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DMR Trunked: Next Generation of LMR Technology

A joint whitepaper explores the increasing penetration of DMR Tier III in mission critical communications

Table of Contents

Executive Summary

ES.1 Introduction

DMR Tier II conventional technology has traditionally been a business-critical technology, supplying communications for enterprise, transportation, utilities, etc. But now, DMR Tier III trunking has arrived in the public safety and security market. With full fleet of features designed for mission-critical users, DMR Tier III trunking is gaining a foothold in public safety and security market around the world.

DMR Tier III Trunking becomes a competitive public safety technology

The majority of DMR Tier III public safety networks are based in regions such as Eastern Europe, Africa, parts of Latin America and Southeast Asia. The market adoption has proved that DMR Tier III is a reliable and efficient public safety and security technology; with deployments in China, Guatemala, Croatia, Ethiopia, Canada, Indonesia and Turkey, the evolution of DMR Tier III will continue and further penetrate the international Public Safety & Security market. Public safety and security will be the largest growing DMR Tier III market, and in 2021 will account for nearly 35% of DMR Tier III shipments. In cases of emergency, fire, Emergency Medical Technicians, police and first responders are often required to conduct joint operations, so the communications systems that link them are highly valuable. DMR Tier III offers a unified solution to these mission-critical environments.

DMR Tier III offers increased advantage for utilities, transportation, business and enterprise

Use of DMR Trunked in the Utilities sector has grown, and will continue to grow across the forecast period, especially in regions of Asia, Eastern Europe and MEA, with pockets of high-end growth in North America and Western Europe. Utilities is anticipated to account for approximately 11% of DMR Tier III shipments in 2021, staying relatively stable throughout the forecast period.

Transportation has provided a perfect environment for DMR to evolve over the last few years. The evolution of DMR Tier III has continued within the transportation and utility markets from a mature business-critical technology to a reliable mission-critical technology, and has created confidence in the use of DMR Tier III in full mission-critical environments (such as the public safety and security sector). Transportation will account for approximately 20% of shipments throughout the forecast period 2016 to 2021.

Business, Enterprise and Industrial DMR Tier III radio shipments will achieve a CAGR of 9% across the forecast period.

ES.2 Infrastructure and device convergence with future technologies

Convergence is landmarked to be the future of the critical communications industry. As more countries begin considering their roadmap to broadband LTE communications systems, hybrid solutions will form a large part of the transition economy.

LTE transition increases importance of converged technology

In response to demand from public safety authorities for access to secure wireless broadband communications, 3GPP is developing specifications to deliver a variety of mission critical capabilities over LTE networks. Significant public safety services networks based on LTE are currently being deployed in South Korea, the UK and the USA as well as in several other regions and municipalities across the globe. Broadband will eventually become a necessary part of the LMR market; broadband will provide the ability for public safety users to operate with more than just voice.

In the short term, LTE will complement critical voice with data, rather than replace LMR altogether. The continuous deployment extensions of LTE networks (such as in the UK and South Korea) highlight the narrative that a converged LMR + LTE solution will ultimately be required to make any LTE transition viable. A converged DMR and LTE solution includes a dual-mode radio which can connect to a cellular network in addition to the DMR network, which is a viable and suitable solution. A dual-mode solution allows video uploading and video calls via the commercial network while connecting to the DMR network for voice: operating video in mission-critical situations for frontier officers means that their situational awareness in the field is extended and becomes superior to what they currently achieve through voice alone. The benefits of using a dual-mode radio are clear and will be a viable solution in the near future.

ES.3 Enhanced DMR solutions will be a gateway to future technology
Enhancing the system design, security and encryption, applications and operational modes will move DMR forward to the next stage of evolution. Revisions schedules set in motion by the DMR Association provide a backdrop for the leading global manufacturers to enhance the current DMR standard through Research and Development opportunities. To stay ahead of the curve, many global market leaders in DMR Tier III are focusing research and development investment into these issues.

Base station innovation has become ever more crucial in the deployment of DMR Tier III, as demands from end-users increase. Flexible deployment and automatic networking are trending innovations in the market. For the majority of end-users worldwide, a comprehensive solution is required to meet the extensive requirements across multiple sectors. For example, one of the major players in DMR Tier III Trunking, Hytera offers a base station that is based on a software configuration, which provides the flexibility for carriers, integrating the baseband signal processing unit and RF processing unit structure; reducing end-user installation cost, time and power consumption. Feeder loss has also been a concern within the industry, which has been mitigated against by Hytera with wall-mounted or pole-mounted designs, meaning that base stations can be directly placed on antenna masts, buildings and towers.

From a radio perspective, there is much debate over the future of the handset. However, in the majority of current DMR Tier III systems that have been migrated from analogue, mobile and handheld terminals are often replaced with new DMR Tier III terminals. Flexible migration solutions support the interoperations between analogue and digital under the same site or between different sites, so that non-critical users are still able to use legacy terminals. This maximizes the end-user's investment until the end of the equipment lifecycle. Multi-mode radios offer a truly convergent platform that will inevitably be required for migration into a broadband future.

With the propensity of cyberattacks and hacking on the rise, the requirements for a secure, encrypted and reliable network is now more important than ever. Electronic Serial Numbers (ESN) check with mutual authentication can be used to identify authenticity before employing it on the network. In addition, end-to-end encryption, such as 256 bits AES E2EE and AIE (Air Interface Encryption) can prevent voice or data transmission from being intercepted from both a software and hardware perspective. Much of research and development for enhanced DMR solutions focuses around the security and encryption for this very reason. Full redundancy and multi-level fallback mechanisms should be adopted throughout any ongoing DMR Trunking solution.

Part 1: Overview of the DMR Trunked market

DMR Tier II conventional technology has traditionally been a business-critical technology, supplying communications for enterprise, transportation, utilities, etc. But now, DMR Tier III trunking has arrived in the public safety and security market. With full fleet of features designed for mission-critical users, DMR Tier III trunking is gaining a foothold in public safety and security market around the world.

1.1 DMR and LMR market overview

A key driver in the adoption of DMR is the rapid worldwide migration to digital technology. Traditionally, LMR (licensed mobile radio) communications technologies were based on analogue. The infrastructure of these analogue networks still exists today, with many organizations still using analogue for basic communications requirements. Analogue still meets the needs of much of the business-critical market; it provides instantaneous voice communications at a low cost. The analogue infrastructure build-out in the early generations of critical communications created a solid and reliable platform for modern technologies to upgrade. As a result, the LMR market today is advanced, forward-thinking and fast-paced, with innovative technologies, concepts and integrations hitting the market regularly. In particular, recent technology announced by the leading players for DMR Tier II, NXDN and dPMR has incorporated equipment supporting communications on both analogue and digital networks – thus facilitating this transition. Meanwhile DMR Tier III trunking has risen to become a mainstream public safety digital protocol.

Market drivers

- **Analogue to digital transition**

By the end of 2016, just under half of LMR users had migrated to digital technologies; this percentage is forecast to increase to over 75% by the end of 2021. The current range of analogue radios is likely to be one of the last cycles of analogue development as manufacturers move their R&D focus to digital devices, with only replacements sustaining this market. As technology in other industries such as the consumer electronic market has progressed, so has the demand for data applications and advanced features in the mobile radio industry. The requirement for 'on-the-go' applications for handheld radios to increase operational efficiency has increased, as has the requirement for every radio to be accessible in mission-critical situations: safety and security features have joined hand-in-hand with administrative applications.

Shipments of Terminals by Technology - World

Source: IHS Markit   © 2018 IHS Markit
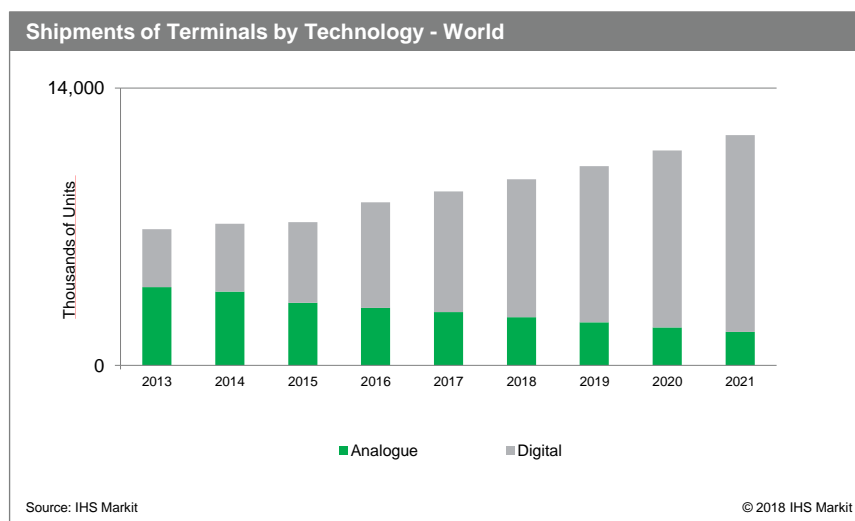
- **The role of emerging markets**

