

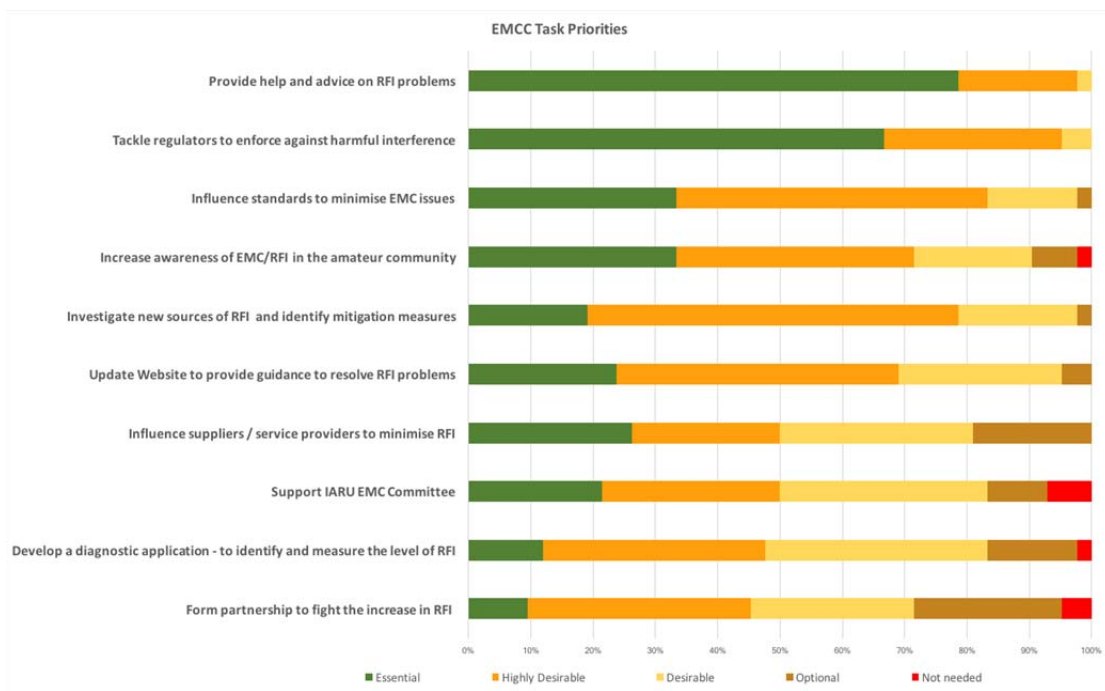
## RSGB EMCC Spectrum Forum Report October 2017

### Background

The EMC Committee has two primary roles:-

- Providing advice and assistance to people suffering from or causing Radio Frequency Interference (RFI), including raising the awareness of RFI problems
- Protecting the Spectrum from RFI particularly in relation to developing threats from new technology, by working on standards and lobbying regulators suppliers and service providers

As part of the RSGB 2022 strategy we revisited our objectives and came up with suggested tasks for future work. We then surveyed the leadership team and others to set priorities for these. The outcome is summarised below.



Our limited resources will concentrate on the top six of these tasks whilst encompassing the others wherever possible.

### Providing help and advice on RFI problems

The EMC Matters forum (55 discussions with 584 messages), problem reporting (96 reports) and email and telephone advice (250 cases) were provided over the last two years. This is escalating fast with 1300 replies received to our recent VDSL RFI survey. To help with on-site assistance a link has been formed with the Regional Teams who will supply names of people in the area willing to help with diagnosis and mitigation of problems.

## Tackling Ofcom about RFI

We have tackled Ofcom on the topic of enforcement at every opportunity, including questioning the lack of emphasis in their annual plan. An article challenging their lack of enforcement against RFI was published on page 20 of February 2017 RadCom. They have improved their market surveillance and reporting as described in their article on page 48 of October 2017 RadCom. They have investigated VDSL but using a flawed test process and we are in discussions with them about further testing at the moment. The Radio Equipment Directive (RED), 2014/53/EU draft transposition Regulations were put out for consultation by BEIS in July this year.

