

A 3 Elements Yagi Antenna for 10 meters Band.

A serious DX 'BIG GUN' antenna for your station.

History first:

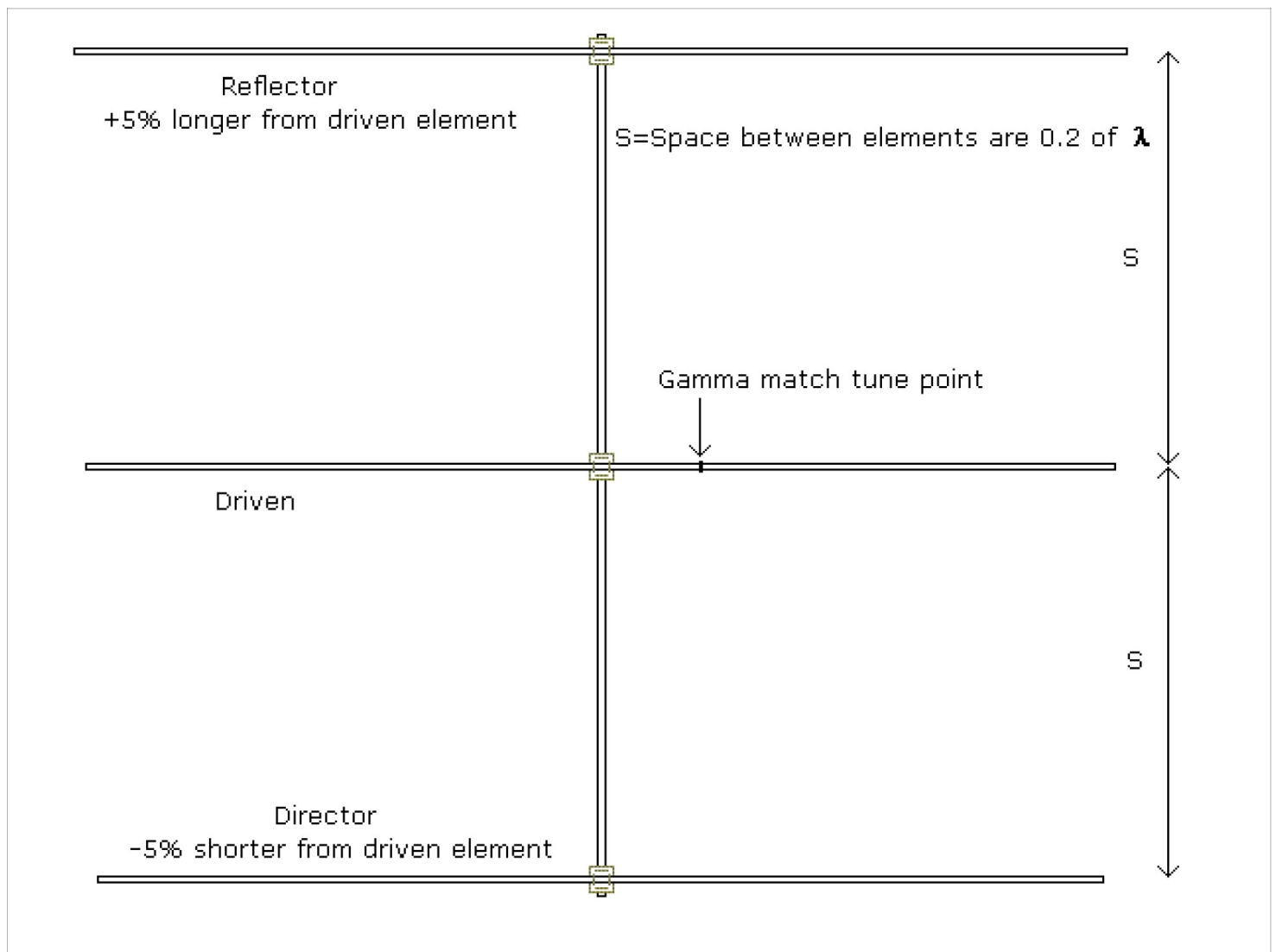
At early of 90's, when I was a CB operator, and I'm looking to build a serious DX antenna. Sooner exclude all the vertical antennas and I was between Quad and Yagi antenna system. The Quad antenna was a very difficult for an inexperienced user like me (I have not been radio amateur yet). So the Yagi antenna system was one-way.

By asking and searching, finally comes in to my hands a Greek book with a title: **"How to become a CB operator"**. In this book existed chapter dedicated to antennas including a three element Yagi. Ooops here we are I think and ... yes ... well I'll try it out.

