumeric color backlit LCD, front	Multiline, alphanumeric backlit LCD, top & front	Multiline, alphanumeric, backlit LCD, top & front
Current drain (standby)	<95 mA	500 mA	100 mA (standby); 50 mA (PowerSave)	100 mA (standby); 50 mA (PowerSave)	--	260 mA	310 mA
Power requirements	7.5 VDC (nom.)	13.8 VDC	7.2 V	7.2 V	7.5 V	7.4 V input	7.4 V input
Battery life/duty	12 hrs. (approximately)	N/A	10 hrs. (analog); 14 hrs. (digital)	10 hrs. (analog); 14 hrs. (digital)	17 hrs.	10 hrs.	10 hrs.
DTMF keypad	Limited keypad	Numeric/text entry	No keypad	DTMF	All	All	All
If radio is trunked:							
# of groups/systems	Yes, NXDN	20	N/A	N/A	≤ 512	≤1,024	≤ 2,048
Unique ID code	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Auto check-in roam	N/A	N/A	N/A	N/A	Yes	Yes	Yes
Selective calling	Yes	Yes	Std.	Std.	Yes	Yes	Yes
Over-the-air programming	N/A	Yes	No	No	Yes	Yes	Yes
Receiver specs:							
Sensitivity	0.22 µV (3% BER) @ 6.25 kHz	-125 dBm @ 10 dB SINAD	-117 dBm (BER 5%)	-117 dBm (BER 5%)	--	-119 dBm	-119 dBm
Squelch sensitivity	-10 dBu	N/A (syllabic voice det.)	-120 dBm	-120 dBm	--	-119 dBm	-119 dBm
Adjacent-channel selectivity	60 dB (narrow)	>70 dB	60 dB	60 dB	12.5 kHz: 60 dB; 25 kHz: 75 dB	12.5 kHz: 60 dB; 25 kHz: 75 dB	12.5 kHz: 60 dB; 25 kHz: 75 dB
Current drain (RX)	<500 mA	500 mA	400 mA @ 1 W	400 mA @ 1 W	--	650 mA	700 mA
Spurious rejection	70 dB	>70 dB	70 dB	70 dB	75-80 dB	80 dB	80 dB
Audio output power	700 mW/8 Ω	4 W into 4 Ω	1 W	1 W	1 W	1 W	1 W
Audio distortion	<3%	<5%	3% @ 500 mW	3% @ 500 mW	3%	1.5%	1%
Frequency stability	±1.5 ppm	0.5 ppm (std.)	1 ppm	1 ppm	VHF: 2 ppm; UHF: 1 ppm; 700/800 MHz: 1.5 ppm	1.5 ppm	1.5 ppm
Transmitter specs:							
RF output power	5 W (low 1W)	100/125 W PEP (max.) (program., H/M/L sel.)	4 W	4 W	VHF: 6 W; UHF: 5 W; 700/800 MHz: 3 W	VHF: 5 W; UHF: 4 W; 700/800 MHz: 2.5/3 W	VHF: 5 W; 700/800 MHz: 2.5/3 W
Spurious and harmonics	66 dB	<64 dB below PEP, <80 dB spurious	-36 dBm <1 GHz; -30 dBm >1 GHz	-36 dBm <1 GHz; -30 dBm >1 GHz	70 dB	75 dB	75 dB
Frequency spread	N/A	N/A	400-470 MHz	400-470 MHz	Full band split	Full band split	Full band split
Current drain (TX)	<2 A	8 A (typ.) voice	1.55 A (analog); 800 mA (digital)	1.55 A (analog); 800 mA (digital)	N/A	2.7 A	2.7 A
FM hum and noise	40 dB (narrow)	N/A	-40 dB	-40 dB	12.5 kHz: 44 dB; 25 kHz: 50 dB	12.5 kHz: 44 dB; 25 kHz: 50 dB	12.5 kHz: 43 dB; 25 kHz: 49 dB
Audio response	+1 to -3 dB	300 Hz to 2.7 kHz (std.)	+1 to -3 dB	+1 to -3 dB	--	+1, -3 dB	+1, -3 dB
Audio distortion	<3%	<5%	3%	3%	2%	1.5%	1.5%
Features:							
Talkaround	Std.	N/A	Std.	Std.	Std.	Std.	Std.
Allows encryption/type	NXDN digital	Opt., AES-256	ETSI std.	ETSI std.	Opt., DES-OFB, AES	Opt., DES-OFB, AES	Opt., DES-OFB, AES
Remote speaker/mic jack	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Auto noise squelch	N/A	Std.	Std.	Std.	Std.	Std.	Std.
Accepts NiMH battery	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Busy-channel indicator	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Lockout	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Accepts CTCSS/DCS	N/A	N/A	Std.	Std.	Std.	Std.	Std.
Time-out timer	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Channel scanning	N/A	Std.	Std.	Std.	Std.	Std.	Std.
Two-tone seq. decoder	N/A	Std.	N/A	N/A	Std.	Std.	Std.
PC programmable	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Programmable ANI	Std., NXDN	N/A	N/A	N/A	Std.	Std.	Std.
Intrinsically safe	No	N/A	N/A	N/A	N/A	N/A	N/A
Cloning capability	Std.	Std.	N/A	N/A	N/A	N/A	N/A
P25 CAP SDoCS	N/A	N/A	N/A	N/A	Std.	Std.	Std.
Warranty	1 year	3 yrs. (std.); 5 yrs. (opt.)	1 year	1 year	3 years	3 years	3 years

Key: N/A means not applicable. -- means information was not supplied. Dimensions may be rounded off.

MANUFACTURER→	Entel	Entel	Entel	Finmeccanica	Finmeccanica	Finmeccanica	Harris
PRODUCT NAME→	HT725	HT986	HT916T	PUMA T4 TE	PUMA T4 LE	PUMA T4 TLE	XL-200P
↓SPECS							
Suggested list price	US$417	US$915	US$1,917	--	--	--	US$2,500 single band; US$4,400 multiband conv.
For what protocols	CTCSS, DCS, 5 tone	CTCSS, DCS, 5 tone, DTMF	CTCSS, DCS, MPT1327, DTMF	TETRA/TEDS, FM	LTE, HSPA+, UMTS, EDGE, GPRS, GSM	TETRA/TEDS, FM, LTE	P25 Phase 1/2
Frequency type	Single	Single	Single	Single	Multiband	Multiband	Multiband or single band
Frequency ranges	136-174 MHz	400-470 MHz	66-88 MHz	380-470, 806-870 MHz	4G: bands 1, 3, 7, 8, 20; 3G: bands 1, 2, 5, 8; 2G: 850/900 MHz, 1.8/1.9 GHz	TETRA: 380-470, 806-870 MHz; 2G: 700/850/900, 1.8/1.9 GHz, bands 1, 3, 5, 7	136-174, 378-522, 768-870 MHz, LTE bands 4, 13, 14
Conventional/trunked	Conventional	Conventional	Conventional/trunked	Trunked	Trunked	Trunked	Both
Analog/digital	Analog	Analog	Analog	Both	Digital	Both	Both
Dimensions (HWD)	13 x 5.9 x 3.7 cm	13 x 5.9 x 3.7 cm	13 x 5.9 x 3.7 cm	13.8 x 6 x 3.8 cm	13.8 x 6 x 3.8 cm	13.8 x 6 x 3.8 cm	14.7 x 5.8 x 3.6 cm (w/ battery)
Weight	277 g	277 g	277 g	400 g	400 g	400 g	431 g w/ std. battery
Housing material	Polycarbonate	Polycarbonate	Polycarbonate	Polycarbonate	Polycarbonate	Polycarbonate	Aluminum, high-impact polycarbonate
Channel capacity	256	256	1,024	--	--	--	12,500
Channel spacing	12.5/20/25 kHz	12.5/20/25 kHz	12.5/20/25 kHz	12.5/25/50 kHz	1.4/3/5/10/15/20 MHz	12.5/25/50 kHz; 1.4/3/5/10/20 MHz	12.5, 25 kHz, NPSPAC
Types of scans	16 scan lists, standard, priority	16 scan lists, standard, priority	MPT	Priority	Priority	Priority	Std., priority, trunked/conventional, voting
Types of displays	LCD	LCD	LCD	3.6-in. touchscreen LCD TFT w/ 16M colors	3.6-in. touchscreen LCD TFT w/ 16M colors	3.6-in. touchscreen LCD TFT w/ 16M colors	Front color & top LCD w/ color visual ch. indication
Current drain (standby)	80 mA	80 mA	80 mA	--	--	--	200 mA
Power requirements	7.4 V	7.4 V	7.4 V	--	--	--	7.5 VDC (nom.) input
Battery life/duty	14 hrs.	14 hrs.	14 hrs.	>20 hrs.	>20 hrs.	>20 hrs.	10 hrs. (min.)
DTMF keypad	Limited	Full w/ DTMF	Full w/ DTMF	DTMF (full soft keypad)	DTMF (full soft keypad)	DTMF (full soft keypad)	DTMF, limited keypad
If radio is trunked:							
# of groups/systems	N/A	N/A	16/4	1,500	1,500	1,500	1,024; 512 systems
Unique ID code	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Auto check-in roam	N/A	N/A	Yes	Yes	Yes	Yes	Yes
Selective calling	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Over-the-air programming	No	No	No	Yes (future release)	Yes (future release)	Yes (future release)	Yes
Receiver specs:							
Sensitivity	-117 dBm	-117 dBm	-117 dBm	EN 300 392-2 compliant	2G/3G/4G compliant	EN 300 392-2, 2G/4G compliant	VHF: -122 dBm; UHF: -121 dBm; 700/800: -120 dBm
Squelch sensitivity	Better than -119 dBm	Better than -119 dBm	Better than -119 dBm	--	--	--	8 ±1.5 dB (typ.)
Adjacent-channel selectivity	70 dB	70 dB	70 dB	EN 300 392-2 compliant	2G/3G/4G compliant	EN 300 392-2, 2G/4G compliant	66/65/63 @ 12.5 kHz; 77/74/72 @ 25 kHz
Current drain (RX)	400 mA (max. volume)	400 mA (max. volume)	400 mA (max. volume)	--	--	--	500 mA @ rated audio
Spurious rejection	70 dB	70 dB	70 dB	EN 300 392-2 compliant	2G/3G/4G compliant	EN 300 392-2, 2G/4G compliant	90/87/84/80 dB
Audio output power	1 W	1 W	1 W	1 W @ 4 Ω	1 W @ 4 Ω	1 W @ 4 Ω	1.5 W rated
Audio distortion	3%	3%	3%	--	--	--	<1.25%
Frequency stability	2.5 ppm	2.5 ppm	2.5 ppm	EN 300 392-2 compliant	2G/3G/4G compliant	EN 300 392-2, 2G/4G compliant	±1 ppm
Transmitter specs:							
RF output power	5 W	1 W	1 W	TETRA: 1.8 W (class 3L); FM: 4 W	23 dBm (LTE)	TETRA: 1.8 W (Class 3L); FM: 4 W; LTE: 23 dBm	VHF: 1-6 W; UHF: 1-5 W; 700/800 MHz: 0.5-3 W
Spurious and harmonics	<0.25 µW	<0.25 µW	<0.25 µW	EN 300 392-2 compliant	2G/3G/4G compliant	EN 300 392-2, 2G/4G compliant	-80 dBc
Frequency spread	38 MHz	70 MHz	22 MHz	EN 300 392-2 compliant	2G/3G/4G compliant	EN 300 392-2, 2G/4G compliant	VHF: 38 MHz; UHF: 144 MHz; 700 MHz: 41 MHz; 800 MHz: 64 MHz
Current drain (TX)	1.7 A	1 A	1 A	--	--	--	VHF/UHF: 2 A; 700/800: 1.7 A
FM hum and noise	>40 dB	>40 dB	>40 dB	--	--	--	-47/-45 @ 12.5 kHz; -51/-54/-50 @ 25 kHz
Audio response	Pre-emphasis 6 dB/octave, 20 dB/decade	Pre-emphasis 6 dB/octave, 20 dB/decade	Pre-emphasis 6 dB/octave, 20 dB/decade	--	--	--	+1, -3 dB
Audio distortion	<5%	<5%	<5%	--	--	--	<1.25%
Features:							
Talkaround	Std.	Std.	Std.	Std.	Std. (future release)	Std.	Std.
Allows encryption/type	Voice inversion	Voice inversion	Voice inversion	Std., air interface/end-to-end (opt.)	Std., air interface/end-to-end (opt.)	Std., air interface/end-to-end (opt.)	Std., single key DES; multikey AES/DES (opt.)
Remote speaker/mic jack	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Auto noise squelch	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Accepts NiMH battery	N/A (Li-ion)	N/A (Li-ion)	N/A (Li-ion)	N/A (Li-ion)	N/A (Li-ion)	N/A (Li-ion)	N/A (Li-poly)
Busy-channel indicator	Std.	Std.	Std.	N/A (avail. in TETRA DMO)	N/A	N/A (avail. in TETRA DMO)	Std.
Lockout	Std.	Std.	N/A	Std.	Std.	Std.	Std.
Accepts CTCSS/DCS	Std.	Std.	Std.	Opt.	Opt.	Opt.	Std.
Time-out timer	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Channel scanning	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Two-tone seq. decoder	Std.	Std.	N/A	N/A	N/A	N/A	Std.
PC programmable	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Programmable ANI	Std.	Std.	Std.	N/A	N/A	N/A	Std.
Intrinsically safe	N/A	Std.	Std.	N/A	N/A	N/A	Opt.
Cloning capability	Std.	Std.	Std.	N/A	N/A	N/A	Std.
P25 CAP SDoCS	N/A	N/A	N/A	N/A	N/A	N/A	Std.
Warranty	2 years	2 years	2 years	2 years (typ.)	2 years (typ.)	2 years (typ.)	2 years (std.)

