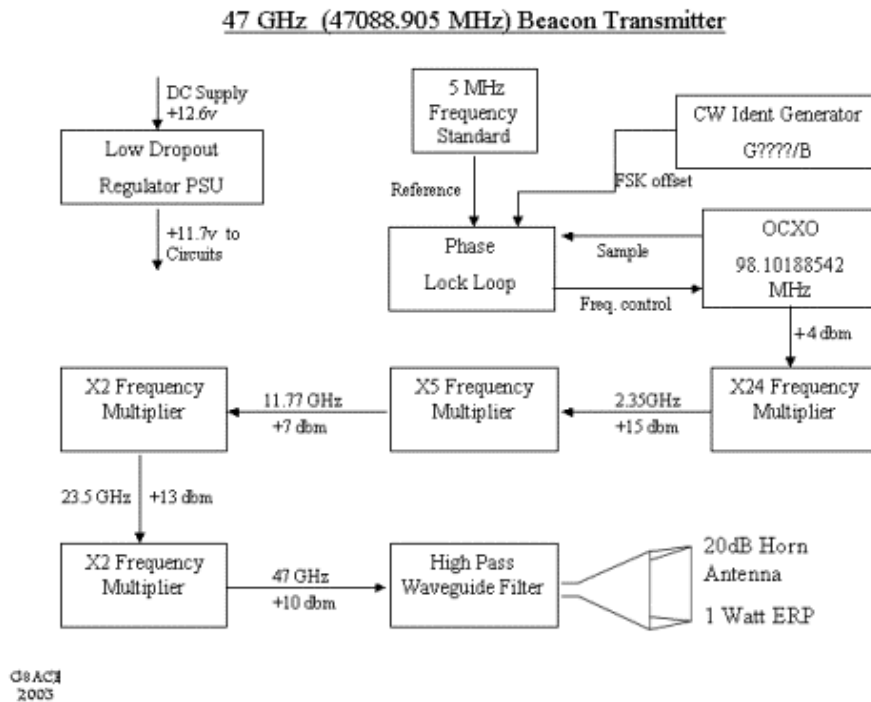


47 GHz (47088 MHz) Beacon Feasibility Tests and now installed and in Operation

During the winter of 2001/2002 some propagation tests were done between the QTH of G8ACE and G3JHM. A beacon transmitter was constructed and operated for six months until April 2001. After that date the transmitter remained unused. During the Autumn of 2003 the beacon was rebuilt with new oscillator (OCXO) and phase lock loop (PLL) modules. This employs the CT1DMK PLL design approach using a CPLD. A high degree of oscillator stability is achieved using a 5 MHz reference oscillator to lock the transmitter oscillator. The block diagram for the beacon transmitter is shown below.



The low power available from the final gaasfet multiplier means that a high gain antenna is required to produce a reasonable ERP.

A 20db horn antenna achieves this but at the expense of directional coverage.

By suitable bearing and location the beacon can cover an area of higher population although reception will be limited to line or almost line of sight (LOS) paths due the nature of millimetric wave propagation.

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The beacon was first tested by reflecting the signal from lorries on the M3 motorway some 2.5 miles distant from the constructors qth. [A Doppler shifted reflection.](#)

The beacon was next tested between a site SE of Winchester and the New Forest adjacent to the A31 main road. This a proven LOS path of 32km which also propagates 76 GHz satisfactorily. With plenty of signal in hand over this path plans were made to try the path between an existing beacon site in Dorset and the Winchester location used in the above test. This proved to be a negative result but by moving to a nearby location the signal was received a little above noise. The difference between sites according to profiles was the mid path obstruction is 32m for the first site and reduced to 22m for the second.

This shows quite well the care which must be taken at these frequencies to plan successful reception points.

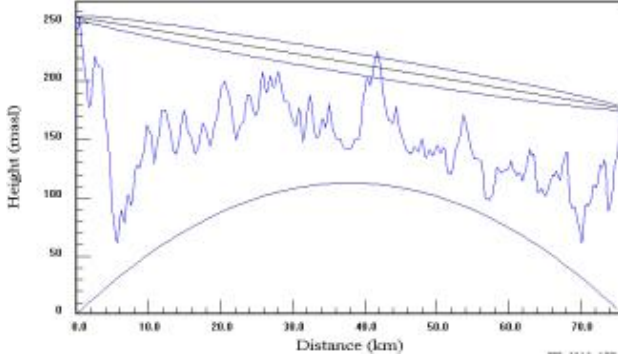
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-
Left.

