Tasmanian BPL Trial – RF Susceptibility Tests

Version: 1.00
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Background:

- Purpose of these tests was to research if it is possible for HF amateur radio to co-exist with the BPL system being trialed in VK7 (Tasmania). Technical staff within Aurora Energy were contacted for assistance however they were on leave at the time of the test.
- Test measurements were taken within the Mt Nelson trial area.
- Mt Nelson has overhead powerlines with backhaul using wireless technology (2.4/5.8GHz).
- Following tests, 14.000MHz (20 metres) was chosen as the test frequency using the continuous wave (CW) mode.
- The 20m band in the test area is notched from approximately 14.000 to 14.350MHz[1].
- Tranceiver used was a Yaesu FT847 into a MobileOne M20-1 helical vertical antenna mounted on the towbar (see appendix 1), the power meter was a Revex W560.
- Minimum transmitter power was 2.5 watts (ave) & maximum was 100 watts (ave).
- Broadband over powerline (BPL) Modem was a Mitsubishi CPE-AW10-01E00-W00-UOS that utilises the 200Mbps DS2 Chipset.
- Polarisation of the transmitting antenna (vertically polarised shortened mobile antenna) and the receiving antenna (horizontally polarised powerlines) were not matched. Larger horizontally polarised wire or directional antennas may affect the BPL network even more. See appendix 1 for picture of antenna used.
- The raw results can be found in the appendix 2 and test locations in appendix 3.

Methodology:

At each location:

1. Observation and recording of the latency time, signal level and link LEDs (lights) on the BPL modem without radio frequency (RF) signal signals present.
2. Observation and recording with minimum RF signal power (2.5 watts ave).
3. Observation and recording changes in latency or LED status with increasing RF signal power levels upto a maximum of 100 watts (ave).
4. Where the latency test indicated a time-out the RF signal was removed and the latency test re-run to prove the timeout was caused by the RF signal presence.
5. The geographical limits were established where the maximum power level was reached with little or no change in both latency and LED status.

Key Findings:

- At the base location, transmitting a minimum amount of RF power (2.5 watts) reduced the BPL modem to no signal, no link and a timed-out network connection that required the user to re-establish the connection to the internet service provider by entering the username and password again.
- 60 to 80 metres either side of the base location only required between 2.5 and 5 watts of RF power to reduce the BPL modem to a timed-out network connection at the base location.
- At locations C, E, H & I, all or some of the signal level LEDs were alight along with the link LED however, the latency test timed-out indicating no network connection at the base location for the period of RF transmission. This indicated that the transmission was not affecting the base location modem and possibly affecting other network equipment.
- At approximately 250 metres either side of the base location maximum power only marginally affected the latency time on the base location modem.

[1] See 20m notch reports at http://reast.asn.au/vk7bplwatch.php#emissionmeasurements

Conclusions:

- The BPL system observed in Hobart (Tasmania) is severely disrupted by ingress of low intensity Radio Frequency energy from nearby radio transmitters.
- Within 60 to 80 metres of the base location, less than 5W transmitter output power (estimated <1W EIRP) from a mobile station adversely affected the BPL service.
- Transmitting can affect network connectivity without necessarily giving visual indication of loss of signal or link on the base location modem.
- BPL notching does not prevent externally transmitted signals from affecting the BPL system.
- Intermittent transmissions and the resultant increase in latency time would affect real-time applications like Voice over IP (phone service) and on demand or streaming video services to a greater extent than email and web browsing.
- Current BPL technology is not suitable for amateurs who require internet connectivity whilst transmitting on the HF band (ie. IRLP, Echolink, DX Clusters, etc).
- Therefore, it would be very difficult for an active HF amateur radio operator in a BPL enabled suburb to co-exist without a range of issues relating to the level of emissions[2] when receiving and RF susceptibility of the BPL system when transmitting.
- This report should flag to customers, carriers and to the regulator the risk to BPL service reliability from ingress, and it would be prudent to put a comprehensive test program on their agenda to better understand the extent of the risk and mitigation measures.

Thanks to Harvey, VK7HK who assisted with the tests.

