224 km Cloudbounce Tests

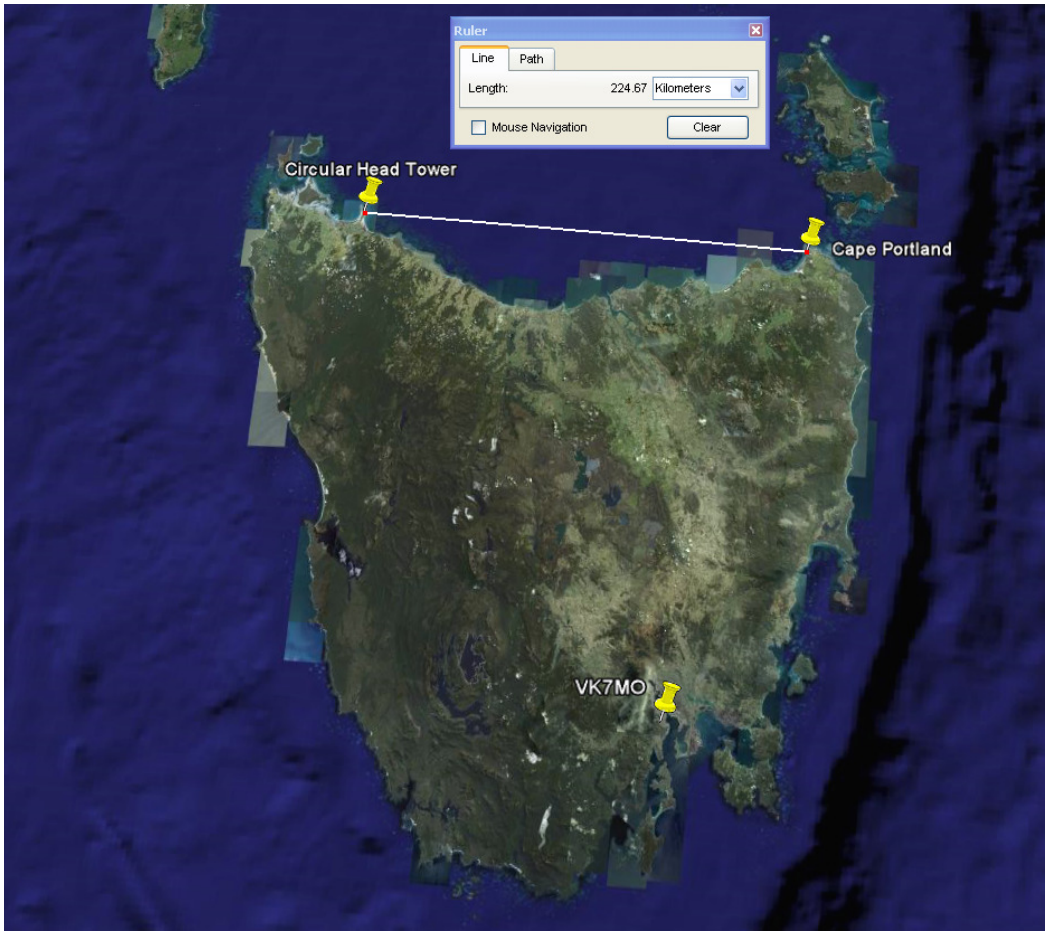
On 22 October 2008 Rex, VK7MO, and Joe, VK7JG, went portable to Northern Tasmania and conducted one way tests over a 224 km path with signal to noise ratio levels peaking 18 dB in 1 mHz bandwidth. There was little if any cloud present and signal levels were insufficient to attempt a WSJT test.

Equipment

The equipment used was the 60 Luxeon array transmitter and 10 mm square APD receiver as used for the 116 km tests and as reported at:

http://reast.asn.au/optical/118_km_Cloudbounce__Final_.pdf

Path



VK7MO was portable near the Circular Head Tower at around 120 metres above sea level and VK7JG at Cape Portland a few meters above sea level (photo below).

Meteorological Conditions

On the morning of the tests Midge Jones, forecaster, at the Hobart Regional Office of the Bureau of Meteorology advised that dry air was moving into the area and clouds were not expected on the evening of 22 October.

From the Circular Head end it appeared to be an essentially cloudless sky (consistent with the forecast) with stars clearly evident. Just prior to sundown there was evidence of thin stratus form cloud around 1 degree above the horizon in the direction of the transmitter. Extensive cloud was evident from the Cape Portland end (photo below).

The meteorological data from Launceston airport (approx half way along the coast but inland) was as below for the period of the tests. The period of the tests is highlighted in Blue and while there is some evidence of high cloud prior to the tests no cloud was reported during the tests.

