´Maria Maluca´ Antenna – more than a compromise ?

Shortwave antennas have to follow the laws of physics as well as VHF/UHF antennas. In both frequency ranges a 3-element-yagi can only offer approximately 6.8 dBd (8.95 dBi) gain. Moreover in this case the boom has to be more than 0.4 λ long.

Contrary to VHF/UHF antennas shortwave ones can usually not be installed in heights that are a multiple of the used wavelength. Therefore significant parameters like elevation angle or matching impedance depend on the height of the antenna. Necessary corrections increase by using multiband- or mini antennas with traps or capacitive loads. An antenna tuner in the shack is no solution of the problem: The additional loss due to high swr on coaxial transmission lines can become extreme.
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Much more efficiency will be achieved by strict implementation of the old trustworthy principle ***antenna - open feeder line - tuner*** as a resonant unit. The loss of traps, loading coils and capacitive loads will be eliminated and the reduced bandwidth of the antenna is longer a problem. Already in the sixties in South America a 2-element antenna for 10, 15 and 20 meters appeared with the charming name ***Maria Maluca***.

This small beam fed with VHF ribbon line consists of a 15 m dipole and a director adjusted for the 10 m band. Gain is detectable on both bands, while on 20 m the antenna reaches the perfomance of a rotary dipole. With a length of 11.7 m or 18.5 m of the feeder a reasonable swr can be achieved on these bands. That was ok for transmitters with pi-filter in the final stage.

It was a challenge to optimize this old antenna design by means of modern software on NEC basis. The result was a 6 band version from 20 m through 6 m showing reasonable dimensions. The main goal of the design was good gain and an easy handling scheme of impedances on all bands. It was really amazing what data this small multiband beam with a rotation radius of 3.9 m was able to offer:

Band	***Impedance Ohm***	***Free Space Gain dBd***	***Gain at 12 m Height* dBi***	***Vertical Elevationangle °***	***F/B Ratio dB***
20 m	28.4 – j275	0.1	8,13	23.5	0.43
17 m	56.9 – j62	1.2	8.45	18.6	2.63
15 m	34.3 + j80	5.1	12.44	15.7	13.72
12 m	144.7 + j417	3.1	10.64	14.0	-7.86
10 m	379.7 + j652	2.6	10.51	12.0	-5.05
6 m	96.4 – j383	3.4	11.27	7.1	-2.06

* above real medium ground

Tab.1 Performance of the optimized 6 Band ‚Maria Maluca'

On the 6 to 12 m band the F/B ratio is negativ because the director acts as reflector of the extended dipole. That means a turnaround of 180° is necessary. This little flaw will be overcompensated by the other data.
The construction of the antenna is quite simple: The 40 x 40 mm aluminum boom shows two 20 mm holes at each end in a distance of 1,46 m to carry the elements. These elements consist of aluminum pipes of different diameters fitting together. The outer ends are slotted and provide together with hoseclamps out of stainless steel an excellent connection. The perfectionist can spend an additional selfcutting screw. This method has an advantage if the antenna is often assembled and disassembled.

A rod made of heavy duty glassfaser reinforced polyamid provides excellent electrical separation of the radiator as well as high bending strength. The easy rod fixing by means of a M8 screw and nut is shown in Fig.1.
The radiator pipes are also fixed with hoseclamps on the rod in a distance of 15 mm to the boom. These clamps can also be used as connection terminal to the transmission line. The impedance of this line is not critical. Both 300 and 450 ohms will fit. Good experience was made with the 450 ohms ‚wireman'-line CQ 552: low loss up to 1kW power and high mechanical/electrical reliability under poor weather conditions.

Fig.1 Rod fixing

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Basically the length of the transmission line is determined by the distance antenna-shack and not critical. On the other hand the line effects a impedance transformation depending on length and frequency. In every case some lengths can be found where the transformion ratio is so comfortable that even tuners onboard of transceivers can handle these impedances. When you form the last 2m of the line as a bifiliar coil you get a low loss broadband balun at the tuner port. For CQ 552 wireman line the transmission loss will be 0.02 dB @ 50 MHz (!). Of course you can save the balun when using a real balanced tuner.

