BACKGROUND NOISE ON THE HF BANDS

The Vulnerability of Small-Signal Services to Continuous Broadband Interference

Ever since the use of the existing copper infrastructure (telephone lines or the electricity mains) to carry high speed data signals using frequencies in the HF bands became a possibility, there has been an attempt by some proponents of such systems to claim that the ambient background noise level on the HF band is already so high that this justifies high levels of broadband noise emissions.

It has always been the RSGB's position that this claim is specious and stems from a misunderstanding of the nature of ambient noise and its effects on small signal radio communications services where the selection of suitable times and frequencies is part of the operating procedure.

Over the years the RSGB has made many presentations in which this point is emphasised. The following is a selection of slides from these presentations, with appropriate notes.

The RSGB first became interested in 1996 when they were advised of a proposal to use telephone lines for a high speed Video-On-Demand service. At that time the Society had only limited information on the ambient noise at typical amateur locations. Data gathered over the years has confirmed the view that the ambient noise floor is lower that many people think. Generally lower than 0dBuV/m - and in some instances much lower. It is acknowledged that locally generated man-made noise is quite high in some locations but fortunately, in residential areas, the degradation of communications is usually limited because the noise affects only a restricted frequency range or occurs for only a limited time.

The term "incidental noise" has been coined to describe this local man-made noise.

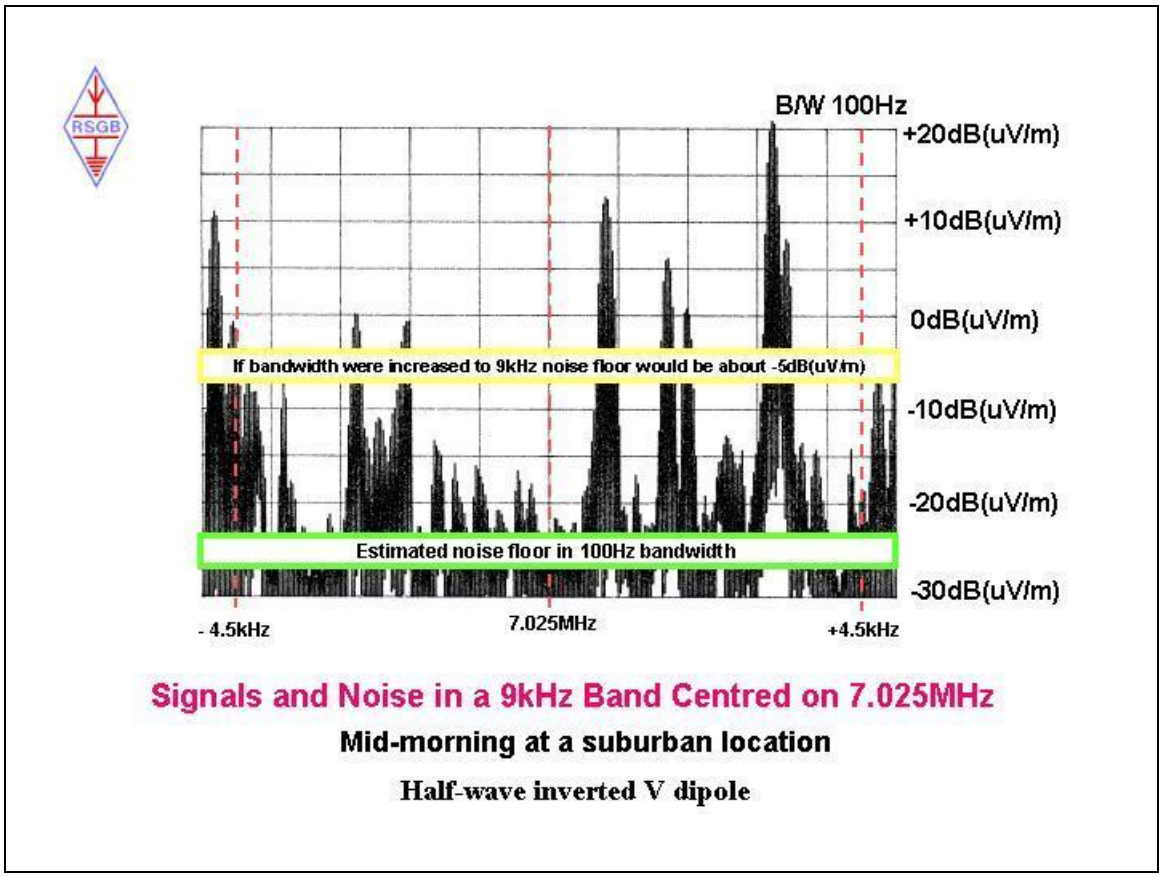
It goes without saying that there is far too much of this incidental noise about, but at least the effect on small signal services is limited by its statistical nature. A number of sources of man-made noise are listed in RSGB Leaflet EMC 04 along with tips for tracking them down.

