Reflected Light Tests on 16 November

The objectives of these tests were:

- To attempt QSO's between VK7TAS and VK7MO and VK7TW and compare the different rigs and path losses.
- To compare signal levels with previous tests to gain an appreciation of propagation variability.
- To vary alignment to determine if signal strength might be improved

Equipment

1. VK7MO Mike's "Big Box"
    a. 3 Watt Luxeon
    b. TX lens 400 x 340 mm
    c. RX lens 400 x 340 mm
2. VK7TW Mike's "Yellow Box"
    a. 1 Watt Luxeon
    b. TX lens 180 x 150 mm
    c. RX lens 250 x 180 mm
3. VK7TAS Mike's "Green Box"
    a. 1 Watt Luxeon
    b. TX Lens 170x140 mm
    c. RX Lens 235x185 mm

Weather Data

I forgot to record the weather data at the time of the test. But during the afternoon Eric and I could see a light haze when looking at the Tasman Peninsular.

Locations

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

VK7TW
Latitude 42 Deg, 53 min, 46.5 secs South
Longitude147 deg, 18 min, 6 secs East

VK7TAS
Latitude 42 Deg, 53 min, 18.90 secs South
Longitude 147 Deg, 18 mins, 39.80 East

Empress Towers
Latitude 42 Deg, 53 mins, 19.03 secs South

Longitude 147 Deg, 20 mins, 11.59 secs East

Distances to Empress Towers

VK7MO 3.4 km
VK7TW 3.0 km
VK7TAS 2.1 km

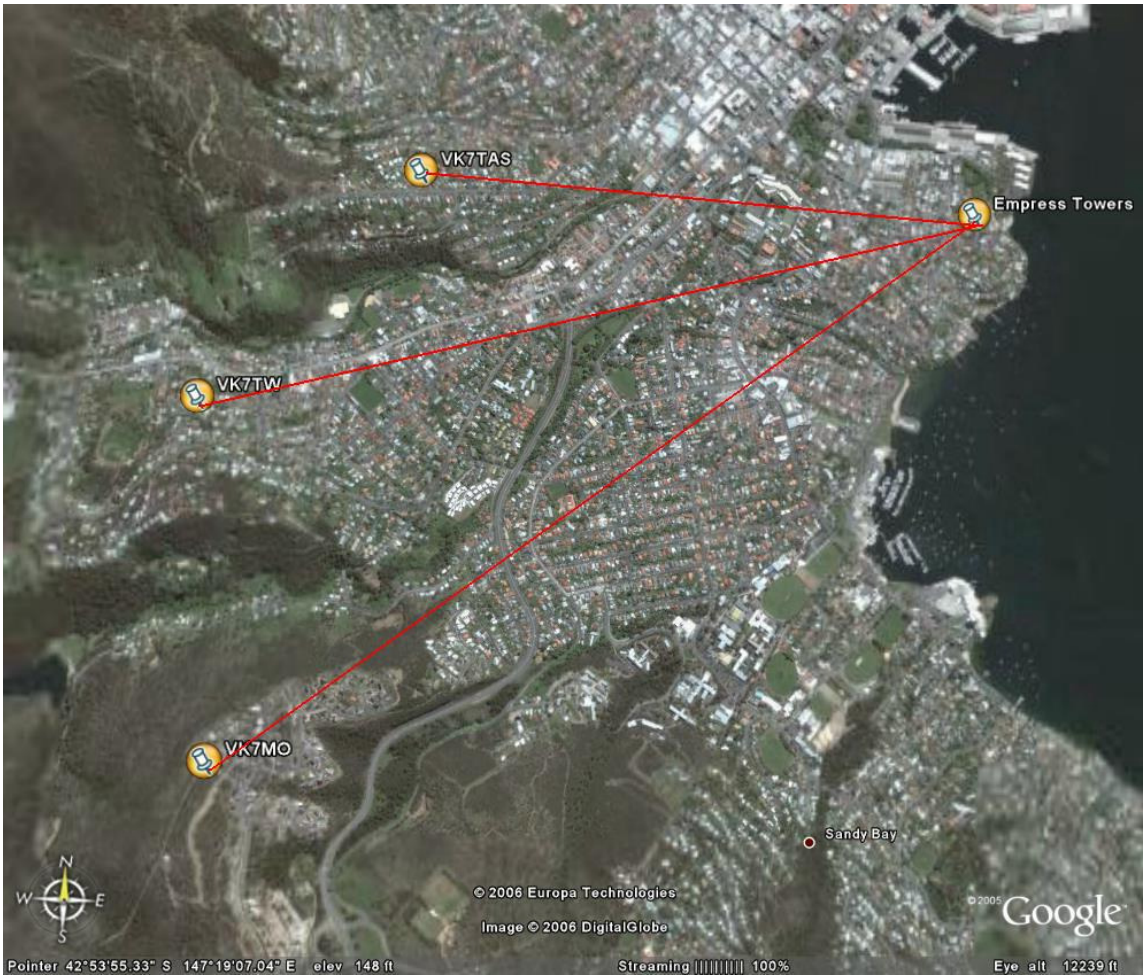
Total Path Length between Stations

VK7MO to VK7TW 6.4 km
VK7MO to VK7TAS 5.5 km
VK7TW to VK7TAS 5.1 km

Relative Propagation Losses of Paths no absorption

VK7MO to VK7TW 4.2 dB
VK7MO to VK7TAS 1.1 dB
VK7TAS to VK7TW 0 dB

Paths are shown in the following Google Earth Image


VK7TAS
Empress Towers
VK7TW
VK7MO
Sandy Bay
N
W
E
S
© 2006 Europa Technologies
Image © 2006 DigitalGlobe
©2005 Google
Pointer 42°53'55.33" S 147°19'07.04" E elev 148 ft
Streaming 100%
Eye alt 12239 ft

Three D image of Paths

QSOs and Path losses

QSO results with median signal levels in brackets were as follows:

VK7MO (-19 dB) to VK7TW (-20 dB) completed
VK7MO (-14 dB) to VK7TW (-17 dB) after alignment
VK7MO (-15 dB) to VK7TAS (-14 dB) completed
VK7TW (-32 dB*) to VK7TAS (-29 dB) not completed

* Rough Estimate Only