Quickly I begin compute all the dimensions the materials how and when and were and ... etc. Few days later I bay all the materials when I need to construct the antenna. I spent two afternoons to marking and drilling carefully all aluminium. I bay also a low duty TV rotator to do the "dirty job" hi-hi. Then I was ready to install my "big gun" I do this in the middle of the summer at 1991. The project looks in my eyes like a beast.

Compute:

The sketch below give the original dimensions of the three elements Yagi antenna.



I start first from Driven element. The equals are: $299,8/F/2 \cdot K$ factor (for 10 meters band using 22 mm diameter tube the K factor is close to 0,94). Reflector is 5% longer and director 5% shorter than the driven element.

ATTENTION HERE PLEASE!

The calculation formula above is valid for a 22 mm diameter aluminium pipe.

If you use a different diameter conductor, the shortening factor changes. If you have in your mind to use as active element any power cable or other type of cable with external insulation, like is a common cable for loudspeaker then you will still be out of desired tuned frequency of antenna.

For example, a friend who tried it built the antenna by using electric power cord, is out of target by -600Khz! Namely, this antenna tuned to 27,500MHz and not 28,100MHz which is the original goal of the project.

So you must pay your attention to shortening factor of active elements. The value of shortening factor depends mainly on the diameter of the conductor and the outside insulation if exist.

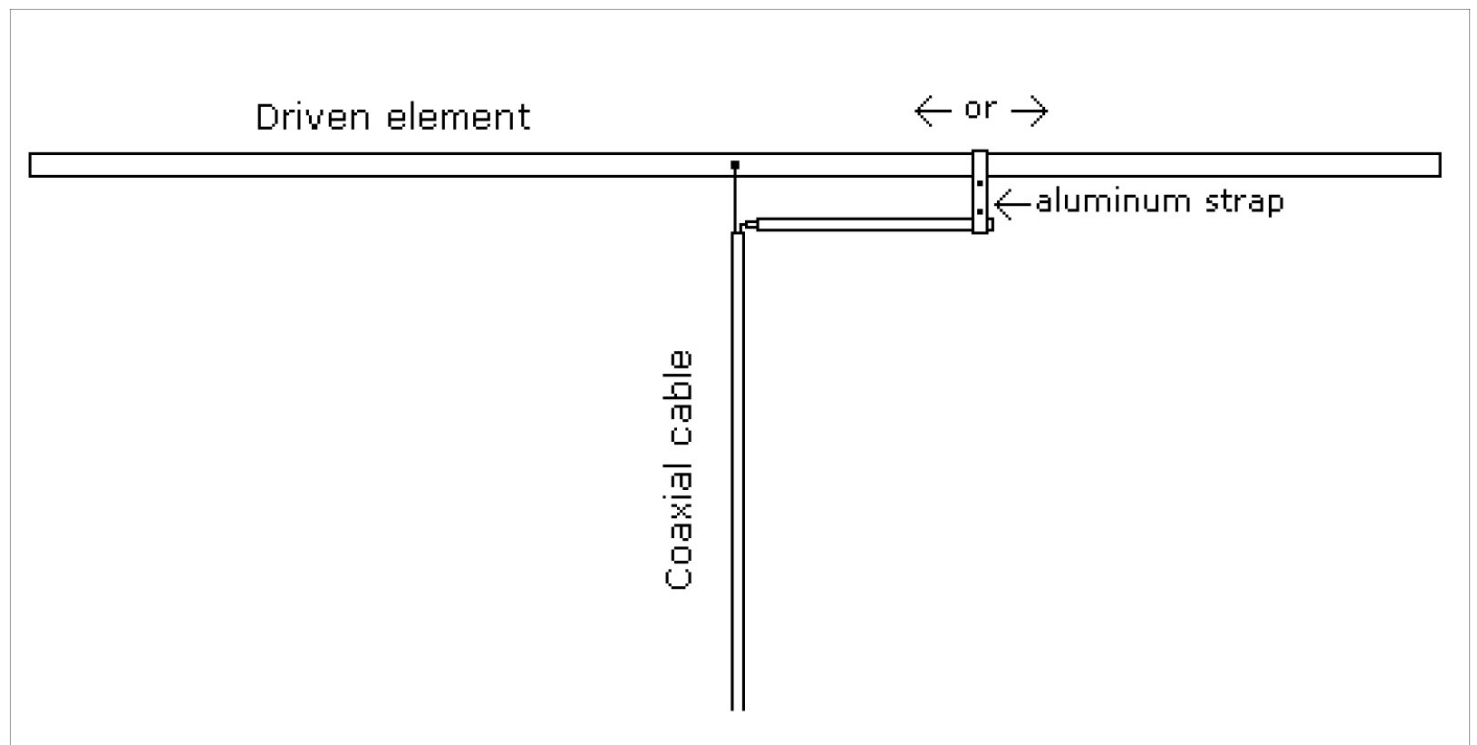
The capacitor of gamma match is about 50pf DIY, I mean I make self-construction.

