LIGHT TESTS 25 NOVEMBER
PRIMROSE SANDS TO TOLMANS HILL

The objectives of these tests were:

- To attempt to break the VK 474 THz digital record
- To attempt a voice contact
- To check if a broad-beamwidth beacon, without a lens, could be copied over this path
- To make a visual evaluation of Justin's new "Big Box"
- To compare the performance of Mike's "Big" and "Green Boxes" on both TX and RX.

Summary

- A new 474 THz digital record was easily achieved with signals at around saturation levels on WSJT.
- Voice contact was made with some difficulty due to feedback.
- The broad-beamwidth beacon could not be copied over this longer path.
- It was not possible to make a visual evaluation of Justin's new "Big Box" due to alignment difficulties.
- Mike's "Big Box" performs about 10 dB better on TX and 15 dB better on RX than his "Green Box".

Equipment at VK7MO as Tolmans Hill

1. VK7MO Mike's "Big Box"
   a. 3 Watt Luxeon
   b. TX lens 400 x 340 mm, gain 51.3 dB
   c. RX lens 400 x 340 mm, gain 51.3 dB
2. VK7TAS Mike's "Green Box"
   a. 1 Watt Luxeon
   b. TX Lens 170x140 mm, gain 40.2 dB
   c. RX Lens 235x185 mm, gain 42.9 dB
3. Beacon
   a. 1 Watt Luxion
   b. No Lens, gain 0 dB

Equipment at VK7TW at Primrose Sands

4. VK7TW Mike's "Yellow Box"
   a. 1 Watt Luxeon
   b. TX lens 180 x 150 mm, gain 40.8 dB
   c. RX lens 250 x 180 mm, gain 43.0 dB

Weather Data

The aviation weather reports on 128.45 MHz gave visibility at beyond 10 km which seems to be the longest distance they give. There was haze prior to sunset in the direction of Primrose Sands and one would therefore assume significant attenuation.

Locations

VK7MO – Tolmans Hill
Latitude 42 Deg, 54 min, 28.60 secs South
Longitude 147 Deg, 18 min, 13.78 secs East

VK7TW – Primrose Sands
Latitude 42 Deg, 53 min, 56.03 secs South
Longitude147 deg, 40 min, 22.89 secs East

Distance between Stations

30.2 km

Relative Propagation Losses of Path compared to VK7ZIF

Based on inverse square law alone (ie assuming no absorption loss) and the following distances:

VK7MO to VK7ZIF 6.8 km
VK7MO to Primrose Sands 30.2 km

Additional path loss for inverse square law losses equals 13 dB.