PORTABLE RADIOS

MANUFACTURER→	Harris	Harris	Hytera Communications	Holzberg Communications	Icom	Icom	Icom
PRODUCT NAME→	**XG-75P**	**XG-25P**	**PT790Ex**	**HC-400HP**	**IC-F9011/F9021 series**	**IC-F3400D/IC-F4400D**	**IC-F1000D/IC-F2000D**
↓SPECS							
Suggested list price	--	--	--	US$375	US$2,020-$2,200	--	US$370
For what protocols	P25 Phase 1/2, OpenSky, EDACS, Provoice	P25 Phase 1/2, OpenSky, EDACS, Provoice	TETRA	--	P25, analog FM	NXDN, dPMR, analog FM	NXDN, dPMR, analog FM
Frequency type	Single	Single	Multiband	Single	Single	Single	Single
Frequency ranges	136-174, 378-470, 450-522, 764-870 MHz	136-174, 378-470, 764-870 MHz	320-380, 380-430, 405-475, 806-870 MHz	136-174, 400-480 MHz	136-174, 380-470, 400-470, 450-520 MHz	136-174, 380-470, 450-512 MHz	136-174, 360-400, 400-470, 450-512, 450-520 MHz
Conventional/trunked	Both	Both	TETRA std., TMO/DMO	Conventional	Both	Both (NXDN Type-C, Type-D, dPMR mode 3)	Conventional
Analog/digital	Both	Both	Digital	Analog	Both	Both	Both
Dimensions (HWD)	14.9 x 6.2 x 4.9 cm	17.3 x 6.2 x 4.7 cm	14.1 x 5.5 x 3.9 cm	15 x 5.8 x 3.8 cm	16.7 x 5.9 x 4.2 cm	12.4 x 5.4 x 3 cm	11.2 x 5.2 x 3 cm
Weight	298 g	281 g	515 g (w/ battery, antenna)	249 g	533 g w/ battery pack	303 g w/ battery pack	260 g w/ battery pack
Housing material	Aluminum, high-impact polycarbonate/ABS	Aluminum, high-impact polycarbonate/ABS	Plastic cement	ABS	IP57; polycarbonate	IP68; polycarbonate	IP67; polycarbonate
Channel capacity	1,024 (std.)	512 (std.); 1,024 (opt.)	25 kHz	16	512 chs., 128 zones	1,024 channels, 128 zones; 32 channels, 2 zones (no display)	128 channels, 8 zones
Channel spacing	12.5, 25 kHz, NPSPAC	12.5, 25 kHz, NPSPAC	25 kHz	12.5/25 kHz	12.5/15/25/30 kHz	6.25/12.5/25 kHz	6.25/12.5/15/25/30 kHz
Types of scans	Priority, ProScan, wide area, trunked to conv.	Priority, ProScan, wide area, trunked to conv.	Frequency, group	Normal	Normal, priority, dual priority, voting	Normal, priority, dual priority, voting	Normal, priority, dual priority, voting
Types of displays	Dot matrix LCD; high-contrast sunlight, more	Dot matrix LCD; high-contrast sunlight, more	LCD	Without display	Full-dot matrixed	Color LCD	No LCD
Current drain (standby)	125 mA	119 mA	92 mA	20 mA w/ battery saver	300 mA	140 mA	110 mA
Power requirements	7.5 VDC (nom.) input	7.5 VDC (nom.) input	--	7.4 V ±20%	7.2 VDC	7.5 VDC	7.5 VDC
Battery life/duty	9-16 hrs.	9-16 hrs.	>14 hrs.	16 hrs.	9 hrs.	16 hrs.	18 hrs.
DTMF keypad	DTMF, limited keypad	DTMF, limited keypad	Full keypad	No keypad	DTMF, limited keypad, no keypad	DTMF, limited keypad, no keypad	No keypad
If radio is trunked:							
# of groups/systems	1,024	512 (std.) 1,024 (opt.)	3,000 groups	N/A	250 groups/4 systems	999 groups/128 zones	500 groups/8 zones
Unique ID code	Yes	Yes	--	--	Yes	Yes	Yes
Auto check-in roam	Yes	Yes	Yes	--	Yes	Yes	Yes (auto check-in)
Selective calling	Yes	Yes	--	--	Yes	Yes	Yes
Over-the-air programming	Yes	Yes	Yes	--	N/A	Yes	N/A
Receiver specs:							
Sensitivity	0.25 µV/-119 dBm	0.21 µV/-120.5 dBm	-116 dBm	0.35 µV @ 12.5 kHz, 0.25 µV @ 25 kHz	0.25 µV (typ.) @ 12 dB SINAD; 0.30 µV (typ.) @ 5% BER	0.24 µV (typ.) @ 12 dB SINAD; -4 dB µV emf. (typ.) @ 20 dB SINAD; -11/-6 dB µV emf. (typ.) (DN/DVN) @ 1% BER	0.21/0.24 µV (typ.) @ 12 dB SINAD; -4 dB µV emf. (typ.) @ 20 dB SINAD; -8 dB µV emf. (typ.)(DVN) @ 5% BER
Squelch sensitivity	8 ±2 dB (typ.)	8 ±2 dB (typ.)	--	122 dBm	0.25 µV (typ.)	0.22 µV (typ.)	0.19 µV (typ.)
Adjacent-channel selectivity	66/69/67 @ 12.5 kHz; 79/77/75 @ 25 kHz	67/60/66 @ 12.5 kHz; 78/72/77 @ 25 kHz	--	60/65 dB @ 12.5/25 kHz	60 dB (typ.) @ digital	65 dB (typ.) @ digital	59/58 dB (typ.) @ digital
Current drain (RX)	252 mA @ rated audio	220 mA	--	150 mA	800 mA (max.)	550 mA	400 mA
Spurious rejection	>80 dB	82 dB	--	-70 dB	80 dB (typ.)	80 dB (typ.)	80 dB (typ.)
Audio output power	500 mW	500 mW	1.2 W	500 mW	1 W (typ.)	8 W (typ.)	8 W (typ.)
Audio distortion	VHF, 700/800 MHz: 1.5%; UHF: 1.7%	1%	5%	5%	10%	5%	5%
Frequency stability	±1.5 ppm	±1.5 ppm	<1 ppm	5 ppm	±1 ppm	±1 ppm	±1 ppm
Transmitter specs:							
RF output power	VHF: 6 W; UHF: 5 W; 700/800 MHz: 3 W	VHF, UHF-L: 5 W; 700/800 MHz: 3 W	1 W	10 W	VHF: 6/2/1 W; UHF: 5/2/1 W	5/2/1 W	VHF: 5/2/1 W; UHF: 4/2/1W
Spurious and harmonics	VHF, UHF-L: -36 dBc; UHF-H: -51.5 dBc; 700/800 MHz: -55 dBc	VHF: -42 dBc; UHF-L: -36 dBc; 700/800 MHz: -55 dBc	--	-36 dBm	80 dB (typ.)	75 dB (typ.)	70 dB (typ.)
Frequency spread	VHF: 38 MHz; UHF-L/H: 92/62 MHz; 700 MHz: 41 MHz; 800 MHz: 64 MHz	VHF: 38 MHz; UHF-L: 92 MHz; 700 MHz: 41 MHz; 800 MHz: 64 MHz	--	VHF: 38 MHz; UHF: 80 MHz	VHF: 38 MHz; UHF: 90/70 MHz	VHF: 38 MHz; UHF: 90/62 MHz	VHF: 38 MHz; UHF: 70/62/40 MHz
Current drain (TX)	1.8 A	1.7 A	--	2.6 A	VHF: 2.2 A; UHF: 2.1 A	VHF: 1.5 A; UHF: 1.8 A	VHF: 1.3 A; 1.4 A
FM hum and noise	Depends on frequency	Depends on frequency	--	45 dB	VHF: 45 dB (typ.); UHF: 44 dB (typ.) @12.5 kHz	54 dB (typ.) @ 12.5 kHz	VHF: 40 dB (typ.); UHF: 44 dB (typ.) @ 12.5 kHz
Audio response	+1, -3 dB	+1, -3 dB	--	+1 to -3 dB	+2 to -8 dB of 6 dB/octave	--	--
Audio distortion	<1%	1%	--	5%	2% (typ.)	1.5% (typ.)	VHF: 1.1% (typ.); UHF: 1.5% (typ.)
Features:							
Talkaround	Std.	Std.	Std.	N/A	Std.	Std.	Std.
Allows encryption/type	Single key DES (std.), multikey AES/DES (opt.)	Single key DES (std.), multikey AES/DES (opt.)	Opt.	No	Std., AES; DES (opt.);	Std., 4-key DES; 256-bit AES w/ OTAR (opt.)	Std., digital voice scrambler
Remote speaker/mic jack	Std.	Std.	Opt.	Std., Kenwood 2 pin	Std.	Std.	Std.
Auto noise squelch	Std.	Std.	Opt.	Std.	Std.	Std.	Std.
Accepts NiMH battery	Std.	Std.	N/A	N/A	N/A, Li-ion (std.); AA (opt.)	N/A (Li-ion)	N/A (Li-ion)
Busy-channel indicator	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Lockout	Std.	Std.	--	Std.	Std.	Std.	Std.
Accepts CTCSS/DCS	Std.	Std.	--	Std.	Std.	Std.	Std.
Time-out timer	Std.	Std.	--	Std.	Std.	Std.	Std.
Channel scanning	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Two-tone seq. decoder	Std.	Std.	N/A	N/A	Std.	Std.	Std.
PC programmable	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Programmable ANI	Std.	Std.	Opt.	Std.	Std.	Std.	N/A
Intrinsically safe	Opt.	Opt.	Std.	N/A	N/A	N/A	N/A
Cloning capability	N/A	N/A	--	N/A	Std.	Std.	Std.
P25 CAP SDoCS	Std.	Std.	N/A	N/A	Std.	N/A	N/A
Warranty	2 years (std.)	2 years (std.)	2 yrs.	1 year	3 yrs. (std.), 6 yrs. (opt.)	3 yrs. (std.), 6 yrs. (opt.)	3 yrs. (std.), 6 yrs. (opt.)