The length of gamma rod is about 60cm, the space between driven element and gamma rod is 8cm. To create a capacitor I use a piece of about 55cm of inner wire from RG-8 or 213 with the outer dielectric.

Then I buy a 60cm long piece of aluminium rod which the internal diameter is equal as the piece of inner of RG cable. I put the piece of inner of RG inside the rod and I measure the capacity and cut or add until my DIY capacitor comes to desired value, which is about 50pf.

To connect the capacitor to driven element, I use a thin but fat aluminium strap, as you can see at sketch, and when I move it until reduce the SWR ratio. When I finish the procedure, I tighten it with two screws.

As you can see at the sketch below the gamma match it is a very simple way to match the 50 ohms coaxial cable with antenna's low impedance.

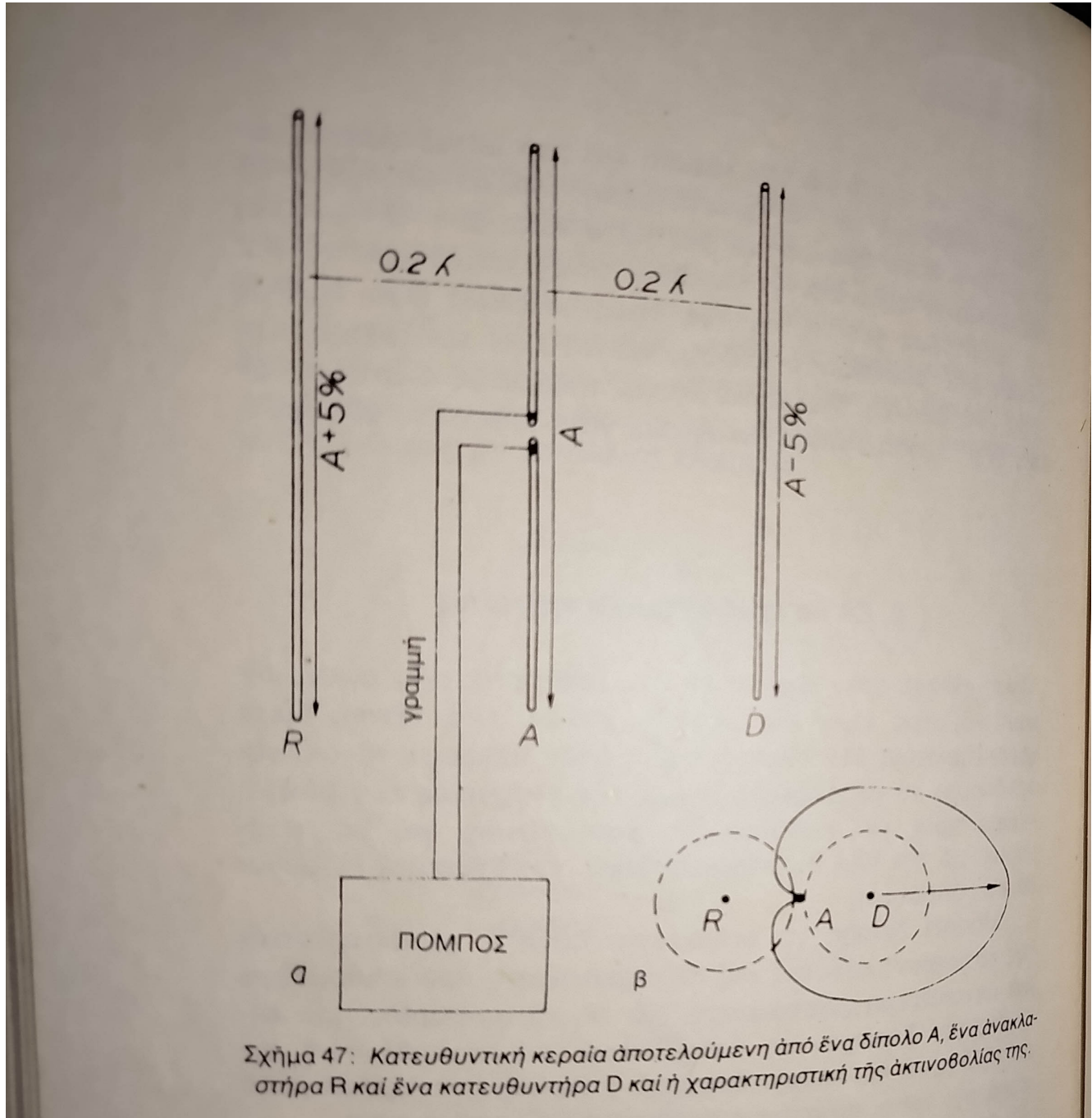


Materials:

Except the aluminium tubes and rod, I bought a piece of aluminium beam (I use it as boom), dimensions: 4.5 meters long, 40mm wide, 40mm high and 2mm thick, three aluminium plates 15X15cm to support the elements up on the boom and one more plate 20X20 to support the boom to mast. I bought also: U bolts, screw, nuts, time and courage!

Tune:

To tune this antenna just I move the aluminium strap carefully a little bit left or right until reduce the SWR ratio.



So, this is the original design on which I use to build the first Yagi-Uda directional beam antenna.

Results:

First of all don't scare about the space between elements. The 0,2 of λ produce high efficiency and perfect front to side ratio.

I have shared all the photos of this project but I keep full bags with QSL cards from this period. Few of my reports: (in the beginning I use a CB Super Star 360 with output power 18 watts) from the Pennsylvania 5/9+5db, Indonesia 5/9+5db, Hawaii 5/8 etc.

As you can see from the reports the antenna is really "big gun". If you have a space and time to test it just try to do.

Nowadays, there is much free and paid antenna calculation software available that make our lives much easier. One of them is **MMANA-GAL** by our dear **Makoto Mori JE3HHT**.



This is another on tree elements Yagi-Uda antenna, based at same computing formula but this time for six meters band.

MMANA-GALbasic c:\mmana-galbasic3\ant\sv1cdy\10 mtrs\beam [yagi-quad]\3el-10m [sv1cdy].maa

File Edit Tools Setup Help MMANA-GALpro

Geometry View Calculate Far field plots

Noname

Freq 28.1 MHz

Ground

☐ Free space

☐ Perfect

☒ Real

Ground setup

Add height 7.00 m

Material Al pipe

WAVE LENGTH = 10.669 (m)

TOTAL PULSE = 129

THE LOWEST POINT OF ANTENNA = 7.000 M

FILL MATRIX...

FACTOR MATRIX...

PULSE	U (V)	I (mA)	Z (Ohm)	SWR	PWR(WT)
w2c	10.00+j0.000	159.6+j132.2	37.15-j30.79	2.13	1.5956

POWER = 1.6 WT

CURRENT DATA...

FAR FIELD (Pin = 1.5956 WT)

NO FATAL ERROR(S)

0.11 sec

No.	F (MHz)	R (Ohm)	jX (Ohm)	SWR 50	Gh dBd	Ga dBi	F/B dB	Elev.	Ground	Add H.	Polar.
1	28.1	37.15	-30.79	2.13	---	12.36	12.56	20.4	Real	7.0	hori.