Measurements and interpretations in these notes are put forward in good faith with the sole intention of illustrating how broadband interference will affect small-signal services such as amateur radio. Figures quoted are not intended to be considered as formal engineering measurements.

Here is a collection of slide presentations that the EMC Committee has produced:

Slide 1. Made for a presentation to the RA Technical Working Group

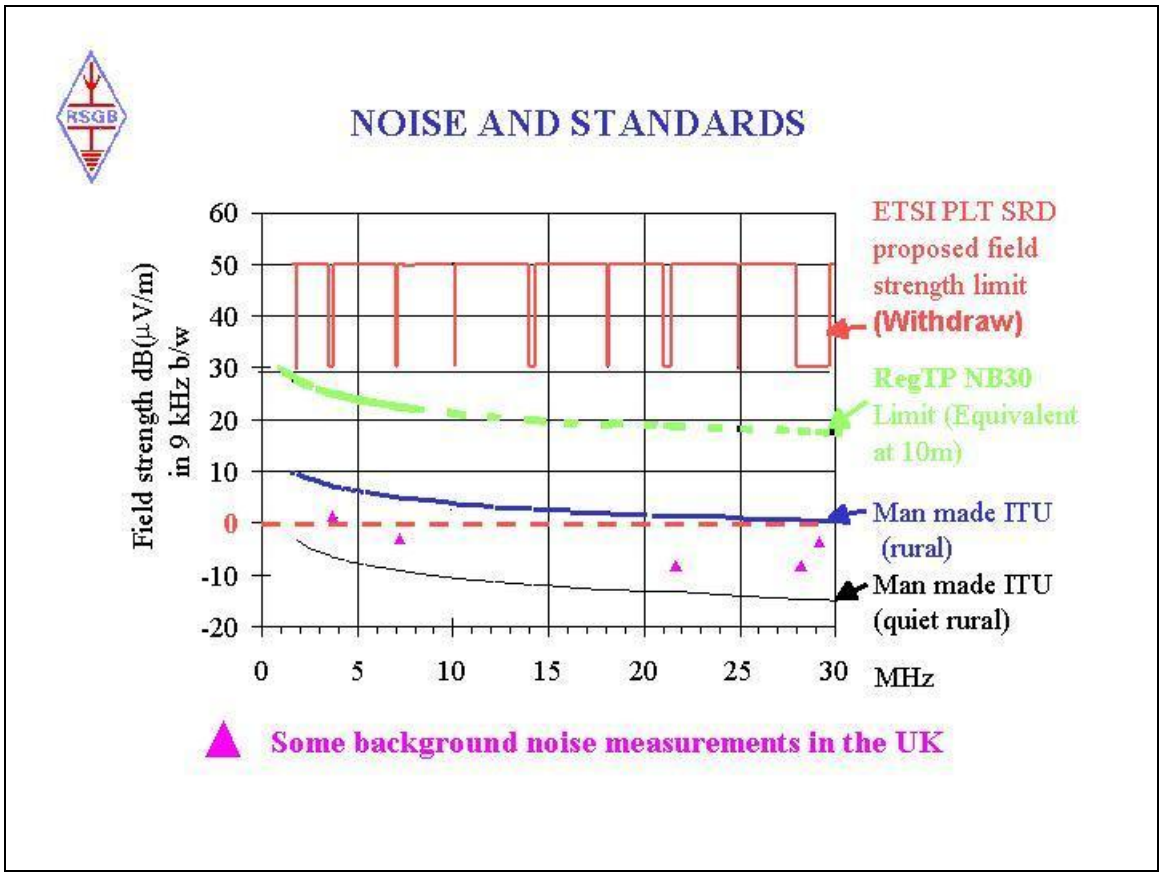
Slide 2. Versions of this slide has been used in many RSGB presentations



