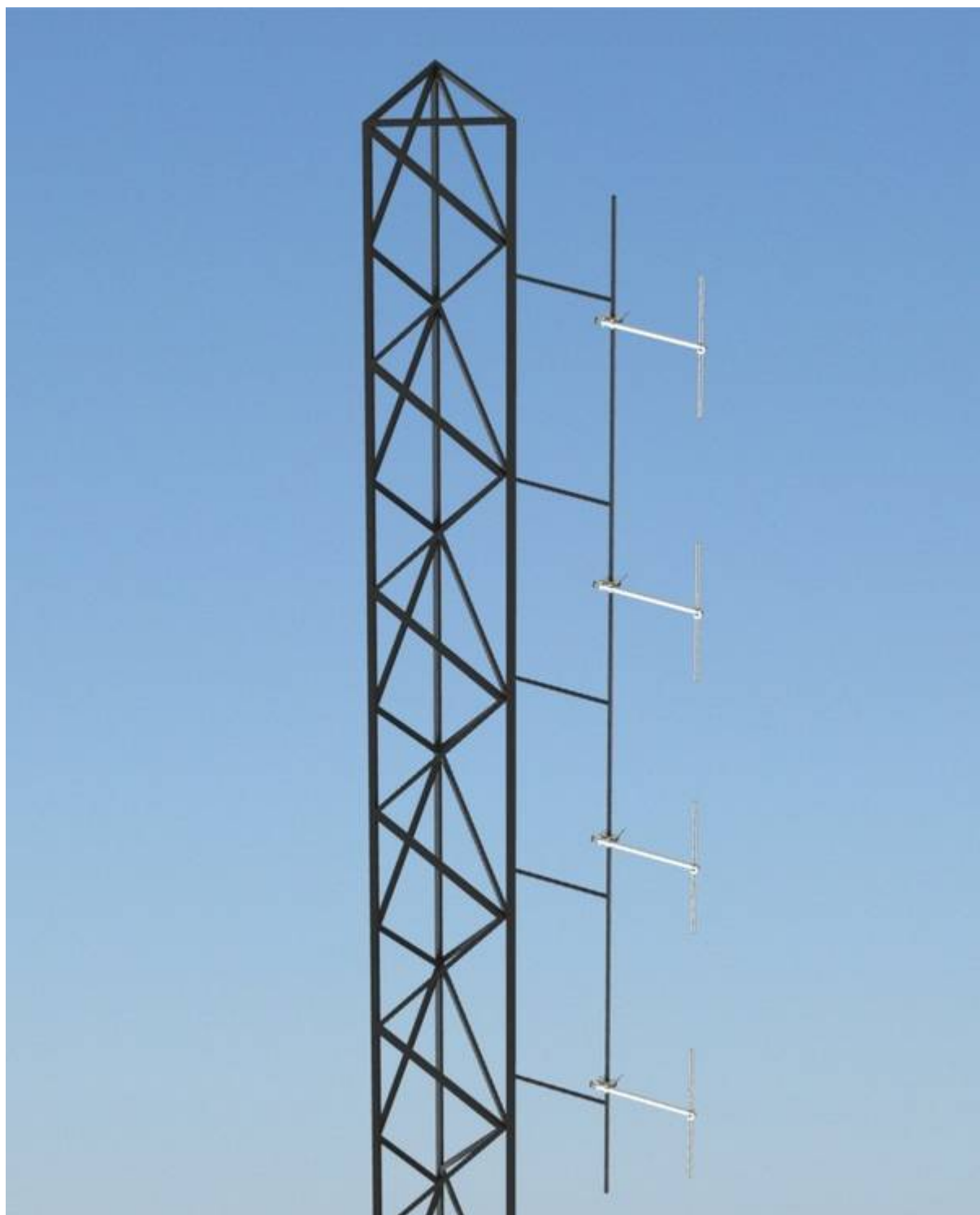


GENERAL INSTRUCTIONS FOR ANTENNA SYSTEM INSTALLATION



TELECFE

BROADCAST SOLUTIONS



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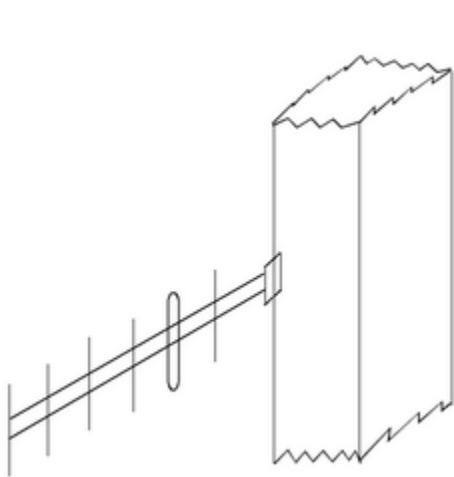
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1 - Antenna - Mast Configurations

The performance of the antenna system depends on the installation.