Start

Optimization

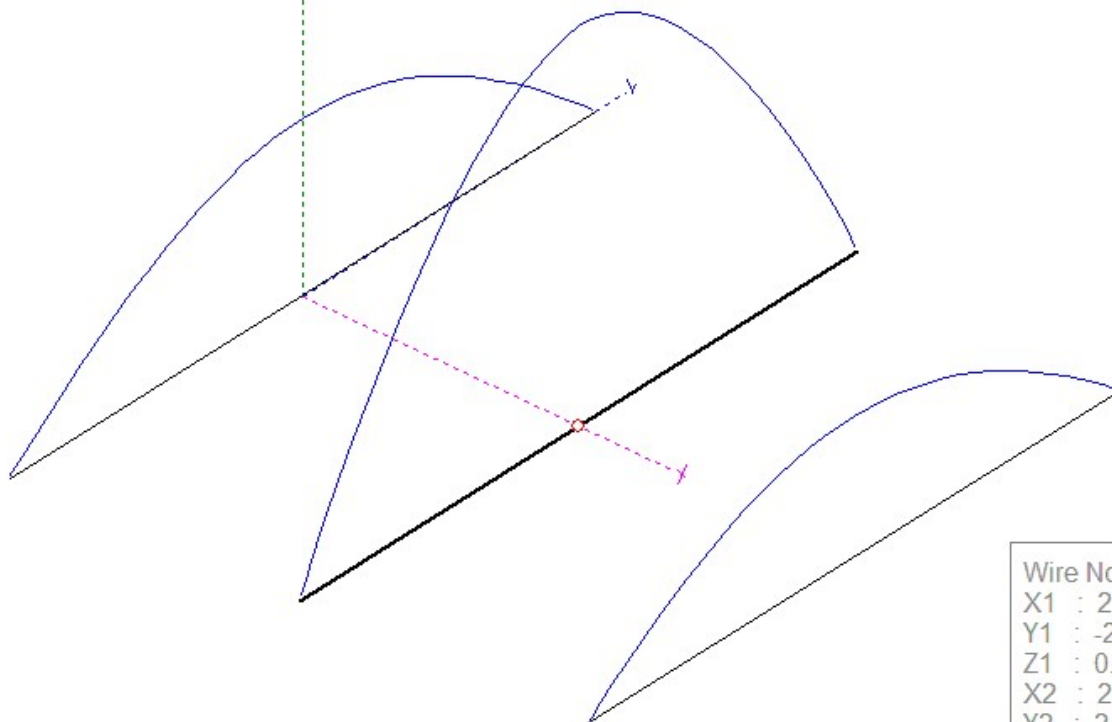
Optimization log

Plots

Wire edit

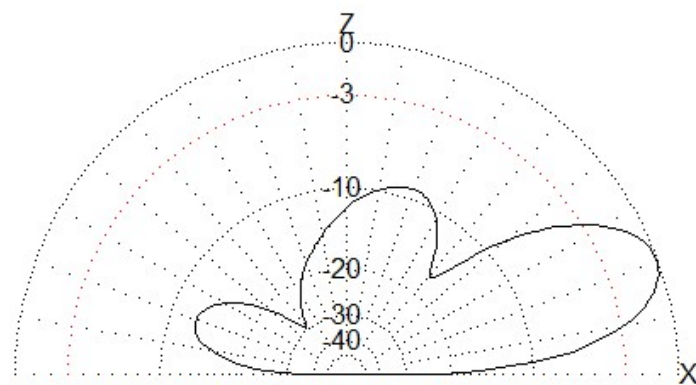
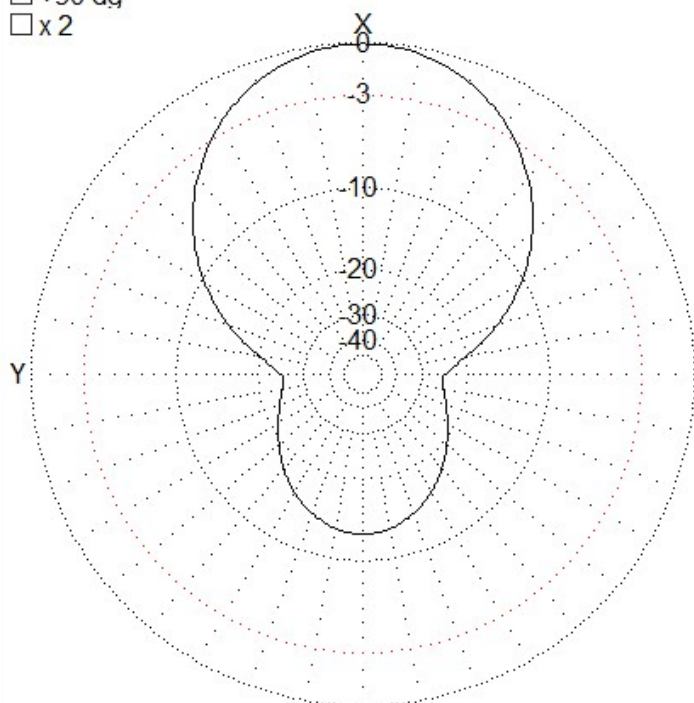
Element edit

○ Source
× Load



Wire No.2
 X1 : 2.15 m
 Y1 : -2.5 m
 Z1 : 0.0 m
 X2 : 2.15 m
 Y2 : 2.5 m
 Z2 : 0.0 m
 R : 0.8 mm
 Length : 5.0 m
 Azim. : 90.0 deg
 Zenith : 0.0 deg

☒ +90 dg
☐ x 2



Ga : 12.36 dBi = 0 dB (Horizontal polarization)
 F/B: 12.56 dB; Rear: Azim. 120 deg, Elev. 60 deg
 Freq: 28.100 MHz
 Z: 37.152 - j30.792 Ohm
 SWR: 2.1 (50.0 Ohm),
 Elev. 20.4 deg (Real GND : 7.00 m height)

I wish good luck to anyone who tries to build it.

SV1CDY George J. Orfanos, Athens - Greece

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