

1W UK MW Station, Aerial system

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To : TECH@WW

Hi Readers,

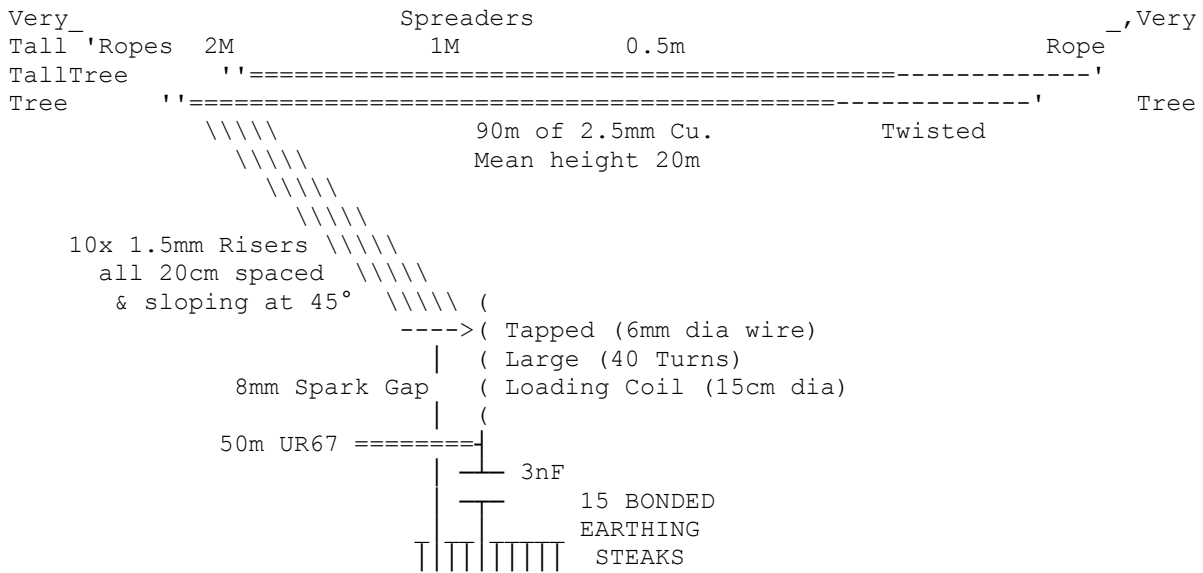
Updated 9/05

I have little ham experience of MF, but I over the last 4 years I have done four 1 month MW U.K. Restricted Service Licence broadcast stations on 531KHz (SUSY RADIO see bul). 531KHz (565m) is more than 3x longer wavelength than topband!

Only vertical polarisation is used for MW broadcasting, so horizontal radiating aerials are of no use. Also there is a severe licence restriction on RSLs that restricts the aerial height to only 20m, so to get a good 1W MONOPOLE ERP that is allowed is not simple!

This is how we do it...

THE AERIAL

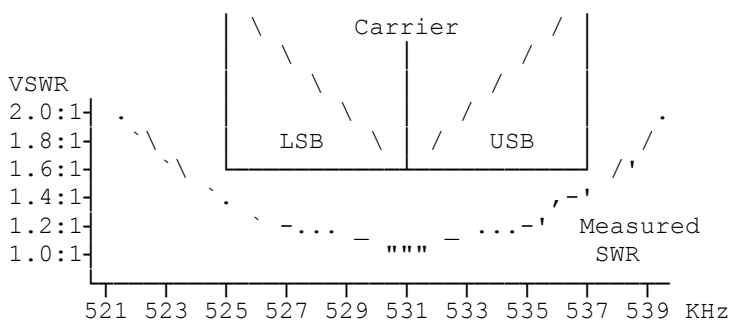


We use a modified inverted L, with a 45° sloping vertical underneath the top section. This proves very effective with no horizontal polarization & suitable for our site!

The 2 top wires were about 90m long, tied off in tall trees (2.5mm² really taugt (50Kg), & the sloper was 10 spaced thinner wires (1.5mm²) to carry the current (as we had plenty of that available). We used 3 plastic pipes as spacer bars for the risers & weight stabilised top spaces.