MANUFACTURER→	Infinity/Kirmuss & Associates	JVCKENWOOD	JVCKENWOOD	JVCKENWOOD	Motorola Solutions	Motorola Solutions	Motorola Solutions
PRODUCT NAME→	K-911-AD1	TK-D240/D340	NX-5200/5300	NX-5400	APX 6000	MTP3350	MTP6550
↓SPECS							
Suggested list price	$199	--	--	--	--	--	--
For what protocols	Analog, dPMR, NXDN	DMR, FM	P25 Phase 1/2, NXDN 6.25/12.5 kHz, FM	P25 Phase 1/2, NXDN 6.25/12.5 kHz, FM	P25	TETRA	TETRA
Frequency type	Dual	Single	Single	Single	Single	Single	Single
Frequency ranges	136-174, 400-512 MHz	136-174, 400-470, 450-520 MHz	136-174, 380-470, 450-520 MHz	Rx: 763-776, 851-870 MHz; Tx: 763-776, 793-806, 806-825, 851-870 MHz	VHF, UHF R1/R2, 700/800 MHz	350-470, 806-870 MHz	350-470 MHz
Conventional/trunked	Conventional	Conventional	Both	Both	Both	Trunked	Trunked
Analog/digital	Analog, digital dPMR	Both	Both	Both	Both	Digital	Digital
Dimensions (HWD)	11.4 x 5.7 x 3.8 cm	12.1 x 5.4 x 3.4 cm	13.9 x 5.8 x 4 cm	13.9 x 5.8 x 4 cm	13.9 x 6 x 3.6 cm	12.4 x 5.3 x 3.4 cm	13.2 x 5.9 x 3.4 cm
Weight	283 g	285 g	382 g	382 g	309 g (w/o battery)	280 g (w/ std. battery)	292 g (w/ std. battery)
Housing material	Plastic	High-impact polycarbonate	High-impact polycarbonate	High-impact polycarbonate	Polycarbonate	Polycarbonate	Polycarbonate
Channel capacity	256	32	1,024; 4,000 (opt.)	1,024; 4,000 (opt.)	1,000	10,000 talk groups	10,000 talk groups
Channel spacing	2.5/6.25/12.5/25 kHz	12.5/25 kHz	6.25/12.5/15/20 kHz;	6.25/12.5 kHz	12.5/20/25 kHz	25 kHz	25 kHz
Types of scans	TO, CO, SE, NT	Multiple	Multiple	Multiple	Conventional, trunked, multisystem	Multiple	Multiple
Types of displays	LCD	N/A	Color 1.74-in. transfl.	Color 1.74-in. transfl.	Top, front LCD	LCD color	LCD color
Current drain (standby)	90 mA	100 mA	110 mA	110 mA	5-5-90	--	--
Power requirements	7.5 V (nominal)	7.5 VDC ±20%	7.5 VDC ±20%	7.5 VDC ±20%	1-6 W	3.7 V	3.7 V
Battery life/duty	12 hrs.	13.5-17 hrs.	10-17 hrs./6.5-11 hrs.	10-17 hrs./6.5-11 hrs.	16 hrs.	16 hrs.	16 hrs.
DTMF keypad	Yes	No keypad	Std. key w/o num. keypad, full key w/ num.	Std. key w/o num. keypad, full key w/ num.	DTMF	Full keypad	Full keypad
If radio is trunked:							
# of groups/systems	--	N/A	1,024 ch.-GID/128 zones	1,024 ch.-GID/128 zones	1,000 channels/35 sys.	10,000 talk groups	10,000 talk groups
Unique ID code	Yes	N/A	Yes	Yes	Yes	Yes	Yes
Auto check-in roam	N/A	N/A	Yes	Yes	Yes	--	--
Selective calling	Yes	N/A	Yes	Yes	Yes	Yes	Yes
Over-the-air programming	No	N/A	Yes	Yes	Yes	No	No
Receiver specs:							
Sensitivity	VHF: 0.23 µV, UHF: 0.22 µV	Digital 1% BER: 0.45 µV; digital 5% BER: 0.3 µV; analog (12 dB SINAD): 0.25 µV	NXDN 6.25: 0.20 µV; analog: 0.24 µV; NXDN 12.5, P25 5% BER: 0.25 µV; P25 1% BER: 0.40 µV	NXDN 6.25: 0.20 µV; analog: 0.24 µV; NXDN 12.5, P25 5% BER: 0.25 µV; P25 1% BER: 0.40 µV	0.216, 0.277, 0.188 µV	-118 dBm (typ.)	-116 dBm (typ.)
Squelch sensitivity	--	3 dB	3 dB	3 dB	0.216, 0.277, 0.188 µV	--	--
Adjacent-channel selectivity	VHF W/N/D: 77/71/71 dB; UHF W/N/D: 74/67/58 dB	Analog @ 25/12 kHz: 74/68 dB	P25: 60 dB; analog: 67/73 dB @ 12.5/25 kHz	P25: 60 dB; analog: 64/73 dB @ 12.5/25 kHz	25 kHz: 75.5/79.3/ 78.3 dB; 12.5 kHz: 67.5/70/68.1/67.5 dB	-60 dBc	-60 dBc
Current drain (RX)	400 mA, 90 mA digital	450 mA	400 mA	400 mA	--	<250 mA @ 50% volume	<250 mA @ 50% volume
Spurious rejection	70 dB (typ.)	70 dB	80/75 dB	75 dB	VHF/UHF: 93.2/80.3 dB; 700/800 MHz: 76.6 dB	-45 dBm	-45 dBm
Audio output power	550 mW	1 W/12 Ω (10% dist.)	1 W/8 Ω (5% dist.)	1 W/8 Ω (5% dist.)	VHF/UHFR1/700/800 MHz: 0.5 W; UHF: 1 W	2 W	2 W
Audio distortion	5%	3%	2%	2%	VHF: 1.2%; UHF: 0.9%; 700/800 MHz: 0.9%	5% (max.)	5% (max.)
Frequency stability	±2.25 ppm	±1-2 ppm	±1-2 ppm	±1.5 ppm	±0.0001% ppm	±0.01 ppm	±0.01 ppm
Transmitter specs:							
RF output power	5 W	VHF: 5 W; UHF: 4 W	VHF: 6 W, UHF: 5 W	3 W	VHF: 1-6 W; UHF: 1-5 W; 700/800 MHz: 1-3 W	Class 3L	Class 3L
Spurious and harmonics	65 dB (typ.)	70 dB	-70 dB	-70 dB	VHF: 93 dB; UHF: 80 dB; 700/800 MHz: 76.6 dB	-78 dBc	-78 dBc
Frequency spread	--	--	--	--	Full band split	350-470, 806-870 MHz	350-470 MHz
Current drain (TX)	1.3 A	2.1 A	2.3 A	2.2 A	--	--	--
FM hum and noise	Analog W/N: 52/46 dB; digital W/N: 50/44 dB	Analog: 40/45 dB @ 12.5/25 kHz	Analog: 40/45 dB @ 12.5/25 kHz	Analog: 40/45 dB @ 12.5/25 kHz	-47 dB	-45 dBc	-45 dBc
Audio response	--	--	--	--	+1, -3 dB	--	--
Audio distortion	--	2%	2%	2%	VHF/UHF: 0.5%; 700 MHz:.0.6%; 800 MHz: 1%	--	--
Features:							
Talkaround	Std.	Std.	Std.	Std.	Std.	--	--
Allows encryption/type	Scrambler analog, dig.	N/A	Std., DES, AES (opt.)	Std., DES, AES (opt.)	Std., ADP, AES, DES, more	Std., air interface, end-to-end	Std., air interface, end-to-end
Remote speaker/mic jack	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Auto noise squelch	Std.	Std.	Std.	Std.	Std.	N/A	N/A
Accepts NiMH battery	N/A	Std.	Std.	Std.	Opt.	N/A	N/A
Busy-channel indicator	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Lockout	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Accepts CTCSS/DCS	Std.	Std.	Std.	Std.	Std.	N/A	N/A
Time-out timer	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Channel scanning	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Two-tone seq. decoder	2 & 5 tone	Std.	Std.	Std.	Std.	N/A	N/A
PC programmable	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Programmable ANI	Std.	Std.	Std.	Std.	Std.	--	--
Intrinsically safe	N/A	N/A	Opt.	Opt.	Opt.	N/A	N/A
Cloning capability	Std.	Std.	Std.	Std.	Std.	N/A	N/A
P25 CAP SDoCS	N/A	N/A	Std.	Std.	--	N/A	N/A
Warranty	2 years	2 years	3 years	3 years	1 year (std.)	1 year	1 year