Paths between Stations (Plan)
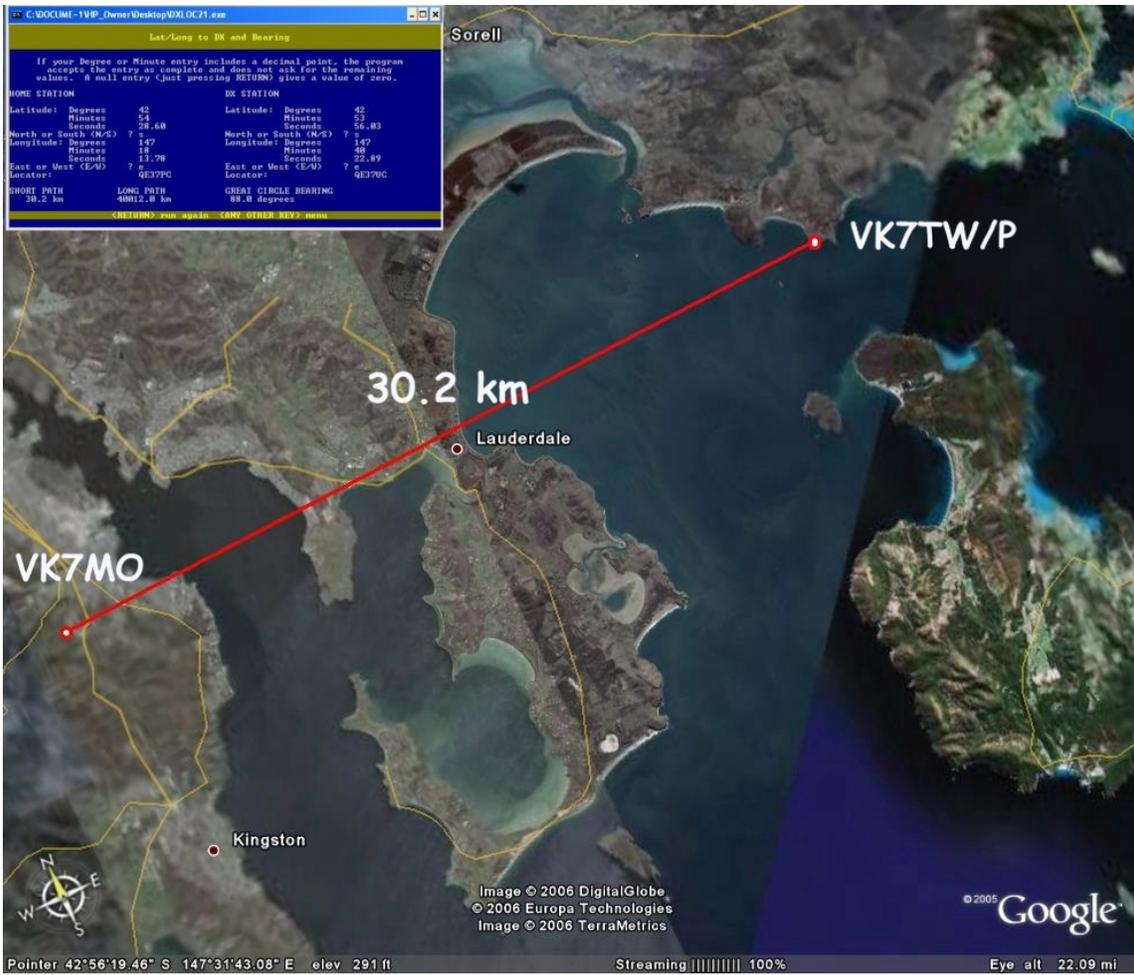
Paths between Stations (Slant view)

Digital Record Attempt

A tone of 1270.43 Hz was used to establish that a path was open and readily received by Justin.

Signals were at saturation levels (more than -6 dB) and a contact was readily completed. The following shows the All.TXT file at VK7MO with details of the contact.

082232 Transmitting: JT65A   VK7TW VK7MO QE37

093600 11 -1 0.7   0 3 *   VK7MO VK7TW QE37   1 10
093708 Transmitting: JT65A   VK7TW VK7MO -01
093800 6 -1 0.7   0 3 *   VK7MO VK7TW QE37   1 10
094000 11 -5 0.5   0 3 *   VK7MO VK7TW -06   1 10
094107 Transmitting: JT65A   VK7TW VK7MO R-01
094200 6 -6 0.5   0 3 *   VK7MO VK7TW -06   1 10
094400 7 -6 0.6   0 3 *   VK7MO VK7TW R-01   1 10
094522 Transmitting: JT65A   VK7TW VK7MO RRR

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094600 8  -5 0.6  0 3 *    VK7MO VK7TW R-01     1 10
094800 10 -1 0.7  0 3 *    VK7MO VK7TW R-06     1 10
095000 14 -2 0.7  0 3 *    VK7MO VK7TW RRR      1 10
095101 Transmitting: JT65A  VK7TW VK7MO 73
095200 12 -4 0.5  0 3 *    VK7MO VK7TW RRR      1 10
095400 8  -2 0.5  0 3 *    VK7MO VK7TW 73       1 10
```

The contact was recorded as completed at 0954 UTC on 25 November 2006.

Green Highlighting shows signals received from Justin and Yellow shows the messages sent by Rex.

The ALL.TXT file from Justin's end is as follows with the Blue highlighting indicating the signals received from Rex and the Red the messages sent by Justin.