Asia has been identified as a strong region, driving the growth of LMR adoption, and will be the fastest growing LMR market in the world. There has been a recent increase in Trunked technologies in China and Hong Kong. DMR has experienced incredible growth in Asia and will continue to do so as more Tier III networks are rolled out. Hytera has played a key role in the development of Trunked technology within Asia. Recent contracts in the public safety sector, such as Shenzhen Police, Chongqing Police, and the Philippines National Police, have proved Hytera to be one of the global market leaders in the deployment of Trunked DMR. The development of LTE – such as in South Korea – will also provide Asia with a strong hand in the future of interoperability and convergence.
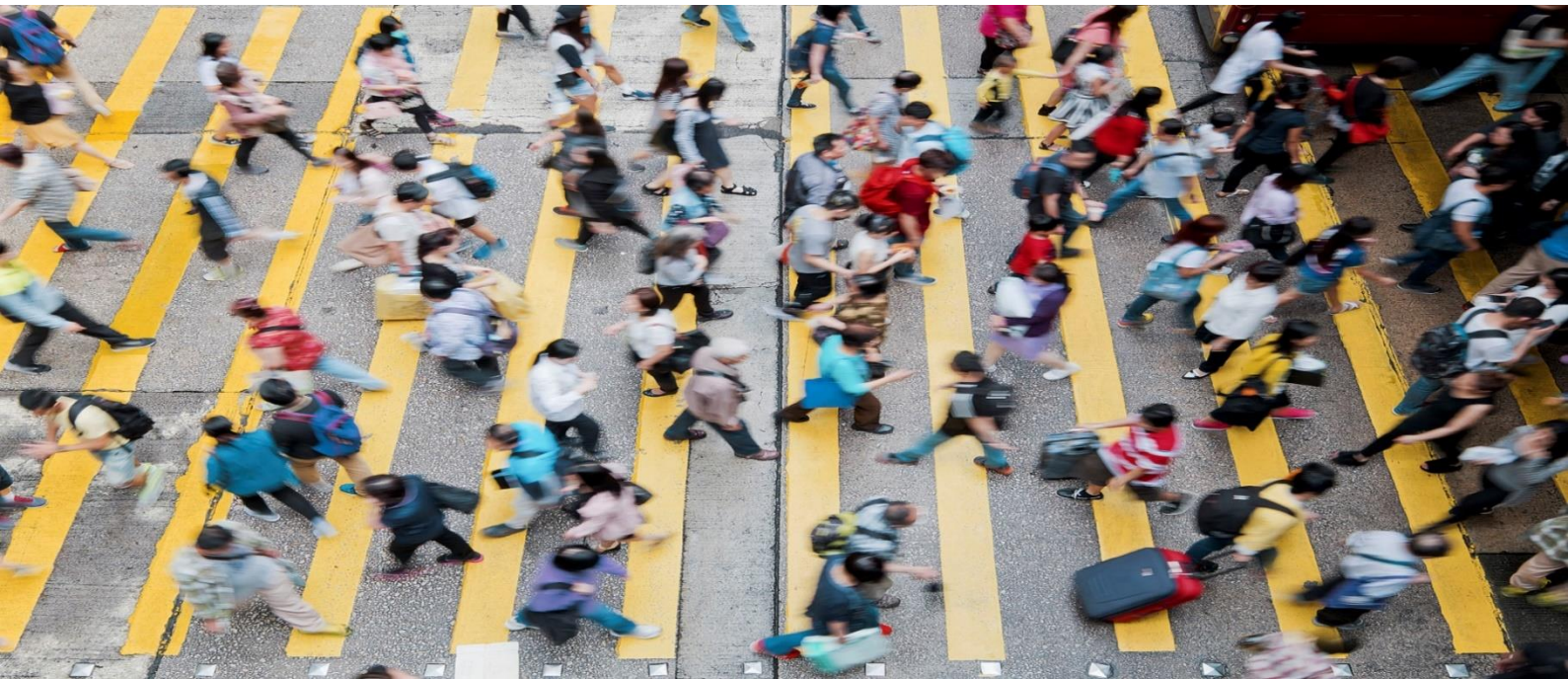

Image source: shutterstock.com

- **Cost Optimized Technologies increasing market share**

There are economic benefits to investing in new generation technologies to replace outdated networks. Updates, maintenance and replacement rates for analogue and early generation digital networks outweigh the equivalent costs of generating new digital networks. Although ongoing network costs of DMR are higher than legacy analogue technology, DMR Tier III has a relatively low infrastructure cost when compared to other digital technologies such as TETRA and P25. Equally, there is a one-for-one replacement of analogue by DMR Tier III TRXs to achieve equivalent performance, reducing capital expenditure for a digital network upgrade. DMR Tier III will experience increased market share, achieving double-figure growth between 2016 and 2021.

- **Efficiency of DMR Tier III unparalleled**

The spectral efficiency of new networks, coupled with options for simulcast and Frequency Division Multiple Access (FDMA) means that new digital technologies are far more efficient than legacy networks. As DMR Tier III and other trunked technologies are more efficient in spectral terms, operators can essentially double the number of users within a 12.5-kHz bandwidth and quadruple the number of available channels in 25-kHz bandwidth. In the case of DMR at 12.5 kHz, the same TRX can be used to achieve this doubling of the number of users.

1.2 DMR Tier III handheld market overview

Cost Optimized Digital technologies accounted for 50% of the total digital installed base of active radios at the end of 2016, and IHS Markit projects this will increase to over 60% by the end of 2021 as Cost Optimized Digital technologies continue to dominate the global LMR markets. DMR Tier III also represents an increasing proportion. While technologies such as NXDN and dPMR are projected to increase in volume over the forecast period, DMR Tier II and DMR Tier III are anticipated to represent the highest proportion of the market during the next few years and will continue to increase share significantly well beyond the forecast period.
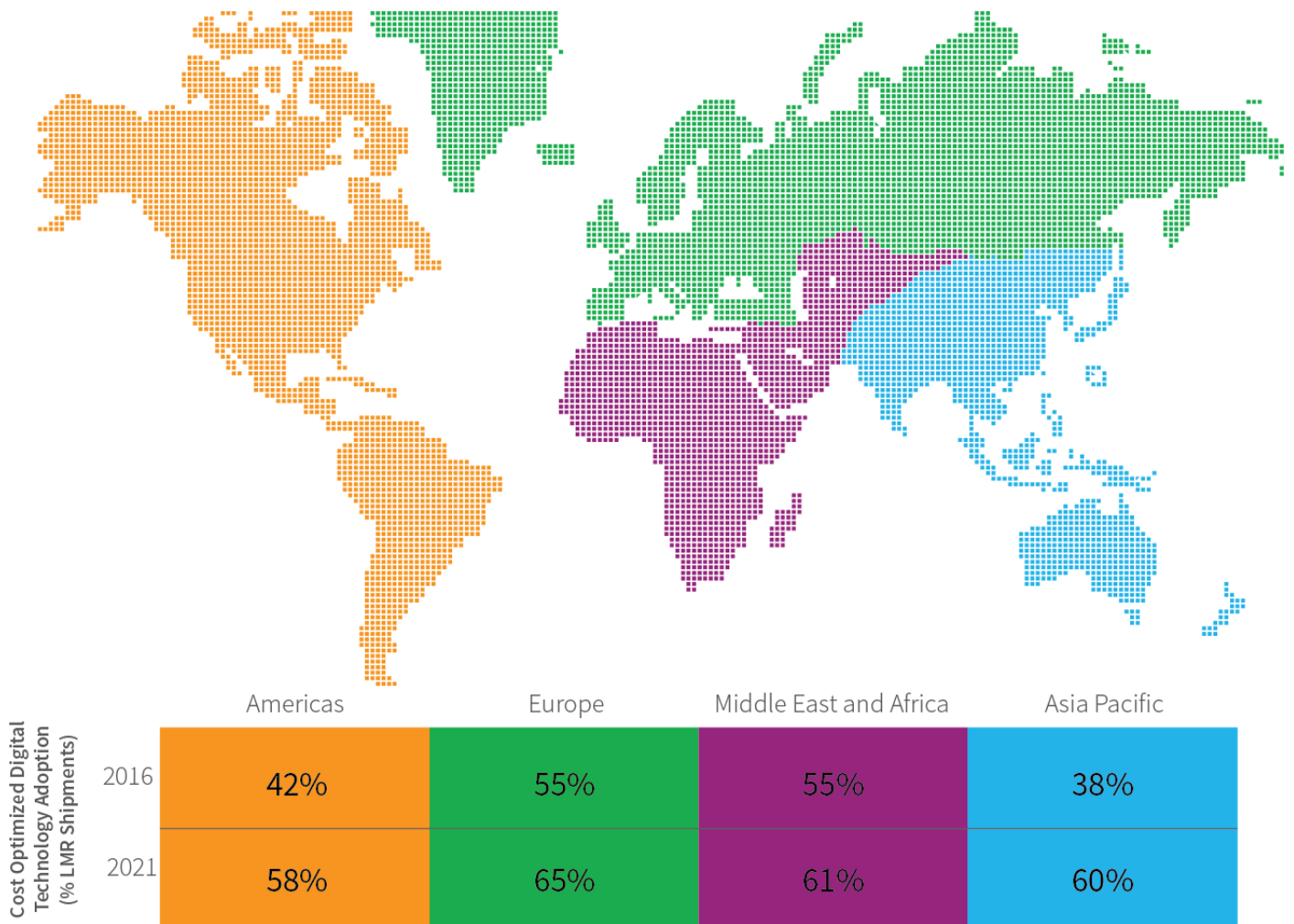
The critical communications market has achieved year-on-year growth and provides a solid industry base from which to continue R&D into new and emerging technologies. DMR Tier III can offer multi-site trunking, which has led to comparisons with technologies such as TETRA and P25. The evolution of the Tier III technology has introduced an interesting dynamic to the DMR market. The greater spectral efficiency, and multi-site and multi-channel operation clearly provides an alternative to technologies in the mission-critical market. DMR Tier III is projected to more than double its shipments between 2016 and 2021.