We have seen no evidence yet of either the EMC or WTA interference Regulations being employed to help amateur cases. Ofcom generally do not consider our complaints meet either the “prevention of operating as intended” or the “Harmful Interference” criteria. Ofcom have provided advice on a number of problems related to domestic appliances like switched mode power supplies, and have assisted by pointing out the problem apparatus. However, there has been no enforcement on the big three problems - broadband connections, wind turbines and Solar PV.

## Influencing the standards to minimise EMC issues

RSGB EMCC standards work has significantly increased following recruitment of extra volunteers and now covers:

- Regular attendance of BSi EMC Standards Committee meetings
- Analyses of and contribution to draft Standards in development
- Improving the visibility of Standards by importance to RSGB-EMCC using numeric scoring
- Improved tracking and recording of EMC Standards. Classified by the particular technology. Currently work is underway on the following:-
  - Solar PV and Wind-farm. CIS/B/688/CDV Amendment 2 Fragment 2 to CISPR 11 Ed.6 Requirements for Semiconductor Power Converters.
  - Electric Vehicle Wireless Power Transfer (WPT) systems. IEC TS 61980-2 ED1: - Part 2 specific requirements for communication between electric road vehicle (EV) and infrastructure with respect to wireless power transfer (WPT) systems. ETSI EN 303 417 Harmonised draft Standard for WPT application in vehicle. Configuration and emission limits.
  - Power-line Communication Devices for frequencies above 30 MHz. EN 50561-3 (An extension of EN 50561-1 for frequencies up to 30 MHz), with low emission limits set and specific notching of the amateur 50 MHz and 70 MHz band segments.
  - Lighting and Domestic appliances using inductive power transfer methods. Regulated under CISPR/F. Covers the increasing number of household devices (and toys) using contact-less battery charging.
  - Measurements and methods. Generally covered under CISPR/A. Inclusion of magnetic field emission limits in the frequency range 0.15 MHz - 30 MHz into the Generic emission standard IEC 61000-6-3 and IEC 61000-6-4.



## **Increasing the awareness of EMC/RFI in the amateur community**

It is important to make amateurs and other interested parties aware of the likely consequences of loss of radio spectrum from RFI. A communications/media campaign initially through Amateur Radio is under preparation with articles and columns proposed for RadCom and Practical Wireless on the impact of RFI on radio communication. The Radcom EMC column written by Dr David Lauder G0SNO will also focus on this subject. Presentations at the convention and talks to radio clubs will continue to be used to spread the word.

An alliance with other groups like radio astronomers and Business radio users is proposed to coordinate approaches to regulators and standards organisations. Questionnaires and Surveys will be used to determine trends in different types of RFI sources.

Work is underway to measure the increase in background noise level in a number of areas PSC, EMCC, IARU Region 1 and VHF manager. Coordination is essential to prevent members being confused by the multiple initiatives. It is also essential that the equipment used can measure down to the quiet rural noise floor if meaningful measurements are to be made. We do not want to repeat the Ofcom mistakes do we?

## **Investigating new sources of RFI and identifying mitigation methods**

**WINDFARMS:** We have measured interference at several windfarms to assess levels and determine what part of the installation the emissions are from. A paper was presented at IARU 2017 conference. It is currently believed the problem lies with the Double Induction Fed Generators which maintain fine speed control (50Hz synchronous to mains) by using the second winding as a motor (to speed up) or generator (to slow down). The magnetic near fields are likely to be very high and the blades made of carbon fibre and with copper rods effectively stir this field to produce radiation. The characteristic beat of blade rotation is a signature of this source. It impacts primarily 160 and 80m at up to 10km.

**VDSL:** We continue to be concerned over emissions from VDSL systems. Leakage is continuous and sounds like white noise so it difficult to identify except at the edges of the VDSL bands.

Recently three new initiatives were started:

- 1) A survey of members to determine numbers impacted and the typical levels of RFI seen
- 2) Drive by readings to determine variation with position and try to identify causes of the worst RFI
- 3) Measurements of the communications not possible at a site with VDSL RFI which are possible at an identical setup at a nearby site without VDSL RFI (“Here and There” testing)

The initial results of this work were presented at the RSGB Convention and a summary is given in Annex-1 to this report.