The basic plot was originally made for the "RSGB Guide to EMC" to emphasise the problems of making measurements in a 9kHz bandwidth. It has been used in various presentations to illustrate the RSGB's contention that the ambient noise floor is lower than is generally thought. The field-strength is nominal, being calculated from the measured signal level using the standard dipole formula. The relationship between the noise in 100Hz and 9kHz is illustrative only since the noise is not really white. Measurements on spot frequencies, such as this one, are simple to carry out requiring only a dipole antenna and an accurate measuring receiver. The plot was obtained by feeding the IF output of the measuring receiver into a spectrum analyser.

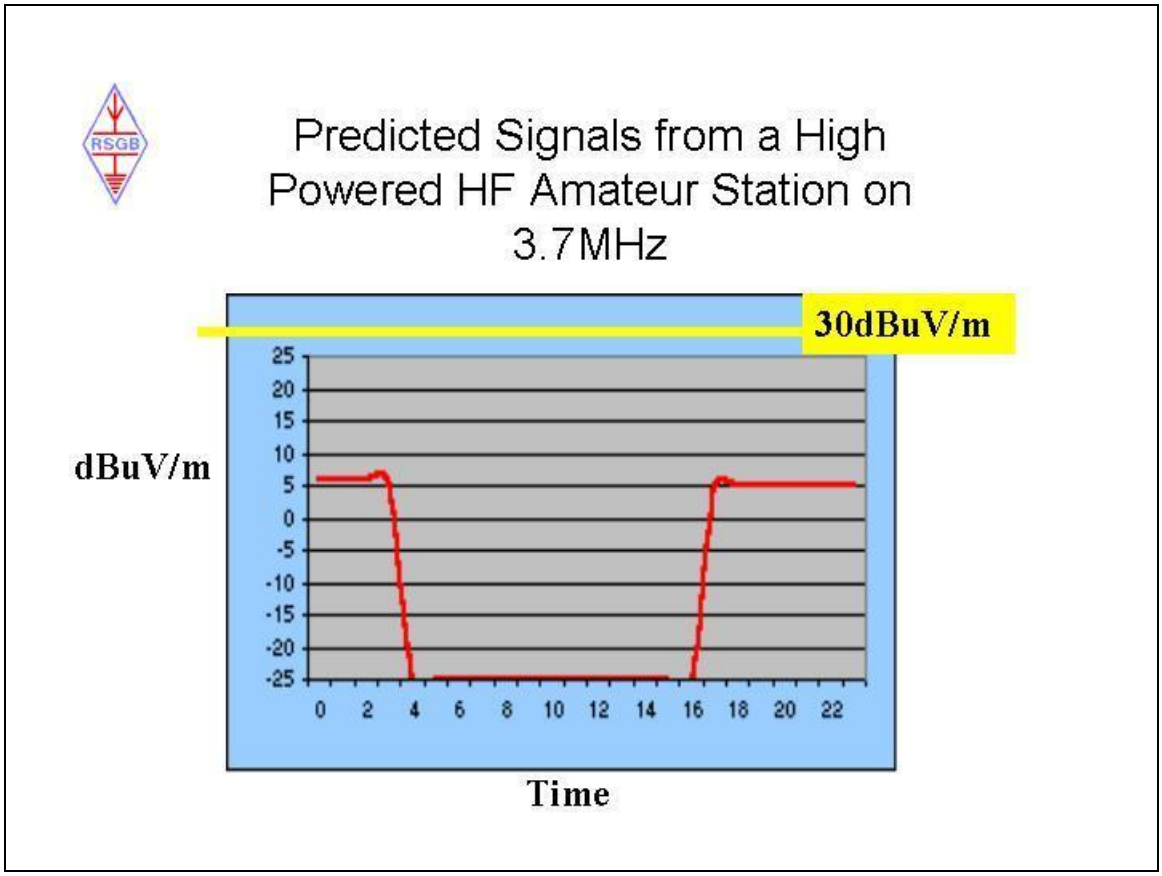
This plot highlights the importance of making sure that any plot of signals and noise on the HF band actually indicates the true ambient noise, and not the instrument noise floor.

Slide 3. Made for a Presentation to the RSGB's HF Convention.



