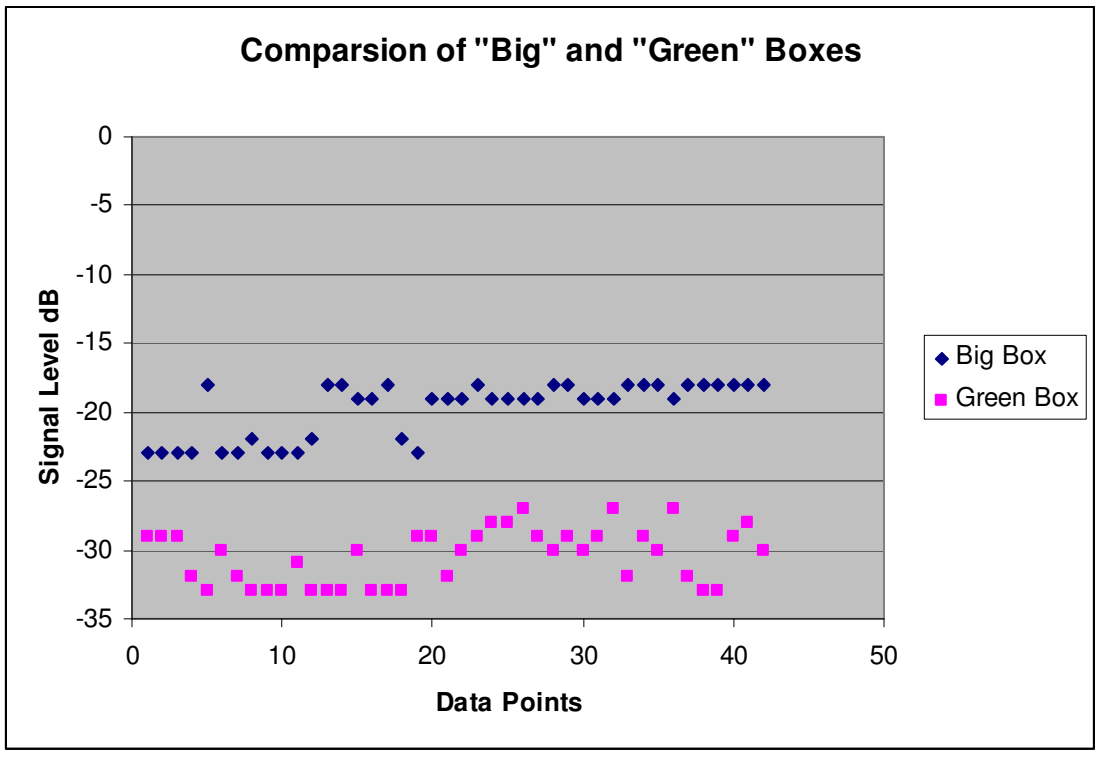
LIGHT TESTS – 13 NOVEMBER 2006

The objective of this set of tests was to use the reflected path from South Hobart (VK7TW) via Empress Towers to Tolmans Hill (VK7MO) to:

- Compare the performance of Mike's "Big Box" with his "Green Box".
- Compare signal levels with previous tests and thus gain appreciation of the variability of path loss.
- Examine the use of attenuators (blocking part of the lens) as a means of controlling signal levels for system performance tests
- Examine the affects of various WSJT setting on performance

COMPARISON ON "BIG" AND "GREEN" BOXES

For the full test the "Green Box" produced a median signal level of -30 dB and the "Big Box" -19 dB suggesting an 11 dB improvement on receive (see graph below). Now in part these results are masked by the fact that the system parameters were being changed on the "Big Box" to optimise it. Never-the-less the improvement is of the order of 10 dB and somewhat more than the 6 dB that Mike predicted on RX. This could be a function of the fact that the "Green Box" which has less (no) shielding suffered from birdies.



Note: On the "Green Box" Clip was set to zero and Zap to off. On the "Big box" clip was initially set hard at 99 until around data point 12 and ZAP was applied around data point 28. It is seen that the removal of clip on the "Big Box" improved signal levels around 4 dB and the addition of Zap might have improved things by part of a dB.

PATH VARIABILITY

The tests on 12 November with the same equipment (Mikes "Big Box" at VK7MO and Mike's Yellow Box at VK7TW) are compared below for median signal levels. The Weather conditions seems relatively clear following rain earlier in the day.

	12 Nov dB	13 Nov dB	13 Nov (clip off, Zap on) db
VK7TW	-21	-21	-20
VK7MO	-26	-23 (clip 99)	-18

Interestingly, Justin's results showed no change from 12 to 13 November, suggesting no change in path loss, where-as Rex's results showed a 3 dB improvement. Another interesting point was that there was very little variation in signal level at either end with the majority of readings within 1 dB. This compares to typical tropo-scatter VHF paths where the variability can be 10 dB or more.

These comparisons are complicated by the fact that system settings for Clip, Sync etc have not been stabilised and recorded. The tests in the next section show that Clip does have a significant effect on signal reports and Zap a smaller effect. For the future tests is is proposed that we standardise on the following settings.