Using the relative propagation losses to correct for distance gives corrected results for comparison of rigs as follows:

VK7MO (-9.8 dB) to VK7TW (-12.8 dB) after alignment

VK7MO (-13.9 dB) to VK7TAS (-12.9 dB completed
VK7TW (-32 dB*) to VK7TAS (-29 dB*) not completed

On this basis both Justin and Eric are receiving Rex at the same level which is consistent with the fact that both are using similar sized receiving lenses.

Rex is receiving Justin 4 dB better than Eric even though both are using the same TX power and similar TX lenses. Justin is receiving Eric about 3 dB worse than the other way. Both of which are consistent with Justin Transmitting about 3 to 4 dB better with the "Yellow Box" than Eric with the "Green Box".

The improvement when the new "Big Box is used at Rex's end is from around -30 dB with the two older boxes to around -12 dB with the new "Big Box" or a total gain for the of around 18 dB. This compares with a previous assessment of the improvement at 10 dB prior to the improvement due to alignment. It is noted that the average improvement is about the same on both Transmit and Receive with the "Big Box". Assuming both the TX and RX are improved by about the same extent due to the increased lens size which Mike estimates at 6 dB much of this 18 dB improvement must be being achieved by improved RX performance and TX performance. Tx performance should be improved with the larger Luxeon. The improved RX performance in the "Big Box" is evidenced as lack of birdies due presumably to improved shielding and narrower beamwidth picking up less light interference.

If it really is true that the "Big Box" is picking up 18 dB on RX and TX then with a second "Big Box" this will bring signal to noise up to positive and reflected voice communication should be possible. It may also be possible to gain further alignment improvement by adjusting alignment at both ends and in the vertical as well as the horizontal plane.

The VK7TW to VK7TAS path did not produce a QSO although Eric did get six decodes at -25 to -30 dB and Justin did get an number of syncs at around -30 dB. A significant factor is that for this path the smaller lenses and Luxeons are being employed at both ends.