PORTABLE RADIOS

MANUFACTURER→	Nautic Devices	Pyramid Communications	Quanzhou Risen Electronics	Quanzhou Risen Electronics	Quanzhou Risen Electronics	Relm Wireless	Relm Wireless
PRODUCT NAME→	**Yapalong4000**	**WM-1000**	**RS-629D**	**RS-208D**	**RS-209D**	**KNG2-Portable**	**KNG-S Portable**
↓SPECS							
Suggested list price	$250	$585	--	--	--	--	--
For what protocols	TDMA, full duplex	P25, NXDN, MPT, LTR, conv., EDACS, PassPort	DMR TDMA	dPMR FDMA	dPMR FDMA	P25	P25
Frequency type	Single	Single	Single	Single	Single	Single	Single
Frequency ranges	902-928 MHz	915 MHz ISM	136-174, 400-470 MHz	136-174, 400-470 MHz	136-174, 400-470 MHz	VHF: 136-174 MHz; UHF: 380-470, 440-520, 763-870 MHz	VHF: 136-174 MHz; UHF: 380-470 MHz
Conventional/trunked	Conventional	Both	Conventional	Conventional	Conventional	Both	Conventional
Analog/digital	Digital	Digital	Both	Both	Both	Both	Both
Dimensions (HWD)	16.5 x 6.4 x 2.3 cm	10.9 x 6.6 x 3.8 cm	13.5 x 6.1 x 3.6 cm	11.9 x 5.3 x 3.6 cm	11.4 x 5.1 x 3.3 cm	14 x 6.4 x 4.6 cm	14 x 6.4 x 4.6 cm
Weight	125 g	170 g	278 g	176 g	181 g	454 g	454 g
Housing material	Plastic	ABS plastic	Polycarbonate, ABS	Polycarbonate, ABS	Polycarbonate, ABS	Lexan	Lexan
Channel capacity	1 Mbps	4 channels	1,024	16	256	5,000	512
Channel spacing	750 kHz	N/A	12.5/25 kHz	12.5/25 kHz	12.5/25 kHz	6.25/12.5/25 kHz	12.5/25 kHz
Types of scans	Auto	N/A	Carrier control	Carrier control	Carrier control	Dual, priority, vote, group (zone)	Dual, priority, vote, group (zone)
Types of displays	No display	LCD	LCD	No display	LCD	Multiline color LCD	13-character multiline LCD
Current drain (standby)	10 uA	50 mA	113 mA (standby); 67 mA (power save)	90 mA (standby); 10-90 mA (power save)	90 mA (standby); 10-90 mA (power save)	170/180/180/150 mA	75/85 mA
Power requirements	200 mA	12 V	7.4 V	3.7 V	3.7 V	10.8 VDC Li-ion battery	10.8 VDC Li-ion battery
Battery life/duty	10 hrs./1,000 charges	24 hrs.	8 hrs.	8 hrs.	8 hrs.	12 hrs.	14 hrs.
DTMF keypad	No keypad	No keypad	DTMF	No keypad	DTMF	DTMF	DTMF
If radio is trunked:							
# of groups/systems	--	--	N/A	N/A	N/A	5,000 channels/64 systems	N/A
Unique ID code	Yes	Yes	Yes	Yes	Yes	Yes	N/A
Auto check-in roam	No	N/A	N/A	N/A	N/A	Yes	N/A
Selective calling	No	Yes	Yes	Yes	Yes	Yes	Yes
Over-the-air programming	No	No	No	No	No	Yes	Yes
Receiver specs:							
Sensitivity	-92 dBm	N/A	-119 dBm (BER ≤5%); -117 dBm (BER ≤1%)	-117 dBm (BER ≤1%)	-117 dBm (BER ≤1%)	-121 dBm	-121 dBm
Squelch sensitivity	--	N/A	-120 dBm	-124 dBm	-124 dBm	>6 dB SINAD, <12 dB SINAD	>6 dB SINAD, <12 dB SINAD
Adjacent-channel selectivity	--	N/A	≥50 dB @ 12.5 kHz; ≥55 dB @ 25 kHz	≥50 dB @ 12.5 kHz; ≥55 dB @ 25 kHz	≥50 dB @ 12.5 kHz; ≥55 dB @ 25 kHz	80 (70) dB	80 (70) dB
Current drain (RX)	180 mA	50 mA	400 mA	420 mA	420 mA	≤250 mA	150/160 mA
Spurious rejection	--	N/A	50 dB	-60 dB	-60 dB	≥80 dB	≥80 dB
Audio output power	500 mW	N/A	≥ 1 W	≥450 mW	≥450 mW	3 W	500 mW
Audio distortion	--	N/A	≤5%	≤5%	≤5%	<3%	≤2%
Frequency stability	--	N/A	±1.5 ppm	±2.5 ppm	±2.5 ppm	0.5 ppm	1.5 ppm
Transmitter specs:							
RF output power	500 mW	13.5 dBm	5/1 W	2/1 W	2/1 W	1-6 W	P15S: 6/5/1 W; P400S: 5/4/1 W
Spurious and harmonics	--	N/A	≤-58 dB	≤-58 dB	≤-58 dB	≥75 dB	≥75 dB
Frequency spread	1 MHz	915 MHz FHSS	136-174, 400-470 MHz	136-174, 400-470 MHz	136-174, 400-470 MHz	38/90/80/107 MHz	38/90 MHz
Current drain (TX)	180 mA	80 mA	1.5 A (analog);1 A (digital)	900 mA	900 mA	1.6/1.1 A	1.5 A
FM hum and noise	--	N/A	≤40 dB	40 dB	40 dB	50 (44) dB	50 (44) dB
Audio response	--	N/A	±9.5 dB	±3 dB	±3 dB	+1, -3 dB	+1, -3 dB
Audio distortion	--	N/A	≤10%	≤5%	≤5%	≤3%	≤3%
Features:							
Talkaround	--	--	Std.	Std.	Std.	Std.	Std.
Allows encryption/type	Std., IP	Std., AES	Std., call digital encryption	Std., call digital encryption	Std., call digital encryption	Opt., AES/DES-OFB	Opt., AES/DES-OFB
Remote speaker/mic jack	No	Std.	Std.	Std.	Std.	Std.	Std.
Auto noise squelch	No	N/A	N/A	N/A	N/A	N/A	N/A
Accepts NiMH battery	Std.	Li-poly	N/A	N/A	N/A	N/A	Std.
Busy-channel indicator	No	Std.	Std.	Std.	Std.	Std.	Std.
Lockout	No	Std.	Std.	Std.	Std.	Std.	Std.
Accepts CTCSS/DCS	No	N/A	Std.	Std.	Std.	Std.	Std.
Time-out timer	No	Std.	Std.	Std.	Std.	Std.	Std.
Channel scanning	Std.	N/A	Std.	Std.	Std.	Std.	Std.
Two-tone seq. decoder	No	N/A	N/A	N/A	N/A	Std.	Std.
PC programmable	No	Std.	Std.	Std.	Std.	Std.	Std.
Programmable ANI	No	Std.	N/A	N/A	N/A	Std.	Std.
Intrinsically safe	Std.	N/A	N/A	N/A	N/A	Opt.	Opt.
Cloning capability	No	N/A	N/A	N/A	N/A	Std.	Std.
P25 CAP SDoCS	No	N/A	N/A	N/A	N/A	Std.	Std.
Warranty	1 year	1 year	1 year	1 year	1 year	2 years	2 years

