

Many people involved with the installation of television receiving aerials and signal distribution systems are now aware of the problem of 'TETRA interference'. A significant number of television interference (TVI) problems have arisen in some neighbourhoods when new TETRA base stations have opened. This PROception information sheet explains the main issues in a simple Q & A format and shows how PROception products can help achieve interference-free reception.



An example of TETRA interference

## What is TETRA?

TETRA (TErrestrial Trunked RAdio) is a fairly new digital mobile radio system for voice and data. It's replacing older analogue private mobile radio (PMR) systems, particularly in larger networks.

At present the only large-scale TETRA network on the UK mainland is operated by Airwave O<sub>2</sub> Limited, a subsidiary of the mobile phone network operator mm-O<sub>2</sub>. Airwave is a private network used by the emergency and public safety services: fire, police, ambulance, coast-guard, etc. For these users it provides a secure 'joined-up' communication system. Roll-out of the Airwave network is now almost complete, except in the most sparsely populated parts of the country. (For more details see the Airwave web site<sup>1</sup>.) Other independent networks operate in Northern Ireland and the Isle of Man.

## Why has it been causing TV interference?

Airwave's TETRA base stations usually transmit in the frequency band 390 to 400 MHz – just below the UHF TV band. The proximity of base stations, particularly in urban areas, can result in TV aerials being exposed to quite high interfering field strengths – sometimes enough to produce interfering signals of 100 dB $\mu$ V (100 mV) or more at the aerial terminals.

The strong TETRA signal reaching the input of the receiver (and any preamplifier or distribution amplifier in the system too), even though out-of-band, can cause interference to the wanted TV signals by overloading the input stages of the receiver or amplifier, causing the effects known as intermodulation and blocking.

## What sort of interference?

The appearance of TETRA interference can vary considerably, but typically it tends to look like horizontal bands of pattering on the screen. "Tyre tracks across the picture" is one description that has been used. The sound is usually only affected in severe cases.

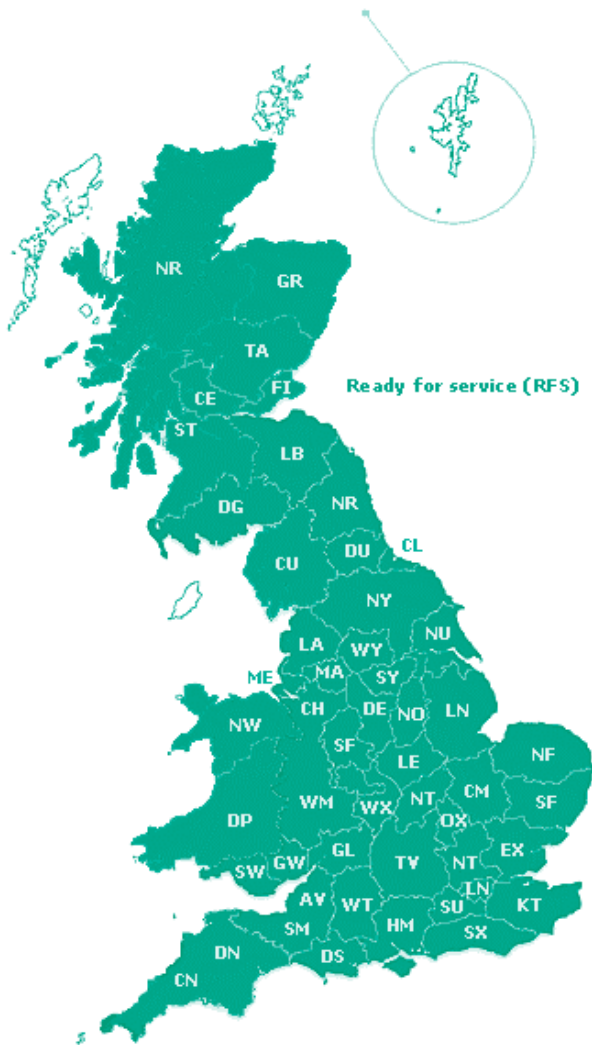
## When is the problem likely to be worst?

Some factors which will tend to increase the risk of interference are:

- the receiving site is within a few hundred metres of the base station (the strength of the TETRA signal tends to peak at roughly 100 m from the mast, due to the shape of its transmitting aerial's radiation pattern);
- the TV aerial is vertically polarised (all TETRA transmissions are vertical);
- the TV aerial is a Group A or wideband type;
- a masthead amplifier is in use, especially a high-gain type, or there are multiple amplifiers with too much overall gain in the chain;
- one of the TV channels being received is on channel 60.

## Channel 60?

Some of the severest interference cases to date have affected reception on UHF channel 60. This is because the second harmonic of the Airwave transmissions fall within this channel. Whilst Airwave go to great lengths to ensure that negligible levels of second harmonic are radiated, an overloaded amplifier or TV tuner will readily



Airwave coverage map (April 2005)

generate the harmonic distortion itself, leading to highly visible interference.

### Does it affect Digital TV?

Yes, but because of the usual 'digital cliff' effect the interference does not show up until it becomes fairly severe, after which total failure of reception follows rapidly. Don't forget though that the presence of lower-level interference is effectively eroding the margin against other things, such as multipath and co-channel interference.

### Whose problem is it?

It's sometimes said that Airwave should fix all the TVI problems, because "they've caused them." In reality though, any interference is almost certainly due to a lack of *immunity* to strong out-of-band signals in the receiving installation. This means it's the responsibility of the householder or the owner of the TV distribution system to fix any problems.

### What can be done?

The main weapon against out-of-band interference is *filtering*. Traditionally most UHF masthead and distribution amplifiers designs have only used fairly basic input filtering – often giving little or no rejection in the

390 to 400 MHz Airwave base transmit band. In existing installations TETRA interference can often be cured by fitting a suitable filter (such as a UHF highpass or band-pass filter) ahead of any active equipment in the signal chain.

### What about new installations?

With the VHF and UHF spectrum getting ever more crowded it has become important to ensure that new installations are reasonably immune to strong out-of-band signals. In the future the number of transmitters operating in urban environments will only increase. The aerial and system installer that recognises this and avoids using amplifiers with 'wide-open' (poorly filtered) inputs will have a clear advantage.

Many PROception amplifier products include 'built-in Airwave TETRA filtering' at the front-end. This typically provides around 30 dB rejection at 400 MHz and below and will contribute to making an installation TETRA-proof in all but the most severe locations. The use of quality filtered amplifiers must of course be combined with good installation practice, such as the use of screened components throughout and benchmarked cable. One more rule that cannot be stressed too highly is to avoid using excessive amplifier gain – for example the PROception proMHD11L 'low gain' (+9 dB) masthead amplifier has sufficient gain for the majority of domestic installations.

### PROception products with built-in Airwave TETRA filtering

Product codes	Description
<b>Available now</b>	
proAMP24 proAMP26 proAMP28	4-, 6- and 8-way TV and FM aerial distribution amplifiers
proAMP24R proAMP26R proAMP28R	4-, 6- and 8-way TV and FM distribution amplifiers with return path for Sky* remote control
proMHD11L proMHD11M proMHD11H	Low, medium and high-gain UHF masthead preamplifiers <sup>†</sup>
proMHD12M proMHD14M	2- and 4-way UHF masthead amplifiers
<b>Coming soon</b>	
More Tetra-filtered products will be added to the Proception range in the next few months.	

<sup>†</sup> Always use the lowest gain amplifier necessary to obtain satisfactory reception.

### Reference

1. See <http://www.airwaveservice.co.uk/>

### Acknowledgements

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