Emerging EMC Threats

Radio Society of Great Britain

Advancing amateur radio since 1913

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What do we mean by “Emerging Threats”? 

- Green Energy
  - Solar PV
  - Wind Farms
  - LED Lighting

- Communications – Broadband
  - xDSL
  - PLT

- Others
  - SMPSU’s USB chargers
  - Wireless Charging – next investigation
Solar PV Characteristics

- **Cause / Reports**
  - Grid-tied Inverter converts DC from panels to AC (synchronous to Grid)
  - Optimisers (switching DC-DC converters) may be fitted to individual panels

- **Spectra / Sounds**
  - Typically peaks at intervals of ~50 kHz modulated with 100 Hz buzz
  - Some recent solar PV systems appear to use Dithered Clocks which spread inverter harmonics over a wider bandwidth

![RSGB Survey Pie Chart]

- **No emissions**
- **3 problems**
- **3 resolved**
Solar PV Spectra

• Mitigation
  – DC cables should be run as closely spaced pairs
  – Clip-on ferrites may be required on DC cables
  – May be necessary to change inverter or optimisers

Broad band emissions up to 40dB above typical background noise level on 10.1 – 10.15 MHz band
Wind Farms

• Some wind farms radiate QRM at up to S9 + 30 dB across the 1.81 - 2MHz band
• Pulse modulated with relatively low duty cycle but peak field strengths of over 40dB(µV/m) at a distance of 3km.
• Only seen so far on wind farms that are built on low-lying fen land, 1 - 2 metres above mean sea level
Noise near Althorpe windfarm
Windfarm noise G3VBS
Noise near Windfarm Goole
• Some LED drivers fail conducted emission limits below 1 – 2 MHz by up to 40 dB (red and blue traces)
• Missing Class ‘Y’ capacitors can increase emissions at 3 – 30 MHz by up to 25 dB (red trace)
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FTTC based VDSL2

• Usage of up/downstream bands depends on distance from cabinet - attenuation increases with frequency

• System uses frequencies with acceptable S/N => reducing use of higher bands further from cabinet

• Upstream signals stronger than downstream at user, but upstream power is backed off to minimise crosstalk

• VDSL is active all the time users modem is powered up

• Few reports of VDSL RFI even with coverage of 66%

• Most reported cases are from someone else's VDSL
VDSL2 – distance from cabinet

10% premises
U1/U2 & D1/D2/D3

50% premises
U1/U2 & D1 / D2

25% premises
U1 & D1 / D2

15% premises
U0 & D1

Normally no problem when underground cables used for final drop
U1 @ QTH M0JAV 1km from cabinet

Looks and sounds like a raised noise floor

Detect by f of band edges
U2 @ QTH G3JWI 500m from cabinet

8.5MHz Band Edge
Plot 137 (B)
11th Sept 2014
1400bst

Antenna 7MHz dipole
RF Attn 0
RF Amp IN

HDSDR Detail in Plot 136 (A)
D1 near Coventry

Noise across 40m band

3.71 MHz bandedge
VDSL during Training

Carriers across upstream and downstream bands

Carriers 4kHz apart
Transmitting can cause retraining
Open circuit $\lambda/4$ wave stub on modem line

System does not use frequencies near $\lambda/4$ wave stub avoiding radiation
Ongoing investigations

• Working with BT to understand the issues better
  – Investigating modes of radiation and variations in near field patterns, including effect of in house extensions
  – Fault conditions can cause lower broadband speeds and increase radiation in all our interests to resolve problems
  – Investigating mitigation for cases suffering interference
  – Trying different common mode filter designs
  – Broadband accelerator can reduce U2 emissions

• Self Install launched may see more mismatches as no centralised splitter and/or distributed microfilters
PLT - update

• EN50561-1 has been adopted but some amateurs are considering legal challenge to the way the standard was set up
• Notches provide some protection for amateur bands but not to our SWL’s
• Some evidence that intermods are filling in the notches as we predicted
• As 50561-2 PLA and 50561-3 VHF are being drafted more parties are worried about the levels set in the EN50561-1
- Two types of mains USB charger
  - Genuine Apple iPhone charger (blue trace)
  - Generic USB charger model TC038 (red trace)
How can you help us?

- **COMPLAIN** if you see these problems
- Use the Forum EMC Matters to tell us
  - Collect data / ask for help / share your knowledge
- Volunteer to help with investigations
- Our aims are
  - To help people identify the source of interference
  - To collect data to influence standards evolution, lobby suppliers and press regulators for enforcement
Plasma TV

- Problems may increase as the plasma ages
- Cooperation of the set owner is key as suppliers will only deal with them
- One of our committee has had good success with manufacturers getting problems resolved particularly with Panasonic and Samsung
- Contact Ken Underwood G3SDW directly or via the EMC Matters forum
- Problem will go away as sets go out of production
How can interferers be found?

- Use leaflet EMC04 to help diagnosis
- Location of source – portable receiver use a poor antenna to get closer to source
- Record Frequencies - problems observed
- Use different Modes to characterise interference
- Try at different times and in different weather
- We are building examples of characteristics to look for
Tools to use

• Portable / mobile receiver / am radio
• Transceiver or Comms Receiver
• Narrowband SDR (<200kHz) eg funcube dongle
• Spectrum Analyser or Wideband SDR (>1MHz)
• Choice of Antenna
  – Normal antennas tell if a problem
  – Loops sensitive and portable
  – Small active dipoles allow polarisation check
  – Current loops when safe to use
KX3 with HDSDR
Funcube dongle Pro+ SDR Sharp
Softrock ensemble SDRSHARP
Winradio SDR 30MHz spectrum