To obtain a good performance install the antenna as described on the following images:

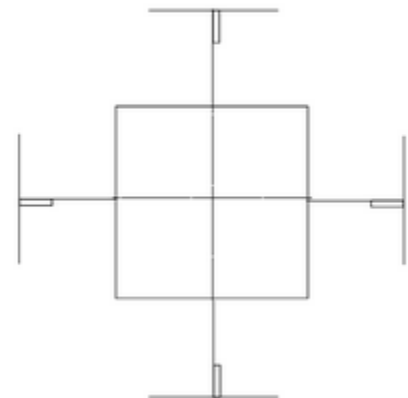


Solid structure

arrays



Triangular mast

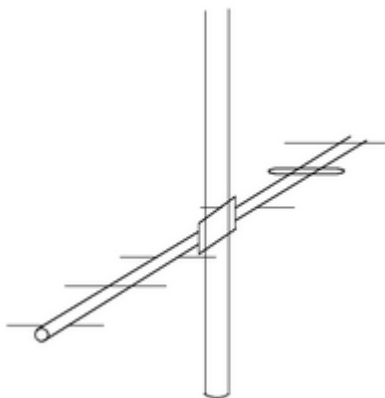


Tier of four

In this case you have:

- little gain and pattern variations
- good cross-polar performance
- good intermodulations results.

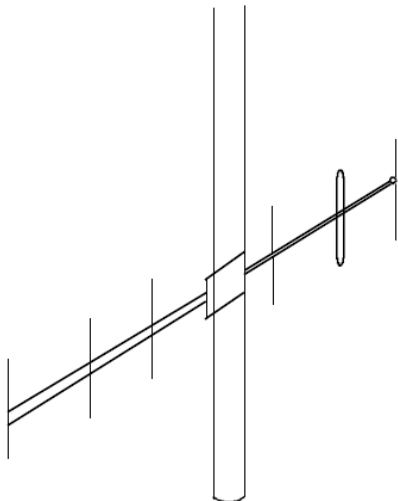
If you mount the antennas on a pole in horizontal polarization, the efficiency of the antenna system will be acceptable:



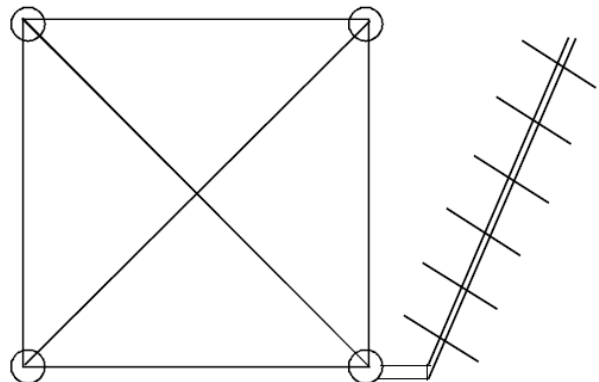
Pole mounting horizontal polarization

- acceptable gain decrease
- small loss of cross-polar performance
- small variation of intermodulation

In the following cases you will obtain a low performance:



Pole mounting vertical polarization

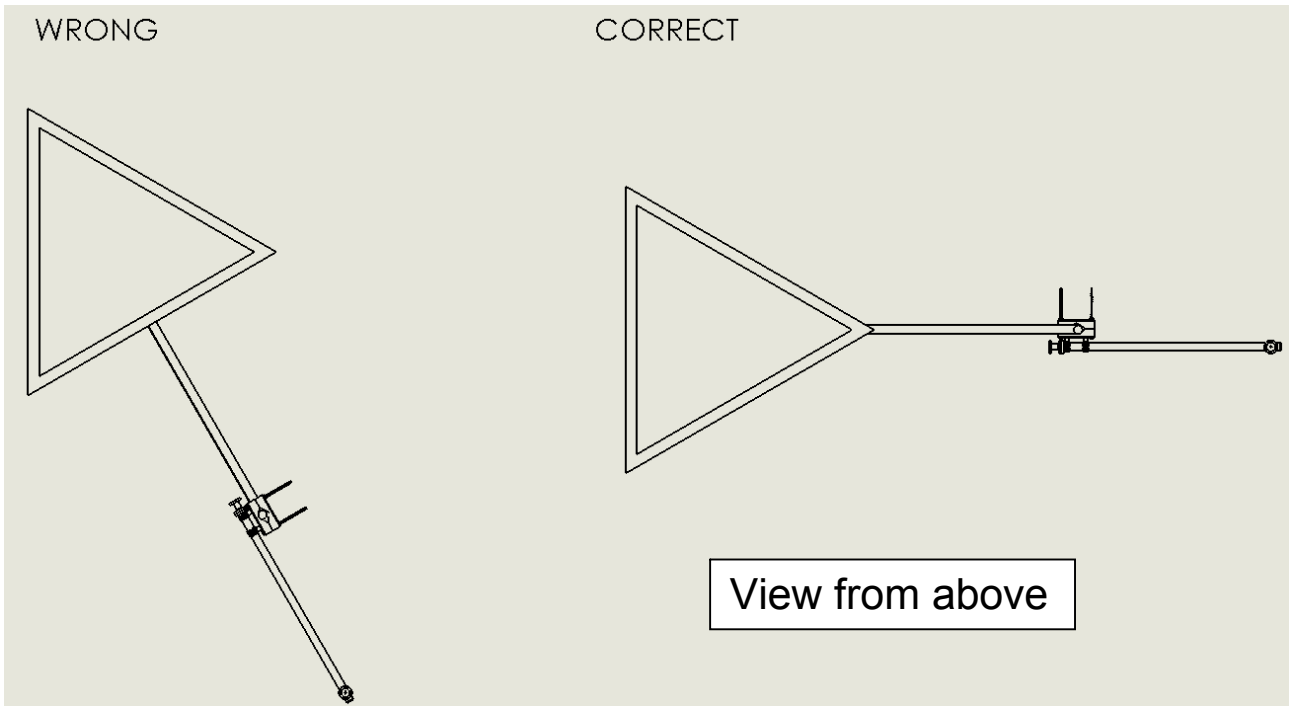


Square section mast

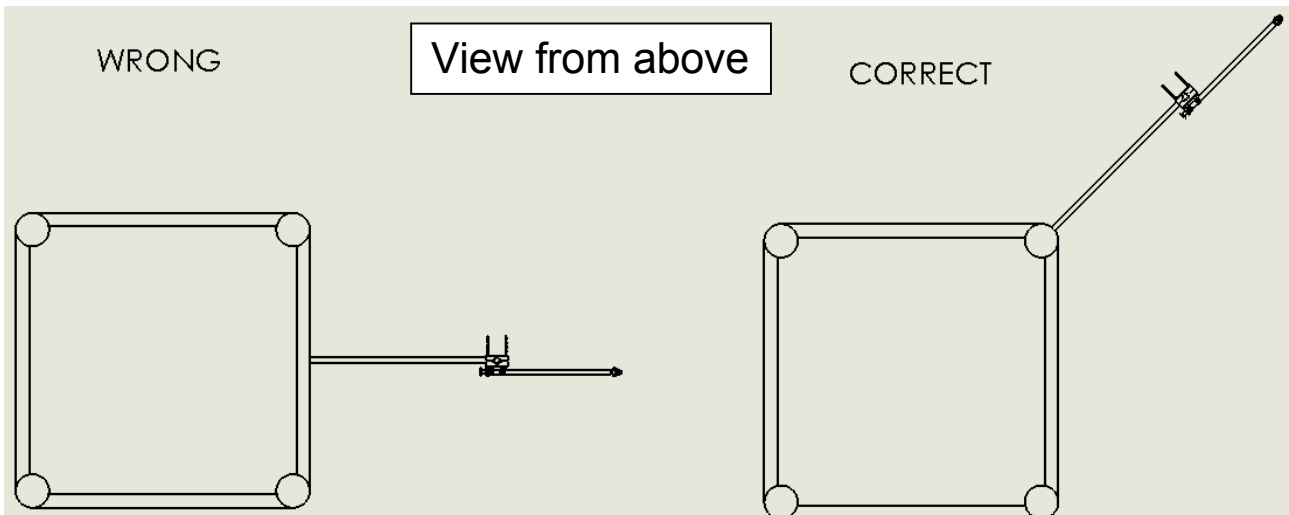
In this cases you obtain:

- substantial loss of gain and directivity
- uncertain cross-polar performance.

