# Delivering SCADA Telemetry over DMR for Mission Critical Communications

Low band data is mission critical for a range of organisations and institutions. As automation and smart technologies become more prevalent, telemetry systems and the data they send is becoming more important than ever. While there are a range of technologies for transmitting Supervisory Control and Data Acquisition (SCADA) communications, Digital Mobile Radio (DMR) is emerging as a leading solution.

simoco
PULSE

Monitoring the Heartbeat of Mission Critical Networks
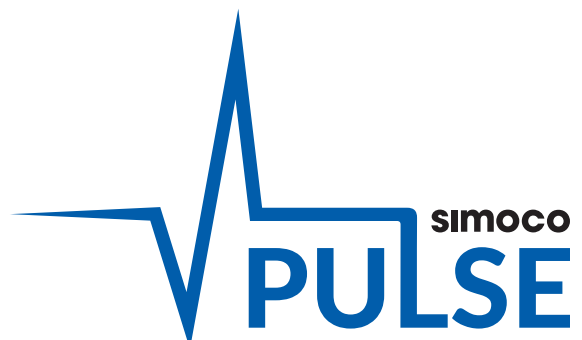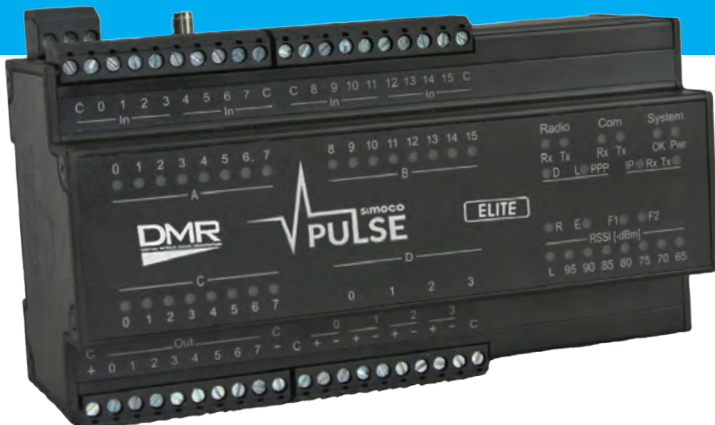
Introduction

It's easy to forget that DMR is a relatively young technology. It's been just over ten years since it was developed by the European Telecommunications Standards Institute as the standard for professional mobile radio (PMR) users. As with any new technology standard, it has taken time for real world deployments to demonstrate the advantages DMR has over other digital public or land mobile radio technologies in the business critical and commercial sectors. However, DMR has now established itself as a leading technology for licensed, reliable communications.

Organisations that may have previously been reluctant to transfer their trust from reliable legacy analogue systems are now increasingly turning to DMR as they face growing pressure to deliver reliability and operating efficiencies.

This is especially true of the public and private utilities, leisure, natural resources and security industries where there is a need to connect equipment and systems separated by large distances.

Operating in environments where cellular coverage is intermittent and installing wired networks has significant cost implications, these organisations are increasingly deploying DMR to deliver automated and remote communications, such as real-time monitoring, network optimisation, and proactive maintenance programmes. This is possible because, in addition to transmitting voice, DMR enables the development of business enhancing data applications such as text messaging, GPS, and telemetry communications.

In this whitepaper, we look at how DMR has become vital in managing the challenges of maintaining a growing networks for a wide range of organisations that are now delivering data applications over DMR for mission critical communications.

We will cover the key considerations when installing and managing systems in this complex sector, look at the future developments for this technology and reference some real world examples of best practice.

DMR Standards DMR is a radio standard which provides two time-slots for voice or data in a standard 12.5 kHz business radio channel. It has quickly become established as a technology upgrade for traditional PMR systems and a digital alternative for existing analogue.

The standard was developed to provide affordable digital systems with low complexity and facilities for voice, data and other supplementary services. The DMR protocol covers unlicensed (Tier I), licensed conventional (Tier II) and licensed trunked (Tier III) modes of operation, although commercial applications today are focused on the Tier II and III licensed categories.