Forecast Installed base by technology: World

Source: IHS Markit   © 2018 IHS Markit

Installed base by user Application: World

Source: IHS Markit   © 2018 IHS Markit
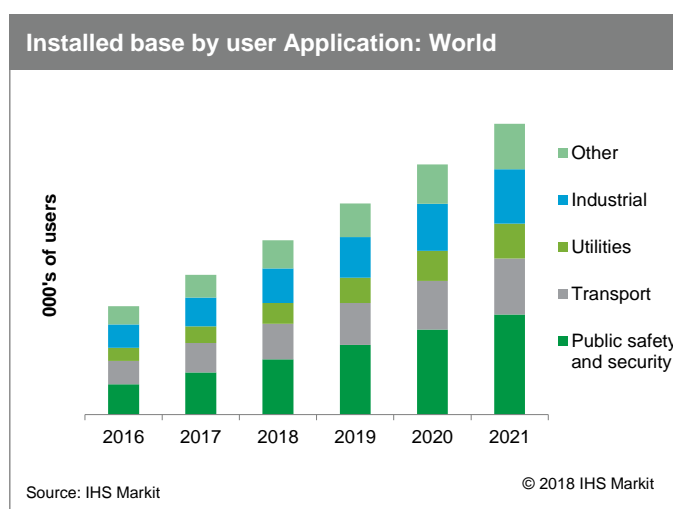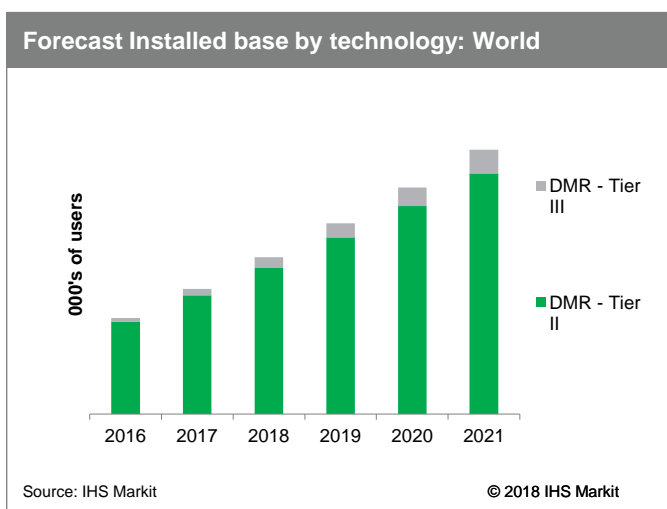
When discussing DMR Tier III it is vital to discuss its conventional counterpart, DMR Tier II. Trunked radio systems are relatively more expensive to maintain and manage than conventional digital systems, primarily because of software-based management and dispatch, and the management of multiple channels and frequencies simultaneously. DMR Tier III will inevitably hold a higher price point than its conventional counterpart. However, the transition from DMR Tier II to DMR Tier III only requires a software upgrade. As such, many networks are looking to make the switch from Tier II to Tier III: despite the ongoing management costs of a trunked network, the benefits of multi-site and multi-frequency management are considered a vital opportunity for mission-critical applications that DMR Tier II cannot deliver.

However, there are key regional differences in technology adoption, specifically when looking at the emerging DMR Tier III market.

Cost Optimized Digital Technology Adoption – Share of LMR Market by Region

Cost Optimized Digital Technology Adoption (% LMR Shipments)	Americas	Europe	Middle East and Africa	Asia Pacific
2016	42%	55%	55%	38%
2021	58%	65%	61%	60%

Source: IHS Markit. © 2018 IHS Markit

DMR Tier III handheld radios experience over 45% increase in worldwide installed base

DMR Tier III is a vital technology for mission critical applications around the world. Mission-critical organizations, particularly those in the public safety and security market, such as government-funded EMS, police and fire divisions, as well as private-funded equivalents, require complex and refined communications technologies to effectively and efficiently deal with public safety concerns. For financial reasons, public safety organizations in developing countries keep using existing analogue networks: priced-out by digital infrastructure, these organizations used a mix of analogue radio technology and cellular phone technology.

Because of heavy R&D investment by LMR companies cost-efficiency and re-use of existing networks are included as part of the package. The multi-site trunking and simulcast options provide emergency services, police forces and other vital public safety organizations with the complex, refined network that they need. Numerous fire brigades in Poland are also using DMR radio solutions and terminal equipment from Hytera, which prove their quality and performance in practice on a broad base.

Europe, Middle East and Africa (EMEA)

Europe is a mature market, and one of the most digitized of the regions. TETRA naturally has the largest installed base, being used widely for public safety and security. However, it is anticipated that the UK TETRA network will be replaced by the LTE ESN Network in the coming years. Delays to the transition have left the market unsettled, and the adoption of Digital technologies – notably DMR Tier III – will continue to experience growth in the public safety and security market. As DMR Tier III has proved itself to be a suitable mission-critical technology, many countries in Eastern Europe have adopted Tier III technology, heightening confidence in the DMR Tier III market. There are contracts across Croatia, UK, Sweden, Russia, and Spain, having demonstrated DMR Tier III's value within the European market.

In the Middle East and Africa, DMR Tier III is the dominant emerging digital technology. Forecast to achieve over 20% growth in shipments over the next five years, and over 40% increase in installed based, DMR Tier III is undoubtedly becoming the technology of choice for the region. One of the underpinning factors is that there are many emerging markets in the region, all looking to achieve the same goal: effective, reliable and efficient digital public safety communications that fit within their budget. DMR Tier III has been adopted throughout the region, with the most notable being the installation of Public Safety Communications in Konya, Turkey and Capital Police in Ethiopia. Similar to other world regions, the MEA utilities and transportation markets use DMR Tier III. The installed base of DMR Tier III in these verticals is expected to achieve double digit growth between 2016 and 2021.

Image source: Hytera Communications

Americas

Trunked LMR has gained ground in North America: trunked P25 is the public safety and security technology of choice. Spectrum efficiency and legislation, are the key factors impacting this market: spectrum efficiency is needed to ensure emergency communications are as widespread as possible. Legislation will be important as FirstNet develops. The need for both voice and data is key to the future of critical communications in the Americas, and the potential for video and other high-bandwidth applications will drive the market forward. The United States provides a good indication of how the success of trunking has grown; there are approximately three times more bids for trunking systems as for conventional ones, mostly on P25 systems.

However, there is a lot of opportunity for other trunked technologies. DMR Tier III has gained significant ground in the utilities and transportation markets, and in some regions of the public safety market. Despite being a digitized market, the division of public safety and security communications on a state, county and even local level means that analogue is still being used in small counties that cannot budget for high-cost P25 systems. In these networks, DMR Tier III is a suitable solution and IHS Markit anticipates migration of some of these networks across to DMR Tier III.

Latin America has seen significant uptake in DMR Tier III, as well as other digital technologies. The rate of digitization in the region is rapid, and DMR Tier III is forecast to take a sizeable proportion of that market over the next few years. The Guatemala National Police have created some headway into this share increase already, and numbers of active radios will continue to grow in the region. There is still a very large analogue installed based in many Latin American countries, leaving a large potential market for DMR Tier III to enter.

Image source: shutterstock.com

Asia

Asia has the highest analogue installed base of any world region. The analogue to digital transition has been slower here; however, predictions indicate that the transition will become increasingly rapid. The Asia installed base at the end of 2016 is estimated to have been nearly 18 million active radios, a 5% increase on the previous year. An increase in the number of active users was noted in Cost Optimized Digital technology, with DMR Tier III installed base enjoying a double figure boost.

DMR Tier III will provide a perfect technology for analogue users to migrate across to digital. The transition to DMR Tier III and PDT in the region will primarily occur in the public safety and security market, as more regional and local emergency services acquire budget to make the transition. Hytera's contract serving the Philippines National Police, for example, enhances the legacy analogue system. 15 DMR Trunking base stations for 3 main cities coverage and 99 DMR Tier II repeaters cover the suburbs and countryside areas. In total, there are more than 20,000 radios, providing full coverage for the region. Worth noting alongside the DMR Tier III transition is the migration to LTE. A convergence of LTE and DMR is anticipated during the next few years.

The development of the South Korean network is making headlines for LTE, and once all barriers and delays to development are removed, IHS Markit anticipates a substantial increase in the LTE installed base in the region, and a move towards convergence with existing digital LMR technologies in the public safety sector.

Source: www.time.com

Part 2: Going beyond the handset

DMR Tier III Technology has enjoyed double figure growth in both installed base and new radio shipments over the last few years. But what of the adjoining infrastructure and application markets? This section will go beyond the handset, to discuss the potential for DMR Tier III as a mission-critical technology with the use of new management, administrative and field-based applications, alongside the market for the network infrastructure.

System Integration leads DMR Tier III infrastructure market

The world LMR infrastructure and system integration market is estimated to have been worth over $4 billion in 2017. IHS Markit anticipates that revenues will grow at a 12% CAGR from 2016 to 2021. DMR Tier III and Cost Optimized Digital technologies are anticipated to experience the highest growth of all technologies in the infrastructure market. DMR Tier II is being widely used for commercial use (including transport, utilities, and some industrial applications), but DMR Tier III is increasingly penetrating the public safety and security sectors in regions such as Eastern Europe, Asia, and Africa. Key regions for DMR include North America and Europe; however, revenues will increase the most in Asia. Latin America will also represent a key market for DMR Tier III expansion. The Guatemala National Police has demonstrated the demand for DMR Tier III in the region; DMR Tier III will contribute to the uptake of digital technology over the next few years.