Also, if it is available a triangular section mast place the antennas on a corner (pole mounting):

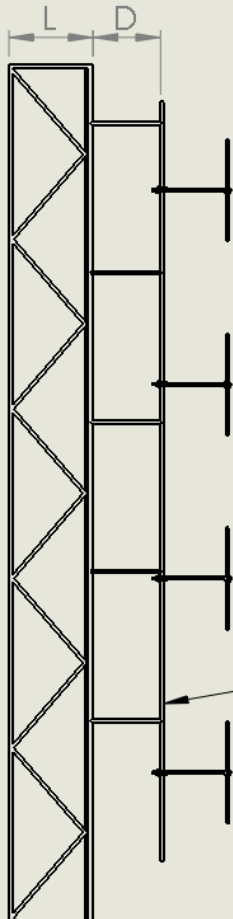


The same for a square cross section mast:



About the pole, respect the following instructions:

RECOMMENDED DISTANCE RADIANT SYSTEM - TOWER
 IN BASE AT DIMENSIONS OF TOWER FOR ANTENNAS
 TYPE DIPOLE POLARIZATION CIRCULAR, VERTICAL AND HORIZONTAL.



If L is	D must be (minimum)
< 24" (0.6 mt)	12" (0.3 mt)
24" ÷ 60" (0.6 ÷ 1.5 mt)	24" (0.6 mt)
> 60" (> 1.5 mt)	36" (0.9 mt)

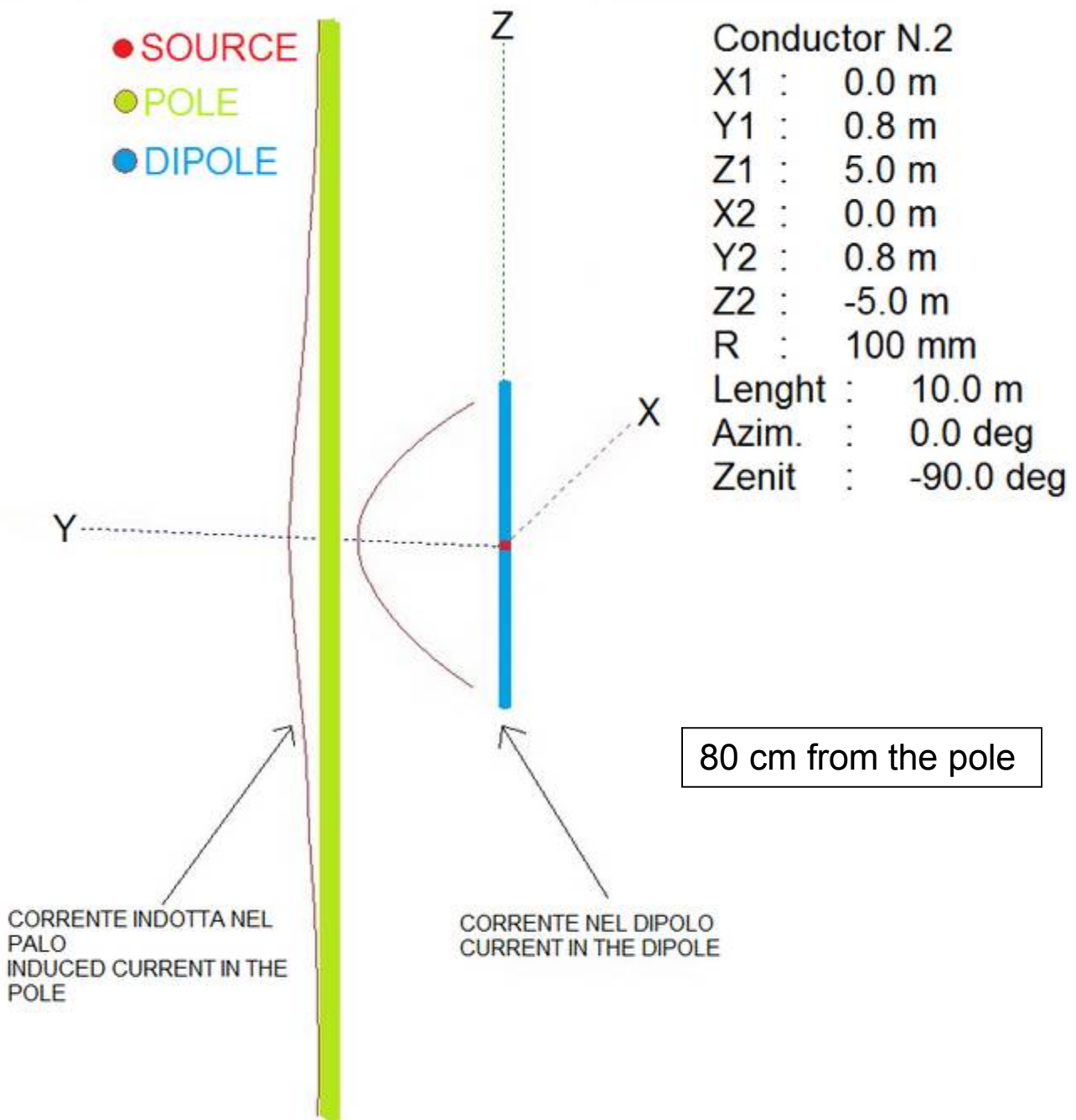
Especially with dipoles (since they are omnidirectional), to avoid unwanted reflection by the rear structure, respect the recommended distance to avoid distortion of the radiation lobe and SWR increasing.