The beacon Tx unit behind a bush supported on a short mast.

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Right.
The 47 GHz Rx dish upper right and the 24 GHz alignment aid using the beacon signal lower left.



The path profile showing a mid path obstruction. In this profile $K=1$ which provides optimum results between profile prediction and practice.

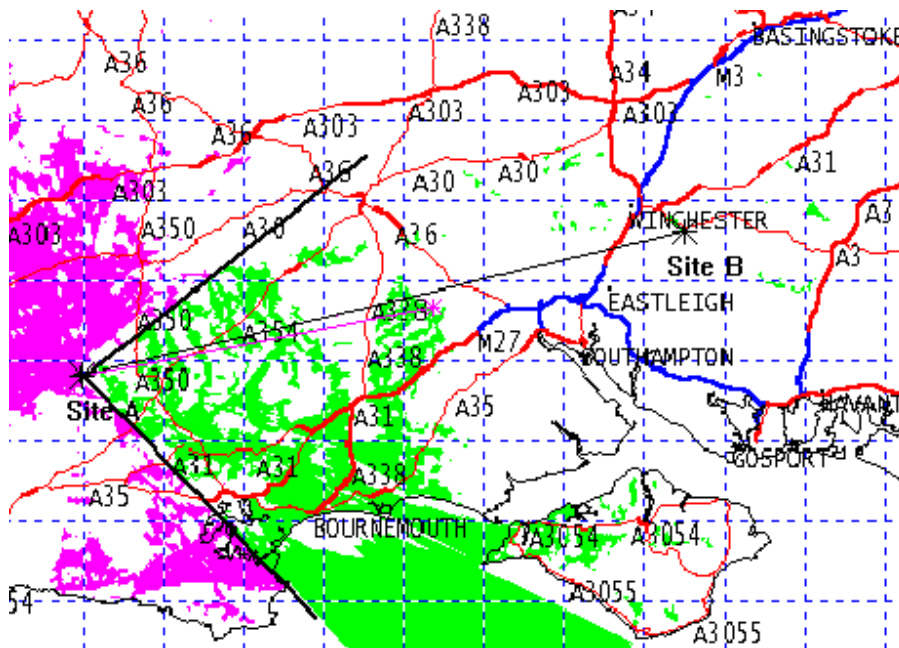
The path profile with its mid path obstruction is particularly challenging at 47 GHz. The mid path obstruction is hopefully a good knife edge diffraction point however located in the New Forest there is a high probability of tree and foliage coverage at this point. Improved elevation of the transmitter will decrease the mid path obstruction.

An audio clip of the received signal over the 75km path shown in the above profile. [Listen](#) The weather conditions were, temperature 7C humidity 69%.

The note of this signal is somewhat jittery. This highlights a further problem at millimetric frequencies where the crystal used is of poor quality. Multiplied by 480

Its deficiencies become quite obvious. Both the transmit and receive crystals have this problem. It was decided not to be to concerned about this as replacements might well be just as bad. Steps to improve this problem are described [elsewhere.](#)

The likely coverage of a beacon for Central Southern England is shown below. Coverage at the edges of the segment shown in green will be at a lower signal level.



The green areas show likely reception points where a LOS path can be established. The mauve reception if an omni antenna is employed but more power would be required to implement this. Reception is already established at Cheesefoot Head SE of Winchester the path shown by the black line. A distance of around 70km. Also at Deadmans Hill indicated by the magenta line. An IF signal margin of 30db here at around half the distance of Cheesefoot Head.



Since this information page was created the beacon has been installed on the Bell Hill mast. Some pictures below show the installation, the unit on the mast situated on the top centre pole and the view east from the Beacon site.



Chris G8BKE tightens the U bolts holding the beacon assembly observed by Andy G4JNT.



The antenna array for bands 2.3 GHz thro 47 GHz



The 47 GHz beam is directed thro the gap in the trees centre to point at Eastleigh shown on the map above.

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