The deployment of base stations will account for much of DMR and other Cost Optimized Digital Infrastructure growth during the forecast period. For the most part, the majority of DMR systems have not been in place for the full hardware lifetime yet, so the deployment of new base stations will be the highest revenue generator for the DMR Tier III market. Even analogue systems that are being migrated across to DMR Tier III, one for one, often require additional base stations to ensure coverage or expand the network as part of the capital investment.

Maintenance of DMR Tier III networks will grow substantially across the forecast period. As more networks are placed, additional revenue is expected to be generated via the maintenance of those networks. As DMR Tier III is a relatively young technology, it is unlikely that any networks will be replaced within the forecast period. System integration is estimated to have accounted for around 30% of total revenues in 2017 and is set to grow approximately 80% across the forecast period. As system integration functions are typically performed in the early stages of network implementation, the emergence of DMR Tier III and other Cost Optimized networks (as opposed to TETRA or P25 expansions) will generate the highest revenues for system integration.

Application development will underline future of DMR Tier III

The market for applications has increased significantly across the LMR market since the introduction of digital technologies. This is true of all LMR technologies, with TETRA and P25 particularly enjoying growth in the applications market. Traditionally, the applications market has been active in safety features: man-down, GPS location (for police and fire), and applications to unify body-worn cameras and voice recording. These mission-critical safety applications have increased in complexity and coverage in both P25 and TETRA. The market for DMR Tier III applications is much newer. Despite its relative youth as a technology, the DMR Tier III applications market has increased rapidly, with more suppliers aligning their applications with the Tier III standard, notably on the dispatch side of the market. The primary reason for this is the development of the technology itself. Traditionally, DMR Tier III applications providers have focused on administrative and business-critical apps, however there is now a migration towards offering mission-critical applications and network management tools.

For example, the availability of new Hytera network management and field-based applications for the DMR Tier III technology has transformed DMR Tier III from a business-critical technology into a suitable,

reliable and efficient mission-critical technology in just a few years. Coverage Analyzing systems will generate network optimization; Hytera's Dispatch Workstation System provides voice recording and dispatching, management, channel monitoring and messaging, and provide visualized dispatch in addition.

Application vendors on both the radio and dispatch sides of the system will be vital in ensuring the progression of DMR Tier III as a viable mission-critical public safety technology.

Part 3: DMR Tier III as a cross-vertical technology

DMR Tier II has traditionally been used as a business-critical technology, servicing the retail, leisure, utilities and transportation markets. However, recent research and supporting case studies have now identified DMR Tier III as having high potential in mission-critical environments as well. This section will explore the potential of DMR Tier III across public safety and security, Utilities, Transport, and Enterprise.

3.1 DMR in Public Safety and Security

As previously noted, the development of the technology, its encryption and its multi-site trunking has equipped DMR Tier III for mission-critical environments. The majority of DMR Tier III public safety networks are based in regions such as Eastern Europe, Africa, parts of Latin America and Southeast Asia. In these regions, where analogue systems are still operating, DMR Tier III provides a cost-effective solution for the digital transition. Key vendors have proved that DMR Tier III is a reliable and efficient public safety and security technology; with deployments in China, Indonesia, Philippine, Croatia, Turkey, Ethiopia, Canada and Guatemala, , the evolution of DMR Tier III will continue and further penetrate the international PSS market. Public safety and security will be the largest growing DMR Tier III market, and in 2021 will account for nearly 35% of DMR Tier III shipments.

In regions of fast development, enhancement of critical communications infrastructure and network management is important: existing analogue networks are sometimes unable to keep up with the mission-critical demand that emergency services face in fast-growing municipalities.

In some cases of emergency, fire, EMTs, police and first responders are often required to conduct joint operations, so the communications systems that link them are highly valuable. Should each department have separate communications networks, the burden on both frequency shortage and municipal spending can be high, so DMR Tier III offers a unified solution to these mission-critical environments.

Shenzhen Police switched its citywide proprietary police digital trunking network from TETRA to PDT in 2016   Source: Hytera Communications

Case Study – Public Safety and Security

Philippines National Police, S E Asia

The Philippine National Police (PNP) is the civilian national police force of the Philippines. Its national headquarters is at Camp Crame in Quezon City, Metro Manila, and it has 170,000 personnel. It is administered and controlled by the National Police Commission and is part of the Department of the Interior and Local Government (DILG). The PNP required a digital transformation of their public safety communications system from a legacy analogue network. Hytera was selected to provide the transition to DMR Tier III. South East Asia has been a growing region for DMR Tier III, due to the cost efficiency and spectrum efficiency gains associated with the technology.

The undertaking involved the delivery of DMR Tier III to help the Philippine National Police establish a preliminary national network and marks a good start to large-scale digital technologies entering the country's public security market. A reliable and advanced nationwide critical communication system can help PNP better fulfill the task of fighting terrorism and criminality, protect the people. The new digital technology was required by the PNP to have high level encryption for secure mission critical communication, and should be compatible with the current analogue network (so that, if required, analogue units could be provided to the most rural areas and still link with the new digital network).

Hytera provided 15 DMR Tier III base stations, to provide 3 key cities with communications infrastructure. Over 20,000 new DMR Tier III radios were supplied into the project, for key use in the main 3 cities. 99 DMR Tier II repeaters were also provided to support the suburbs and outlying countryside: Tier III is ultimately compatible with both Tier II and analogue, so the system was suitable for the requirements in place. Some of the key benefits of the Hytera DMR Tier III system included: seamless roaming and handover, customised police applications, advanced encryption and national digital coverage.

Ultimately, the network will develop business and competition in the Philippines, and provide the country with an efficient digital public safety network. PNP required not only basic voice communication, but more enhanced data features and open structure for future migration: Police officers can use the terminals to check the vehicles' plate number for violation query or people's ID number for searching wanted persons; A unified gateway will make sure a smooth inter-system communication between DMR conventional, DMR trunking, and legacy analog system, with auto roaming and handover between different base stations and repeaters.

According to the PNP, DMR was the 'latest technology that can address all the disadvantages of TETRA and P25; top among them is the compatibility with PNP's existing analogue systems, the high cost of acquiring P25 and TETRA, and the DMR's far-reaching capacity geographically' (Chief Inspector Berniel Gotoman, of the PNP-Communication and Electronics Service).

Source: Hytera Communications

Case Study – Public Safety and Security

Guatemala National Police, Guatemala

National Police projects are widely varied in application, but Hytera's selection for the Guatemala National Police project, in partnership with system integrators Crelosa, highlighted the importance of DMR Tier III in South America. South America has proved to be open to DMR Technology for a number of years, and has more recently made headway in using DMR Tier III for public safety and security.

This prestigious project is being based partly on DMR and partly on China's PDT standard, a digital trunked radio technology which, in Hytera's implementation, runs on the same hardware platform as DMR. Within the project, DMR Tier III was selected to provide coverage for the rural areas, and PDT for the busy municipalities, with MPT 1327 supported throughout the network to ensure that the transition remains seamless. The transition from municipalities to rural areas will also be seamless, as the technologies used will quickly switch from one to the other should a radio travel outside of the PDT coverage area.

The first phase of deployment is currently being completed, and is concentrated on police deployment. Further stages will expand the system, to include jails and border force.

The benefit for the Guatemala Police in this case is the ease of transition from analogue to digital. As previously mentioned, with DMR Tier III the transition across can be made easier by reducing initial capital investment and re-using existing network infrastructure. There is no large investment in antennas, cables, duplexers, or repeater sites because the infrastructure already exists and can be overlaid with the DMR Tier III equipment and software to ensure multi-channel operation.