Slide 3 illustrates the significance of ambient noise levels and proposed standards in the HF band. The NB30 limits have been calculated for a distance of 10m from the original levels at 3m. The ETSI PLT SRD limit was from a draft document which has since been withdrawn. It is included as an indication of the magnitude of the regulatory problems.

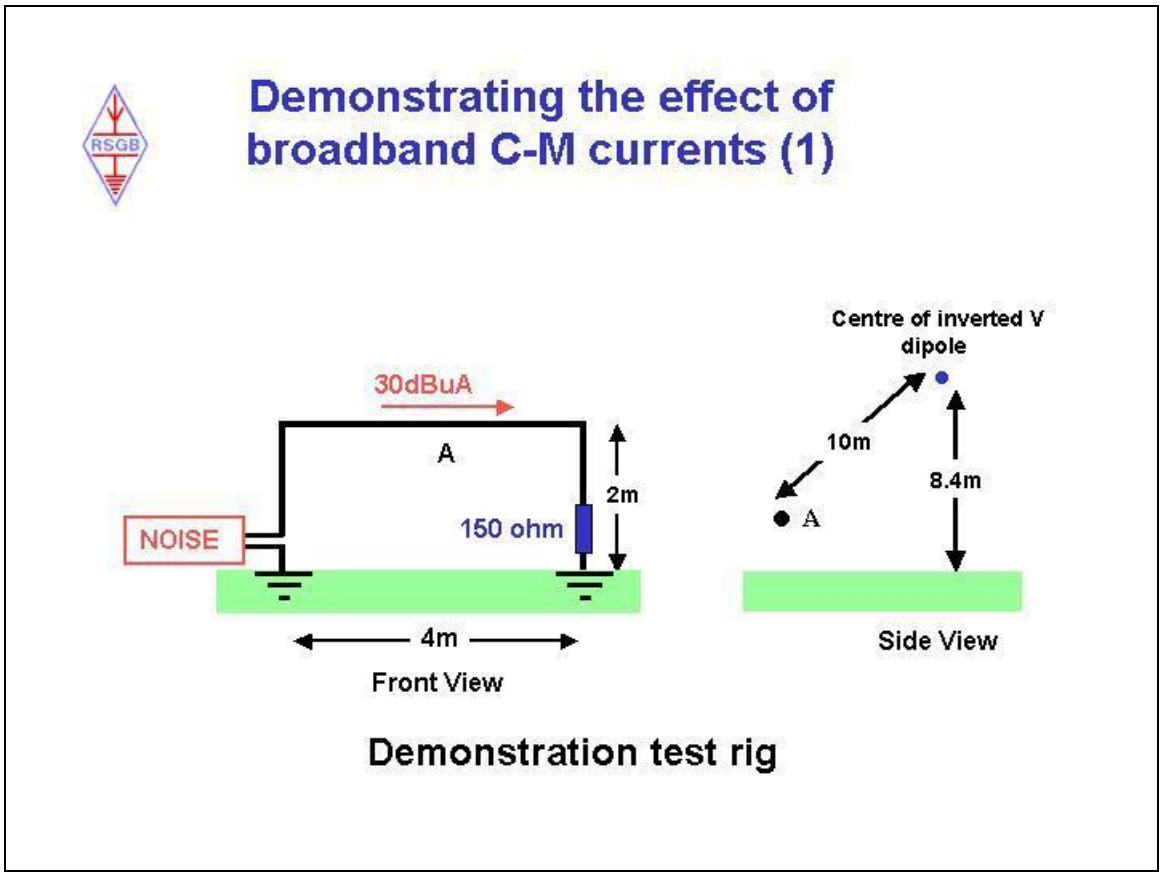
Slide 4. Made for a presentation to the RA Technical Working Group.



The basic slide is taken from the predictions of signal strength in the UK for signals from the "Dexpedition" station on the Comoro Islands. This would be running relatively high power to a good antenna. A 30dBuV/m line was added because a 30dBuV/m limit for the amateur bands was under discussion at the time. The proposal which gave rise to this has since been withdrawn.

It should be noted that the "capture area" of a resonant antenna on this frequency is quite large so that 5dBuV/m represents a reasonably good signal at the receiver input (about S7).

Slide 5. Made for a presentation to the IIR 4th Powerline Conference.