Fig.2   Example of an ‚airwound' Balun

On the 20 m band this balun guarantees with an effective length of aprox. 0.1 λ still full performance at a loss of only 0.01 dB. So please don't use any ferrit loaded devices.

Two current probes were fitted in both legs of the wireman to check the balance. The symmetry of the whole antenna system was absolutely sufficient.

Take care that the distance to metal parts along the line is at least 15 to 20 cm.

Fig.3 Maria Maluca ‚on the air'

Fig..3 shows the *Maria Maluca* on top of the roof during tests. Above this smart beam you can see a 13 element yagi for 432 MHz operation.

The results were convincing. In comparison with a multiband vertical in the same heigth signal/noise ratio was at least 10 dB better. The Maria Malica also collected less noise from the neighborhood.

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The tuner is also effective in the RX path and easily improves the selectivity of the RX.

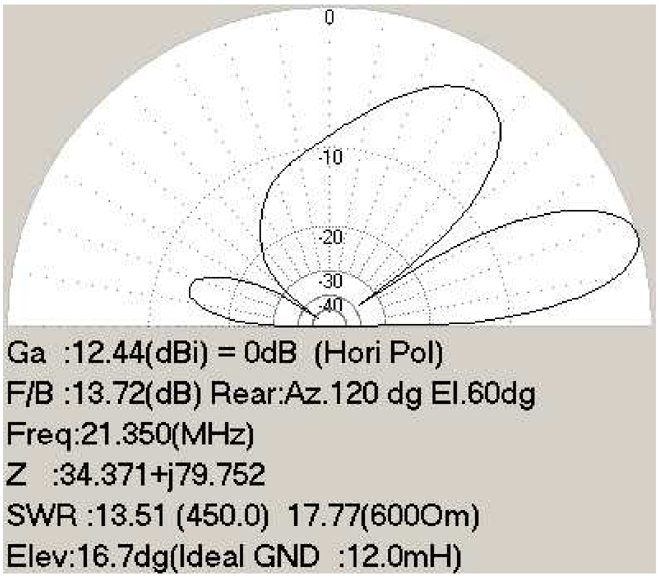

Fig..4   Vertikaldiagramm für 15 m Band

The typical vertical elevation diagram shows in Fig. 4 the unlimited qualification as DX antenna. On the 15 meter band the optimized *Maria Maluca* is evenly matched with a 3 ele. fullsize beam, who needs double boom length for additional 0.7 dB gain.

This small 6 band antenna is also recommended for portable- and expedition operation. During transportation most of the pipes fit in boom tube. The necessary space is less than a pair of ski with maximum length 1.50 m and 12 lb weight.

Assembling will take less than 15 minutes, when the resulting lengths of the pipes have been marked before (e.g. color, tape).

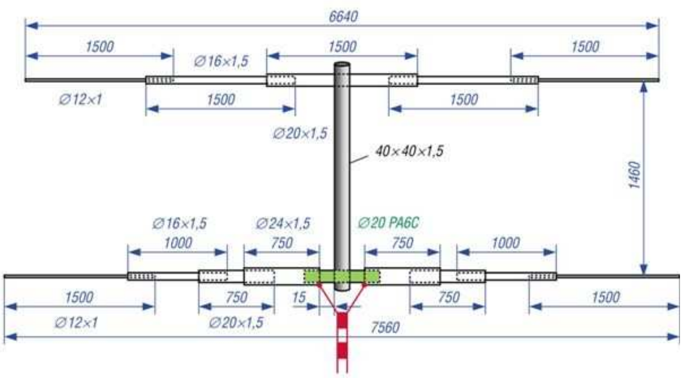

Fig. 5 Structure of the antenna

The dimensions of different aluminum pipes are shown in Fig. 5. The structure of the aerial was designed acc. to mechanical requirements and the availibility of standard stuff.

Material Kits with all hardware are available from the author Dipl.Ing. Helmut Oeller, DC6NY via oeller@freenet.de