Source: Johan Ordonez/AFP/Getty Images
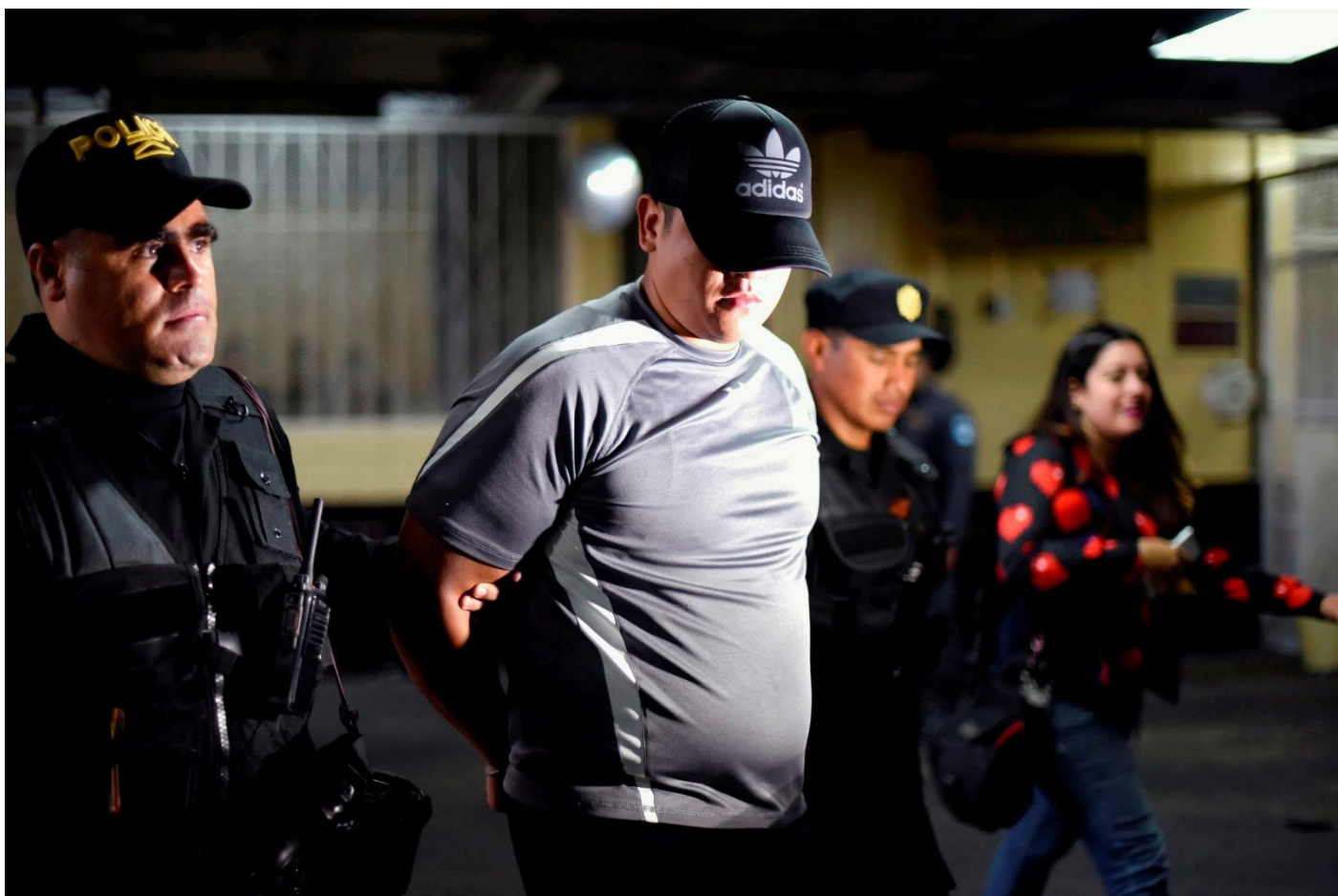
3.2 DMR in Utilities

The application of DMR Trunked technology in the utilities market is one that will continue to grow over the next five years, notably in Europe and the Middle East and Africa (MEA). The majority of utilities applications – notably the oil and gas sector – requires use of intrinsically safe and ATEX devices, coupled with high level encryption and safety features to ensure safety of users. The deployment of these DMR Tier III intrinsically safe radios will also increase across the forecast period.

The oil and gas sector can be divided into distinct markets: on-shore communications and offshore communications. Offshore systems are one of the communication platforms that can provide a range of portable radios with Marine VHF, data messaging and dispatcher workstations. High levels of redundancy and diagnostic alarm control systems are essential for offshore communications, ensuring safety of users in all circumstances. A DMR trunked solution from Hytera has been implemented at the Galloper offshore wind field in the UK. Onshore communications typically surround gas pipelines and onshore oil drilling activities and can be more complex; they are large communications systems that can stretch thousands of kilometres along a gas pipeline, requiring sensors, diagnostics, alarm control systems and along its length. Hytera is ranked as one of the global market leaders for DMR Trunked technology. Hytera was selected to provide a DMR Tier III network for Powerco (New Zealand's second largest electricity company in 2016), increasing Hytera's global DMR Tier III footprint in Utilities, and spurring Hytera to be considered one of the largest DMR Tier III providers in the business-critical sectors.

Use of DMR Trunked in the Utilities sector has grown, and will continue to grow across the forecast period, especially in regions of Asia, Eastern Europe and MEA, with pockets of high-end growth in North America and Western Europe. Utilities is anticipated to account for approximately 11% of DMR Tier III shipments in 2021, staying relatively stable throughout the forecast period.

Case Study – Utilities, Oil and Gas
Gazprom transgaz Yugorsk (OOO), Russia

Gas transportation is one of the most vital parts of the oil and gas sector. The transportation of gas along pipelines run thousands of kilometres, and the monitoring of these pipelines ensures both safety and mitigates loss of revenue.

Gazprom transgaz Yugorsk (OOO) is the largest gas transportation company in Russia. OOO conducts gas transportation from fields in west Siberia (Medvezhie, Urengoi, Yamburg, Zapolyarnoe etc), to the consumers of the European part of the country, the Commonwealth of Independent States (CIS) countries and non-CIS countries. OOO transports gas over 15,000 kilometres across the country, up to 1.5 billion cubic meters of gas per day. Due to the length and volume of the pipeline, constant monitoring and communications coverage is required: if coverage is weak, a break or deformation of the pipeline could result in heavy maintenance and repair expenditures and could even result in emergency situations.

The connection between the infrastructure facilities and the production departments in both Yugorsk and Sovetskiy municipalities was weak on the existing analogue network. Hytera worked a solution to combine these two factions in a single PMR network. Hytera provided base stations, portable and mobile radios, repeaters, and the network management and dispatcher systems to ensure network coverage was greater than before and ensuring safety features – such as emergency signals – were of paramount importance in the development of the dispatching and network management system.

The resulting support from visual dispatcher communication, recording voice calls and analysis of emergency signals positively influenced the operation of the security service connecting the employees between Yugorsk & Sovetskiy cities and the operating department.

Case Study – Utilities, Oil and Gas

Powerco, New Zealand

Hytera, a leading solution provider of Professional Mobile Radio communications, partnered with Broadspectrum, a renowned Communication Technologies service provider in New Zealand, was awarded the Radio Voice project by Powerco, New Zealand's largest electricity distributor in terms of network length (around 30,000km) and second-largest in customer connections (around 330,000km).

The project included 14 base stations in phase 1, and an additional 20 base stations in phase 2. However, the key facets of the system were the AIS interface support and SCADA connection, and the redundancy backup for the Mobile Switch Office (MSO). A deliberate design of redundancy backup for Mobile Switch Office (MSO) will be extensively applied – the radio network will replace the cellular network in times of phone network congestion in a disaster; hours or days of battery backup to prevent the power cut with cell sites. A SCADA solution will also be deployed in the Powerco project to achieve smart management and higher operation efficiency of power network as well as to shorten processing time and ensure safety of power distribution. A key feature of this solution is to utilize the dedicated SCADA digital channel to collect data from remote sites and important facilities, which is an in-depth and further application of DMR Tier 3 trunking network. AIS interface connection tests were performed with Zetron to ensure compatibility of the system; The AIS interface allows vendors to write applications that can be used with any DMR manufacturer's AIS-compliant equipment.

One of the key features of this project is the compatibility of DMR Trunked and Analogue technologies. The DMR system implemented – including all portable radios and base stations – are completely compatible with analogue systems. The DMR repeaters added onto the analogue base stations did not inherently turn the analogue system currently being used into DMR, it simply allowed both communications to be present.

The DMR system can be used in this way to slowly digitise large projects: a complete overhaul of a communications system stretching 30,000 kilometres would entail large capital expenditure. The option to provide digital repeaters and a proportion of DMR capable ATEX radios at high-risk points is less expensive in the short term, and allows the network to digitise as lifetime limits for both radios and base stations come into effect. This is one of the key benefits of the DMR Trunked system: the ability to extend expenditure over time and allow a full ROI on the existing analogue infrastructure and handheld radios before transitioning, while still experiencing the benefits of a digital system. It is anticipated that as the expansion occurs, Hytera will be at the forefront of digitising the system.

Source: Hytera Communications

3.3 DMR in Transport

Transportation, along with the utilities sector, has been the antecedent market for DMR technology. Despite some areas of transportation requiring high levels of encryption and mission-critical features, a large proportion of each network is focused on business-critical requirements. As such, transportation provided a perfect environment for DMR to exist and evolve. The evolution of DMR Tier III has evolved within the transportation and utility markets from a mature business-critical technology to a reliable mission-critical technology, and has created confidence in the use of DMR Tier III in full mission-critical environments (such as the public safety and security sector).

The dispatching solution is specifically designed for the transport sector, aligning with DMR Tier III technology. Its unified dispatching platform allows for powerful dispatching functions and hierarchic management which is seen as vital in the transport industry. The ability to connect to Flight Information Display Systems (FIDS) and Global Airport Operational Databases (AODB) allows a full turnkey solution to be implemented. Features such as fleet management, logging, GPS tracking and voice dispatch can result in the ability to talk to maintenance, cargo, cleaning and fuelling teams on different levels and dispatch accordingly: differentiating dispatch between frontier and office staff is an important tool, especially when considering the prioritisation between auxiliary, supplemental information compared with real-time flight-critical information. Growing deployments for Hytera in the transportation markets, with large airport systems in Saudi Arabia, metro systems in Spain and others has spurred Hytera to be considered one of the largest DMR Tier III providers in the business-critical sectors.

Transportation will account for approximately 20% of shipments throughout the forecast period 2016 to 2021.

Source: Hytera Communications

Case Study – Transportation

Saudia, Saudi Arabia

Saudia is Saudi Arabia's national airline, based in Jeddah. With significant growth in both enterprise and tourism to the region, the airline has experienced growth and therefore required a digital communications system to replace its existing infrastructure. This was the latest step in a major programme to bring the company's information technology infrastructure up to date, and to meet the air transport demands of a booming region.

Hytera provided a Trunked DMR network, based on the requirements for an open digital standard, and one that could be cost-efficient for the region while still providing the reliability, dependability and safety features associated with higher-end networks like TETRA. The capability of the DMR digital Trunked system to integrate with the enterprise and business processes and back-end operations while still maintaining the complex voice and safety features required for frontline staff meant that DMR was the best choice for Saudia.