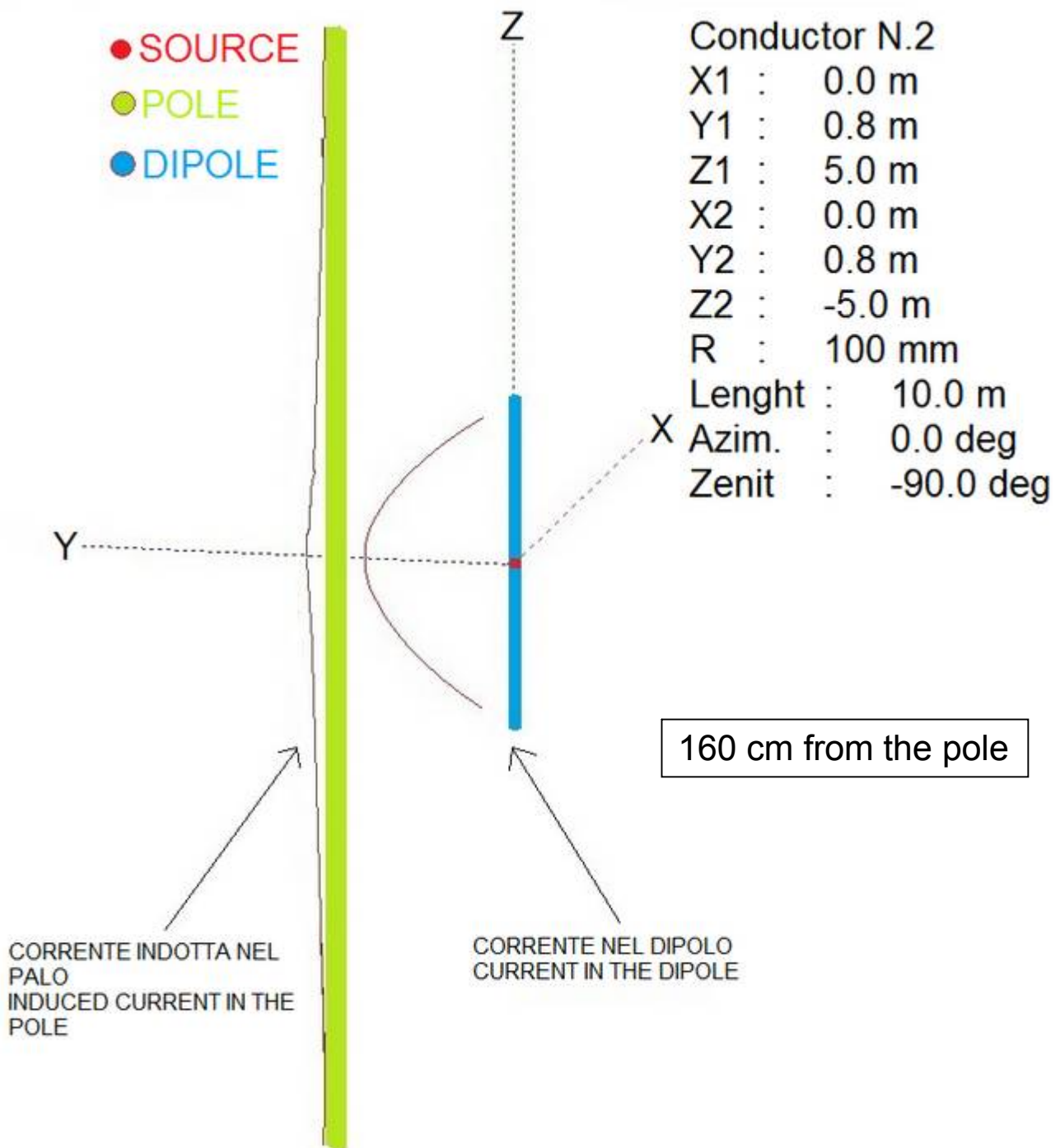
DIMENSIONS OF THE PIPE:
 FROM 2" IPS TO 3" IPS [2-3/8" ÷ 3-1/2" (60 ÷ 89 mm) OD]

METAL PIPE AND PIPE MOUNTING PROVIDED BY CUSTOMER

Let's consider some aspects of the design of an antenna system, which are not always kept in the proper consideration. In particular, the question we will try to give a short answer is this: "how the metal structures placed in the closeness of the antennas can modify the emission characteristics?".

