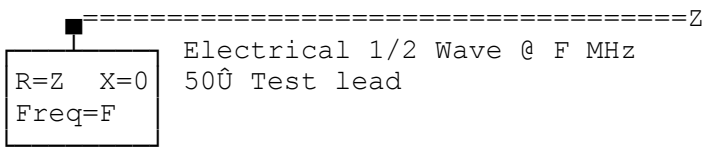
True VHF Impedance with MFJ259B

By G8MNY (Updated Dec 16)
(8 Bit ASCII graphics use code page 437 or 850, Terminal Font)

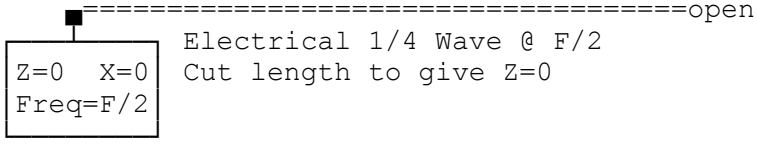
I have used this SWR Analyser instrument to verify & tune up a new commercial VHF Broadcast aerial for a local community radio station. I needed to confirm it was on resonance, the aerial design Z was as predicted (27Û) from aerial design (MM-ANA-GAL), & that my Matching & Balun to 50Û unbalanced, was all working correctly to help assure the predicted polar diagram would be met too.

MAKING A HALF WAVE LENGTH TEST LEAD

At VHF this is the starting point, so that anything placed on the end of the test lead, gives a true reading, without the need for Smith chart coax transformations.
Any multiple of an electrical half wave length will do this (1, 1.5, 2 etc.), but coax losses can mask the real impedance.



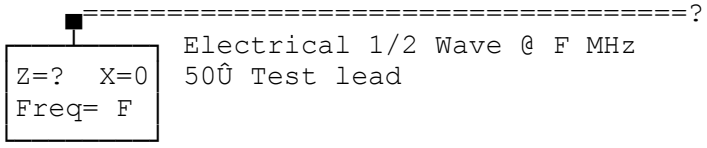
To make this lead I would normally use the quoted velocity factor of the actual coax. But with this analyser it is easy to cut to length, for a half wave, just use half the wanted frequency, that gives a short circuit reading..



Measuring the length also confirms the coax velocity factor & termination length errors. (Start at a slightly lower frequency so there is something to cut off as you get on frequency).

TESTING PRINCIPLE

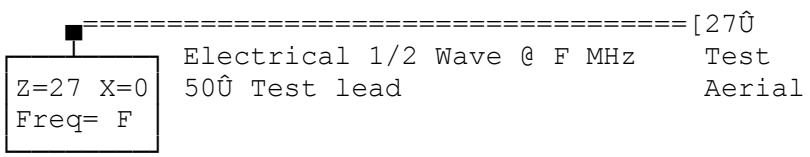
Now with this test lead made, I was able to confirm the accuracy of my method & testgear..



Any good RF Resistors & combinations (?) I put on the test lead, the Analyser accurately saw it, in the range to 0-650Û, & of course a good dummy load reads 50Û.

Testing the actual experimental aerial, I needed the coax with fly leads for the screw terminals, but later I terminated it in a PL259.

AERIAL TESTING & TUNING

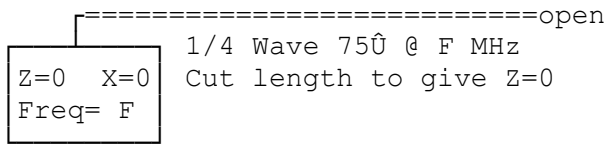


Using the test lead for measurement gave pretty close to the theoretical Z for

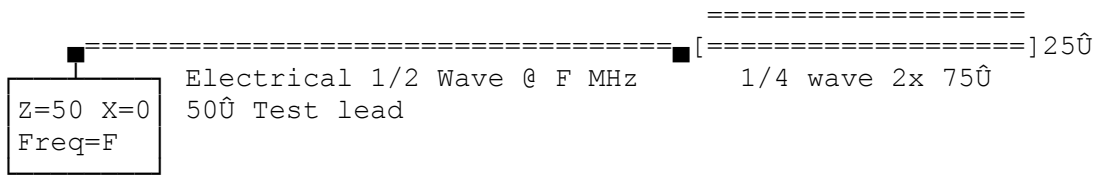
the aerial, but I had made it a bit bigger on purpose, so the reactance X was 0 at a lower frequency. I was then able to cut the aerial shorter until the resonance (X=0) was exactly on frequency.