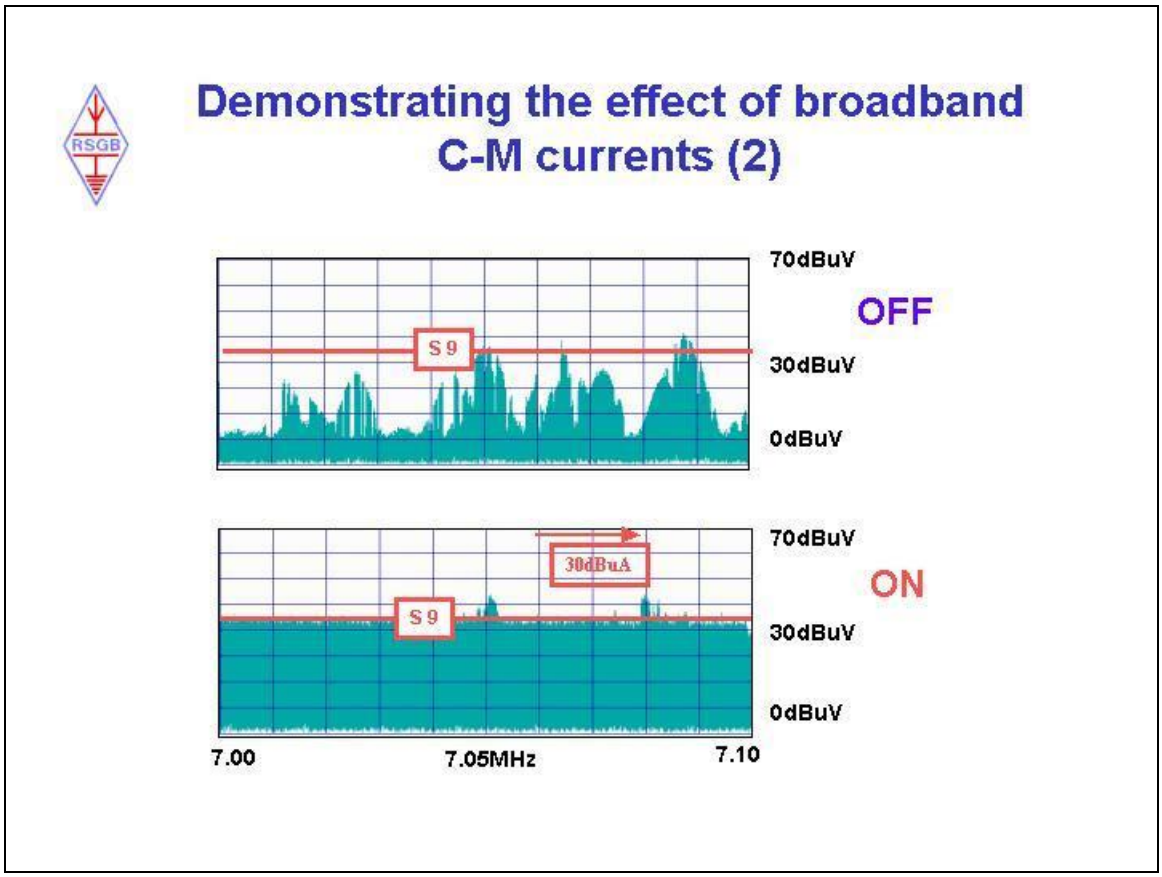
The intention of slides 5 and 6 is to draw attention to the fact that, where conductor deployment leads to a significant proportion of the energy being radiated, the levels of common-mode current permitted by product standards such as CISPR 22 would give rise to severe interference to small-signal services.

The current was measured with a current transformer and was constant to +/- 2dB throughout the wire between source and load.

On Slide 6 (below) The top plot shows signals in the band 7.0 to 7.1MHz when the noise generator is switched off. The lower plot shows the effect when the noise generator is switched on.

As a confidence check a communications receiver was connected in place of the spectrum analyser. The receiver was tuned to a signal of approximately S9 and an audio recording made. The wanted signal was strong and clearly audible but became unintelligible when the noise generator was switched on.

Slide 6. Made for a presentation to the IIR 4th Powerline Conference.



The vertical axis is the signal from the inverted V dipole. The baseline of the plot is the instrument noise floor not the ambient noise (see slide 2 above).

Slide 7 Made for a presentation to the RSGB's HF Convention.

Prepared by Robin Page-Jones (G3JWI)