TETRA Health Group

About TETRA – what is TETRA and what does it offer?

TETRA (Terrestrial Trunked Radio) is a technology used to provide the robust, resilient 'mission critical' private mobile communications services that are needed by professional users such as the emergency services and commercial organisations with mobile workforces or large fleets of vehicles. These users generally need particular features to enable them to work effectively. These include secure encrypted networks, mobile phone calls and two way radio messaging, assured coverage and call quality, the ability to send voice, data and images, direct mode operation which allows rapid communications between groups of workers (such as an emergency service response team at a major incident), and managed fall-back for additional resilience. TETRA has characteristics in common with the mobile networks with which we are all familiar but offers the additional features which are required to meet these needs.

Like the cellular mobile phone networks, TETRA networks use a series of base stations which direct calls between terminals connected to the network. Low-powered radio signals or radio waves in the non-ionising frequency band are used to transmit messages across the network. Radio waves are part of our daily lives, bringing us the benefits of television and radio and communications on the move.

TETRA is an international open standard, developed by the European Telecommunications Standards Institute, which defines a particular way of coding radio signals to provide digital mobile communications services. TETRA is widely used across the world by emergency services, transport organisations, security organisation, and public utilities. The TETRA and Critical Communications Association's website contains more information on the deployment of TETRA around the world.

Below you will find further information on various aspects of TETRA, click on the appropriate heading to see more.

On the Links page of the web site of the TETRA Health Group (THG), you can access many useful sites including the Advisory Group on Non-Ionising Radiation (AGNIR), Health Protection Agency (HPA), International Commission for Non-Ionising Radiation Protection (ICNIRP), Mobile Manufacturers Forum (MMF), Mobile Operators Association (MOA), Mobile Telecommunications and Health Research programme (MTHR), the TETRA and Critical Communications Association (T&CCA), World Health Organisation (WHO) etc.

Health and Safety - A Brief Overview

For many years questions have been raised as to whether radio waves might have an effect on the health and safety of users or the general public. There has been a lot of research on the subject over more than 50 years. This research has looked at various analogue and digital signals, power levels, frequencies and modulations, including those used by TETRA. Research has been reviewed by independent panels of scientific experts and standard setting bodies around the world such as the Health Protection Agency (HPA), the International Agency for Research on Cancer (IARC), the International Commission for Non-Ionising Radiation (ICNIRP) and the World Health Organisation (WHO). In short there has been no evidence established that exposure to radio waves within the accepted exposure guidelines results in any adverse health effects. See also the Science and Standards pages of the THG web site for further information.

The exposure guidelines, designed to protect both the public and occupational users of radio technologies, are set by independent expert organisations such as the ICNIRP. The guidelines are endorsed by the World Health Organisation and other authorities around the world. They set limits for exposure, incorporating a significant safety margin, based on extensive reviews of the scientific evidence. Companies that produce radio equipment or build networks must ensure they comply fully with the guidelines through careful product design and rigorous testing. The extensive body of scientific research into radio-frequency emissions, to which scientists continue to add, and which is

reviewed regularly by expert bodies and standard setting organisations, provides a sound basis for confidence in the safety of radio technologies, including TETRA.

Base Stations

A TETRA network will have a number of base stations, located to ensure comprehensive and reliable coverage wherever and whenever it is needed by the user organisation.