Propagation Variability

	12 Nov dB	13 Nov dB	13 Nov* dB	16 Nov* dB	16 Nov# dB
VK7TW	-21	-21	-20	-20	-17
VK7MO	-26	-23 (clip 99)	-18	-19	-14

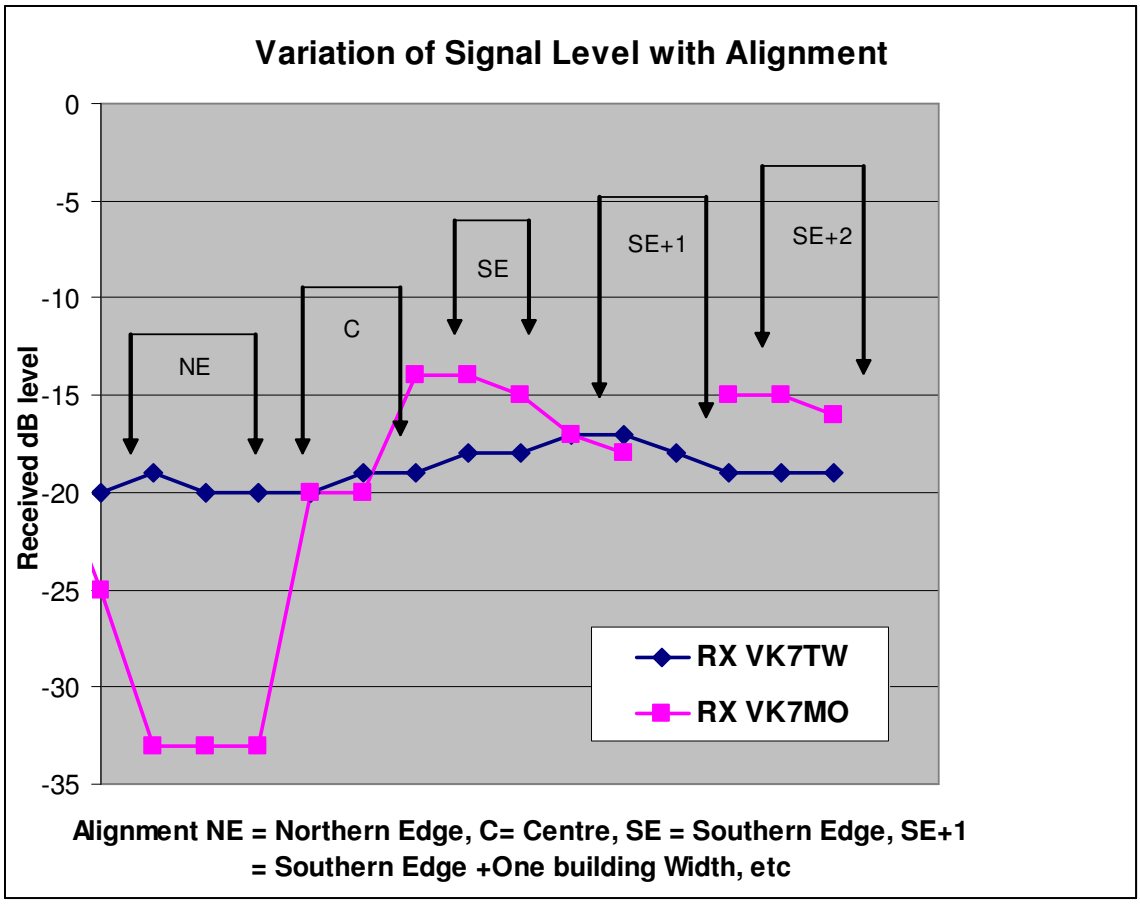
* Clip off and Zap on
# After Alignment

From the above results there is little evidence of propagation variability over these three days of testing and what little is indicated may well be masked by differences in WSJT settings and alignment as discussed in the next section. The only significant evidence of propagation variability was on 12 November when fog/cloud affected the path.

I think we will have to wait until we have sorted out the alignment issues before we can do much more on propagation variability.

Alignment

For this test Rex kept aiming at the centre of Empress Towers and Justin varied his aim in the horizontal plane only. The variations in received dB level are shown in the graph below:



The most obvious feature of the graph is the rapid fall in signal received by Rex when Justin beamed at the North Edge of Empress Towers. The measured signal level of -33 dB is the lowest that WSJT will go so the level could have well been lower. While the signal did peak for Rex on the South Edge of the building there was no rapid drop-off on the Southerly side. One explanation is that the TX lens at Justin's end is in fact miss-aligned and that it points to the building when the alignment telescope is around the SE

edge. It would be interesting to go even further South to see if there is a similar rapid drop-off at some point and then we could estimate alignment on the basis of half way between the rapid drop-off positions. I think there is a lot more we need to do to understand what is going on, such as adjusting alignment in the vertical dimension as well and also in both dimensions at Rex's end. The peak signal level at the South Edge is -14 dB at Rex's end compared to earlier results of -19 or -20 dB so there seems plenty of potential to improve system performance by optimising alignment in both dimensions and at both ends.

Another interesting point is that the signal level received by Justin varied to a much less a degree but also peaked around the south edge. This seems to imply that the receiving beamwidth at Justin's end is wider than the TX beamwidth but again to understand whether this is so I think we need to do tests that go sufficiently far either side to find the rapid drop-off in signal.