The application of dPMR in Transport Operations

By Pete Hizzey

The functionality of analogue PMR radios has been greatly extended with the introduction of digital technology in both licensed and license-free formats.

System developers have exploited this enhanced functionality to offer applications that specifically target the truly mobile operations of the transport industry.

Automatic vehicle location (AVL) is a commonplace application for transport. Previous generations of analogue radios with digital signalling, such as BIIS1200, supported AVL functions.
Other proprietary technologies offered data systems such as mobile credit card terminals.
A new technology was needed that could package all the common requirements
into one open standard and then back it up with further standards to ensure equipment from different manufacturers would interoperate without issues.

This has been achieved by the European Telecommunications Standards Institute (ETSI) dPMR protocol.
Because dPMR radios can offer simultaneous voice and data traffic, it is simple to embed the GPS position of a vehicle inside a voice call.
However, the dPMR protocol offers more. Imagine you want to add an extra drop off point to a driver's route. Just send the address as a data text message, and it will be displayed to the driver, with confirmation of display as well if needed.
Vehicles can be polled for position or status.

Because dPMR radios are fully digital it would have been a mistake not to include Internet Protocol (IP) connectivity. A transport radio network can now be fully IP connected with dPMR, and old-style telephone patching hasn't been forgotten either.

Transport managers can log in to the system in real time anywhere. The radio network can be fully integrated into a corporate operating system, and the result is a total communications package beyond what was possible in the past.

As well as offering the ability to interface data and control applications to the radio network via IP, the voice traffic can also be connected via IP and multiple radio networks can be easily interconnected. Because all the radio network activity is available via IP, it can be routed to a central processor that compiles a complete daily log of all events and traffic. This log would be accessible from workstations in all departments of a company for the purposes of validation, tracking queries and missed delivery claims.

Mobile services where the routing is fixed are available for users, such as security guards at a large terminal or transport hub. In these cases, the real-time AVL operation is useful but does not offer an adequate picture of what is happening on the ground.

A typical solution would be to establish the critical areas and buildings within the zone and install proximity transponders at each location. Security guards would then have to stop at each location and place the handheld radio against the transponder. The radio then automatically reports back to the controller. Transponders are numbered, calls are time and date stamped, and a record shows that every critical zone was physically checked. If the level of security warrants it, the system can include GPS location, man-down alerting and panic buttons.

 Other types of wireless transponders are also available that offer a proximity detection solution to the same problem. These wireless transponders also find applications in the field of high value items.

Where justified, the dispatched item can have a wireless transponder included in the packing. Provided the package remains within the same zone as the dPMR radio of the driver, all is well. As soon as the package is out of that zone, it is automatically reported to the system. This would be analysed in terms of AVL data — delivery status messages to ensure that a valid delivery occurred — otherwise the system could automatically generate alerts to all responsible personnel that an unexpected incident happened.

For operators where security is a concern, the dPMR protocol allows for remote activation of the radio in a covert manner. Radios can be commanded to transmit without any indication that they are doing so. Such monitoring can be vital in incidents of personal attack, theft or hijack.

Coverage and Other Considerations

The coverage area is one detail that separates radio solutions for the transport industry from other uses. The major players in global shipping are obliged to opt for satellite-based solutions, but a great number of smaller companies have operations that are city or county based.

The only solution in many of these cases is to use a multiple repeater network to provide radio coverage in the required area. dPMR has several ways of addressing the issue of area coverage.

For large users with a significant number of vehicles, dPMR offers trunked radio solutions in single channel multisite or multichannel, multisite configurations.

This solution is probably not the most cost effective for smaller companies that may have only a few vehicles covering a wide area. For this type of user, dPMR offers a second solution where co-channel repeaters are used to cover the area required without the need for trunking controllers. Where the system is required to cover multiple zones rather than a single large area, the IP connectivity of the data, control and voice traffic allows for easy integration.

A mobile radio network represents a considerable investment, especially for a wide-area network with multiple repeaters. If you then have to also change all existing radios to digital, finance requires careful planning. To this end, dPMR was designed to offer the most cost-effective upgrade path.

Cost-efficient migration from analogue to digital radio communications

Because dPMR uses the same FDMA technology as almost all analogue PMR radio systems, it is possible to offer repeaters and controllers that support systems on an existing radio channel. Once such a system repeater is installed, the user can operate either radio type.
A user can add new digital radios to the network as and when old analogue equipment needs replacing. There is no need to tear out the old system and replace everything at once just because the technology is different. The migration path possible with dPMR is user and budget friendly.
There are other reasons for this dual-role upgrade route.