The converged network provided carries data, voice and video, and interconnects more than 500 Saudia Arabian Airlines offices in 60 countries. This is one of the largest DMR transportation networks, covering 4000 portable radios, mobile radios, and base stations. Given the large number of individuals requiring constant communication accessibility, the DMR Trunked system increases the frequency efficiency through simultaneous use of TDMA channels and effectively doubles the capacity of existing licensed channels. The system also provided backwards spectrum compatibility with the legacy systems: like other DMR Trunked solutions, it supports a staged digitization of the network, allowing existing systems to maintain operations until the end of their life cycle.

The use of intrinsically safe radios is vital in airline operations, and so the provision of ATEX-certified portable radios was an important aspect of the system, as this capability is required by front-line staff, baggage handlers, and cargo handlers, to ensure safety.

DMR has traditionally been used in the transportation industry for a reason: the business-critical operations of the industry can be fully supported with DMR Trunked technology. Now, however, the application of frequency efficiency technologies has resulted in its use for a large-scale network comprising both business-critical and emergency situations. The deployment of DMR Trunked in one of the largest national airlines in MEA provides a stepping stone for the wider use of the technology across the transportation industry in the region.

Source: Hytera Communications

3.4 DMR in Business and Enterprise

Industrial and business environments often require a different network established compared to, for example, the public safety and security sector. Industrial communications networks are primarily based around intrinsically safe and ATEX radios, much like utilities and some transport environments. Often these are large private networks required by factories or plants that cover all communications within a given geographic area. Occasionally, these will be provided on a multi-site basis for larger organizations. This means that the networks themselves are isolated, but require stringent safety and encryption protocols, and are often complex networks to install.

Business, retail and enterprise are considered business-critical networks, and so do not require the same amount of safety protocols. Encryption is still vital; recent terrorism activity in EMEA and North America focusing on large events have highlighted the importance of critical communications in the enterprise environment, and of encrypting those communication networks.

There are several systems dedicated for use within the business and enterprise sectors. Billing Management Systems, for example, have been widely used across platforms in PMR operation, where multi-level management and flexible billing are required to manage the networks. Business, Enterprise and Industrial DMR Tier III radio shipments will achieve a CAGR of 9% across the forecast period.

Case Study – Business, Enterprise
Marcus Communications, USA

Marcus Communications is the largest trunking radio network operator in Connecticut, USA. Its trunking radio communications network covers the whole state across a wide variety of sectors, including the police, fire, medical aid, urban engineering and taxi services.

The project was initiated on the back of increased demands within Marcus Communications' user base; unclear communication quality and difficulty with blind spots in coverage caused significant issues for operators, and lack of GPS system was becoming a struggle for those requiring visual dispatch (such as taxi services). The legacy analogue system could not resolve the issues facing the operators, and Marcus Communications instead looked to DMR Tier III to rectify the situation. Compared with the previous LTR analogue network, the newly built Hytera DMR Trunking Pro benefited Marcus with cost-saving and high-efficiency.

The analogue to digital transition is rapid in the USA, with a number of end-users starting to consider the benefits of digital over the next few years. This is expected to be one of many DMR Tier III installations on a local and state level across North America before 2021. DMR Tier III is a beneficial technology for analogue to digital transition as it utilises the existing infrastructure to operate, requiring a simple software upgrade and minor infrastructure add-on to initiate the network.

In the case of Marcus Communications, the DMR system provided double the user capacity and traffic capacity, from 900 to 1800, using the same equipment as the legacy system. During Phase 1, 3 trunking base stations were installed covering 4 major municipalities. Phase 2 provided 20 trunking base stations to cover the rest of the network.
The benefits from a frequency perspective were clear: DMR technology adopts TDMA two time-slot technology which divides the 12.5kHz bandwidth into two 6.5 kHz time slots to support 2 simultaneous communication channels, greatly enhancing spectrum efficiency and system capacity. Ultimately, the issues created by the legacy analogue network were resolved by the use of DMR Tier III as a digital technology, and provided better communications service for the end-users.

Case Study – Business, Enterprise

Altech Fleetcall, South Africa

Altech Fleetcall, a division if Altech Radio Holdings (ARH) and part of the Altron TMT Group, the largest privately owned converged solution provider in Africa, upgraded a large part of its analogue radio trunking network to DMR Tier III in association with Hytera. Based in South Africa, ARH initially created one of the largest MPT1327 networks in the world, with the aim of providing blue chip companies communications technologies to increase their technological efficiency and operational advancement. Its legacy MPT1327 network reached over 180 base stations and contained nearly 30,000 terminals: this is one of the largest migration potentials for DMR Tier III in the MEA region.

ARH's move to DMR signified the next big step in critical communications for enterprise and business – Altech Fleetcall counts many blue-chip companies within its remit, and chose to invest in an upgrade for the legacy analogue network. MPT1327 is still being used widely around the world, but as DMR and other digital trunking systems become more technologically advanced, large users of analogue systems are starting to migrate across to digital as the analogue system cannot match their requirements. The benefits of migrating from the MPT1327 network are clear in this case: the options for higher data speed, GPS tracking, flexible dispatching and multi-level monitoring would be appropriate for business and enterprise usage.

Given that Altech Fleetcall comprised one of the largest business and enterprise networks in the world, DMR provided an exceptional transition solution, so the analogue network would be able to run effectively as legacy base stations and mobile/portable handsets would be able to run their lifecycle while still operating under the new digital system. The DMR Trunked bandwidth stands at 12.5KHz, which is the same frequency that MPT1327 operates under, saving time and money for ARH in applying and maintaining a new spectrum license. Due to the limited capital expenditure involved in migrating to DMR Tier IIII, ARH chose to make the migration as quick as possible: over 50 base stations and 6000+ mobile/portable handsets were delivered as part of this case, migrating most of the network across to digital immediately.

The ARH network migration will continue, with the potential for an additional 200 sites to migrate across to DMR Trunked, and thousands more digital handsets to be provided as part of the network. While this is a phased approach, based on the idea of running the existing base stations to the end of their lifecycle, the options for digital migration through DMR are not capital expenditure-heavy. The ongoing costs and services associated with the DMR Tier III network are relatively high compared to MPT1327 (notably for the unified dispatching, frequency management, and network management associated with all digital systems), but it means that ARH can continue to operate and maintain existing systems for as long as required without needing to migrate the network fully. It's expected, however, that additional users of the network could be implemented immediately with a digital solution.

Source: Hytera Communications

Part 4: Convergence with future technologies

Convergence is landmarked to be the future of the critical communications industry. As more countries begin considering their roadmap to broadband LTE communications systems, hybrid solutions will form a large part of the transition economy. This section investigates both the integrated handheld technology convergence (Bluetooth, Wi-Fi, and Push-to-talk-over-Cellular technologies) and the Hybrid LTE systems of the future.

4.1 Integration of handheld technologies on the rise

Push to talk over Cellular (PoC) solutions have been commonplace in the LMR market for some years; however, with the potential for hybrid and full LTE networks in the next few years, IHS Markit anticipates that more commercial-style radios will become available and be used as a secondary frontier device in public safety environments. Ultimately, major users of traditional networks are unlikely to fully migrate to PoC in the short term, as the benefits of Trunked LMR technology far outweighs that of PoC. However, The ESN network to be deployed in the UK will make the most of the PoC solution, using it to add coverage on top of its existing Airwave network as the LTE transition takes place.

Before the LTE market takes off, however, PoC systems (such as those deployed as part of DMR Tier III systems) are highly beneficial for smaller user-bases, and likely to be deployed by organizations that are newcomers to the communications market and do not want the capital expenditure of LMR. PoC systems offer over-the-air programming – which enables end-users to manage handsets remotely and eliminate the requirement to regularly travel long distances to perform simple tasks. These commercial devices are built as professional two-way radios, with a PTT (push to talk) button to allow radio communications across cellular networks. This is beneficial for smaller users: with PoC, even small numbers of users can benefit from the features associated with modern high-end radio systems, without having to pay for expensive infrastructure and radio licenses.

Integrated low-power wireless technology, such as Wi-Fi and Bluetooth, are integrated into many DMR portable radios around the world. IHS Markit estimates that a substantial proportion of DMR radios are already equipped with these technologies. The primary reason for assimilating these technologies is to allow integration of smartphone, tablets, PDAs and other handheld technology that will ultimately be of most use in a hybrid commercial and LMR network. As hybrid networks become more commonplace, the integration of Bluetooth and Wi-Fi will undoubtedly ease the transition across to LTE.

In addition to allowing integration with handheld devices, body worn devices are becoming increasingly popular in frontier operations, and the market for body worn devices in public safety and security is growing. For example, body worn cameras and video glasses allow recording and logging of emergency operations, and smart holsters include motion and pressure sensors to allow recording of gun deployment. These devices connect via low-power technologies such as Bluetooth and Wi-Fi. The deployment of radios that already integrate these technologies looks ahead to a future where body worn devices will become commonplace.

4.2 LTE transition will increase necessity for converged technologies

DMR and other LMR technology users are facing new struggles, especially in the public safety and security sector. Over the last decade, there has been a significant increase in citizens' mobility, use of technology and distribution, which has resulted in a potentially chaotic period for mission-critical communications users. As public technology increases, there is pressure for emergency services to follow suit, to keep up with technological advances, as well as stay ahead of technology-based criminal activity.