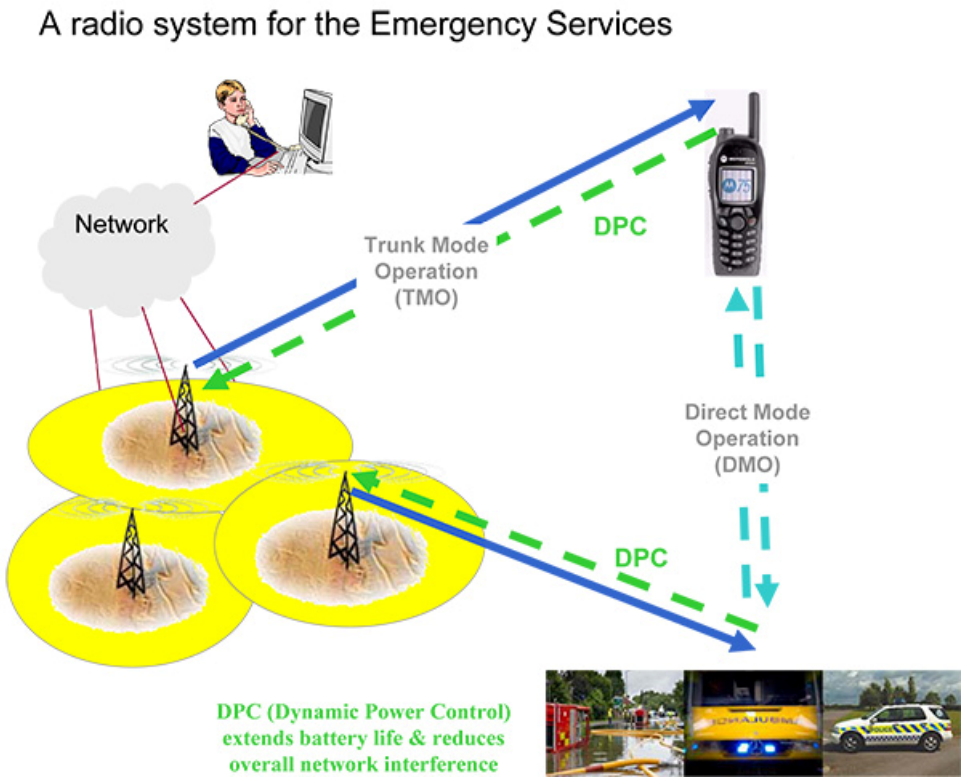
Like the mobile phone networks, a TETRA network operates by dividing a geographical areas into a number of 'cells' each served by a base station which transmits and receives signals from handsets and terminals connected to the network, enabling users to move between cells without losing communication. A system based on cells allows the use of lower-powered equipment to cover a larger area than would otherwise be possible. The system works through the exchange of radio signals between the base stations and terminals, with signal levels managed carefully to optimise network performance.

A base station antenna may be mounted on a freestanding tower or pole, or on a building. For aesthetic reasons antenna are sometimes built to blend into their environment, integrated into the design of buildings or disguised as trees. In some applications of the technology, particularly along railway lines or in tunnels, cables called 'leaky feeders' are used instead.

Planning a radio network is similar to planning lighting. The location of lights needs to be planned carefully to avoid shadows or dark areas, and likewise the location of base stations needs to be carefully planned to avoid gaps in communications coverage or areas where it is patchy or unreliable. The strength of a radio signal diminishes rapidly with distance from the base station or transmitter, and the distance over which the signal can travel is also reduced by obstacles like trees and buildings. Base stations need to be sited carefully to provide the seamless coverage users need.

Many countries have planning and consultation guidelines that cover the siting of base stations. These often recommend site sharing with other operators where possible, siting base stations on buildings or other existing structures, and only erecting a new pole or tower if there is no suitable alternative.

A TETRA base station is similar to those used by the mobile phone networks. They operate at low power levels, typically hundreds or thousands of times lower than the maximum exposure levels set out in the ICNIRP guidelines. The World Health Organisation has advised people who live near base stations that the field strengths around base stations are not considered to be a health risk.



Handsets

There are various manufacturers offering TETRA products to meet different customer needs, including hand-held portable radios, those worn on lapels or belts, those designed to be installed in vehicles and personal digital assistants (PDAs).

A TETRA radio device can be used to communicate in a variety of ways including as a two-way radio, via a control room or direct to another user in the same talk group as a phone, and to send and receive data, such as images and short text messages.

A TETRA system uses a network of base stations, which provide radio coverage so as to enable TETRA devices to emit lower power than those of most other conventional professional systems. If a TETRA radio is awaiting or receiving a call the human exposure to radio wave emissions is so low as to be virtually unmeasurable. When transmitting the power level from a portable radio is typically up to 1.8 Watts, and that from the mobile radios installed in vehicles is around 3 Watts. TETRA devices use a feature called Adaptive Power Control, which adjusts the power output to the lowest level needed to maintain reliable communication with the base station.

TETRA devices, like other wireless equipment, are subject to rigorous, science- based safety guidelines, set by independent expert groups like the International Commission on Non-Ionising Radiation Protection (ICNIRP). These guidelines govern human exposure to radio frequency emissions and incorporate substantial safety factors to protect both users and the general public. The exposure standard for portable and mobile devices employs a unit of measurement known as the Specific Absorption Rate (SAR) which is measured in Watts per kilogram. The ICNIRP guidelines set a localised exposure limit for occupational use of 10 Watts per kilogram, averaged over 10 grams of body tissue.