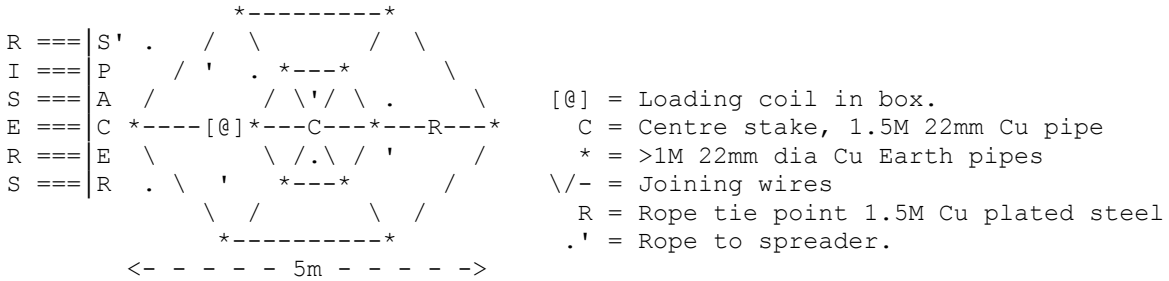
TUNING & BANDWIDTH

Loading was by a large tapped series L with 3nF across the coax as well. The tapping point (copper strip with wires attached) is moved up & down & around the coil around until the return loss is > 35dB (SWR 1.04:1) is found. Then the tapping point is soldered on to the coil & retested. Normally there is some frequency offset of a few KHz to this process, so it is repeated knowing the offset to get this well centred graph.



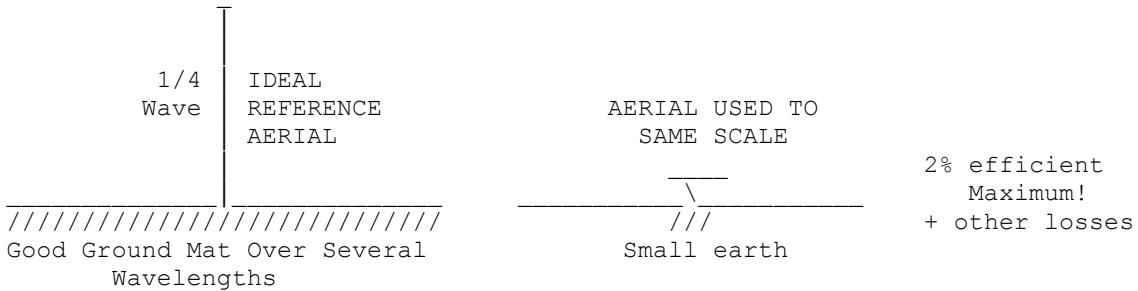
Tuning is very critical & only a narrow aerial bandwidth of ±6KHz is possible, up to 1.5:1, but this is just about OK of Broadcast AM. The Tx system is >-40dB @ ±9KHz.

EARTHING SYSTEM



The earths use copper pipes in 2 circles. We found that adding any more did not alter the aerial Z at all! Also adding 463ft counter poises had no effect. I think this was due to the wet ground conditions 1m underfoot! Watering & salting the copper rods can also help keep the earth mat losses low in dry summers.

AERIAL EFFICIENCY & ERP



As the aerial height was only 1/7 of a 1/4 wave, the maximum aerial gain is in the order of 2% (1/7 x 1/7) (-17dBi) as it was only base loaded. This figure is very close the radiation resistance method of calculation that gives 2.9%. But really the true aerial efficiency is all about ground surface resistance at the frequency, over something like 10 wavelengths radius & not just the local resistance!

As with all aerials there is near field (cube law) component & this should be much stronger than with a full size aerial due to "transformer action" (like TV timebases). This uncalibrates local field strength measurements, so it is not a very accurate method of estimation. Also affecting the field strength method are variations in the terrain, (e.g. wet clay valleys & nearby dry chalky hills). Of course in free space it is easy & accurate.

THE TX

The Old DECCA transistor LW Tx, on 531KHz was only capable of about 400W PEP max, above that it was totally non linear (Linear PA OK for CW @ 800W on LF!). So about 50W AM carrier is used for 1W ERP. In it's 1st life these Tx can produce 10W Monopole ERP (CW) with a tall 140M tower @ 250-300KHz, where linearity was not important as a CW beacon.

HARMONICS

With this frequency the 2nd & 3rd harmonics are actually in band (MW)! With the Tx harmonics are > -60dB & the high Q of this aerial system results in them being greatly suppressed. They actually can't be detected over sky noise at 400M from the aerial! (>-100dB ?)

1w ERP RANGE @ 531KHz

Coverage is about 60 miles with a good normal Rx (only 15 miles @ night due co. ch). With a comms Rx with quiet locations >400 miles. eg. we have Rx Dx reports from Finland, N Italy, N.Scotland, Channel Isle etc.

This seems extreme for a QRP MW station, but it would only be 1/3 of this range @ 1593KHz, and 1/9 the coverage area!

Why don't U send an interesting bulletin?

73 de John G8MNY @ GB7CIP