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**Notes on the Final Report of the RA's TWG on the Compatibility of
DSL and PLT with Radio Services 1.6 to 30MHz**
Compiled by the RSGB for the benefit of Radio Amateurs

1. Introduction

About five years ago RSGB became aware of plans to transmit high speed data over the "existing copper infrastructure" (electricity mains or telephone lines). Since then we have been involved in a large number of meetings and discussions in the UK and other countries of the EU. Our objective was, and still is, to ensure that radio services and particularly the amateur service, are protected from interference. During the last two years the Society has taken part in the Radiocommunications Agency's Technical Working Group (TWG) on the compatibility of DSL and PLT with radio services in the range 1.6 to 30MHz.

The Final Report of this TWG is available as a pdf file of 6Mbytes on the RA's web site at:

<http://www.radio.gov.uk/topics/interference/documents/dslplt.htm>

These notes are intended for radio amateurs and short-wave listeners who wish to familiarise themselves with this document, but who do not have the time to read carefully through all the 427 pages, and who would like some guidance as to the parts likely to be of special interest.

2. Presentations of Radio Interference Data

2.1 Nomenclature

Since the rise of interest in the use of existing copper infrastructure for the transmission of high speed data the number of documents relating to EMC and radio interference has increased very significantly. Many of these documents contain plots purporting to indicate the relative levels of RF interference and the ambient noise.

Not all documents use the same nomenclature for the various factors involved. The Final Report defines such things as ambient noise, ambient noise floor, incidental noise etc in the glossary (pages 6 to 10). Footnotes indicate that this was done "for the purposes of this report". However the RSGB is in complete agreement with these definitions and would recommend them for use in all discussions of RF interference.

2.2 Interference Data presented on spectral plots

Spectral plots of signals and noise can be very useful, but can in some cases be dangerously misleading.

Before drawing any conclusions from plots of signal and noise on the HF band, careful consideration should be given to all the conditions of measurement. Common causes of misunderstanding are:

- a) If measurements are taken on a standard EMC measuring set up the instrument noise floor will be much higher than the ambient noise floor. This gives the

- impression that the ambient noise floor on the HF band is much higher than it actually is.
- b) Plots taken by sweeping over a wide frequency range (such as 1.6 to 30MHz) using the traditional EMC measuring a bandwidth of 9kHz can give a completely erroneous indication of the ambient noise. This is because the HF band is so crowded that a 9kHz bandwidth is too wide to discriminate between legitimate signals and the ambient noise. The effect is to lift the bottom line of the plot, again giving the impression that the ambient noise is much higher than it is.
 - c) Plots, which do not indicate whether the readings are peak, quasi, peak, or average.

3. The Main Body of the Report

3.1 Overview

The Final Report was compiled by a drafting group drawn from the working group, but the final decision on content rested with the RA. On completion of the drafting group's work the document was reviewed and amended by the RA. Most of the points raised by the RSGB were addressed, but we would have liked to see a more explicit summing up of interference potential of various broadband systems, though it should perhaps be mentioned that the terms of reference (page 17) do not call for a "judgmental" approach. All the sections of the report are worth reading. The brief notes below are intended to point out area which might be of special interest to radio amateurs.

3.2 Brief review of the sections

Section 1 Management Summary.

This would normally require no comment but for the fact that it contains a statement which, if taken out of context, could be misunderstood to be a conclusion of the report, which is not warranted. Page 14, second paragraph, says "Limited field measurements have shown that undue interference to radio reception at distances of more than a few meters from a single VDSL or PLT line is most unlikely". If "a few metres" is taken as, say, 5 or so metres, then this is demonstrably untrue. However on reading remainder of the paragraph it is clear that the intention is to compare the effect of a single source and multiple sources at a measuring point some distance away.

Section 2 Introduction and Background

This section sets out the terms of reference of the TWG, and discusses the regulatory background.

Section 3 Overview of Emerging Broadband Wired Telecommunications Technologies Considered.

This section describes the data transmission systems under consideration. Radio amateurs will find paragraph 3.1.6.2 *EMC mitigation* (for VDSL) and 3.2.2 *PLT interference mitigation* (for Access PLT) and 3.3.1.6 *Interference mitigation* (in house PLT) of particular interest. It is instructive to compare the proposals as to how interference problems would be approached in the three systems. The questions to ask oneself are, firstly is any particular proposal physically practical and, secondly, whether it could economically be applied to complaints of interference from a private citizen.

Section 4 the radio Spectrum Between 1.6 and 30MHz

This section describes the noise environment on the HF band, and its significance in radio communication. It is a very important section defining the conditions of the Electromagnetic (EM) Environment and is the background from which any conclusions of potential interference must be drawn.

Section 5 UK Spectrum Allocations in the Range 1.6 to 30MHz

This section consists of contributions from organisations representing HF radio users including the amateur, broadcast, military, aeronautical and maritime services. These make very interesting reading.

Section 6 Protection Requirements of UK Radio Services, 1.6 MHz to 30 MHz.

This summarises information extracted from Section 5, and states the various contributors' requirements. Figs 9a and 9b are included in this section. These figures bring together information from standards and protection requirements from a number of sources, which use different criteria. The curves are drawn to a common standard and annotated with the relevant information. It should be noted that, reference is made to the relatively high levels permitted in FCC part 15. When considering these levels due account should be taken of the sections of FCC part 15 defining legal and operational obligations relating to the stated levels. Interested parties should consult the complete document before jumping to any conclusions.