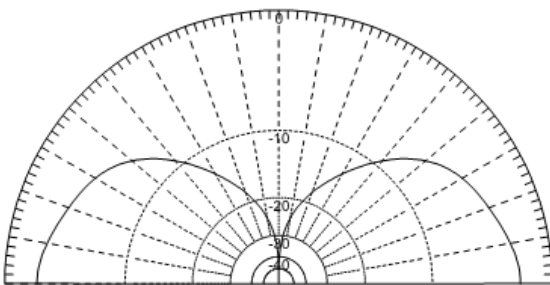
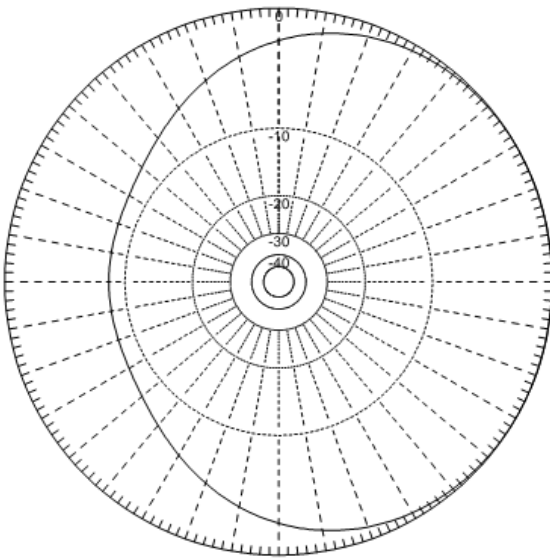
In responding to the questions we will use a simulation program:





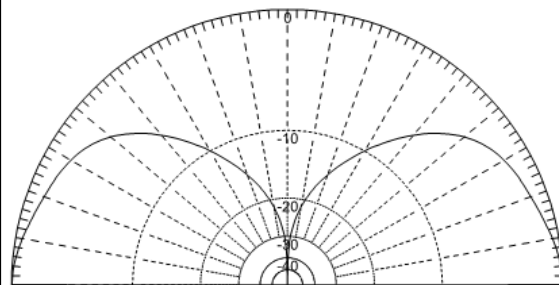
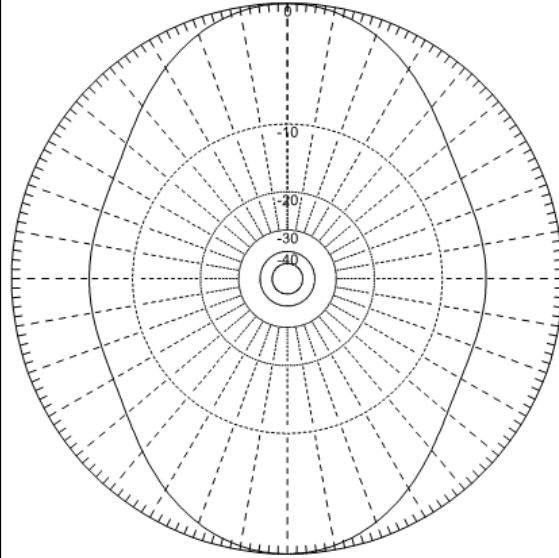
Presenting some simulated examples, the previous images show respectively the case of a resonant dipole at 98 MHz (but this concept is extendable to any frequency) at 80 cm from the metal pole support, and 160 cm from the same, and at 80 cm from a metal mast. The metal structure is crossed by high frequency current induced by the radiator of decreasing intensity at increasing distance.

80 cm from the pole



Ga : 4.8 dBi = 0 dB (Polarizzazione Verticale)
 Gh : 2.65 dBd
 F/B: -2.15 dB; Posteriore: Azimut 120 gradi, elevazione 60 gradi
 Freq: 98.000 MHz
 Z: 77.326 - j2.371 Ohm
 ROS: 1.5 (50.0 Ohm),
 Elev: 0.0 gradi (Spazio libero)

160 cm from the pole



Ga : 4.74 dBi = 0 dB (Polarizzazione Verticale)
 Gh : 2.59 dBd
 F/B: 0.00 dB; Posteriore: Azimut 120 gradi, elevazione 60 gradi
 Freq: 98.000 MHz
 Z: 61.763 - j20.392 Ohm
 ROS: 1.5 (50.0 Ohm),
 Elev: 0.0 gradi (Spazio libero)

