20m Covert Dual 3-Element Beams - G3ASG

By adopting to use a single reflector element which is common to both beams, the antenna can be made to fire in opposite directions. Fig.1 gives a plan view of the system.

Limitations of the available loft space determined the spacing between the elements. It was found that by using 0.1 wavelengths between each of the elements the two antennas would just fit the QTH's loft.

Lengths of the elements for the 20m antenna were calculated for 14.17MHz using the formulae shown on the next page.

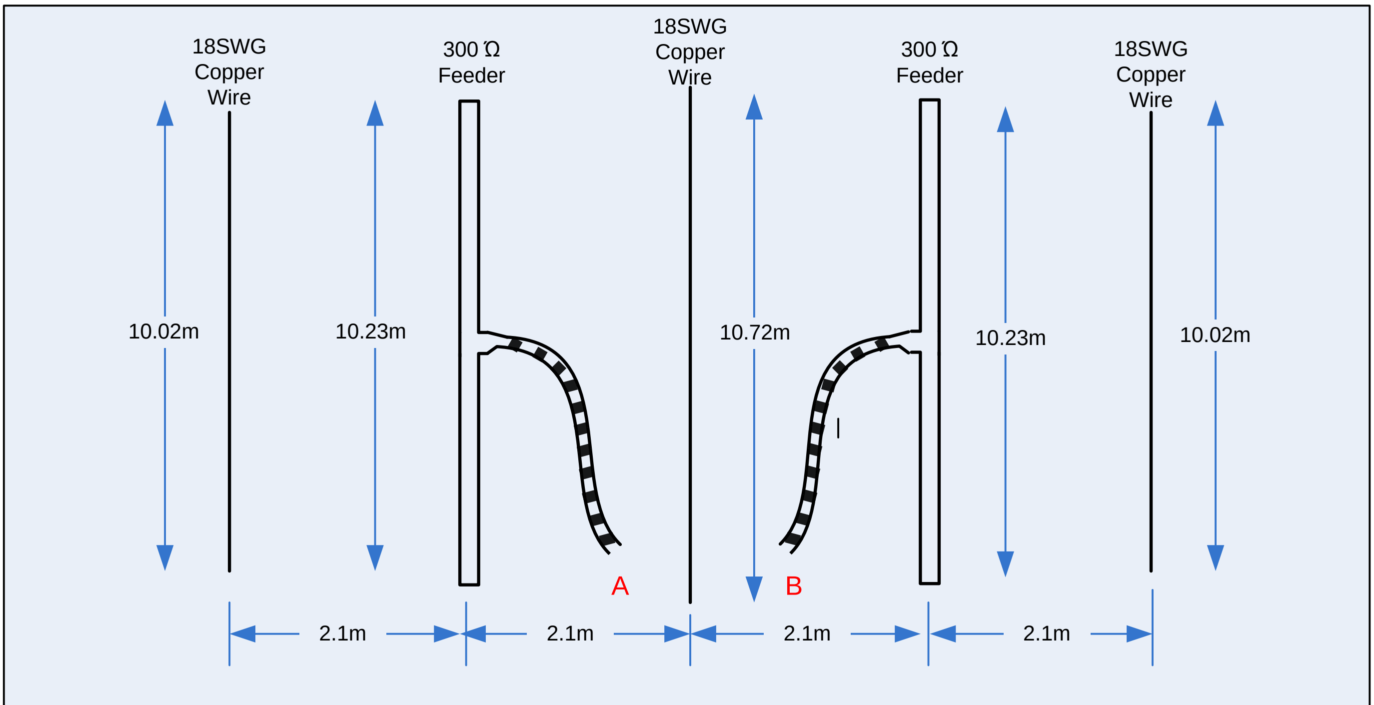

Fig 1   PLAN VIEW OF LOFT

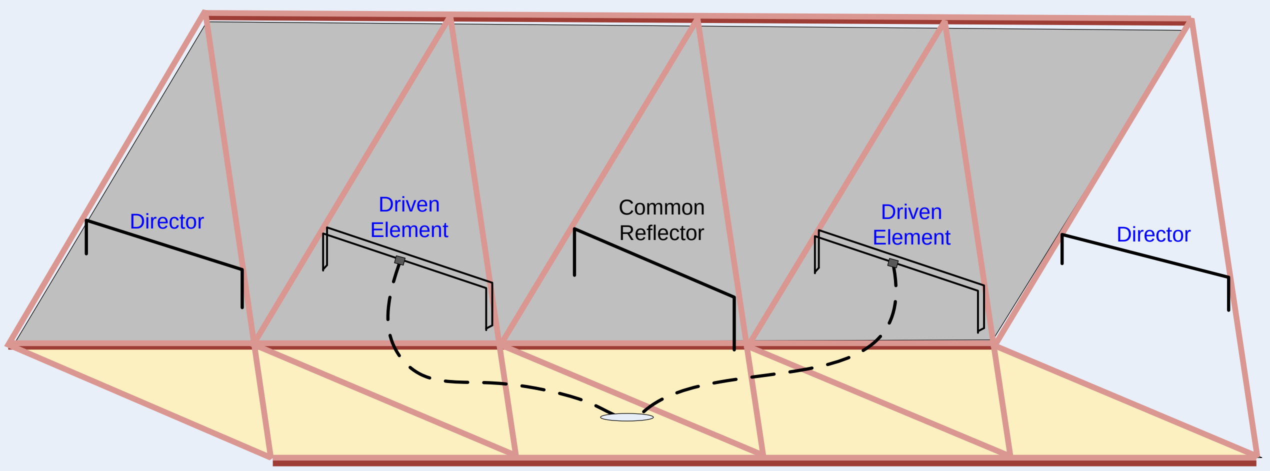

Fig2   How the Antennas are deployed in the loft

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The formulae used to calculate the beam's elements

Common reflector length $L_{refl} = \frac{152}{f} = \frac{152}{14.17} = 10.72m$

Driven element lengths $L_{driv} = \frac{145}{f} = \frac{145}{14.17} = 10.23m$

Director element lengths $L_{dir} = \frac{142}{f} = \frac{142}{14.17} = 10.02m$

For a 20m antenna using this design it is likely that a maximum spacing 0.1 wavelengths will be possible. However whatever space you've got divide the length of the loft by 4. This will give you the maximum spacing possible between the elements,

e.g. If the loft is 9m long, then the spacing will be *9+4* = 2.25m

which is a spacing of 0.106 wavelengths on the 20m band.