MANUFACTURER→	Relm Wireless	Rexon Technology	Rexon Technology	Royal Communications International	Simoco	Simoco	Simoco
PRODUCT NAME→	KNGP150/400/500/800	RL-D800K	RL-D800	Pathfinder	SDP760	SDP660	SRP9180
↓SPECS							
Suggested list price	--	--	--	--	--	--	--
For what protocols	P25	DMR	DMR	HF-SSB ALE backpack configuration	DMR conv./trunked, MPT1327, analog, conv.	DMR conv./trunked, MPT1327, analog, conv.	P25 conventional/trunked, MPT 1327, analog
Frequency type	Single	Single	Single	Single	Single	Single	Single
Frequency ranges	VHF: 136-174 MHz; UHF: 380-470, 440-520, 763-870 MHz	66-88, 136-174, 405-480, 450-512 MHz	66-88, 136-174, 405-480, 450-512 MHz	1.6-30 MHz	136-174, 400-470, 450-520 MHz	136-174, 400-480, 440-520 MHz	136-174, 400-480, 440-520 MHz
Conventional/trunked	Both	DMR	DMR	Conventional	Both	Both	Both
Analog/digital	Both	Both	Both	Both	Both	Both	Both
Dimensions (HWD)	14 x 6.4 x 4.6 cm	11.3 x 5.4 x 3.35 cm	11.3 x 5.4 x 3.35 cm	22.1 x 22.1 x 11 cm	12.4 x 5.3 x 3.6 cm	13.7 x 6.4 x 3.6 cm	14.5 x 6.1 x 3.6 cm
Weight	454 g	270 g	260 g	225 g	320 g	337 g	377 g
Housing material	Lexan	ABS, polycarbonate	ABS, polycarbonate	Backpack	--	--	High-impact plastic
Channel capacity	5,000	1,000	64	200 (std.)/1,000 ALE	1,024	2,000	1,500
Channel spacing	6.25/12.5/25 kHz	12.5/25 kHz	12.5/25 kHz	10 Hz	12.5/20/25 kHz	12.5 kHz, 25 kHz	2.5/5/6.25/7.5/12.5/25 kHz
Types of scans	Dual, priority, vote, group (zone)	All, priority	All, priority	5 groups, 100 ch./group, 1-5 sec./ch., more	Normal, priority, TX voting	Normal, priority, TX voting	Normal, priority, dual watch
Types of displays	Multiline LCD	Matrix	N/A	LCD	TFT LCD	TFT LCD	LCD graphic dot matrix
Current drain (standby)	117/128/128/154 mA	115 mA	110 mA	0.9 A	--	--	See batt. life in hrs.; Li-ion battery pack
Power requirements	10.8 VDC Li-ion battery	7.4 VDC	7.4 VDC	13.8 VDC	7.2 VDC (Li-ion)	7.2 VDC (Li-ion)	7.2 VDC (Li-ion)
Battery life/duty	12 hrs.	12 hrs.	12.5 hrs.	--	≤15 hrs.	≤12 hrs.	9-13 hrs.
DTMF keypad	DTMF	Keypad	No keypad	Enhanced keypad	DTMF	DTMF	Full keypad (prog.)
If radio is trunked:							
# of groups/systems	5,000 channels/ 64 systems	N/A	N/A	--	1,024/1	--	128 scan groups/ 5 systems
Unique ID code	Yes	Yes	Yes	N/A	Yes	Yes	Yes
Auto check-in roam	Yes	No	No	N/A	Yes	Yes	Yes
Selective calling	Yes	Yes	Yes	ALE	Yes	Yes	Yes
Over-the-air programming	Yes	No	No	No	Opt.	N/A	N/A
Receiver specs:							
Sensitivity	P150: -121 dBm; P400/500/800: -119 dBm	0.22 µV	0.22 µV	0.5 µV @ 10 dB SINAD (0.35 µV typ.)	-120 dBm (12 dB SINAD)	-117.5 dBm (12 dB SINAD)	<0.3/0.5 µV @ 12/20 dB SINAD
Squelch sensitivity	>6 dB SINAD, <12 dB SINAD	-123 dBm	-123 dBm	Constant SINAD (dig.)	Programmable	Programmable	6-25 dB SINAD (programmable)
Adjacent-channel selectivity	P150: >80 (>70) dB; P400: >77 (>66) dB; P500: >76 (>66) dB; P800: >74 dB (>66) dB	-65 dBc	-65 dBc	-60 dB @ -1 kHz; +4 kHz	75 dB @ 25 kHz, 70 dB @ 20 kHz, 60 dB @ 12.5 kHz	60 dB @ 12.5 kHz	>65/73 dB @ 12.5/25 kHz
Current drain (RX)	≤250 mA	150 mA	145 mA	0.9 A	--	--	<120 mA
Spurious rejection	≥80 dB	-57 dBm	-57 dBm	-80 dB	75 dB	70 dB	>70 dB
Audio output power	500 mW	1 W	1 W	5 W	1 W	500 mW	500 mW
Audio distortion	≤2%	3%	3%	2.5% distortion	3%	<3%	<5%
Frequency stability	0.5 ppm	±1 ppm	±1 ppm	0.6 ppm	±0.5 ppm	±2 ppm	±1.5 ppm
Transmitter specs:							
RF output power	P150: 6/5/1 W; P400/ P500: 5/4/1 W; P800: 3/1 W	VHF: 5W; UHF: 4W	VHF: 5 W; UHF: 4 W	5/10/15/25 PEP and AVG	VHF: 1, 5 W; UHF: 1, 4 W	5 W (programmable)	1-5 W (3 levels programmable)
Spurious and harmonics	≥75 dB	-36 dBm	-36 dBm	-64 dB/PEP (-70 typ.)	-36 dBm	-36 dBm	-36 dBm
Frequency spread	38/90/80/107 MHz	22/38/62/75 MHz	22/38/62/75 MHz	1.6-30 MHz	Full band	Full band	Full band
Current drain (TX)	1.6/1.1 A	1.6 A	1.59 A	11 A (max.)	--	--	<2.5 A
FM hum and noise	50 (44) dB	40 dB	40 dB	-50 dB	45 dB @ 25 kHz, 43 dB @ 20 kHz, 40 dB @ 12.5 kHz	40 dB	40 dB
Audio response	+1, -3 dB	+1, -3 dB	+1, -3 dB	350 Hz to 2.7 kHz @ -6 dB	+1, -3 dB	+1, -3 dB	+1, -3 dB
Audio distortion	≤3%	3%	3%	2.5%	3%	3%	<3%
Features:							
Talkaround	Std.	Opt.	Opt.	N/A	Std.	Std.	Std.
Allows encryption/type	Opt., AES/DES-OFB	Std., privacy voice	Std., privacy voice	Std., AES	Opt.	Opt., scrambling	Std., DES-OFB, AES
Remote speaker/mic jack	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Auto noise squelch	N/A	Std.	Std.	Std.	Std.	Std.	Std.
Accepts NiMH battery	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Busy-channel indicator	Std.	Std.	N/A	N/A	Std.	Std.	Std.
Lockout	Std.	Std.	N/A	Std.	Std.	Std.	Std.
Accepts CTCSS/DCS	Std.	Std.	Std.	Opt.	Std.	Std.	Std.
Time-out timer	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Channel scanning	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Two-tone seq. decoder	Std.	Std.	Std.	Constant SINAD (digital)	N/A	N/A	Std., 20 tones
PC programmable	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Programmable ANI	Std.	Std.	Std.	N/A	Std.	Std.	Std.
Intrinsically safe	Opt.	N/A	N/A	N/A	N/A	N/A	N/A
Cloning capability	Std.	N/A	N/A	N/A	N/A	N/A	N/A
P25 CAP SDoCS	Std.	N/A	N/A	N/A	N/A	N/A	Std.
Warranty	2 years	--	--	1 yr. (std.); 5 yrs. (opt.)	2 years	2 years	2 years

PORTABLE RADIOS

MANUFACTURER→	Tait Communications	Tait Communications	TecNet International	TecNet International	TecNet International	Unimo Technology	Unimo Technology
PRODUCT NAME→	TP9400	TP9300	TDP-1124/1424	TP-5000	TP-8000	PT-1500GD	dPH-100/400
↓SPECS							
Suggested list price	--	--	$665	$217	$258	--	--
For what protocols	AS-IP, P25 Phases 1, 2	DMR Tiers 2, 3; MPT 1327; MDC-1200	DMR, MDC-1200	Conventional	Conventional	TETRA	dPMR
Frequency type	Simplex, half duplex	Single	Single	VHF/UHF	VHF/UHF	Single	Single
Frequency ranges	136-174, 400-470, 450-520, 762-776, 792-825, 851-870 MHz	136-174 MHz	136-174, 400-470 MHz	136-174, 400-470 MHz	136-174, 400-470 MHz	380-400, 806-870 MHz	136-174, 400-470 MHz
Conventional/trunked	Both	Both	Conventional	Conventional	Conventional	Trunked	Conventional
Analog/digital	Both	Both	Both	Analog	Analog	Digital	Both
Dimensions (HWD)	4.1 x 6.5 x 13.6 cm	4.1 x 6.5 x 13.6 cm	13.2 x 5.6 x 3.8 cm	11.2 x 5.1 x 3.2 cm	11.2 x 5.1 x 3.2 cm	5.3 x 3.3 x 10.2 cm	5.3 x 3.3 x 10.2 cm
Weight	325 g	325 g	333 g	283 g	258 g	244 g	244 g
Housing material	Polycarbonate case, aluminum frame	Polycarbonate case, aluminum frame	Polycarbonate	Polycarbonate	Polycarbonate	Polycarbonate	Polycarbonate
Channel capacity	2,000	2,000	1,024	16	512	--	1,024
Channel spacing	12.5/15/20/25/30 kHz	12.5/15/20/25/30 kHz (6.25 equivalent on 12.5 kHz)	12.5/20/25 kHz (6.25 equivalent)	12.5 kHz	12.5 kHz	25 kHz	6.25, 12.5 kHz
Types of scans	Channel, dual priority, in zone, talk group, background	Channel, dual priority, talk group, in zone, background	Priority, normal, dual	Multiple	Multiple	--	Normal, priority
Types of displays	4-line graphical backlit LCD	4-line graphical backlit LCD	High-resolution color LCD	N/A	Alphanumeric	Alphanumeric LCD	Alphanumeric LCD
Current drain (standby)	98 mA	98 mA	120 mA	60 mA	65 mA	--	110 mA
Power requirements	7.5 V (nom.)	7.5 V (nom.)	7.4 V	7.5 V	7.5 V	7.5 V	7.5 V
Battery life/duty	Li-ion: >12 hrs.	Li-ion: >12 hrs.	14 hrs.	15 hrs.	15 hrs.	17 hrs. (90/5/5)	11 hrs. (90/5/5)
DTMF keypad	Limited/full keypad	Limited/full keypad	12-key DTMF	Yes	Yes	--	Limited keypad
If radio is trunked:							
# of groups/systems	Multiple talk group lists w/ 1,000-2,000 members each	1,500	N/A	N/A	N/A	--	--
Unique ID code	Yes	Yes	N/A	N/A	N/A	--	Yes
Auto check-in roam	Yes	Yes	N/A	N/A	N/A	--	--
Selective calling	No	Yes	N/A	N/A	N/A	--	Yes
Over-the-air programming	Yes	No	N/A	N/A	N/A	--	--
Receiver specs:							
Sensitivity	0.22 µV	0.22 µV	0.22 µV	0.282 µV @ 12 dB SINAD	0.28 µV @ 12 dB SINAD	112 µV	0.25 µV
Squelch sensitivity	8-16 dB	8-16 dB	-120 dB	0.25 µV @ 10 dB SINAD	0.25 µV @ 10 dB SINAD	--	--
Adjacent-channel selectivity	-60 dB @ 12.5 kHz; -73 dB @ 25/30 kHz	-60 dB @ 12.5 kHz; -73 dB @ 25/30 kHz	60 dB @ 12.5 kHz; 70 dB @ 25 kHz	60 dB	60 dB	--	60 dB
Current drain (RX)	226 mA	226 mA	400 mA	350 mA	350 mA	--	--
Spurious rejection	75 dB VHF (digital)	75/70 dB VHF/700-800 MHz (both digital)	≥75 dB	70 dB	70 dB	--	70 dB
Audio output power	Rated 500 mW, speakers: 2 W (max.)	Rated 500 mW, speakers: 2 W (max.)	1.5 W	1 W	1 W	--	1 W @ 16 Ω
Audio distortion	1.5%	2.5%	<3%	<5%	<5%	--	5%
Frequency stability	±0.5 ppm	±0.5 ppm	±1 ppm	2.5 ppm	2.5 ppm	--	--
Transmitter specs:							
RF output power	VHF: 5 W; UHF: 4 W; 700/800 MHz: 3 W	VHF: 5 W	VHF: 5 W, UHF: 4 W	5/4 W (VHF/UHF)	5/4 W (VHF/UHF)	1/1.8 W	VHF: 2/5 W; UHF: 2/4 W
Spurious and harmonics	75 dB	75 dB	<1 GHz -36 dBm, >1 GHz -30 dBm	-65 dB	-65 dB	--	60 dB
Frequency spread	148-178 MHz	TX: 762-870; RX: 794-824 MHz	VHF: 38 MHz, UHF: 70 MHz	VHF: 38 MHz, UHF: 70 MHz)	VHF: 38 MHz, UHF: 70 MHz	--	VHF: 38 MHz, UHF: 70 MHz
Current drain (TX)	1.7 A	1.7 A	≤1.6 A	1.5 A	1.5 A	--	1.5 A
FM hum and noise	45 dB	45 dB	40 dB @ 12.5 kHz, 45 dB @ 25 kHz	40 dB	40 dB	--	40 dB
Audio response	+1, -3 dB	+1, -3 dB	±3 dB	+1, -3 dB	+1, -3 dB	--	--
Audio distortion	1.5%	2.5%	<3%	5% (max.)	5% (max.)	--	5%
Features:							
Talkaround	Std.	Std.	Std.	Std.	Std.	--	Std.
Allows encryption/type	Std., AES, DES	--	Std.	Std., inversion	Std., inversion	TEA 1&3	Frequency inversion
Remote speaker/mic jack	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Auto noise squelch	Std.	Std.	Std.	Std.	Std.	N/A	N/A
Accepts NiMH battery	N/A	N/A	N/A	N/A (Li-ion)	N/A (Li-ion)	N/A	N/A
Busy-channel indicator	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Lockout	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Accepts CTCSS/DCS	Std.	Std.	Std.	Std.	Std.	N/A	Std.
Time-out timer	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Channel scanning	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Two-tone seq. decoder	Std.	Std.	Std.	Std.	Std.	N/A	N/A
PC programmable	Std.	Std.	Std.	Std.	Std.	Std.	Std.
Programmable ANI	Std.	Std.	Std.	Std.	Std.	--	Std.
Intrinsically safe	Opt.	Opt.	N/A	N/A	N/A	N/A	N/A
Cloning capability	N/A	N/A	N/A	Std.	Std.	N/A	Std.
P25 CAP SDoCS	Std.	N/A	N/A	N/A	N/A	N/A	N/A
Warranty	2 years	2 years	3 years	3 years	3 years	1 year	1 year