STN	TIME DD/HHMM	ALTM inHg	TMP F	DEW F	RH %	DIR deg	SPD kt	GUS kt	VIS mile	CLOUDS
YMLT	22/1730	30.39	34	30	86	0	0		6.2	
YMLT	22/1700	30.42	34	30	86	0	0		6.2	
YMLT	22/1630	30.42	36	32	87	0	0		6.2	
YMLT	22/1600	30.42	36	32	87	240	5		6.2	
YMLT	22/1530	30.42	36	32	87	210	5		6.2	
YMLT	22/1500	30.42	37	32	81	210	6		6.2	
YMLT	22/1430	30.45	37	32	81	210	5		6.2	
YMLT	22/1400	30.45	36	30	81	190	5		6.2	
YMLT	22/1330	30.45	39	34	81	200	6		6.2	
YMLT	22/1300	30.45	37	34	87	200	7		6.2	
YMLT	22/1230	30.45	39	34	81	190	7		6.2	
YMLT	22/1200	30.45	39	32	75	200	6		6.2	
YMLT	22/1130	30.45	41	34	75	170	5		6.2	
YMLT	22/1100	30.45	41	34	75	160	6		6.2	
YMLT	22/1030	30.47	43	34	70	130	7		6.2	
YMLT	22/1000	30.47	45	32	61	140	11		6.2	
YMLT	22/0930	30.45	45	32	61	130	9		6.2	
YMLT	22/0900	30.45	46	32	57	130	9		6.2	
YMLT	22/0830	30.45	46	32	57	140	9		6.2	
YMLT	22/0800	30.45	48	32	53	140	10		6.2	
YMLT	22/0730	30.42	50	34	54	130	13		6.2	
YMLT	22/0700	30.45	52	34	50	140	13		6.2	SCT056
YMLT	22/0630	30.42	52	36	54	140	13		6.2	SCT055
YMLT	22/0600	30.42	54	32	44	150	15		6.2	BKN055

Background Light levels

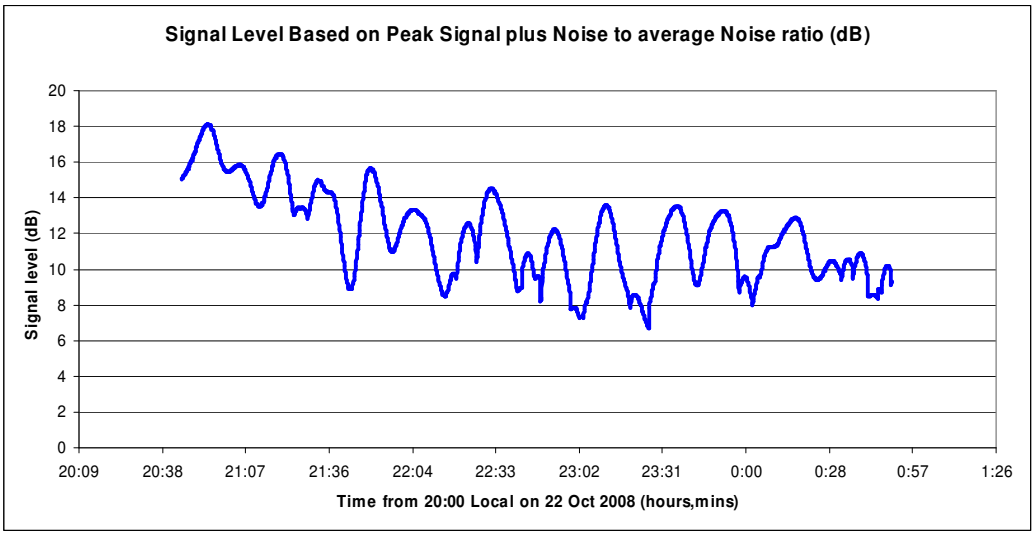
A cover up test showed the background light level fell only marginally as follows:

Exposed or Covered	**Milli-Volt reading**	**Equivalent nA level**
Exposed	1.0 to 1.2 mV	10 to 12
Covered	0.9 to 1.0	9 to 10

The moon was below the horizon and by beaming over the water there was virtually no external light, other than a minor amount from the village of Stanley that might be scattered in the air. Thus system performance was limited only by receiver noise**.**

Signal levels

Initial tests where conducted to measure signal to noise ratio of a tone in 20 mHz bandwidth using Spectrogram. These showed no evidence of a signal and bandwidth was reduced to 1 mHz and gave the following results:



It is seen that signal levels dropped over the 5 hours of the test with best signals at the start. This is consistent with the fact that reported cloud cover dropped off from earlier in the evening. The variations in signal level do, however, suggests that some variable was affecting signal levels and thus is seems likely that some residual amount of cloud was present throughout the period of the tests. It is noted that any residual amount of cloud can be quite small as when beaming at low elevation angles the cumulative cloud cover will be very much larger. The variation is signal level could suggest some standing wave pattern in the residual cloud.

Comparison with 165 km tests

The earlier 165 km tests (http://reast.asn.au/optical/165_km_Cloudbounce.pdf) gave signal to noise ratios of 26 dB (after correction) in 20 mHz bandwidth or equivalent to 39 dB in 1 mHz bandwidth. They were also conducted in moon light increasing background noise levels by around 4 dB giving an equivalent signal to noise ratio of 43 dB. The longer path 224 km path would account for about 9 dB difference so propagation losses (aside from path length) increased by around 12 dB.

For the 165 km tests there was around 30 to 50% cloud cover compared to just residual cloud cover in this case. It seems likely that the 16 dB or so reduction in signal level would be explained by the reduction in cloud cover.

CONCLUSIONS

- Signals have been detected via cloudbounce at over 200 km, even with negligible cloud cover.
- It seems that very small amounts of residual cloud might be sufficient to propagate light by scattering due to the increased cumulative cloud cover at low elevation angles.

Further tests are planned for the same path at times when good cloud conditions are forecast.