Clip = 0
ZAP = ON
Sync = 0
NB= OFF
Tol = 10
Freeze = ON
AFC = OFF

In future we might try recording the weather conditions from the Hobart Battery point site at http://www.bom.gov.au/products/IDT60900.shtml

The record for Tuesday morning was as follows:

Station Name	Date/Time EDT	Temp ℃	App Temp ℃	Dew Point ℃	Rel Hum %	Delta T ℃	Wind					Press hPa	Rain since 9 am mm	Low Temp ℃ time	High Temp ℃ time	Highest Wind Gust		
							Dir	Speed km/h	Gust km/h	Speed knots	Gust knots					Dir	km/h time	knots time
Hobart	14/08:24am	8.0	3.1	4.2	77	1.8	NNW	19	20	10	11	1003.2	2.4	6.7 04:36am	8.0 08:23am	NNW	54 03:15am	29 03:15am

ATTENUATOR TESTS

The basis of these tests was to reduce the area of the transmitter lens ("Big Box") to see if signal level was reduced in proportion to area. The reduction was achieved by covering the outer perimeter on the lens with black cardboard. Test attenuators giving 6 dB and 10 dB reduction in area were prepared prior to the test. The results are set out in the Table below. It is seen that even a 6 dB reduction in area reduces the signal level to -33 dB or a reduction of 11.5 dB. -33 dB is the limit of signal detection on WSJT and thus the reduction may well be even greater. Thus is seems the light across the lens may be far from linear and appears to be much greater around the perimeter of the lens.

Area Reduction dB	Signal Level dB	Signal Reduction dB
0	-21.5	
6	-33	11.5
3.4	-27	5.5

A second test was then done with the area cut out to approximate only 3 dB reduction (as it turned out later measurements showed this to be 3.4 dB). The signal reduction is still much more than linear again suggesting that the light density is greater around the perimeter of the lens.

It would be interesting to confirm these results by reversing the procedure and blocking the centre of the lens to see if in fact less energy is lost and thus confirming that a lower proportion of energy is directed through the centre of the lens.

Note: On radio frequencies at 1296 MHz one goes to some trouble to try and equalise the density of the signal across the dish to obtain optimum performance. It would seem that a similar situation would apply to optical optimisation. For example, if the system was extremely non-linear then the inside of the lens would contribute nothing to system its performance and be wasted. In addition if the peak density is near the perimeter of the lens then it is likely that a significant amount of energy is being lost outside the lens and thus there might be potential for optimising system performance with a better distribution of energy across the lens.

WSJT SETTINGS

WSJT provides a range of settings designed to assist the recovery of decodes in situations where there is interference etc.

CLIP: Tests showed that clip has a significant effect on the signal reports with Clip =99 giving a median signal level of -23 dB and Clip = 0 giving -19 dB for reception by Rex. A test was done with Justin receiving at marginal signal level of -27 dB with Clip =0 and

when he moved to Clip = 99 indicated signal level dropped to -33 dB and he got no decodes. In normal VHF operations clip is useful for decoding in the presence of strong meteor pings and it was thought that perhaps it might be useful in clipping strong birdies, but these tests indicate that for Light transmission it is best to run with no clipping.

ZAP: Zap is designed to zap birdies (narrowband signals of approximately constant amplitude). It could be expected to have advantage when trying to receive a JT65 signal in the presence of harmonics from AC Hum or due to AC lights. Justin found it gave around 1 dB improvement in signal level and Rex who has almost no hum or light harmonics with the new "Big Box" saw perhaps a part of a dB improvement.

TOL/FREEZE: The Tolerance/Freeze facility allows one to set the frequency range at which WSJT attempt to find the JT65 reference tone of 1270.5 Hz. It is useful in avoiding the program locking on to birdies. In the case of out AM system the signal is always very close to 1270.5 Hz so it can be set without the need to retune as for SSB on VHF.

NB: The Noise Blanker is designed to cut out short impulse noises before decoding. As there is no evidence of impulse noise this is best left in the Off condition.

SYNC: The synchronisation setting establishes the minium correlation to find sync on the reference tone sequence. On VHF it can be useful in reducing the number of false decodes but in our case where we can operate with a very narrow tolerance false decodes are very rare so it is useful to set sync to zero. It should also be noted that WSJT attempts to average the results of successive transmissions in the lower window and that this can allow the decode of two or more transmissions that gain sync but do not decode. This process is only effective if the messages are not changed during the averaging cycle and thus one must continually clear the average if it is likely the message has changed for it to be effective. It can be useful in decoding signals that are reasonably consistent in amplitude around -29 to -31 dB. Given the relatively constant signal levels we have seen in the case of optical paths may well allow the last few dB of performance to be achieved.

AFC: The automatic frequency control function is unnecessary in this situation as the frequency is always stable unlike on SSB where a small drift between regs or due to Doppler off the moon needs to be followed.