MANUFACTURER→	Vertex Standard	Vertex Standard	Vertex Standard
PRODUCT NAME→	eVerge EVX-539	VX-P829	VX-264
↓SPECS			
Suggested list price	$540	$2,150	$290
For what protocols	DMR digital/analog	P25	N/A
Frequency type	Single	Single	Single
Frequency ranges	134-174, 403-470, 450-512 MHz	134-174, 400-470, 450-512 MHz	136-174, 403-470, 450-512 MHz
Conventional/trunked	Conventional	Conventional	Conventional
Analog/digital	Both	Both	Analog
Dimensions (HWD)	10.4 x 5.8 x 3.4 cm	9.7 x 5.8 x 3.8 cm	10.9 x 5.8 x 3.3 cm
Weight	313 g	309 g	281 g
Housing material	--	--	--
Channel capacity	512	512	128
Channel spacing	12.5/20/25 kHz	12.5/20/25 kHz	12.5/20/25 kHz
Types of scans	Priority, dual watch, follow me, mixed mode	Priority, dual watch, follow me, follow me dual watch, talkaround	Priority, dual, follow me, group, talkaround
Types of displays	Full dot matrix multilingual w/ ≤40 characters	12-character alphanumeric	8-character alphanumeric
Current drain (standby)	Digital: 85 mA; analog: 70 mA (w/ saver)	50 mA (w/ saver)	70 mA (w/ saver)
Power requirements	7.5 V (nom.)	7.4 VDC ±20%	5/1 W
Battery life/duty	7-15 hrs.	19-21 hrs.	7-15 hrs.
DTMF keypad	DTMF	DTMF	DTMF
If radio is trunked:			
# of groups/systems	N/A	N/A	--
Unique ID code	N/A	N/A	--
Auto check-in roam	N/A	N/A	--
Selective calling	Yes	N/A	--
Over-the-air programming	N/A	N/A	--
Receiver specs:			
Sensitivity	0.25 µV	0.25/0.32 µV	0.25 µV (typ.)
Squelch sensitivity	--	-119/-117 dBm	--
Adjacent-channel selectivity	TIA603: 70/60 dB; TIA603C: 70/45 dB	75/70 dB	60/65 dB (12.5/25 kHz)
Current drain (RX)	Digital: 320 mA; analog: 300 mA	250 mA	--
Spurious rejection	70 dB	75 dB	70 dB
Audio output power	500 mW @ 4 Ω	700 mW @ 16 Ω	700 mW @ 16 Ω (int.); 500 mW @ 4 Ω (ext.)
Audio distortion	<5% (3% typ.)	<3% @ 1 kHz	<5%
Frequency stability	±1.5 ppm	±2.5 ppm	±2.5 ppm
Transmitter specs:			
RF output power	5/2.5/1/0.25 W	5/2.5/1/0.25 W	5/1 W
Spurious and harmonics	70 dB below carrier	70 dB	70 dBc
Frequency spread	136-174, 403-470, 450-512 MHz	134-174, 400-470, 450-512 MHz	136-174, 403-470, 450-512 MHz
Current drain (TX)	Digital: 640 mA; analog: 1.5 A	1.7/1.9 A	--
FM hum and noise	40 dB	46/40 dB	40 dB
Audio response	0 dB @ 1 kHz	+1, -3 dB	--
Audio distortion	<5% (3% typ.)	<3% @ 1 kHz	<5%
Features:			
Talkaround	Std.	Std.	N/A
Allows encryption/type	Std., digital enhanced privacy	AES/DES (opt.)	Voice inversion
Remote speaker/mic jack	Std.	Std.	Std.
Auto noise squelch	Std.	Std.	Std.
Accepts NiMH battery	N/A	N/A	N/A
Busy-channel indicator	Std.	Std.	Std.
Lockout	Std.	Std.	Std.
Accepts CTCSS/DCS	Std.	Std.	Std.
Time-out timer	Std.	Std.	Std.
Channel scanning	Std.	Std.	Std.
Two-tone seq. decoder	Std.	Std.	Std.
PC programmable	Std.	Std.	Std.
Programmable ANI	Std.	Std.	Std.
Intrinsically safe	Opt.	Opt.	N/A
Cloning capability	Std.	Std.	Std.
P25 CAP SDoCS	N/A	N/A	N/A
Warranty	3 years	3 years	3 years

3M Peltor

The 3M Peltor two-way headset radio platform includes the LiteCom BRS, PowerCom Plus and Lite-Com Pro II. All headsets come with integrated multichannel radio communications with hearing protection; headband, backband and hard-hat attachments; optional ambient microphones; programmability; and FM intrinsically safe certification.

www.peltor.com

A.W. Enterprises

A.W.'s protective two-way radio cases are made of materials such as 0.3-centimeter top-grain leather and Cordura nylon. The company's AWedge clip and loop clips in from any direction and holds securely until a user inverts the radio for extraction. The cases protect radios against loss and damage in everyday user applications, company officials said.

www.awenterprises.com

Cape Products USA

Cape's 18-way gang charger charges up to 18 batteries or two-way radios simultaneously. The device charges NiMH, NiCd, Li-ion and Li-poly batteries, and interchangeable pods allow it to charge most radios, including Motorola Solutions, JVCKENWOOD, Icom, Vertex Standard and Hytera Communications. Features include a rugged polycarbonate design, in-line power input of 110 or 240 volts of alternating current (AC), two- to three-hour charge time, an on/off switch and charger status display.

www.capeltd.com

David Clark

The Aurora class HBT series industrial wireless headset uses Bluetooth 4.0 low energy technology and provides up to 80 hours of continuous talk time on one charge. The headset works with smartphones, ruggedized tablets, computers, leak-detection equipment and other smart devices. The headset comes in over-the-head and behind-the-head models. Single-ear, dual-ear and listen-only styles are available. The product is suitable for high-noise environments, company officials said.

www.davidclark.com

Earphone Connection

The INTERCEPTOR Bluetooth wireless speaker microphone has two push-to-talk (PTT) buttons and a simultaneous listen feature, allowing users to listen to dual audio from two paired Bluetooth devices at the same time. The microphone allows users to transmit to two talk groups with the separate PTT controls and receive two incoming PTT transmissions from a radio or a smartphone simultaneously. The device can pair to either two Bluetooth-enabled smartphones or a Bluetooth-enabled smartphone and a two-way radio with a BlueWi Bluetooth adapter or dongle. The microphone is unidirectional and has more than 20 hours of talk time, 128-key Bluetooth encryption and a 3.5-millimeter audio jack.

www.earphoneconnect.com

Hytera Communications

The SM27W1 remote speaker microphone (RSM) helps expand the reach of a radio core, provides good penetrability, and has both volume and channel adjust functions, company officials said. The mic provides communications 10 meters away from a vehicle and has a battery life of 16 hours. The product is suitable for mobile and police dispatching, company officials said.

www.hytera.com

Impact Radio Accessories

The PBH-2 is a heavy-duty, single-speaker headset with a noise-canceling boom mic. The headset has Kevlar-reinforced cabling and premium, Knowles acoustical components. The product comes in a behind-the-head model and can be worn with most ballistic helmets. A single speaker outside the ear provides clear audio without in-ear contact. The headset has a cable pull strength of 13.6 – 18.1 kilograms and an operating temperature of -20 to +60 degrees Celsius. The product is ideal for special weapons and tactics (SWAT) teams, military and other tactical operations, company officials said.

www.impactcomms.com

JCK Jean Couk Enterprise

Jean Couk's acoustic tube earphone has a transducer assembled in the ear bud to minimize volume loss through the ear tube and transmits audio through ear-bone vibration for crystal-clear quality, company officials said. Other features include a sealed, waterproof ear bud that limits the buildup of earwax or sweat; a waterproof design that allows cleaning by flushing the device with water; and a quick easy-change assembly and two-pin connector, making it easy to clean or replace.

www.jeancouk.com

Jing Deng Industrial (JDI)

Jing Deng Industrial (JDI) introduced the JD-900X antenna handheld microphone for two-way radios. The product relocates the radio antenna to the mic to enhance signal range and coverage. The product works with most radios and meets IP54 and IP67 requirements. The mic is available with three function buttons.

www.jdi-co.com

Visit JDI at
HKEF (Autumn), Booth# 5BC42

JDI JING DENG INDUSTRIAL CO., LTD.
+886 2 29822275 TAIPEI. TAIWAN.
jdi@ms13.hinet.net CE RoHS

