

Propagation and unification: how to build a radio communications network

Two principles for achieving robust, reliable and resilient radio coverage

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Video might have killed the radio star, but radio communications are still quietly operating the foundations of a huge range of industries. They underpin communications for emergency services, road and rail networks, utilities firms and are the basis for new technologies, such as LTE and 5G. They work across vast areas and in complex conditions. They are robust, reliable and secure.

But radio communications networks aren't always easy to build. Achieving reliable coverage depends not just on deploying the right technology but on actually designing the architecture of the radio network in the most effective way. And if, as in so many contexts, your radio network is going to cover a range of different environments, including restricted ones, then that design process gets even more complicated.

Nevertheless, even though the challenges and restrictions of each individual radio communications network are unique, understanding two key principles can go a long way towards streamlining your network design process.



Principle 1: Radio Propagation

The foundation of any radio communications network has to be an in-depth understanding of how radio waves behave when they are moving – that is, of radio frequency (RF) propagation.

All types of waves are subject to a range of disruptive phenomena as they move. Refraction occurs when waves pass from one medium into another – from air into water, for example. Scattering is the process of a radio wave deflecting from its straight trajectory thanks to disruptions or obstacles. Diffraction involves a wave bending round an obstacle or spreading out after a gap in an obstacle, while absorption occurs when it encounters certain materials. Radio waves are subject to all of these phenomena – and in different ways depending on where on the electromagnetic spectrum that particular radio wave falls. It's also important to consider the impact of the weather and conditions like air pollution on the transmission of said waves. All such phenomena affect the path a radio wave takes and how much it decays or is adulterated on its journey.

This means, in the first instance, that careful understanding of the propagation of the particular frequencies you are working with is essential when it comes to designing an effective network. More specifically, it means that when a clear line-of-sight connection cannot be maintained to radio transmission – as in underground spaces, for example, or in buildings and vehicles made with certain restrictive materials – specialist skills in so-called confined spaces engineering are required.

There are two core approaches to confined spaces engineering. Additional antennas can be placed within the confined space, so as to create a kind of signal 'hotspot'. Alternatively, radiating cables or 'leaky feeders' can be deployed; cables with tiny holes placed at regular intervals to allow the signal to radiate outwards along a tunnel or similar confined space.

All of these aspects of RF propagation need to be carefully considered and accounted for when planning a new radio communications infrastructure.

Principle 2: Unification

However, you're still not ready to build and install your new network until you've also considered how the network works together as a whole. It's important to consider this in terms of both the technology deployed and the variety of environments covered.

From a technology perspective, your new network might be deploying one or several different types of radio-based communication standards, from digital mobile radio (DMR), to DAB radio, to long term evolution (LTE) cellular technology. Many organisations or environments also require different types of radio. An underground road tunnel, for example, might require one system for maintenance and engineering teams with DAB, FM or even MW radio also required to avoid members of the public losing connection when driving their vehicles. There's a future-proofing element at play too, with



many organisations needing to ready themselves for the deployment of the new Emergency Services Network (ESN), a LTE based infrastructure set to replace the existing Airwave network, which uses Terrestrial Trunked Radio (TETRA) as its standard.

Many radio communications networks are not built entirely from scratch, either. Rather, they are installed in existing buildings and settings containing legacy technology that has not been updated and may even no longer be supported.

As such, the engineering behind your radio communications network should be technology-agnostic; that is, capable of supporting all standards of radio, from the latest, Digital Mobile Radio (DMR) to other standards such as TETRA systems and GSM Cellular services. Installing additional antennas and leaky feeders are both technology-agnostic approaches that can be used to support and integrate a variety of radio-based technologies.

All this means taking a unified communications approach to developing new radio networks, whereby multiple different radio technologies are consolidated onto single, streamlined, UC networks, using precisely the right combination of additional antennas and radiating cables to cover every nook and cranny.



Ready to build?

Only after considering how your radio communications network is going to meet these principles of strategic propagation and solid unification are you ready to start mapping out its architecture and choosing the right combination of hardware and software to support it. By doing so, you are best-placed to achieve the robust, resilient and secure coverage that radio is famous for, while also positioning your network well for future technological and protocol developments.

For further information, visit www.simocowirelessolutions.com or email us at customer.service@simocowirelessolutions.com