One of the main strengths of the DMR Tier lll protocol is its ability to deliver voice and coded data signals (SCADA) over the same network at the same time, with each receiving its guaranteed quality of service.

The technology allows several users to share the same frequency channel by dividing the signal into different time slots. The users transmit in rapid succession, one after the other, each using its own time slot. This allows multiple stations to share the same transmission medium (the radio frequency channel) while using only a part of its channel capacity. When combined with the resource-management facilities of trunking, DMR Tier III offers a fresh perspective on combined voice and data networking.

The trunked radio system makes use of the probability that not all the users in an organisation will use the radio at the same time. By dynamically assigning a channel to a call upon request – and not a static, perpetual assignment – a control channel co-ordinates conversations between users, making effective use of idle time between conversations.

This allows many dynamic channel-conversation relationships at the same time, effectively saving time on any specific channel by sharing it across multiple users.

When compared to public cellular services, DMR delivers improved coverage, reliability and resistance, contention, security, group communications and performance. The digital landscape is crowded, though, with a number of public safety digital standards such as TETRA and P25, as well as low cost digital solutions including DMR (Digital Mobile Radio), dPMR (digital Private Mobile Radio), NXDN and PDT (Professional Digital Trunking).

DMR
DIGITAL MOBILE RADIO ASSOCIATION

Increased call capacity – DMR uses 2-slot TDMA (Time Division Multiple Access) to double the number of calls supported on each radio channel, giving you twice the calling capacity when compared to an analogue system using the same spectrum, without the need for additional antenna combining equipment.

Clearer audio – DMR provides clear speech right to the boundaries of reception even in environments with high background noise.

Lower power consumption – DMR terminals only transmit for half of the time, which gives an increased battery life of about 40% over FDMA and analogue technologies, providing significant power savings and longer work shifts.

Integrated data applications – DMR brings greater capacity for messaging and data applications, enabling alerting, tracking, telemetry, monitoring and many more applications natively within the radio system.

Open Standards Based - the openness of the standard and the collaboration of the members of the DMR Association in ongoing standards development ensures that DMR doesn't just meet market requirements today, but is being supported for longer term usage.

The growing importance of SCADA telemetry systems

SCADA (Supervisory control and data acquisition) is an industrial automation control system at the core of many modern industries.

The term refers to centralised systems which monitor and control entire sites, or complexes of systems spread out over large areas (anything from an industrial plant to a country). The system consists of a number of Remote Terminal Units (RTUs) which collects field data automatically and connects back to a master station which enables the operator to perform remote monitoring and control tasks.

Modern SCADA systems allow real-time data from industrial networks to be accessed from anywhere in the world. This access to real-time information allows businesses and individuals to make data-driven decisions about how to improve their processes. A further benefit is more efficient, reliable and most importantly, safer operations, which result in lower costs of operation compared to earlier non-automated systems. In their early days, SCADA systems were designed as telemetry reporting systems with little to no control because of communications bandwidth constraints. Today, SCADA networks consist of many more remote terminal units (RTUs) and stretch beyond monitoring to controlling and supporting new applications.

RTUs and SCADA systems transmitting low band data can be comfortably handled by a narrowband system such as DMR. The provision of low band mission critical data services enables organisations to have greater control over a robust and resilient network. This advanced use of SCADA is becoming more common and increasingly important to a range of industries. For utilities companies, the drive towards greener energy means they have to provide more information on what is going on in their network, such as flow, capacity and volume. The arrival of micro-generation, wind farms and solar power with their variable energy flows has made this a much bigger issue for them now.

These utility communications systems carry an increasing amount of important data. Part of that data is considered mission critical because it is required to ensure the continuity of the utility's services. While utilities can use third party networks for some data, it is wise to remain in full control of the network that carries the utilities mission critical data and they can do this through smart grid technology.

Simoco Pulse

Simoco Group's Pulse portfolio enables utility and public service operators to manage and control smart grids and cities across vast and remote operational areas, where cellular coverage is intermittent and installing wired networks has significant cost implications.