Section 7 Measurement Programme to Determine Emissions from Broadband Wired Telecommunication Systems in the Range 1.6 to 30MHz.

This section describes trials of VDSL and PLT installations. In the case of VDSL the trials were hosted by BT and HF radio users, including the RSGB were invited to attend the trials and make their own measurements.

Trials of PLT were much less open, radio users not being able to attend the trials at Chalfont St Peter. From the radio amateur's point of view, the most important aspect of PLT is emissions from domestic dwellings. Generally the work reported on in Section 7 did not cover this aspect in any depth. Only Fig 30 being relevant to this.

It is worth noting that since this report has been compiled, more work has been done on interference from PLT installations. As much as possible of this will be made available on this web site.

Section 8 Determination of Far Field Effects This is of less immediate interest to the average radio amateur who is more likely to be concerned about interference from his own or neighbour's houses. This section reflects the tension between contributors who thought that the cumulative effect could be a serious issue and those who wished to minimise the perceived risk. Perhaps the best advice would be to read this section with cautious scepticism.

Section 9 Summary and conclusions.

This section should be read even if other parts of the Report are skimmed!

4. The Appendices

The Appendices form a large section of the document some 313 pages out of the total of 427. These fall into two basic types. Some are purely informative, such as Working Group membership, list of HF frequency allocations and EU documents etc. These require no comment. Others were supplied by members of the working group purporting to address technical issues. Appendices E, F, G, H, I, L, M, N, O, P, Q, R, S, T, U, V, W, X, and Y fall into this category.

To meet the TWG's objective of being open to contributions from all interested parties, no formally submitted appendices were excluded. Because of this, the only way to counter what might be considered to be an erroneous presentation was to submit another giving a different interpretation. This accounts for the large number of appendices and also the fact that they vary in technical quality and objectivity. It is noteworthy that not all the appendices are rigorous in giving details of measurement technique such as RF bandwidth, instrument noise floor or whether measurements are peak, quasi peak or average. (See 2.2 above) In some instances the justification for the interpretation of the results is open to question.

While it was inappropriate for the report itself to comment on the relevance of specific appendices the knowledgeable reader will not have too much difficulty sorting the wheat from the chaff. The big problem is simply the quantity of material to read.

The list below gives some indication of the content of the appendices and highlights the ones which might be of particular interest to radio amateurs and possibly also to other HF radio users concerned about interference.

Appendices in bold are of particular interest to radio amateurs and short wave listeners

	Organisation	Subject	Comment	
E	White Box Solns.	Supply Networks	Does not address interference issues	
F	OneLine	System description	Mainly covers system function. Limited reference to EMC issues.	*
G	White Box Solns	Screening Efficiency	Not specifically relevant to domestic interference.	
H	British Telecom	Other interference sources.	Data quoted mainly from commercial environments.	*
I	RSGB	The practical interference situation	Generated to refute implications that existing interference levels in residential areas are higher than in fact they are.	*
K	BT Exact	Emissions in Office Building	Relates specifically to an office environment.	*
L	BBC	An analysis of the effects of broadband interference on AM broadcasting	A BBC White Paper giving a theoretical analysis of the effects of various levels of interference, with clear cut conclusions.	*
M	BBC	Proposed emission limit	A BBC White Paper. Proposes an emission limit based on increase in the ambient noise floor	*
N	DERA (QinetiQ)	Effect of broadband noise on military HF communications.	Background on military HF communications including noise floor measurements and the results of field trials on VDSL.	*
O	BBC	Emissions at a VDSL trial, plus comments and conclusions	A very comprehensive report. Probably represents the best available work on the subject.	*
P	RA	Draft plan for PLT measurements	Some of the stated objectives were not achieved.	
Q	nSine	Emissions from a PLT system	Measurements of interference from an in-house PLT system.	*
R	BBC	Cumulative effects	A BBC white Paper. Different data can be “plugged-in” to the mathematical model. Some assumptions have been challenged, but so far as is known the mathematical procedure has not been disputed.	
S	Joy Engineering (For Radio Shack)	Cumulative effects	The HomePlug HF Propagation model and estimates related to aircraft.	
T	Joy Engineering (For Radio Shack)	Cumulative effects	The HomePlug HF Propagation model and estimates.	
U	Joy Engineering (For Radio Shack)	Cumulative effects	Discusses parameter estimation assumed in the BBC White paper (App R)	
V	BT Exact	Cumulative effects	Consideration of potential cumulative interference from VDSL compared to other sources.	
W	BT Exact	Cumulative effects	Further considerations on the paper of App. V	
X	White Box Solns	Ground wave cumulative effects	Consideration of the protection provided by a 1500m exclusion zone	
Y	White Box Solns	Cumulative effects	A presentation considering PLT operational factors and their effect on interference to aircraft HF radio.	

* Reference should be made to Section 4.2 of the main body of the Report when interpreting measurements and spectral plots relating to signals and noise.

5 Final Comment

Considering the different interests which are involved in any attempt to protect the radio spectrum while permitting reasonable exploitation of new technologies, it might be appropriate to finish these notes with a quote from one of the twentieth century's best known physicists:

"For a successful technology, reality must take precedence over public relations, for nature cannot be fooled." Richard Feynman