

Dear XXXX,

Thank you for your assistance on Monday evening in Tuam. Here are some notes on my findings. I would be happy to clarify any points for you or assist with any further tests of this nature.

The tests I conducted involved transmitting a carrier (un-modulated signal) on various HF frequencies that I am a licensed user of.

The RF power supplied to the antenna was approximately 40w (16 dBw)

14.205 Mhz the download stopped for a few seconds then resumed at a lower speed indicating that the system adapted to the rf ingress  
10.122 Mhz Stopped for a few seconds then the PLT system adapted and continued at a lower speed.

7.060 Mhz The system stopped completely for the duration of the transmission and took a while to recover once the transmission ended. \*\*\*\* reported that the PLT modem appeared to hang completely, possibly indicating that it had lost sync with the rest of the system. Did the mannet system logs show anything interesting?

3.680 Mhz The system stopped completely and took a few seconds to recover after the end of transmission

18.120Mhz, 21.200 Mhz, 24.940, 28.200Mhz and 50.200 Mhz transmissions all had some impact on overall performance affecting the speed of the download by between 20% and 60 % but it is hard to quantify the impact this on the basis of a single transmission on each frequency at a single PLT test site.

On most occasions effects were seen by \*\*\*\* when I was tuning the antenna between tests, this is interesting in that tuning is done with low power (~5W) applied to the antenna however the varying impedances of the antenna during the tune process would have created a variable field strength at the test house. It is possible that the effects of a modulated signal on the PLT system will be more severe than the effects of an un-modulated signal.

The worst impact was seen on 7.060 Mhz and during the test we conducted where I drove into the estate from the vicinity of the ESB offices the system appeared to stop (at least from the perspective of the download at the test house ) from approximately the point at which I entered the estate(\*1).

One important factor that needs to be taken into account when evaluating the results of these tests is that power supplied to the antenna is not radiated efficiently at HF frequencies due to the relative size of the antenna in proportion to the wavelengths in use.

It is hard to calculate the exact efficiency of a mobile HF antenna since the efficiency will vary depending on the type and size of the vehicle as well as from location to location due factors such as the local ground quality.

My estimates of the radiation efficiency of my mobile HF antenna as fitted to my van are as follows

3.680 Mhz	antenna gain -16dBi	estimated EIRP 0 dBw	(1Watt)
7.060 Mhz	antenna gain -13 dBi	estimated EIRP 3dBw	(2 Watts)
10.122 Mhz	antenna Gain -8 dBi	estimated EIRP 8dBw	(6.3 Watts)
14.205 Mhz	antenna gain -2.8 dBi	estimated EIRP 13.2 dBw	(20 Watts)
18.120 Mhz	antenna gain -2.4 dBi	estimated EIRP 13.4 dBw	(~20 Watts)
21.200 Mhz	antenna gain -2 dBi	estimated EIRP 14 dBw	(25 Watts)
24.940 Mhz	antenna gain -1.7 dBi	estimated EIRP 14.3 dBw	(~25 Watts)
28.200 Mhz	antenna gain -1 dBi	estimated EIRP 15 dBw	(32 Watts)
50.200 Mhz	antenna gain 0 dBi	estimated EIRP 16 dBw	(40 watts)

Estimated EIRP levels are based on my transmit power during the tests of 40w (16dBw )

A typical fixed Station operating on these frequencies would be operating with power levels of 100w (20dBw) operation is permitted in Ireland with power levels of up to 400w (26 dBw)

A typical station operating on the lower frequencies (10.1 Mhz and below) would employ a resonant 1/2 wave Dipole antenna, typical antenna gain of such an antenna in an urban setting would be in the region of 1 to 3 dBi

On 14 mhz and above HF yagi antennas are in quite common usage, typical antenna gain figures for a HF Yagi would be of the order of 7 to 9 dBi

Each doubling of distance between the transmit antenna and the receiver results in approximately a 6dB reduction in the signal strength at the receiver in free space, so for example if effects were observed at a distance of 50m from a mobile station operating at an EIRP of 3dBw one could expect the same effects from a 400w (26 dBw) Fixed Station using a dipole (2 dBi gain, EIRP 28 dBw ) at a distance of over 800m. However the presence of powerlines acting as a distributed feeder system will have unpredictable effects with the actual results varying by location

During the download considerable interference to HF reception was observed on the following HF frequencies. The interference level was directly proportional to the amount of Internet traffic

3.680 Mhz

7.060 Mhz

10.122 Mhz

lower but still quite severe levels of interference were observed on 14.205 Mhz

No interference was observed on the other test frequencies at the test location and I made no attempt to observe interference on the HF broadcast bands.

The PLT installation in the estate you brought us to would appear to offer limited opportunity for Rf ingress / egress.

All exterior wiring is underground and all streetcabs are grounded metal structures. This screens the ESB network in this area from RF.

In this area RF Ingress / Egress is predominately by means of the household wiring in the houses connected to the ESB network.

In areas with overhead ESB wiring it would be reasonable to assume that the levels of RF ingress / egress would be substantially greater.

I would be most interested in carrying out a similar experiment with the forthcoming DS2 deployment. It may make sense to combine this test with D\*\*\*\* \*\*\*\*'s visit since it will at that time be possible to accurately measure the the amount of RF ingress into the system with COMREG's calibrated spectrum analyser. It may also be worthwhile revisiting the Mainnet trial with a view to accurately measuring the ingress levels that cause the system to cease passing data.

regards

Brendan Minish

\*1 Entrance to estate is approx 500m from the test house. Test House was adjacent to a PLT Repeater.