The DMR Tier III trunked solution helps organisations to deliver automated and remote communications, such as remote monitoring, network optimisation, and proactive maintenance programmes.

Simoco Pulse allows SCADA telemetry applications to be quickly and cost effectively deployed using wireless radio infrastructure. The technology meets the needs of a wide range of utility operations but also serve any sector where there is a requirement to acquire and control data from remote equipment and systems.

Simoco Pulse AIR and AIR Pro - Data Modems

These products are aimed at customers who already have RTUs either integrated into their equipment or have existing RTUs deployed over unreliable unlicensed channels or public networks such as 3G or GPRS. The data modem directly interfaces with any RTU that uses standard telemetry protocols, and transport data back to the SCADA master using reliable digital radio over licensed VHF or UHF channels.

Simoco Pulse ELITE - Integrated RTU

For in-field deployments, Simoco has developed a fully integrated RTU with digital and analogue inputs for the collection of data and status information from plant equipment such as actuators, meters, switchgear and PLCs (programmable logic controllers). The RTU also features digital outputs to enable wireless control or distributed automation of these remote devices via actuators.

Gateway

Simoco's Gateway products enable SCADA masters to seamlessly interface with the digital radio infrastructure. This makes the radio infrastructure transparent to the SCADA application and requires no customisation or integration in order to deploy SCADA over radio.
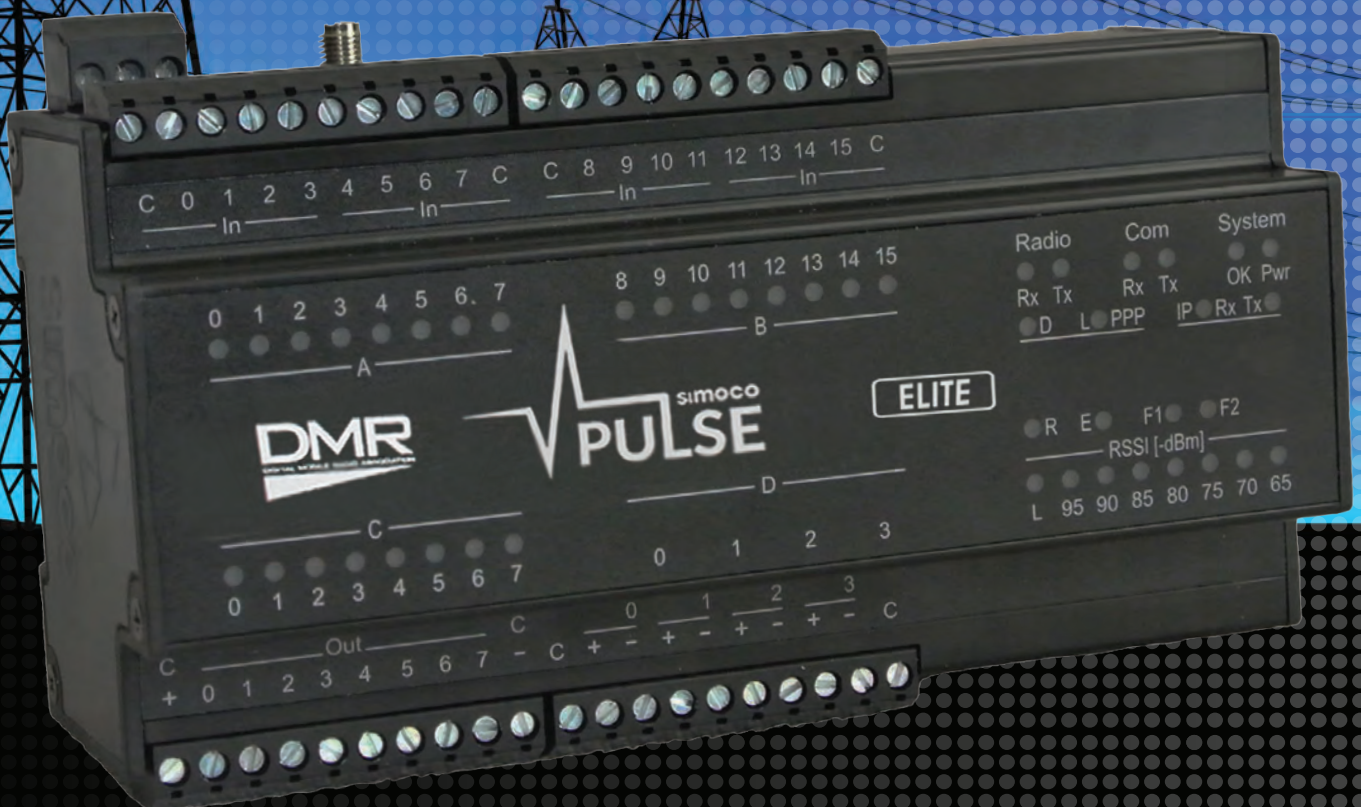
Systems can either be fully deployed over PMR or can be used to form part of mixed technology telemetry solutions.