Mobility Sound Technology

The BTH-900 Bluetooth earmuff provides two-way radio and cellphone communications. The headset's push-to-talk (PTT) button for two-way radios is separate from the cellphone button. A noise-reduction feature provides hearing protection and good-quality audio in noisy environments, company officials said.

www.mobilitysound.com.tw

Motorola Solutions

The APX XE500 remote speaker microphone (RSM) was designed to ensure good communications in extreme environments. Features include exaggerated knobs and controls that are easy to operate with bulky gloves and an asymmetrical shape that makes it easy to find the controls without looking. A channel knob allows firefighters to easily change channels when their radios are worn under their turnout coats. Five integrated microphones and enhanced water drainage provide users with the flexibility to wear the mic any way they want, and the device can withstand heat of 260 degrees Celsius for up to five minutes.

www.motorolasolutions.com

OTTO

OTTO Connect 200 wireless intercoms use MULTIVOICE technology and are ideal for work group communications, supporting up to eight simultaneous speakers on a single channel and virtually unlimited listeners over a secure network, company officials said. The intercoms and headsets feature full-duplex, hands-free communications over distances up to 1,200 meters with up to 18 hours of talk time. Each intercom has six channels, enabling a supervisor or crew chief to easily switch between different work teams.

www.ottoexcellence.com

PJ & RHS

PJ &RHS cases for TETRA, analog and digital radios are manufactured using fine grades of leather and fittings and are available with a range of belt-fixing options, including a click-on quick release system suitable for emergency service use.

www.rhssupplies.co.uk

Plantronics

The CA12CD-S is a cordless headset adapter that provides wireless communications and push-to-talk (PTT) functionality for applications within E9-1-1 dispatch and air traffic control. The adapter uses digital, 64-bit encryption and operates within the unlicensed personal

communications services (UPCS) band. The product has built-in battery chargers and two batteries that provide eight hours of talk time each. The adapter's base has a 10-foot coil cord with a PJ7 connector.
www.plantronics.com

Pryme Radio Products

The two-piece WTX-Kit for covert communications includes a cell-

phone headset adapter for two-way radios and a wireless, lightweight, finger push-to-talk (PTT) switch with a Velcro mounting strap that can attach to steering wheels, handlebars and more. The company's Bluetooth low energy technology allows the kit to be self powered, eliminating the need to recharge batteries, and the PTT switch coin-cell battery lasts up to two years. The adapter is compatible with most off-the-shelf cellular headsets.
www.pryme.com

Samhoo Science and Technology

The non-numerical mobile hand microphone for the company's SPM6000 mobile radio has a good touch, is made of reliable materials, and provides loud and clear voice quality, company officials said. The microphone can be used in professional areas.
www.samhoo-pmr.com

Sensear

The SM1R uses Sensear's SENS technology to provide an affordable intrinsically safe (IS) option that protects hearing and allows

communications while retaining situational awareness. By drawing power from the radio, the headset makes it so users have to charge only one device, making it useful for organizations with multiple shifts, such as ground crews at airports, workers in manufacturing plants and engineering teams working in noisy environments, company officials said.
www.sensear.com

Sonim Technologies

The XP Channel Select Module (XP CSM) for Sonim's XP6 smart-

phone provides radio-like channel selection using a dial for an intuitive user experience. The channel position indicator on the module eliminates the need to interact with the smartphone's touchscreen, company officials said. A push-to-talk (PTT) application and subscription are required, allowing the user to assign up to six talk groups to the channels.
www.sonimtech.com

Stone Mountain

The Phoenix speaker microphone series comes with the AllClear noise-canceling system that includes dual omnidirectional microphones and advanced surface mount circuitry to provide optimum noise cancellation through custom calibration to the mic's enclosure. The omnidirectional microphones allow for greater flexibility and comfort during normal use while maintaining excellent noise suppression during voice audio transmissions, company officials said. The product is ideal for police, fire, EMS, commercial, transportation, heavy industrial and military applications.

www.stonemountainltd.com

TecNet International

The UDM series provides a two-in-one communications device that allows on-site intercom capability and repeater mode communications through a base station or vehicular-mounted mobile radio. With a talk range of up to 100 meters in repeater mode and 50 meters in intercom mode, the product's wireless speaker microphone has two separate push-to-talk (PTT) buttons for ease of use. The repeater units interface with most mobile radios, and intercom capability is up to 16 units with dynamic programming of each.

www.tecnetusa.com

Threat4

The GHOST II micro, ultra-sensitive, Knowles electret condenser microphone can be hidden under the collar of short- or long-sleeved shirts for covert applications. Users can wear a wireless, waterproof push-to-talk (PTT) switch on a finger or elsewhere. The kit works with any stereo headset with a 3.5-millimeter plug, is compatible with most two-way radios and comes with Kevlar cables.

www.threat4.com

Wireless Pacific

The XFB-LTE dual radio-smartphone Long Term Evolution (LTE) interface for the X10DR secure wireless microphone allows the microphone to receive all traffic on both the host mobile radio and the LTE/push-to-talk (PTT) application, as well as other microphone voice traffic when multiple users are connected. A unique marker tone is attached to the tail of each radio reception to identify each different device's audio. The interface unit is configured to use the talkaround button as a secondary PTT to transmit on the smartphone LTE communications channel. The X10DR maintains a secure link to the mobile radio up to 300 meters from a vehicle.

www.wirelesscorpltd.com

MOTOTRBO Portfolio and CAD Software

Motorola Solutions introduced the next generation of its MOTOTRBO line that includes Wi-Fi-enabled portable radios, an enhanced trunking solution and a high-power repeater. The XPR 7000e and 3000e and SL 7000e series radios

have Wi-Fi capability that allows users to update their firmware over the air, reducing the amount of work time lost by upgrading radios, company officials said. The Capacity Max trunking solution is scalable for a variety of system sizes, leverages a central controller to provide more effective fleet and radio management, and has a standard IP architecture to provide good bandwidth at sites. The SLR 8000 is a high-power repeater built on the same modular platform as the company's SLR 5000 repeater and has a flexible architecture, allowing users to configure it to their system needs.

The company also released its CommandCentral software that integrates with CAD systems and shows a unified, real-time operational view to command center staff. The Aware component of the product provides an intuitive, on-premise method to collect and integrate large amounts of data and multimedia from disparate systems, including CAD, streaming video, real-time alerts, advanced data analytics, resource tracking, social media analytics, and voice and records information, and show it on a single screen. The software then can quickly search multiple data sets. Data are converted into alert-driven intelligence, which is clickable on a layered geospatial map view. The web-based Inform component extends command center situational awareness into the field and can be used on various devices, operating systems or networks. Officers can apply or remove layers of information, including locations of personnel, resources, events, alerts and analytics, from the geospatial map in real time.

www.motorolasolutions.com

Multiband Configuration and NEXEDGE Gen2

JVCKENWOOD USA announced its NX-5000 multiband configuration to enable full tri-band receive and transmit operations in VHF, UHF, and 700 and 800 MHz with a single- or dual-control head and up to three RF decks. The configuration allows analog, Project 25 (P25) Phases 1 and 2, and conventional and trunked operation and supports NXDN protocols. The product can be used in first responder and other incident command vehicles, including vehicles with limited space. Based on Kenwood's NX-5700/5800/5900 mobile radios, the set offers a wide range of installation options.

The company also unveiled NEXEDGE Generation 2 (Gen2) digital system architecture with enhanced operating features for improved scalability and increased system capacity. With a capacity of more than 1,000 sites, the architecture is designed for public safety, utilities, large-scale manufacturing and other facilities with multiple sites and systems across a wide area.

www.kenwoodusa.com

Data Modem Radio

Icom introduced its IC-F5122DD data modem that allows point-to-point and point-to-multipoint communications, and can be used for telemetry and low-speed supervisory control and data acquisition (SCADA). The radio can be deployed for vehicle management, traffic monitoring and remote system management for utilities and oil, company officials said. The device uses licensed VHF/UHF bands and delivers 25 watts (W) of high-output power from a Mil-Std chassis. The transparent data modem also features serial and Ethernet interfaces, a 500-code data encryption function and 128 channels.

www.icomuk.co.uk

LTE Smartphone

Harris released the Android-based LMC-1000, a Long Term Evolution (LTE) smartphone designed for public safety that supports international commercial carrier bands. The device measures less than 8 centimeters wide, weighs 180 grams and meets Mil-Std-810G for shock resistance and IP67 for water and dust protection. The phone has a 12.7-centimeter, full high-definition (HD) LCD touchscreen and features high-performance speakers and multiple microphones with active noise cancellation. According to company officials, the product emphasizes security with multiple layers of hardware and software protection, runtime integrity checks, an application permission firewall, encryption keys and encrypted mass memory.

www.pspc.harris.com

Repeater Replacement

Codan Radio Communications launched Cyclone, a drop-in replacement platform for existing conventional core radio repeaters and base stations. Using rugged MT-4E repeater design and Avtec's RIC-M technology, the system is designed for existing legacy repeaters that rely on a proprietary v.24 interface into existing core networks. The product uses the Project 25 (P25) Digital Fixed Station Interface (DFSI) to allow future migration to a P25-based network and backhaul over Ethernet, reducing the need for leased lines and T1 connections. The platform is designed with a five-rack-unit (5RU) footprint, which fits the dimensions of existing legacy stations, company officials said. The system is available in the VHF, UHF and 700/800/900 MHz bands.

www.codanradio.com

Upgraded CAD

Zetron updated its CAD system. The improvements include enhanced incident handling and management, support for multiple databases operation, interface

support for next-generation automatic location identification (ALI) standards, enhanced resource management and improved location validation that includes a variety of search criteria.

www.zetron.com

MOTOTRBO Console Support

Avtec announced compatibility of its Scout true VoIP dispatch console system with Motorola Solutions' MOTOTRBO Capacity Max scalable, secure trunked radio solution. The Scout 4.3 release will support Capacity Max and other MOTOTRBO series systems and provide a full-featured wireline interface.

www.avtecinc.com

Railways Standard Compliance

Teltronic, part of the Sepura Group, announced compliance with European standard EN 45545 for its onboard products portfolio. The European Committee for Electrotechnical Standardization standard (CENELEC) regulates fire safety for railway vehicles and replaces pre-existing European Union (EU) fire safety criteria. Designed specifically for the transportation environment, the products are compliant with part one of the standard, which governs classification of rail vehicles in operational and design categories, as well as fire safety objectives, and part two, which describes requirements for fire behavior of materials and components, company officials said.