```
093425 Transmitting: JT65A  VK7MO VK7TW QE37
093400 0 -33 -1.8  5 3
093600 9  -7 -0.3  0 3 *   VK7TW VK7MO -01     1 10
093800 14 -6 -0.2  0 3 *   VK7TW VK7MO -01     1 10
094010 Transmitting: JT65A  VK7MO VK7TW -06
094000 10 -6 -0.3  0 3 *   VK7TW VK7MO R-01    1 10
094211 Transmitting: JT65A  VK7MO VK7TW R-06
094217 Transmitting: JT65A  VK7MO VK7TW R-01
094200 12 -7 -0.1  0 3 *   VK7TW VK7MO R-01    1 10
094400 2 -22 -0.2 -5 14 *
094600 13 -6 -0.3  0 3 *   VK7TW VK7MO RRR     1 10
094800 Transmitting: JT65A  VK7MO VK7TW R-07
094807 Transmitting: JT65A  VK7MO VK7TW R-06
094800 9  -6 -0.4  0 3 *   VK7TW VK7MO RRR     1 10
095000 Transmitting: JT65A  VK7MO VK7TW RRR
095000 11 -5 -0.2  0 3 *   VK7TW VK7MO 73      1 10
095200 13 -6 -0.1  0 3 *   VK7TW VK7MO 73      1 10
095400 Transmitting: JT65A  VK7MO VK7TW 73
```

Voice Contact Attempt

After initial problems with feedback at Rex's end a voice contact was completed at 1035 UTC with Rex giving Justin 5/7 report and Justin giving Rex a 5/9 report.

The feedback problems might be related to the fact that Rex was operating behind a glass window as the voice contact was being undertaken in Duplex. However this needs further investigation as Rex has a feeling that the feedback is present even when not used behind glass. Rex was able to overcome the feedback by switching to the data input but this dropped signal levels to almost undetectable at Primrose Sands.

Beacon

Two attempts were made to receive the beacon based on a 1 watt Luxeon without a lens and thus some 51 dB down on Lens gain and another few dB for reduced Luxeon intensity.

Justin reported only one sync (at -32 dB) on the first attempt towards dusk and nil on a second attempt after dark.   On checking Justin's ALL.TXT file the next day is was seen that this sync had a timing of +0.7 seconds and a DF of +8 Hz compare to earlier valid syncs of -0.2 or -0.3 seconds and a DF or zero so this was in fact a false sync and we can conclude that nothing was received in either beacon tests.

The negative results of this test are a little surprising as the beacon gave signal levels of -4 dB when located at VK7ZIFs location which should be only 13 dB down in terms of inverse square law propagation loss. Other factors are atmospheric attenuation which increases according to distance and the lower receive performance of the "Yellow Box" in comparison with the "Big Box". If we assume the "Yellow Box" receive performance is similar to the "Green Box" this represents a loss of 16 dB - see tests below. Atmospheric attenuation is given in Mike VK7MJ's paper http://www.bluehaze.com.au/modlight/GrothArticle1.htm as follows:

TABLE II.   THE INTERNATIONAL VISIBILITY CODE

Code No	Daylight visual range	Description	Attenuation cofficients	
			(km^{-1})	(dB/km)
0		Dense fog		
	50 metres		92	400
		Heavy fog		
	100 metres		46	200
1		Thick fog		
	200 metres		23	100
2		Moderate fog		
	500 metres		9.2	40
3		Light fog		
	1 km		4.6	20
4		Thin Fog		
	2 km		2.3	10
5		Haze		
	4 km		1.2	5
6		Light haze		
	10 km		0.46	2.0
7		Clear		
	20 km		0.23	1.0
8		Very clear		
	50 km		0.09	0.4
9		Exceptionally clear		

If we assume that the haze noted prior to sunset persisted into the evening and that it was in the range "Light haze" to "Haze" on the above table then an additional 2 to 5 dB per km was possible or around 60 to 150 dB on this 30.2 km path. Thus compared to the beacon tests to VK7ZIF the situation is as follows:

	VK7ZIF	Primrose Sands
Distance	6.8 km	30.2 km
Relative Inverse Square Law loss	-	-13 db
Relative RX performance	-	-16 db
Atmospheric Attenuation	?	-60 to-150 dB
Expected Relative Signal Level	-	-89 to – 179 dB
Actual signal level	-4 dB	less than -30 dB

From the above we can see that the signal level could have dropped some 90 to 180 dB from the VK7ZIF tests so it is not surprising that nothing was received from the beacon.

The fact that something was received with the Yellow Box allows us to make some estimate of atmosphere attenuation as a balancing item in the following table:

	VK7ZIF Beacon	Primrose Sands "Yellow Box"
Distance	6.8 km	30.2 km
Relative Inverse Square Law loss	-	-13 db
Relative ERP	-	+40 db
Estimated Atmospheric atten'n	?	-24 db
Relative Received signal level	**-**	**+3 dB**

The above suggests that the actual atmospheric attenuation was around -24 dB or only around 0.8 dB per km which from Mikes table is in the range clear to very clear.

If we now recalculate the beacon comparison on the basis 24 dB atmospheric attenuation we get:

	VK7ZIF	Primrose Sands
Distance	6.8 km	30.2 km
Relative Inverse Square Law loss	-	-13 db
Relative RX performance	-	-16 db
Atmospheric Attenuation	?	-24 dB
Expected Relative Signal Level	-	-53 dB
Actual signal level	**-4 dB**	**less than -30 dB**

So even on the basis of only 24 dB atmospheric attenuation the signal level would be 53 dB lower on the Primrose Sands path so the fact that it was not received is in fact not so surprising.

Visual Comparison with Justin's New 400 mm square lens "Big Box"

Due to the difficulty of alignment it was not possible to make any useful comparison.

Comparisons of Performance of "Big Box" and "Green Box"

Rex was able to receive Justin on both the "Big Box" and "Green Box" at the same time and after Justin attenuated the signal it was found that the "Big Box" was receiving some 14 to 16 dB better than the "Green Box" which compares to only an 8.4 dB improvement that would be expected on the basis of Lens gains. This additional improvement could be due to improved pre-amplifier performance on the newer "Big Box".

To compare the TX performance of both boxes Justin attenuated his receiver lens and recorded the following:

```
111600 0  -4 0.3   0 3 *    VK7TW VK7MO QE37      1 10 Big Box TXing
111800 5 -18 0.2   0 3 *    VK7TW VK7MO QE37      1 10
112000 12 -7 0.3   0 3 *    VK7TW VK7MO QE37      1 10 Attenuator in place
112200 14 -4 0.5   0 3 *    VK7TW VK7MO QE37      1 10 Paper slipped!
112400 10 -5 0.4   0 3 *    VK7TW VK7MO QE37      1 10
112600 7  -4 0.3   0 3 *    VK7TW VK7MO QE37      1 10
112800 8  -6 0.3   0 3 *    VK7TW VK7MO QE37      1 10 Attenuator back in place
113000 4 -19 0.1   0 3 *    VK7TW VK7MO QE37      1 10 Green Box
113200 7 -15 0.5   0 3 *    VK7TW VK7MO QE37      1 10 Green Box
113400 5 -16 0.4   0 3 *    VK7TW VK7MO QE37      1 10 Green Box
```

The received signal level is in the third column and suggests that once the attenuator was in place the signal level varied from -6 dB on the "Big Box" to around -16 dB on the "Green Box" or a 10 dB improvement. Based on the increased lens gain one would expect an 11 dB improvement. Mike estimates only a further 1 to 2 dB from the increased power of the Luxeon as it spreads its energy over a wider area. Thus the expected increase is around 12 to 13 dB compared to the 10 dB achieved. However, as the signal level on the "Yellow Box" was -6 dB and close to the saturation level on WSJT this test needs to be repeated at slightly lower signal levels before we can draw firm conclusions.
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