The Pulse portfolio

Simoco Pulse AIR and AIR Pro - Data Modems

Simoco Pulse ELITE - Integrated RTU

Western Power Distribution

WPD asked Simoco to consider using DMR in the Midlands to carry SCADA telemetry data owing to poor coverage, interference and reliability issues.

WPD was looking to move away from its current GPRS solution to connect some 8,000 devices, dispersed across a wide geographic area.

Following the development of Simoco Pulse, WPD began rolling out the solution across the Midlands in November 2015. On completion of the roll-out in the Midlands region, the technology will be expanded into the WPD South West and Wales regions.

Simoco Pulse uses a fully integrated IP network to connect information sent from data modems or RTUs to SCADA masters via hilltop base stations. This functionality makes it easy to scale the solution to include more modems, RTUs or even voice transmission to the same network. It means DMR becomes a practical way of managing a large and complex amount of information, with operators and maintenance teams having constant insight into grid performance at any location where issues have occurred.

As WPD already had existing RTUs in place, they were supplied with the Simoco Pulse AIR data modem. The solution use the widely adopted DNP3 protocol when communicating across the DMR network. The gateway provides a robust DNP3 connection to the SCADA master, and uses reliable digital radio over licensed VHF and UHF radio channels to directly interacting to any RTU that also uses this standard telemetry protocol.

The three-year programme to upgrade the current WPD network and introduce 100 new sites with DMR infrastructure included an initial roll out of 8,000 data modems across the Midlands region. Delivery of the infrastructure and first 2,000 Pulse AIR Data Modem units was completed in November 2015, with the first sites expected to go live in early 2016. On completion of the roll out in the Midland region, the solution will be expanded into the WPD South West and Wales regions.

Simoco's Pulse solution has enabled WPD to add smart grid management and control functionality to its operations. This includes remote monitoring, network optimisation, delivery of proactive maintenance programmes and the remote implementation of commands and updates. If a problem on the network occurs, WPD saves time and costs by knowing exactly where the problem is located rather than having to dispatch teams to manually search areas of the grid. Before the introduction of telemetry data this involved physical visits to the site in order to locate the source of an outage.

Setting up a communications infrastructure to support reliable low-band data transmission

"By moving SCADA to DMR we have a secure and reliable picture of our network and the ability to react quickly when issues occur"...

..."*In the areas where the Simoco Pulse solution has already been installed, WPD's target of restoring power within 60 minutes of an outage is well on the way to being achieved, meaning we are well placed to meet the demands of today and the future.*"

**Kevan Scott. Surf Telecoms Manager at Western Power Distribution**

can be challenging for utility companies such as WPD, where cellular coverage can be patchy and intermittent and installing wired networks has significant cost implications. However, the Simoco Pulse solution provides a stable path for the limited but critical amounts of data associated with SCADA communications as a result of the use of robust DMR.