Next find the centre of the loft where the common reflector will be located, then mark the positions for the other two elements each side of the reflector. The driven elements need to be placed half way between the common reflector and the directors that will be located close to the extreme ends walls of the loft as shown in Fig 2.

By using 300 ohm feeder for the driven elements, and making them into folded dipoles, the antenna terminal impedance is multiplied by 4. This is useful as close-spaced beams give rather low impedance lit their feed points and may then be difficult to match.

Panel pins driven through the centre of the Feeder insulation into the timber is quite good enough to ensure support for the driven elements. If ordinary wires are used for the reflector and directors, then just give the wires a single turn around a panel pin hammered into the timber to give support every couple of metres. This simple type of fixing is quite effective as the antenna will never get affected by rain or snow, etc. (At least it shouldn't!)

Each driven element is fed with 300 ohm feeder connected as shown in Fig. 1. If the two feeders are made *exactly* the same length then it should require very little adjustment of the antenna tuner controls when changing from one beam to the other on the same frequency.

The two equal lengths of 300Ohm feeders could be wired to a 2-pole 2-way switch(suitable for transmitting as in Fig 3.) Then it would be simple to switch from one beam to the other

This is very helpful if you happen to be a contest type! Obviously this antenna design is not as effective as a rotateable three element beam mounted on a 60ft tower, but the two indoor beams do work!

Enjoy Ray G3ASG

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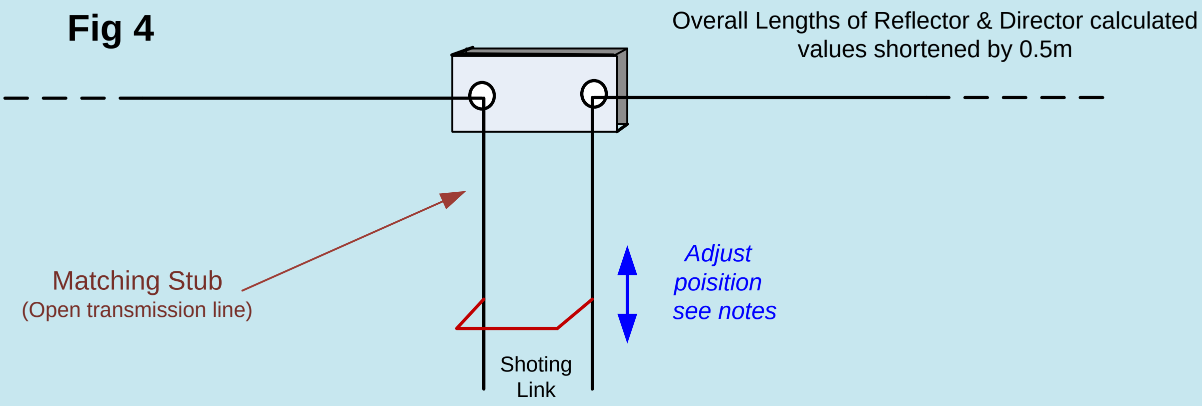
Fig 4



OPTIMISING THE BEAM'S PERFORMANCE

If you have a friend who is able to help you it is possible to set up the element lengths for optimum performance. This operation needs a Field Strength Meter (FSM) placed several wavelengths away in line with the direction you want the most signal to be radiated. It also needs the reflector and both director elements to be cut about *0.5m shorter* than the design figures, and a tuning stub of about a metre inserted at the centre of each element (see Fig. 4.)

Then it's a matter of adjusting the position of the short (a piece of wire about 2cm long with a crocodile clip fitted at each end)

i). *On the directors for **maximum** field strength indication*

and *ii). On the common reflector for **minimum** field strength indication*

to give the best forward gain with maximum front-to-back ratio for each of the beams.

An insulator has to be inserted into the centre of the reflector and director to support the open transmission line matching stub. This can be made from any type of insulating material, e.g. polythene of Perspex sheet with holes drilled in it for the two wires that will hang vertically.

The optimised condition is obtained by first setting all the shorting links of the stubs to the midway position (as in Fig. 4), then switching on the transmitter at the band-centre frequency (14.17MHz for 20m) then matching with the Antenna Tuner Unit (ATU) and noting the initial FSM indication.

Start by moving the reflector stub about 10cm nearer to the element and re-adjusting the ATU controls to match the antenna again.

iii). If the new FSM indication is less (what we want to achieve) then move the stub some *5cm* nearer to the element.

iv). If the meter indication increases then move the stub some *5cm* away from the element.

Each time a change in stub position is made, remember to re-adjust the ATU for correct tuning and matching.

Finally, when no further improvement can be achieved, carefully mark the position of each shorting wire using a marker pen, and then remove the temporary shorts. Solder a piece of wire across each marked position. It may be a bit of a struggle, but well worth the effort for the improvement in performance.

Please note that optimisation can be quite a lengthy business before the correct positions for reflector and director stubs are found, since a change to one element nearly always affects the stub position of the others! Eventually, though it is possible to get to the best compromise.

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