**WIRELESS POWER TRANSFER:** The charging of electrical devices, especially vehicles, is a potential concern. We are engaged in this via IARU Region 1.



## **Updating the website to improve guidance on resolving RFI problems**

An update of the website diagnosis pages and leaflets is underway to help Amateurs self-diagnose their problems. Step by step approaches to locating and identifying the RFI are proposed using videos where possible to show the process. More signatures of different interference types are needed and your help with this would be appreciated.

**Dr John Rogers M0JAV**

Chairman RSGB EMCC

20<sup>th</sup> October 2017

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October 2017

## Annex-1 Survey to measure levels of RF Interference (RFI) from VDSL

Over 150 Amateurs had reported problems caused by RFI from VDSL broadband connections (FTTC). These problems had been investigated by the EMC Committee and a report submitted to Ofcom and Openreach requesting action. To Support our case, we set up a survey (Sept 2017) which asked amateurs to measure VDSL RFI and background noise levels, to find the true extent of this problem.

### What was survey designed to determine?

VDSL RFI can be recognised by its 'signature' which is a change in level at VDSL upstream/downstream transition frequencies - the level normally drops at the transition (or guard-band where no tones are activated) and rises on either side (see Figure-1 below).

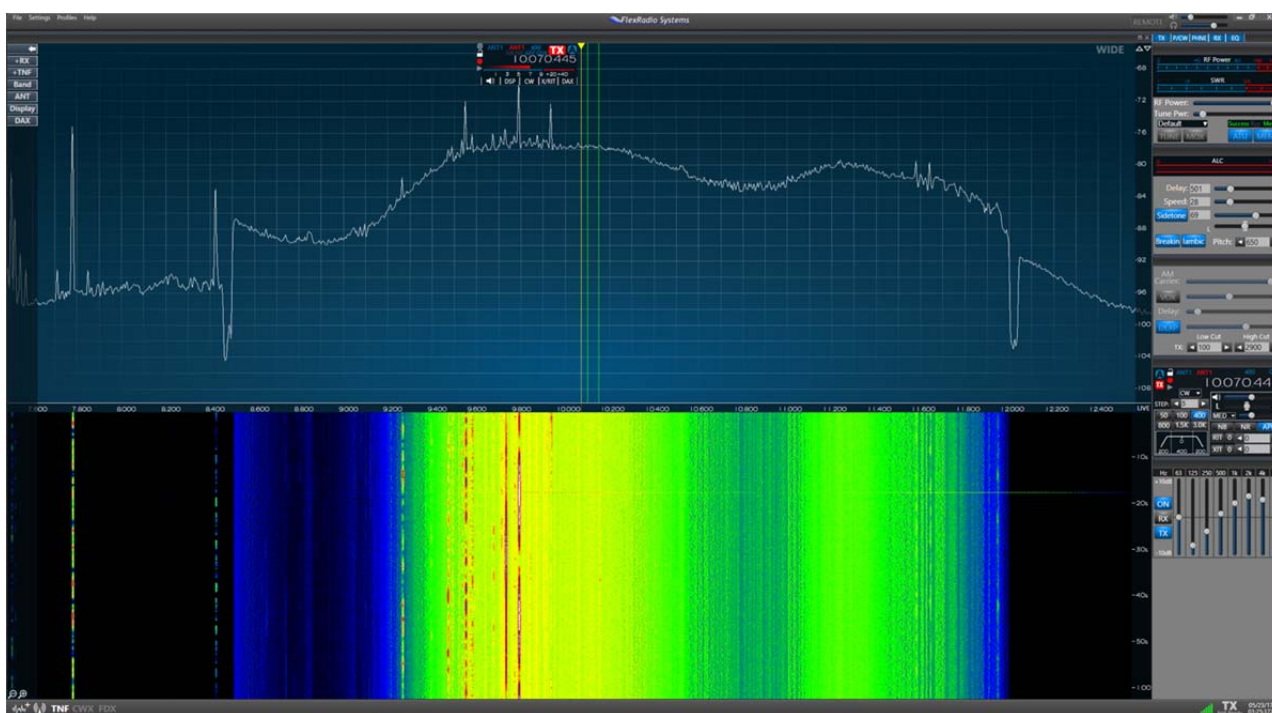


Figure 1: VDSL Spectrum

This can be measured with a 'S' meter, or by using spectra or waterfalls with a 1 or 2 second average to show mean level of VDSL RFI noise. We then calculate the difference in levels to determine the noise step. As these frequencies are only 100 kHz apart this eliminates any variation between receivers, antennas and S meters of the respondents. We received 1200 responses in five weeks many thanks to all of you who replied.

### What was found?

More than 50% of respondents found steps of more than 6dB in noise level at VDSL band transitions, of these more than 25% found steps of more than 12dB. Histograms for each of the VDSL bands are shown in Figure 2.

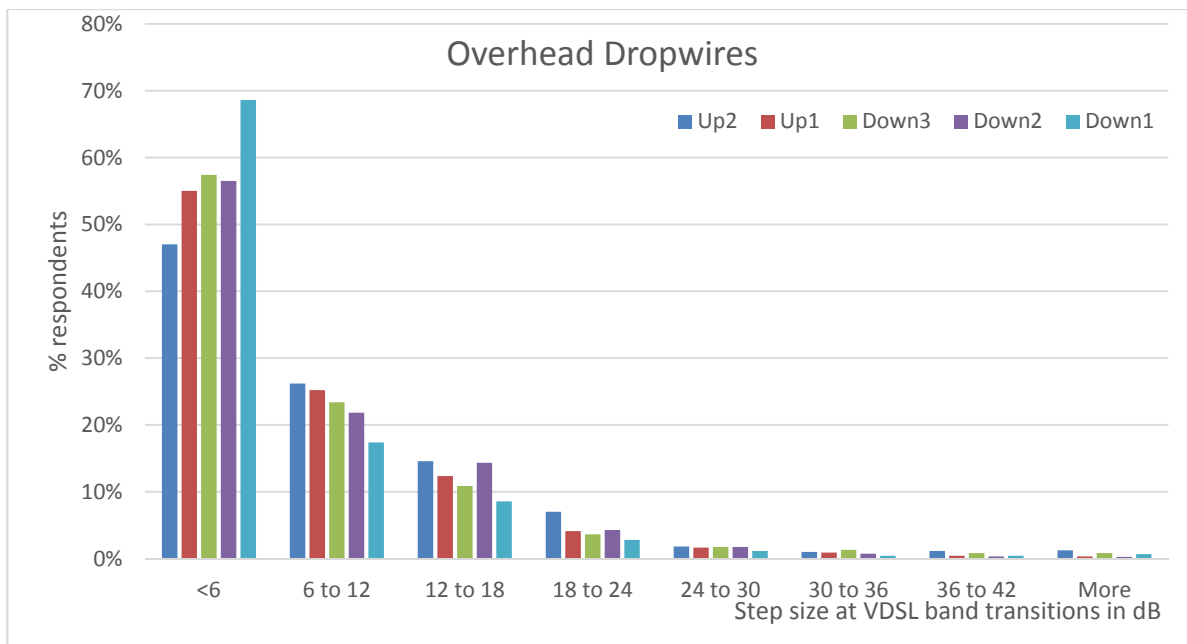


Figure 2 Changes in noise level vs VDSLband

The percentages for each band are shown separately for overhead and underground feeds in Table 1 below.

Table 1	>6dB Overhead	>12dB Overhead	>6dB Underground	>12dB Underground
Up 2	53%	27%	35%	16%
Up 1	45%	20%	33%	15%
Down 3	43%	19%	32%	13%
Down 2	42%	21%	33%	12%
Down 1	31%	14%	26%	12%

This shows more problems with RFI from upstream than downstream. Actual RFI Levels found for underground feeds were higher than expected at only 5 to 10dB below overhead dropwires. Levels reported for overhead and underground are shown in Figure 3 below, note the two peaks at S7 and S9.