While larger amounts of data can be carried across overlaid broadband networks, providing connections to wide bandwidth devices such as smart phones and tablets, it remains an unreliable and sometimes insecure way of transmitting mission critical data – especially during disasters and under failure conditions when such networks are overloaded and/ or functionally constrained.

In contrast and by their very definition, PMR networks are 'private', less open to security threats and less congested than public or broadband networks. The latest digital radio standards include the necessary levels of security demanded by public safety services and government agencies.

Private Radio systems also provide a predictable cost of ownership. WPD's system has been designed to its exact requirements and once installed at the budgeted cost, there are no further call charges or unexpected upgrades as new technologies are rolled out.

Finally, the Simoco Pulse DMR Tier III trunked solution also has the benefit of being able to offer WPD and other users a flexible way of migrating voice communications from analogue systems to a DMR network. By using DMR to transmit both voice and low band data, mission critical communications can be unified on the same, reliable and cost effective licensed infrastructure.

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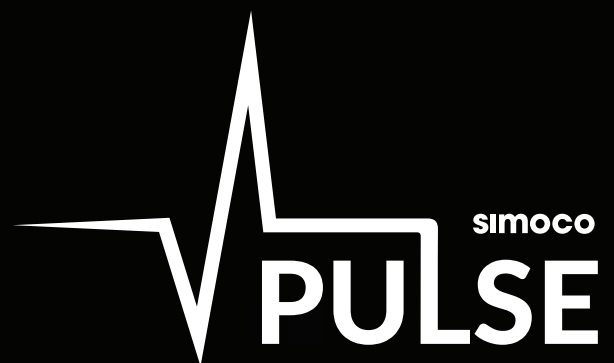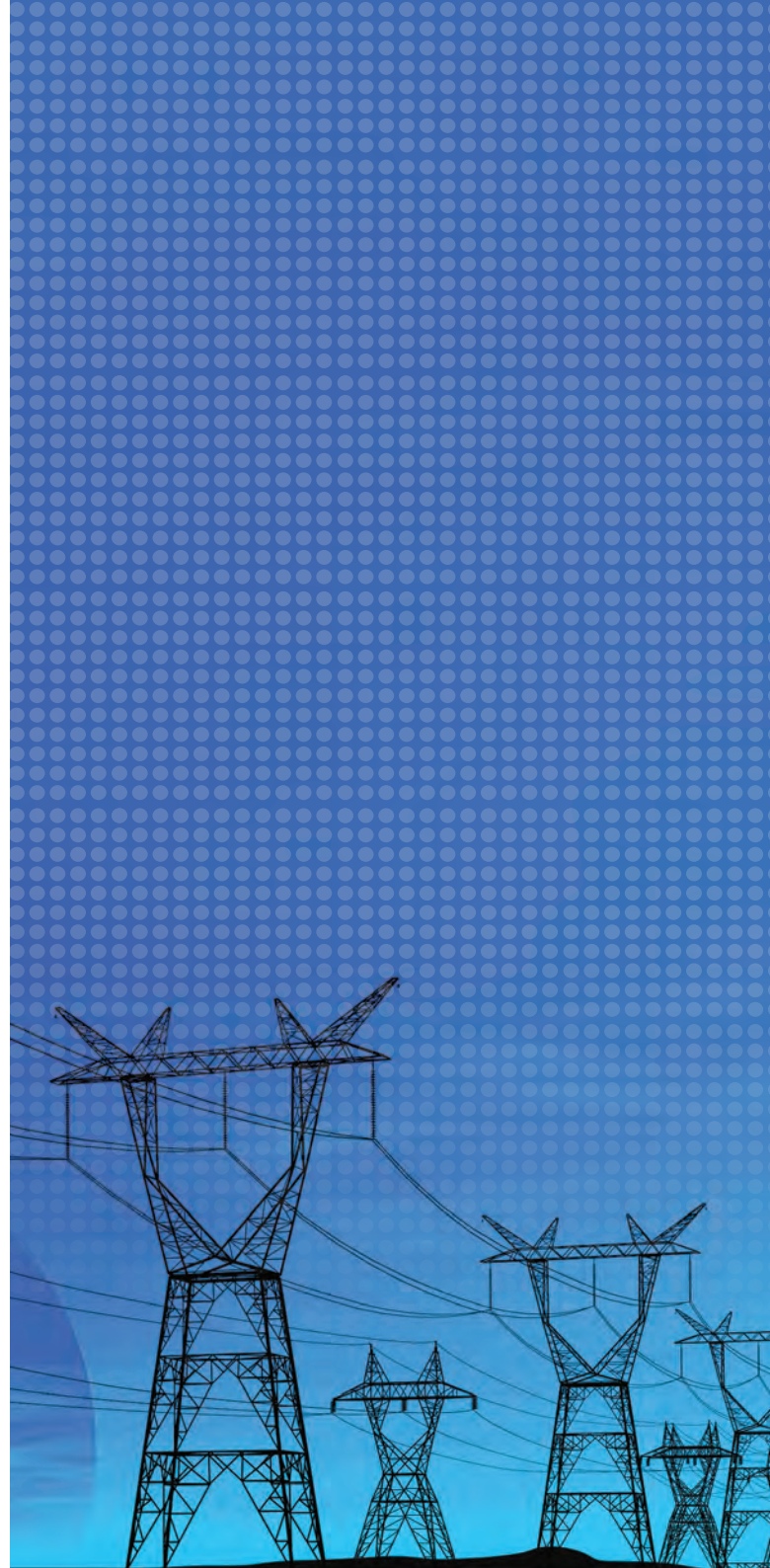**WESTERN POWER DISTRIBUTION**
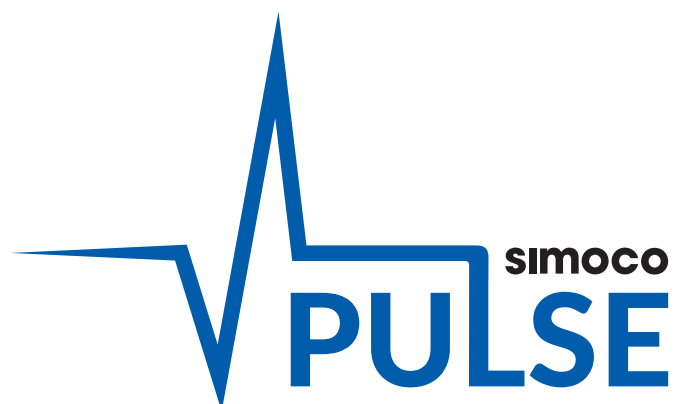
Conclusion