Whilst there may be differences between the SAR levels of various devices, and variations depending on the way they are used and how they are carried or worn, all the products supplied by members of the TETRA Health Group comply with the ICNIRP guidelines for radio-frequency exposure.

TETRA devices and pulsing

TETRA portable and mobile devices pulse at 17.65Hz. Concern about pulsed 16Hz radio frequency emissions arose as a result of some inconclusive research dating back to the 1970s. This study suggested that 16Hz emissions affected the movement of calcium, which is important in the human nervous system. The Stewart Inquiry, which reported in May 2000, suggested that "*If such effects occur as a result of exposure to mobile phones, their implications for cell function are unclear and no obvious health risk has been suggested. Nevertheless, as a precautionary measure, amplitude modulation around 16 Hz should be avoided, if possible, in future developments in signal coding".*

Since the Stewart report there have been further research studies around the world, including the work of a team at the UK Defence Science and Technology Laboratory, published in the International Journal of Radiation Biology in December 2005. Importantly, none of these studies has found any impact on calcium movement or any other adverse health effects.

Compatibility and Interference

Electromagnetic compatibility is the ability of a piece of equipment to function properly in its own electromagnetic environment without disturbing other equipment nearby. We use increasing numbers of electronic products – including phones, microwave ovens, TVs, laptops, car alarms and toys – so the radio spectrum is becoming more crowded and radio frequencies allocated to one type of product are getting closer to adjacent frequencies used by others. Nearly all electronic equipment is susceptible to interference; for example TV reception can be affected by microwave ovens, passing aircraft, hairdryers, or automatic garage doors.

Laboratory and clinical tests have found that digital wireless phones might interfere under certain conditions with some pacemakers and hearing aids. Often, there are steps users can take to minimise or prevent interference, such as keeping an operating phone six inches (15 cm) from an implanted pacemaker or adopting other measures to accommodate the use of hearing aids. Users should follow the advice provided by the manufacturers of medical equipment.

Since 2000 a European Directive known as the RTTE has required equipment to be constructed so it does not generate a disturbance of a magnitude which would affect equipment working at adjacent frequencies, and that it is itself protected from interference. The CE mark on equipment certifies that it complies with the directive. Regulations require the transmitting characteristics of electromagnetic equipment to be confined to specified ranges or 'masks' within the spectrum. Outside these ranges power levels must be kept to a minimum. All TETRA equipment complies fully and operates squarely within its allocated frequency bands.

However, equipment that pre-dates the directive, or does not comply with it - for example older car alarms or TV sets or radio receivers which are not required to comply – may cause or be susceptible to interference. An example would be when a car alarm is triggered by the operation of some nearby equipment which is operating properly within its frequency band. Once a potential problem is identified it can usually be remedied or alleviated; some equipment, not including radio transmitters, can have suppression circuits fitted.

Unlike some other professional radio communications systems, TETRA devices have a transmit-inhibit function. They can be prevented from transmitting, while the user can still receive communications. This feature is particularly useful in medical environments.

For more information on compatibility and interference, see the section below. Also, the FAQs page of the THG web site has sections on both handsets and compatibility and interference.

TV and Radio Interference

When planning TETRA services considerable care is taken in siting transmitters to avoid interference. Occasionally, TV interference occurs in areas of poor reception or with older sets which pre-date the regulations when boosters or filters may need to be fitted. Regulators, like the Radio & Television Investigation Service in the UK, advise householders and aerial installers on the steps they can take to ensure that domestic TV and radio receivers perform to an adequate standard with minimal interference.

Medical Devices

Many hospitals insist that all equipment which transmits radio signals should be switched off inside clinical areas in case there is interference with sensitive medical equipment. In this case TETRA handsets are no different from mobile phones, although users benefit from the transmit-inhibit feature which allows handsets to receive communications but prevents transmission. This can be a useful feature for use in medical environments. Regulatory agencies like the UK's Medicines and Healthcare Products Regulatory Agency (MHRA) accept that communications equipment can be essential in hospitals but acknowledge the risk of interference. The MHRA does not recommend a blanket ban on the use of mobile phones in hospitals, however, under certain circumstances, the electromagnetic interference from a mobile can affect the performance of some medical devices. See the relevant page of the MHRA web site for further information - click here. Users should respect any local guidelines and should switch off or use transmit-inhibit mode in any areas where critical care or life support equipment may be in use.

****