Some of the more accurate work was done outside, to eliminate the building affecting things, e.g. any approach to either end of the elements saw quite a change!

AERIAL MATCHING
As this was to be a permanent aerial, & I did not want exposed gamma matching joints etc, so I used 1/4 wave of 37.5Û coax, which is actually 2x 75Û in parallel. Tuning up the length of this was done in the same way as the test coax except as 1/4 wave was wanted F was used...

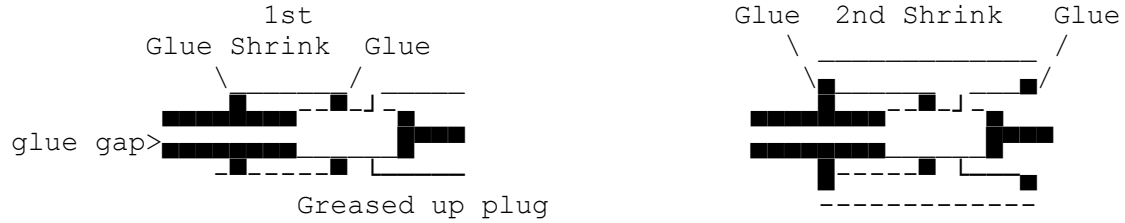


Then using 25Û load the matching was tested..,



The 2 matching coaxes were put into a PL259 plug, well you can't get 2 coaxes into one plug other than a PL259! It was convenient to use a PL259 to terminated onto an "Aerial Discharge Unit" bolted on the boom, The alternative was to use the bigger waterproof 'N' connectors, & a T joiner near the aerial.

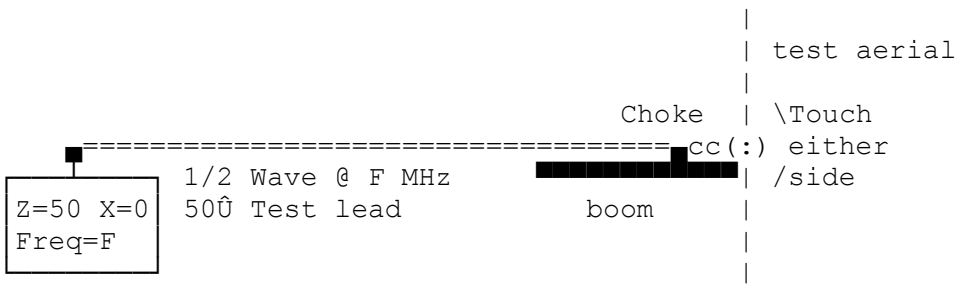
The PL259 was sealed from the Wx with water repellent Hot Vaseline inside, & then the outside cleaned, & heat glued in the cable gap, & a heat shrink sleeves put over the joint.



Once screwed up tight on the Aerial Discharge Unit, a 2nd glued on heat shrink was applied over the lot & painted up. This was an alternative to Self Amalgum tape, that can't be used with water repellent grease.

AERIAL BALUN
The 2x 75Û matching coaxes were coiled up to make a choke Balun. The whole lot was cable tied up close to the connection box to make the coils stay in place & painted to stop movement & UV damage etc.

The plug was connected to an Aerial Discharge Unit bolted to the boom. This ensured there would be no residual RF on the coax feed outer.



The effectiveness of the balun could be seen with the Analyser by touching the driven element either side of the connection box (:), it give the same SWR readings. If the choke balun was not working, or the aerial was slightly unbalanced, there would be a significant difference between the readings.

PROBLEM IN USE
One problem I found using the MFJ Analyser on a hill top, was due to external high field strengths being picked up by the aerial. In this case the low osc power sent to the aerial was lower than the RF power being picked up from nearby broadcast masts on the same hill. This resulted in as a misleading high SWR & time wasted faulting "Red Herrings".

See my Tech Buls "PL259 Losses", & "Coiled Coax Choke Balun for VHF"

Why don't U send an interesting bul?

73 de John G8MNY @ GB7CIP