Companies that are striving to deliver the dream of smart technologies are finding that they are faced with major communications challenges when it comes to providing the information and control required for insight when outages occur. These companies are often working in remote areas, across large distances, where cellular coverage can be patchy and intermittent and installing wired networks has significant cost implications.

The increasing demands of these smarter systems mean that data is becoming an increasingly important part of the mission critical mix. It is typically reliable low-band telemetry data that becomes essential for diagnosing problems in the event of outages and that's why a wide range of industries are turning to remote low-band data communications over DMR infrastructure.

The delivery of mission critical voice and SCADA over a common network is opening up a new world of possibilities. SCADA telemetry applications can be quickly and cost effectively deployed over DMR Tier III trunked networks, delivering robust and reliable communications.

By automating and enhancing distribution grids, improving security, addressing compliance requirements and providing critical information in near real time, this technology is now an essential communications solution to support the operational needs of industries including utilities companies, airports, oil and gas pipelines and emergency services.

Many organisations operating in these sectors are beginning to capitalise on efficiencies derived from the DMR Tier III systems they have deployed and are starting to see how it changes the way they carry out their day-to-day operations. When you combine a robust private radio network with extensive data functionality that's when real business value is gained for companies that rely on mission critical communications. The DMR Tier III trunked system used by Simoco Pulse has been designed to connect tens of thousands of devices, meaning companies can scale the solution to ensure coverage across vast operational areas.

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