In response to demand from public safety authorities for access to secure wireless broadband communications, 3GPP is developing specifications to deliver a variety of mission critical capabilities over

LTE networks. Significant public safety services networks based on LTE are currently being deployed in South Korea, the UK and the USA as well as in several other regions and municipalities across the globe. The ability in the long term to demonstrate that devices conform to this standard will be of critical importance to all potential users; especially public safety authorities.

Broadband will eventually become a necessary part of the LMR market; broadband will provide the ability for public safety users to operate with more than just voice. Broadband will bring image and data transfer, video and more to the market, which will in turn create a more efficient user experience. Ultimately, this will provide the public safety market with the technology it so desperately requires to keep up with public technology usage. The spectrum efficiency and group capacity will increase with the use of broadband and will enable over 2000 users per site. The evolution to future technologies (such as 5G) will only increase this capacity. Should the critical communications market fall too far behind the evolution roadmap of LTE and 5G, the expense and complexity of upgrading the system in the future will be high.

In the short term, LTE will complement critical voice with data, rather than replace LMR altogether. The continuous deployment extensions of LTE networks (such as in the UK and South Korea) highlight the narrative that a converged LMR + LTE solution will ultimately be required to make any LTE transition viable. From a safety perspective, ensuring LTE mission-critical networks have the security, reliability and coverage needed to support public safety departments is of absolute necessity. A combination of LMR, cellular and an emerging mission-critical LTE will be the solution of choice for many countries looking to migrate to full LTE in the future.

Among the major LMR vendors, Hytera is a big advocate of convergence solutions, and its converged DMR and LTE solution includes a dual-mode radio which can connect to a cellular network in addition to the DMR network. Data over the network will operate over commercial networks, as the data capability over commercial is stronger than traditional LMR. However, voice can be used across both commercial and DMR networks. The benefits of using a dual-mode radio are clear: commercial networks create an additional layer of coverage and can reduce the need for additional LMR infrastructure. Running over an IP backbone, the system will overlay both a core LTE network (including LTE eNodeB base stations) and DMR Trunking base stations simultaneously, providing a single core network for LTE and DMR. While some market leaders are focusing on a converged handset (combining traditional LMR and LTE in the same radio), others are looking at multiple device deployment. As there is still a strong division of assets between traditional LMR and LTE (with traditional LMR preferred for voice communication, and LTE preferred for video and other high-bandwidth applications), it is not surprising that convergence in the handset has taken some time to evolve.

Video is a key feature identified by IHS Markit as part of the future of LMR – at the moment, the primary way to enable video operation is via a commercial cellular network (preferably LTE), while retaining voice in the LMR hemisphere. A dual-mode solution allows video uploading and video calls via the commercial network while connecting to the DMR network for voice: operating video in mission-critical situations for frontier officers means that their situational awareness in the field is extended and becomes superior to what they currently achieve through voice alone.

From a command and control perspective, video also allows operational efficiency and situational awareness benefits. A dispatcher that can assist frontier officers via video call are able to add another pair of eyes on the field and inform them of potential emergencies much quicker than they are currently able to do. Videos convey complex situations more efficiently and can improve rescue operations. In a converged dispatching solution, integration can be achieved with CCTV, PSTN and MPT, as well as providing dispatchers with high-end applications such as GPS, location, alarm monitoring and other visual data. The link between the dispatcher and the frontier officer becomes closer and enables the operation to become more efficient.

Visualization of Commercial and DMR/TETRA integration network.
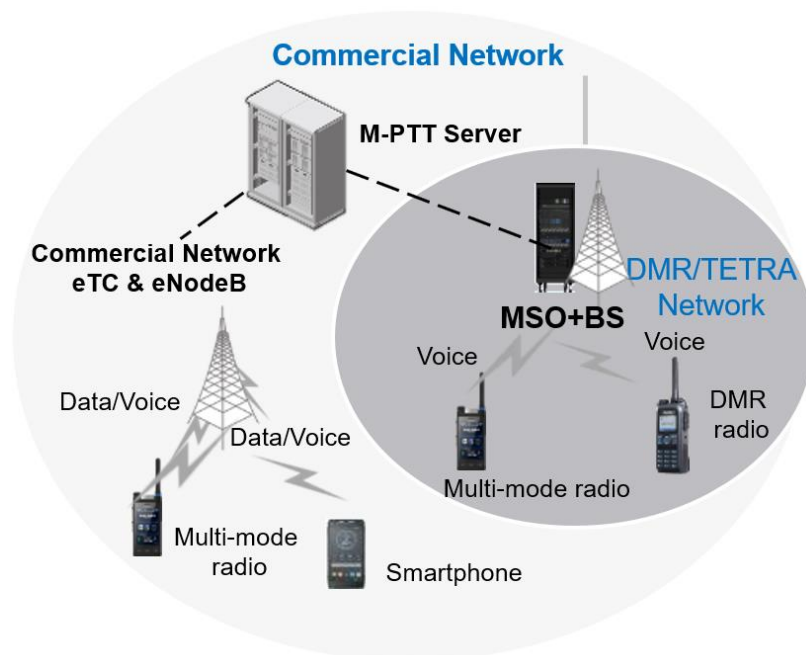
IHS Markit anticipates that before mission-critical commercial networks become commonplace, the commercial network will operate as a support system for built-up municipalities. Non-line-of-sight (NLoS) technologies (such as cellular) become increasingly important in providing full visibility in hot spots. In addition, municipalities typically have a higher rate of emergencies than rural areas: the increased coverage and situational awareness support that dual-mode can bring will be most helpful in highly populated cities and towns.

Part 5: DMR Enhanced as a New Generation Technology

The DMR Tier III standard has become increasingly popular in all world regions due to its open standard, and there is a high level of development into the technology and many good practices throughout different industries. DMR Trunking systems provide the security and scalability and features required by national public safety organisations, in the evolution of the technology. Enhancing the system design, security and encryption, applications and operational modes will enhance DMR to the next stage of evolution. This section explores some key features of the DMR Tier III system.

Enhanced migration from analogue to digital trunking

One of the key reasons for the relative success of DMR Tier III is the ease of transition from analogue. DMR provides increased coverage but still uses the same frequency bandwidth. From an infrastructure perspective, the transition is simple, requiring a software upgrade to analogue repeaters in order to keep the legacy infrastructure and reduce initial investment outlay.

The DMR Tier III standard provides double capacity to end users than the existing MPT analogue systems. However, improving single site capacity is still an issue within the DMR industry. There can be signalling congestion of the registration and call control. DMR systems based on key research and development provides an enhanced capacity for single sites, by providing multi control channels processing simultaneously. This sharply reduces the registration period for users, and ultimately improves the radios service quality. And unique 3-diversity receiving technology achieves wider coverage.. The enhanced DMR

trunking network platform has up to 360 MSO connections and 48 carriers per single base station site – which significantly increases the capacity of a DMR Tier III network; and the flexibility of control channels and wide coverage allows for flexibility within the networks. Enhanced platforms such as these will move DMR Tier III forward in the public safety sector.

Enhanced Migration Key Factors

Single Site Capacity
- Up to 40+ carriers, 8000+ users

Multi System Capacity
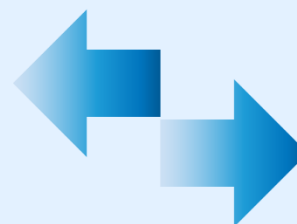- Up to 300+ system interconnect for nationwide or global network

Flexible Control Channels
- Up to 4 control channels per site for burst registration

Full Duplex Support
- Terminals and system support full duplex option

Source: Hytera Communications

Latest design concepts in DMR Trunking

Base station innovation has become ever more crucial in the deployment of DMR Tier III and hybrid DMR+LTE networks. The current DMR platform is maturing: existing infrastructure has developed to account for current issues in the emergency and public safety sectors. Hytera provides DMR based ad-hoc repeaters and LTE based product for flexible deployment and automatic networking in emergency scenarios without trunking network coverage. This means DMR is effective both in cities, where building coverage is dense, and in rural areas, where the network needs to cover a long distance.
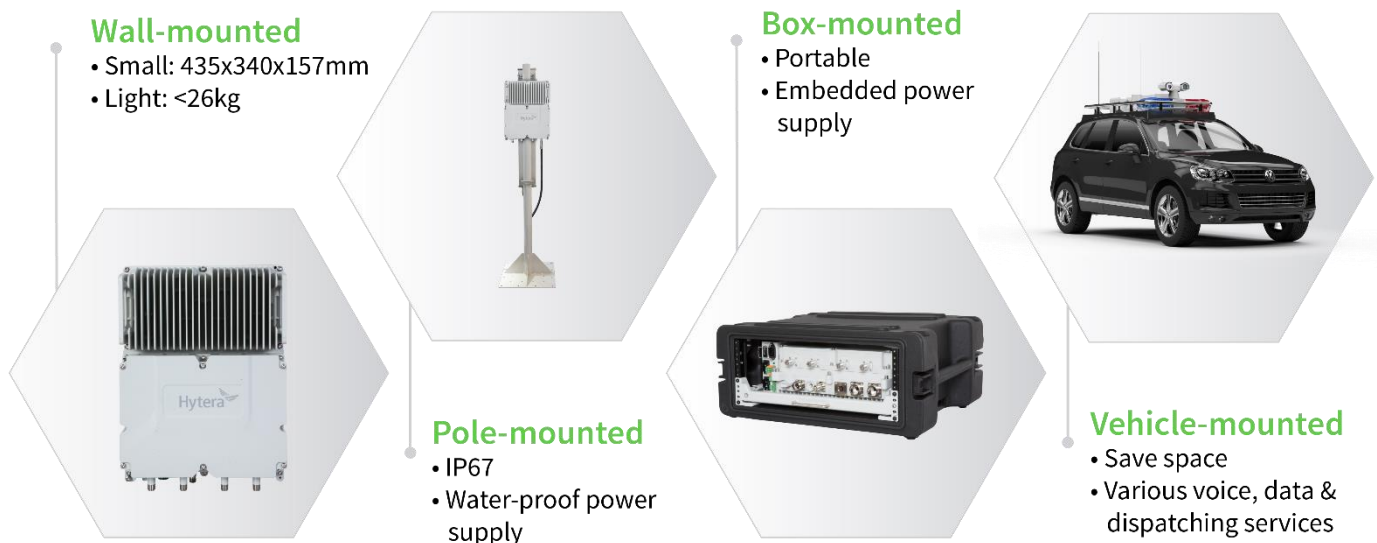
From an infrastructure hardware perspective, continuous new deployments from all providers have seen innovative features. DMR Tier III as a standardized technology provides a smooth migration across from MPT, as the software and base station hardware can simply be laid over the analogue infrastructure. However, successful DMR Tier III installations in the future, will provide flexible DMR/MPT channel allocation, with shared hardware (such as the base stations themselves). An underlying dispatch and network management system which is unified across analogue and digital will be beneficial for the digital transition. The latest DMR systems integrate simulcast for higher spectrum efficiency, smooth roaming and handover, and flexible deployment options across common-frequency areas.