System unavailability is a term that doesn't exist as operations would come to a grinding halt should that happen.

Most mobile radio systems are extremely mission critical, 24 hours a day and seven days a week. dPMR allows for the possibility to hot switch to a dual-role repeater and controller to avoid any dead time. Because it is highly unlikely that all mobile radios can be replaced at once, it is now possible to schedule such replacement to cause the absolute minimum disruption.
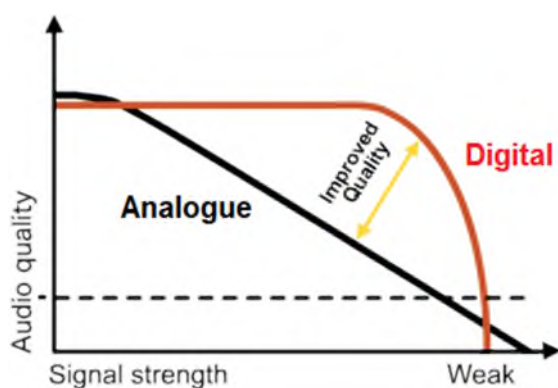

One area where digital can make a difference is at the edge of the radio coverage.
Most mobile radio users are familiar with the scratchy and noisy received audio when they get to maximum range.

The audio is usually made worse by the flutter effect as the signal goes up and down. With digital, the effect is different. In true digital fashion, either the receiver can decode the signal or it can't. This means the signal to noise remains just about constant right to the limit of radio coverage and is then lost completely. The concept of marginal quality near the coverage limits can be forgotten.

Benefits of true 6.25 kHz FDMA narrowband technology
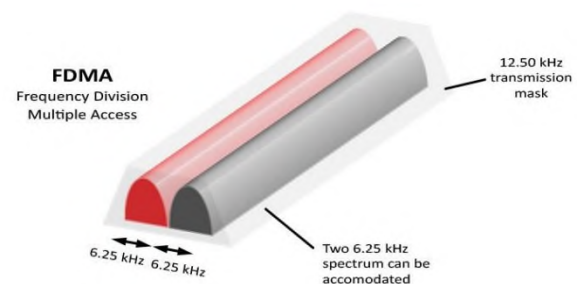
dPMR then goes one step further because it is a true narrowband technology that operates with less than half the bandwidth of normal PMR.

Being only 6.25 kilohertz, a typical dPMR receiver is more sensitive than other PMR technologies. So not only do you get increased usable range because the transmission is digital but also extended range because of the narrowband receivers.

Users of handheld dPMR radios have the choice of using the extra range possible or, if battery life is important, reducing the transmit power to give normal range and get longer battery life.

The fact that dPMR is based on FDMA technology is not only important from the point of view of migration from analogue systems but also from the ease of having direct-mode subsystems in a radio network.

A good example would be an emergency service that has a repeater network with regional coverage. Once responders are onsite at an incident, there is often the demand for local peer-to-peer operation that does not use the main repeater network.

With dPMR, the radios always operate in 6.25-kilohertz channels, both on the repeater network and in the local direct mode.

Interoperability is at the heart of the dPMR standard

Interoperability

The dPMR Interoperability (IOP) process is a documented test procedure conducted under controlled conditions which establishes the compatibility of equipment from different manufacturers to ensure products of the same class are compatible with each other when used in a dPMR system.

This complete set of standards is to ensure that users of dPMR can buy from different manufacturers without operational problems. Ensuring equipment interoperability results in increased competition in terms of product development and pricing, making dPMR both a dynamic and cost-effective solution.

The dPMR standard is further reinforced by the dPMR Association, a memorandum of understanding (MoU) group comprised of manufacturers and supporting industries working together to ensure the successful development of dPMR equipment and systems. dPMR Association member companies have also agreed to fully adopt the ETSI standards for interoperability and conformance testing as the basis of granting use of the dPMR trademark with compliant equipment. The first dPMR interoperability tests between different manufacturers took place in 2010 and the dPMR protocol has since been subject to continual development and now includes professional license-free PMR 446 radios, licensed peer to peer and IP connected base station and repeater systems, through to sophisticated, high-functionality, wide-area trunked system networks.

dPMR technology is employed in numerous road, rail and air implementations enabling voice and data communications and supporting safety, security and operational efficiency.

About the author
Pete Hizzey is one of the co-authors of the ETSI dPMR standards, TS 102 490 and TS 102 658, as well as chairman of the dPMR Association. He has been involved in European standardisation since 1988 and is responsible for many radio standards including those covering professional mobile radio (PMR), Maritime and Amateur Radio.