The previous pictures show the resulting radiation patterns in the horizontal plane. More the structure is close and large, more is accentuated the "directivity" of the antenna, in practice, in the metal structure hit by the radiated field currents are induced at the same frequency, giving rise to new radiation. This will cause, in turn, modifications in the configuration of the currents in the radiator. The radiation pattern it will be significantly different from the expected one. Of course also the impedance of the dipole will change with the distance by the reflecting element and as a function of its extension. The phenomenon of the alteration of the currents in the radiator is rather important even when two or more antennas are placed to realize an array. In this case the overall gain may be lower than the theoretical (3 dB for each doubling of the number of

elements of the array) due to the disturbance that each radiator undergoes at work of others and the consequent alteration of the radiation diagram, consequently we note the different distribution current in the two central elements of the array than the two ends. Another typical case of deformation of the radiation lobe is one in which one of the radiating elements is installed in the lower part of the mast, near the metal box of the workstation.

In conclusion, we can make the following general statements:

1. The antennas can present a different emission characteristics and impedance depending on the proximity and the extension of the metal support structure. In particular, the dipoles are most affected by the change in these conditions because the metal support directly enters into play becoming an integral part of the antenna. Therefore, if you want to avoid surprises, you must consider, in the simulation or calculation of the radiation pattern, the overall configuration of dipole-support.
2. A system of collinear dipoles not necessarily realize an omnidirectional antenna, unless the support is dielectric or far from the dipoles.
3. It is good that the lower dipole in the system is still far some wavelength of the metal workstation box (and, of course, from the ground) to prevent deformation of the vertical diagram of radiation.
4. It is possible that the overall gain of the antenna array (collinear) is slightly lower than the ideal theoretical (reached only in case of absence of interaction between antennas, or infinite distance between the antennas) because of the disruption of the current distribution of that each antenna induces on the others. This phenomenon will be, in general, quite evident in the case of dipoles arranged parallel to each other (broadside).

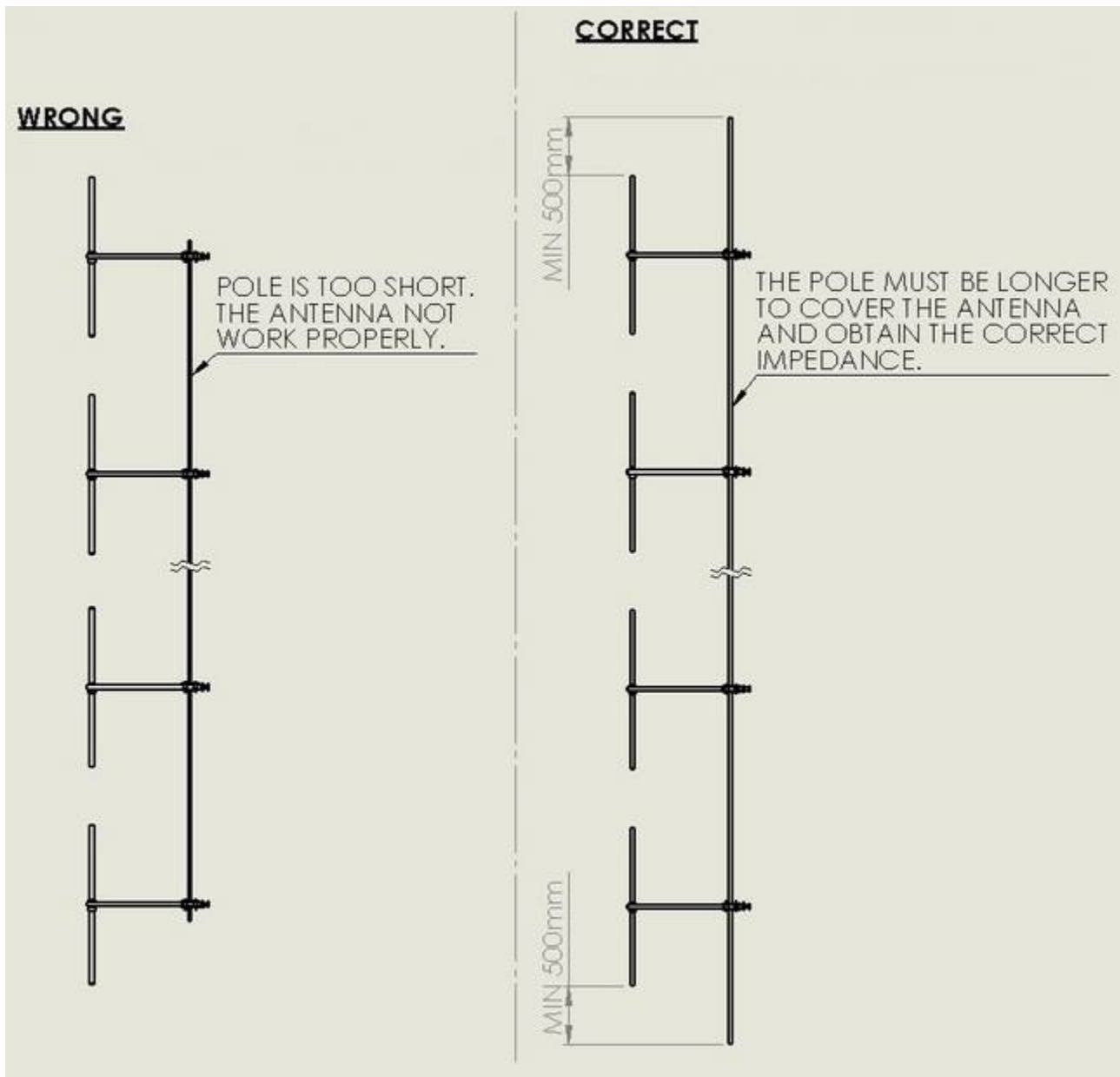
Horizontal radiation pattern (hrp)