### Q22 Level measured at 8.6MHz

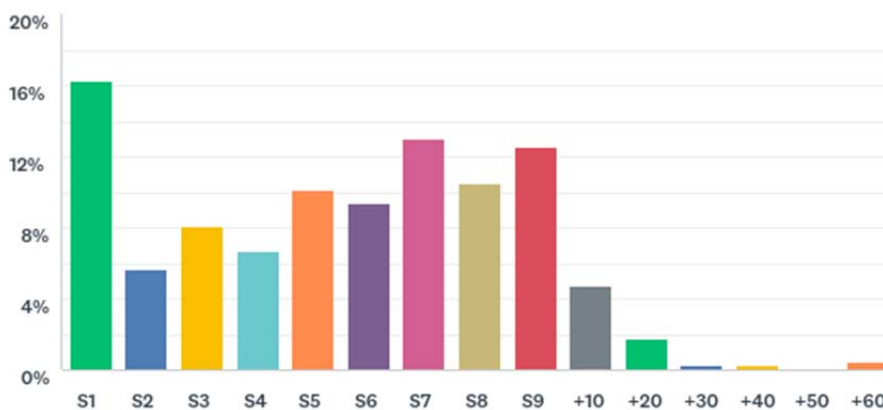


Figure 3: RFI Levels

Training carriers (a comb of tones at 4kHz intervals) were reported by 13% respondents, many on more than one band. These persisted from under a minute to several hours; and for some they never stopped.



## So what conclusions can we draw from the survey results?

- More than 50% of survey respondents are suffering from degraded signals because of VDSL
- Downstream is strongest near to cabinet - as it is the sum of many VDSL connections emanating from the cabinet whereas further from the cabinet it is only the sum of nearby neighbours' lines
- Upstream is strongest further from the cabinet as the modems use higher signal strength to overcome line losses in longer lines
- Overhead dropwires act as resonant antennas and the RFI level depends on their length and their proximity to amateur's antenna
- In house extension wiring also acts as resonant antenna and causes RFI particularly near dense housing - flats or townhouses - Sky Q has a third antenna the mains wiring connection for PLT
- RFI is worst if antenna is in the near field of overhead wires or extensions

## What is the impact of VDSL on Amateur Radio?

VDSL2 superfast broadband is present 24 hours a day, 7 days a week. It is pink noise which degrades radio reception up to 17.7MHz by obstructing signals of levels lower than the received VDSL RFI level. For each 10dB increase in this VDSL level above the background noise level over 80% of signals present are obscured. At some locations, only a few percent of the signals present (the strongest ones) can be received in the impacted bands, the rest are masked by the noise from VDSL.

To persuade Openreach to take necessary action we need Ofcom to recognise the scale of the Harmful Interference. Ofcom will only act against actual Harmful Interference (degraded, obstructed or repeatedly interrupted communication signals). One way to show actual harm is to set up two receivers near to each other, one suffering from VDSL RFI and the other not. Then automatically log signals received at both and compare to find which are not received because of Harmful Interference - "Here and There" testing.

## What can Openreach do to reduce RFI?

- Improve Line Balance where necessary – mechanism in place to request line balance on nearby lines via the EMC Committee
- Clean-up self-installs - difficult when a neighbouring property is the cause
- Remove upstream band interference by universally notching 10.1-10.15MHz with guard-bands and by increasing the D1 to U1 guard-band to always protect 3.7-3.8MHz emergency frequencies
- Selectively notch amateur bands in downstream (particularly 14MHz) at affected premises
- Reroute the overhead cables so they are further from the antennas when necessary
- Provide FTTP instead of FTTC at problem locations

## So what are the next steps?

RSGB will conduct more "Drive by surveys" to measure the variation in VDSL RFI and encourage you to do "Here and There" testing to demonstrate Harmful Interference. Ofcom will visit some of the survey sites to witness the problems. Then we must campaign for Openreach to take action. More information can be found on the EMCC pages of the website

<http://rsgb.org/main/files/2017/08/2017-RFI-Update-RSGB-Convention.pdf>