Appendix 1 – Mobile Antenna and Mount

MobileOne M20-1 (14MHz) Helical Vertical on towbar mount

[2] http://reast.asn.au/vk7bplwatch.php#emissionmeasurements

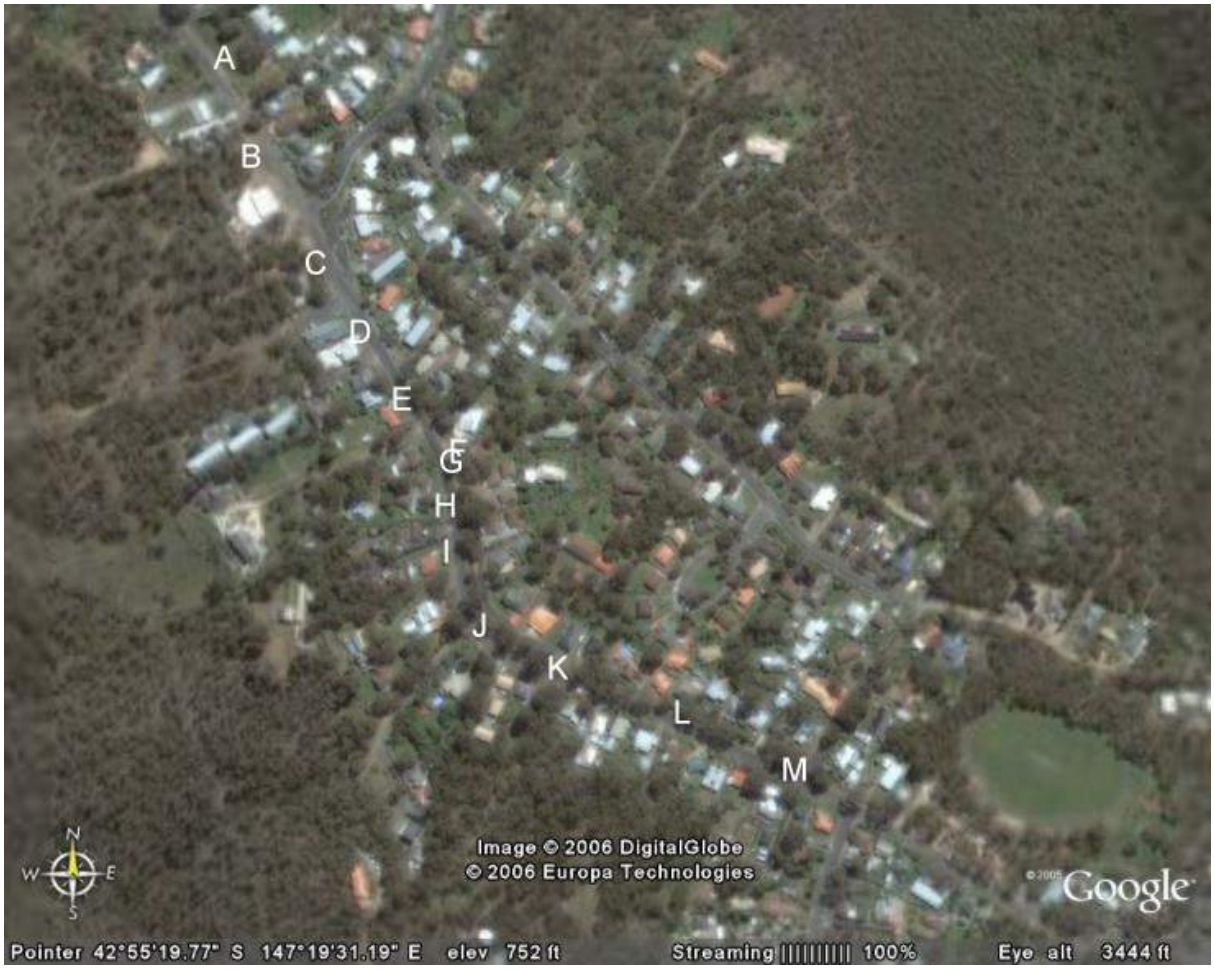
Appendix 2 – RF Susceptibility Test Raw Results

Test Date:	September 2006
Base Location:	QTH – VK7HK – Mt Nelson
Test Equipment:	Yaesu FT 847 Minimum power output 2.5w and maximum power output 100w
	Revex W560 Power/SWR meter
Test Antenna & Mount:	MobileOne M20-1 20m Helical Vertical
	Towbar mounted.
BPL Modem	Mitsubishi – CPE-AW10-01E00-W00-UOS – DS2 Chipset
Latency Test Utility	www.speedguide.net - TCPOptimiser.exe
	Latency function using the default URLs to get an average latency time in milliseconds (ms) whilst not-transmitting to get baseline then whilst transmitting.
Frequency:	14.000MHz
Mode:	CW
Testers:	VK7TW & VK7HK

State Measured -> **Location - Mt Nelson Rd V**	**Location Comments**	**Power (ave watts)**	**Modem signal LEDs (number on 3=Max Signal 0=no signal)**	**Modem Link LED (on/off)**	**Latency (ave ms)**
A **350m North West**	Opposite side of street to powerlines	0	3	On	277
		2.5	3	On	284
		20	3	On	287
		50	3	On	283
		100	3	On	292
B **270m North West**	On powerline side of road	0	3	On	281
		2.5	3	On	275
		20	3	On	260
		50	3	On	308
		100	3	On	292
C **200m North West**	On powerline side of road - opposite Olinda Grove, Mt Nelson Rd T-Junction	0	3	On	283
		2.5	3	On	Timed-out - no network connection
D **120m North West**	On powerline side of road - Front of Shop/Chemist	0	3	On	274
		2.5	2	On	299
		20	1	On	594
		30	1	On	638
		50	0	Off	Timed-out - no network connection
E **60m North West**	On powerline side of road	0	3	On	282
		2.5	3	On	Timed-out - no network connection

State Measured -> Location - Mt Nelson Rd ∨	Location Comments	Power (watts)	Modem signal LEDs (number on 3=Max Signal 0=no signal)	Modem Link LED (on/off)	Latency (ave ms)
F Driveway:	QTH of VK7HK - Notched area: 13.970MHz AM BPL present at S9+20 and at 14.000MHz AM BPL present at S7	0	3	On	283
		2.5 for 20 seconds	0	Off	Timed-out - no network connection and needed to re-login to ISP
G Curbside:	Front footpath of VK7HK QTH - opposite side of street to powerlines	0	3	On	296
		2.5	2	On	384
		10	1	On	1117
		15	0	Off	Timed-out - no network connection
H 40m South	Opposite side of street to powerlines	0	3	On	280
		2.5	2	On	Timed-out - no network connection
I 80m South East	On powerline side of road	0	3	On	292
		2.5	3	On	799
		5	2	On	Timed-out - no network connection
J 100m South East	On powerline side of road	0	3	On	294
		40	2	On	349
		100	2	On	508
K 160m South East	On powerline side of road near injection box.	0	3	On	290
		20	2	On	334
		100	2	On	360
L 250m South East	On powerline side of road	0	3	On	295
		100	3	On	310
M 400m South East	On powerline side of road	0	3	On	290
		100	3	On	297

Appendix 3 – Test Locations Aerial Map



Source: Google Earth.