The number of co-phased elements required in plan to give a nearly circular radiation pattern, increases with the transversal dimensions of the mast and this may influence the choice of the type of support since stayed masts will generally be of smaller section than towers and may result in a cheaper antenna.

By using a number of dipoles per tier, the variation of gain may be limited to 2 dB overall, but this result may be achieved with fewer elements by careful design.

To limit hrp variations the mast-face dimension should be kept below 1,8 m.

2 - Length of the pole



3 – The position of metals in the galvanic series

The use of dissimilar metals in an antenna support structure may cause considerable trouble due to electrolytic corrosion.

Unless metals of similar potential are used, or the appropriate protective paints applied, corrosion will occur at the point of contact even when care has been taken to exclude moisture. An example of this phenomena when iron is used is known as the Rusty bolt effect, which may result in intermodulation interference.

The various metals may be arranged in groups according to their electro-potentials. Metals from the same group may be used together with little risk. However, metals from different groups will suffer corrosive effects.

Data is available detailing the electro-potentials of various metals. The data is normally expressed as the potential difference of the metal relative to a Hydrogen electrode as given in the table 1. This serves as useful information, but more relevant would be the position of metal in the galvanic series relative to a saline solution. Table 2 gives the position of various metals in the galvanic series in sea water. To avoid corrosion metals should be selected from the same group wherever possible.

Table 1: Galvanic series (Potential between metal and a hydrogen electrode)

Metal	Potential (Volts)	Metal	Potential (Volts)
Magnesium	+2,40	Iron	+0,045
Aluminium	+1,70	Brasses	
Duraluminium		Bronzes	
Zinc	+0,762	Nickel/Copper	
Chromium	+0,557	Copper (CU2+)	-0,344
Chromium/Iron Alloys		Copper (CU+)	-0,470
Iron	+0,441	Silver	-0,798
Cadmium	+0,401	Lead	-0,80
Chromium/Nickel/Iron		Platinum	-0,863
Nickel	+0,231	Gold (AU4+)	-1,360
Tin	+0,136	Gold (AU+)	-1,50
Lead	+0,122		
Iron	+0,045		
Brasses			
Bronzes			
Nickel/Copper			
Copper (CU2+)	-0,344		
Copper (CU+)	-0,470		
Silver	-0,798		
Lead	-0,80		
Platinum	-0,863		
Gold (AU4+)	-1,360		
Gold (AU+)	-1,50		

Table 2: Galvanic series in sea water

Magnesium alloys
Zinc
Galvanised steel
Galvanised wrought iron
Aluminium: 52SH, 4S, 3S, 2S, 53ST
Aluminium clad
Cadmium
Aluminium: A17ST, 17ST, 24ST
Mild steel
Wrought iron
Cast iron
Ni-resist
13% chromium stainless steel type 410 (active)
50-50 lead-tin solder
18-8 stainless steel type 304 (active)
18-8-3 stainless steel type 316 (active)
Lead
Tin
Muntz metal
Manganese bronze
Naval Brass
Nickel (active)
Inconel (active)
Yellow brass
Admiralty brass
Aluminium bronze
Red brass
Copper
Silicon bronze
Ambrac
70-30 copper-nickel
Comp.G, bronze
Comp.M, bronze
Nickel (passive)
Inconel (passive)
Monel
18-8 stainless steel type 304 (passive)
18-8-3 stainless steel type 316 (passive)

4 - Grounding the antenna system