For the majority of end-users worldwide, a comprehensive solution is required to meet the extensive requirements across multiple sectors. Different environments provide different challenges; for example, a city area will require a different LMR network approach to a highway. For highways, for example, simulcast is a suitable solution providing a stable service quality during the handover procedure between different sites. Simulcast can also help to build a large coverage network with higher spectrum efficiency and smooth

roaming and handover. For tunnels or indoor, the BDA solution can provide continuous signal coverage. For cities, a hybrid solution (BDA and base station) resolves both traffic volume and good coverage. Hytera has researched and developed a solution that can be applied across multiple environments, and an enhanced platform that can offer a comprehensive solution.

For example, Hytera's DMR Trunking Cube base station is based on a software configuration, which provides the flexibility for carriers, integrating the baseband signal processing unit and RF processing unit structure; reducing end-user installation cost, time and power consumption. Feeder loss has been a concern within the industry, which has been mitigated against with wall-mounted or pole-mounted designs, meaning that it can be directly placed on antenna masts, buildings and towers, ultimately reducing feeder loss. From a security and encryption perspective, the software configuration supports IP67 and is designed to be robust against extreme environments and save the infrastructure cost of the network (for example the building, air conditioning, etc.).

Trunking Cube Base Station Design

Wall-mounted
• Small: 435x340x157mm
• Light: <26kg

Box-mounted
• Portable
• Embedded power supply

Pole-mounted
• IP67
• Water-proof power supply

Vehicle-mounted
• Save space
• Various voice, data & dispatching services
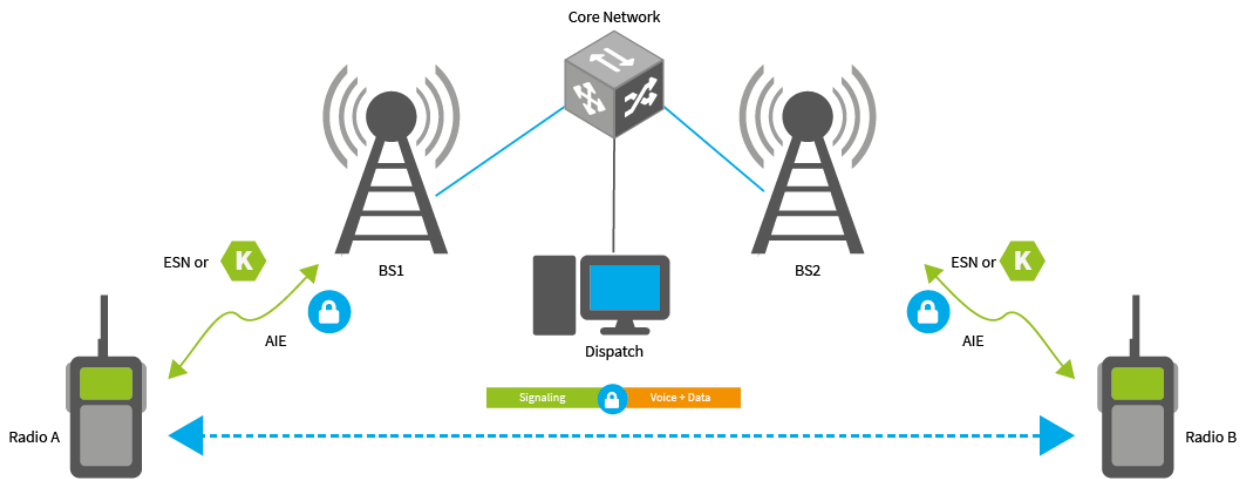
Source: Hytera Communications

From a radio perspective, there is much debate over the future of the handset. However, in the majority of current DMR Tier III systems that have been migrated from analogue, mobile and handheld terminals are often replaced with new DMR Tier III terminals. Flexible migration solutions support the interoperations between analogue and digital under the same site or between different sites, so that non-critical users are still able to use legacy terminals. This maximizes the end-user's investment until the end of the equipment lifecycle. Multi-mode radios will offer a truly convergent platform that will inevitably be required in the future (especially as PTT comes into effect properly).

Security and Encryption in DMR Trunking

Security and encryption requirements for organizations and public safety departments around the world are ever increasing. With the propensity of cyber-attacks and hacking on the rise, the requirements for a secure, encrypted and reliable network is now more important than ever. Based on the DMR standard, there is a requirement for safety mechanisms to provide the whole service procedure security protection and multi-layer end to end encryption. For mission-critical environments, such as front-line public safety,

the importance of maintaining a safe, private network is paramount, and coupled with the rise in cyber-attacks, manufacturers of LMR infrastructure and service providers of the network management and dispatch need to ensure protection is in place in their Research and Development plans.

DMR Network Visualization

Source: Hytera Communications

Hytera, for example, has made significant headway with the Research and Development for enhanced DMR solutions. The unlicensed market is a grey area for the mobile radio industry, and many imitation or low-end brand radios are frequently used, especially in developing regions. Electronic Serial Numbers (ESN) check with mutual authentication – numbered among Hytera's recent additions – can be used to identify authenticity before employing it on the network. In addition, end-to-end encryption, such as Hytera's E2EE AES-256bit can prevent voice or data transmission from being intercepted from both a software and hardware perspective, and AIE (Air Interface Encryption) performs likewise in software.

Much of research and development for enhanced DMR solutions focuses around the security and encryption for this very reason. Full redundancy and multi-level fallback mechanisms should be adopted throughout any ongoing DMR Trunking solution. Over the Air Rekeying (OTAR) provides a straightforward way for the update of E2EE keys through air interface. Hytera's solution, which manages this process via a Key Distribution Management Center, can unify the management of rekeying, supporting from both a software and hardware perspective. These are essential requirements for public safety, and should DMR be considered as a public safety technology of the future, selected manufacturers of the DMR Trunked solution need to ensure than full redundancy is a key feature.

Dispatch application development underlines future of DMR Trunking

Command and Control integration will generate enhancements in the DMR market, specifically with the integration of location-based and visualization applications to support field operations. The use of video will be crucial in dispatching: the ability to offer additional situational awareness by accessing video, CCTV and other visual resources will help the dispatcher manage the field operation more clearly. Furthermore, enhanced GPS location services will provide an additional layer into the dispatching system and underline the importance of management frontier fleets.

For example, the availability of new network management and field-based applications for the DMR Tier III technology has transformed DMR from a business-critical technology into a suitable, reliable and efficient mission-critical technology in just a few years. For example, Hytera's dispatch Workstation System provides voice recording and dispatching, management, channel monitoring and messaging, and provide visualized dispatch in addition.

There is an enhanced data transmission capability associated with Enhanced DMR solutions. Enhanced GPS services (e.g. active GPS reports and voice with real-time GPS) create real-time visual situational awareness support, and SCADA wireless transmission is vital for the improvement of industry automation. Coverage analyzing systems, which use big data techniques to provide a visual interface for the DMR network coverage status are also vital to monitor the network and incidents. These features make it easier for end-users to monitor coverage and communication in real-time and provides visibility on areas of low-coverage or high-activity which can identify areas of network expansion.

Application vendors on both the radio and dispatch sides of the system will be vital in ensuring the progression of DMR Tier III as a viable mission-critical public safety technology; without appropriate and standardized mission-critical applications available for the DMR Tier III market, the growth of DMR Trunked in public safety will take longer than initially anticipated. With the rate of dispatching and application management increasing, IHS Markit anticipates that enhanced DMR features will provide confidence in DMR Tier III as a viable, dependable, and reliable mission-critical technology.

About IHS Markit

IHS Markit (Nasdaq: INFO) is a world leader in critical information, analytics and solutions for the major industries and markets that drive economies worldwide. The company delivers next-generation information, analytics and solutions to customers in business, finance and government, improving their operational efficiency and providing deep insights that lead to well-informed, confident decisions. IHS Markit has more than 50,000 key business and government customers, including 85 percent of the Fortune Global 500 and the world's leading financial institutions. Headquartered in London, IHS Markit is committed to sustainable, profitable growth.