www.teltronic.es

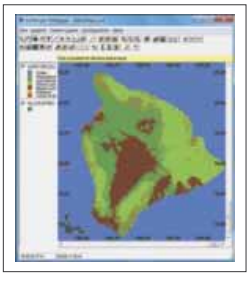
Alignment Software

Cobham AvComm released two automated test and alignment software applications to support new Motorola Solutions APX 8000 radios. The applications are options for the 3920B series analog and digital radio test platform and the 8800 series digital radio test set. The 3920B unit, with its low phase noise RF signal

generator, was extensively tested by the Motorola Continuing Product Engineering (CPE) group for the APX radio. The 8800S offers portable capabilities for field test applications. According to company officials, the product has the industry's largest color display, a lightweight design, ruggedness and 2.5-hour battery operation.
www.aeroflex.com

Terrain Analysis Software

SoftWright announced Terrain Analysis Package (TAP) 6.3 release 2534, which supports moderate-resolution imaging spectroradiometer (MODIS) international clutter and land use data. MODIS 2012 data is available in 12-by-16-degree tiles and is available for purchase on a per-country basis. The clutter and land use data makes path and coverage studies more accurate by telling the software what is on top of terrain, company officials said.



www.softwright.com

IPB Weatherproofing Kits

Times Microwave Systems introduced its new IPB weatherproofing system for long-term outdoor deployments and mission-critical short-term deployments. The boots come with N or 7/16 DIN interfaces. The products are sized for specific cables and available with either male or female threads, and can be used for LMR-400 and 600, as well as some corrugated cables. O-rings are available for N and 7/16 DIN female bulkheads, which can be used with any of the male cable boots for LMR-400 connectors. The products are IP68-rated and are Restriction of Hazardous Substances (RoHS) and Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) compliant.

www.timesmicrowave.com

Batteries and Chargers

Anderson Electronics introduced smart batteries for Icom radios. The BP-232 and BP-254 models can be charged by standard two-way chargers and by the company's Smart-Intelli-Battery chargers. According to company officials, the products are built of high-quality Japanese cells and offer end users and two-way radio dealers higher capacity and battery "smarts" without a price premium. The LCD on the charger shows features such as battery condition, charging status, capacity, number of uses and remaining battery life, without requiring a computer. The product can be used as a quick charger or a conditioner and users can charge a variety of batteries with the

device's interchangeable battery cups.
www.anderson-intelli-smartbattery.com

Adapters

RF Connectors, a division of RF Industries, unveiled its 4.3-10 connector interface to support more spectrum without increasing the infrastructure footprint. According to company officials, the

product weighs 60 percent less and uses 40 percent less space than 7-16 DIN connectors in the same applications, and the product's passive intermodulation (PIM) performance is greater than that of 7-16 DIN and 4.1-9.5 interfaces. The product's return loss and PIM performance are independent of torque applied, and cables can be flexed with little detrimental effect. The connector is IP68-rated, supports up to 500 watts (W) at 2 GHz, and is an option for remote radio heads, jumpers and antennas.
www.rfindustries.com

Area Monitor

Narda Safety Test Solutions released the AMS-8061, a selective area monitor that monitors electromagnetic fields from 100 kHz to 6 GHz in up to 20 freely definable frequency bands. Autonomous monitoring allows field exposure levels from various wireless technologies to be recorded separately. The device stores results internally, and the results can be read out locally via Ethernet, USB or RS 232, transferred to an SD card or accessed remotely over a cellphone link. The unit has a weatherproof casing.

www.narda-sts.com

Aircraft Antenna

Globalstar's light aviation aircraft antenna allows general aviation pilots to make calls, send emails and text messages, and browse the Internet from the cockpit, without cellular access. The antenna pairs with the company's cradle and comes with devices such as the GSP-1700 mobile satellite phone and Sat-Fi satellite hotspot. The voice and data package comes with the cradle, SPOT Trace tracking device — which tracks the plane's location down to every 2.5 minutes — and its 9600 data interface. The Sat-Fi voice and data package includes the antenna and SPOT Trace. Both packages allow pilots and passengers to communicate via voice, text, email and tracking, company officials said.

www.globalstar.com

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DATE: month _____ day _____ year _____

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/Senior 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 areas of the world do you do business? (mark all that apply)
❑ 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

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 _____

Q216

9 – 11 May: LTE MENA, Dubai, United Arab Emirates. Informa Telecoms & Media: http://mena.lteconference.com

18 – 19 May: PSCE Conference, Brussels. Public Safety Communication Europe (PSCE): www.psc-europe.eu

31 May – 2 June: Critical Communications World, Amsterdam. TETRA + Critical Communications Association (TCCA) and Informa Telecoms & Media: www.criticalcommunicationsworld.com

31 May – 3 June: CommunicAsia, Singapore. Singapore Exhibition Services: www.communicasia.com

7 – 9 June: General Police Equipment Exhibition and Conference (GPEC), Leipzig, Germany. Exhibition and Marketing Wehrstedt: www.police-exhibition.eu

22 – 23 June: Comms Connect, Sydney. Westwick-Farrow Media: http://sydney.comms-connect.com.au

28 – 30 June: 5G World Summit, London. Informa Telecoms & Media: www.5Gworldevent.com

14 – 17 August: APCO Conference & Expo, Orlando, Florida, USA. Association of Public-Safety Communications Officials (APCO) International: www.apco2016.org

7 – 8 September: Wireless China Industry Summit, Beijing. InfoEX-World Services: www.wirelesschina-summit.com

13 – 16 September: VSAT, London. Informa Telecoms & Media: http://vsatevent.com

21 – 22 September: Emergency Services Show, Birmingham, United Kingdom. Broden Media: www.emergencyuk.com

26 – 28 September: 5G World Asia Pacific, Singapore. Informa Telecoms & Media: http://5gasiaevent.com

27 – 30 September: European Utility Telecom Conference, Frankfurt, Germany. European Utilities Telecom Council (EUTC): www.utc.org/europe

10 – 12 October: LTE Voice Summit, London. Informa Telecoms & Media: http://voice.lteconference.com.

7 – 8 November: Critical Communications Middle East, Dubai, United Arab Emirates. TETRA + Critical Communications Association (TCCA) and Informa Telecoms & Media: www.criticalcommunications-me.com

9 – 10 November: B-APCO Autumn Event, Newcastle upon Tyne, United Kingdom. British APCO (B-APCO): www.bapco.org.uk

14 – 17 November: ITU Telecom World, Bangkok. International Telecommunication Union (ITU): http://telecomworld.itu.int

15 – 17 November: LTE Africa, Cape Town, South Africa. Informa Telecoms & Media: http://africa.lteconference.com

22 – 24 November: PMR Expo, Cologne, Germany. Bundesverband Professioneller Mobilfunk: www.pmrexpo.de

23 – 24 November: Comms Connect, Melbourne, Australia. Westwick-Farrow Media: http://melbourne.comms-connect.com.au

23 – 24 November: PSCE Conference, Athens, Greece. Public Safety Communication Europe (PSCE): www.psc-europe.eu

30 November – 1 December: U.K. Security Expo, London. U.K. Security Expo: www.uksecurityexpo.com

TCCA Renews Focus on Standards, Spectrum

By Mladen Vratonjic

The critical communications market is in a time of unprecedented change, and I am fortunate to be in the forefront of an association that is key to the direction and management of this exciting evolution. The challenge is charting a course between exploiting the unrivalled historical expertise of the TETRA + Critical Communications Association (TCCA), while ensuring that the knowledge will steer the new wave of critical communications services.

The TCCA exists for, and because of, its members and is open to all parties interested in critical communications — users, operators and the wider industry. The 20-year-old association is looked to by the market and key decision-makers for advice and direction on the need for, and benefits of, the coordination and standardization of specialized mission- and business-critical communications. TCCA promotes open standards because they guarantee an open market and a multi-vendor environment with interoperability, multiple choices, better prices and more application providers.

TCCA recognizes that the critical communications market is moving toward Long Term Evolution (LTE) — rapidly in some markets, less so in others. Without coordination and structure, there is a real danger that the solid foundation of standards-based, reliable, robust, secure and fit-for-purpose critical communications will be diluted and undermined in the commercial rush toward delivering broadband services. Therefore, the TCCA will become more focused. We will continue to promote, support and facilitate the exchange of information, but we will become more involved in standards creation and development, spectrum policies and the evaluation of critical communications technologies. Our focus will include end-to-end services, solutions and interfaces for the mission-critical communications industry, with the goal of becoming more credible, influential and directly relevant to the millions of end users whose lives or operations depend on mission- and business-critical communications.

We want to extend our expertise to all users and operators, including public operators, and aim to be the go-to choice for advice on best practices and solutions. The association was formed to promote and regulate the TETRA standard, and the TETRA Interoperability Process (IOP) remains the gold standard for ensuring the widest choice of compatible equipment from the supplier base. TETRA will be present in critical communications for years.

Building on the success of our Critical Communications Broadband Working Group and the subsequent creation of the Third Generation Partnership Project (3GPP) Technical Group SA6 for mission-critical applications, the TCCA will help develop a migration path to mission-critical broadband (MCB). This will be based on open standards, and we will increase our representation and liaison with standardization bodies to achieve maximum influence. In parallel, we will work more closely with operators and users to meet requirements and expectations of the public-safety market.

We will continue the momentum created by the 2015 World Radiocommunication Conference's delivery of the first recommendation in the history of the International Telecommunication Union Radiocommunication Sector (ITU-R) for a global harmonized spectrum range for mobile broadband services to support public-safety and emergency services. In Europe specifically, we will help ensure international harmonized conditions for the allocation of frequencies for critical communications broadband, lobbying the European Conference of Postal and Telecommunications Administrations (CEPT), the EU, national regulators, users and other influencers to help us achieve seamless cross-border mission-critical communications.

Critical communications is a small market in terms of commercial potential but a critical one. We will ensure that commercial network operators are aware of the needs of critical communications users to safeguard the levels of service those users have with TETRA. We will clearly define the security requirements and lead the campaigns for their implementation within all critical communications technologies.

The TCCA has more than two decades of interfacing among users, manufacturers and standardization bodies around the development and adoption of the best voice and data critical communications standards in the world. With our renewed focus, future players in critical communications will look to the TCCA as the global leader and the driving force for ensuring that the critical services needed by our industry are standardized and implemented. ■

Mladen Vratonjic has been chair of TCCA since May 2015. Vratonjic has 33 years of experience, including more than 10 in public safety. He was responsible for all telecommunications systems for the Serbian police and fire brigades including emergency call centers and the TETRA network. He is also vice president of the European Emergency Number Association (EENA), former chair of the Western Balkans Telecommunications Committee for improving cross-border cooperation and expert member of Geneva Centre for the Democratic Control of Armed Forces (DCAF). For more information, email admin@tandcca.com.

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