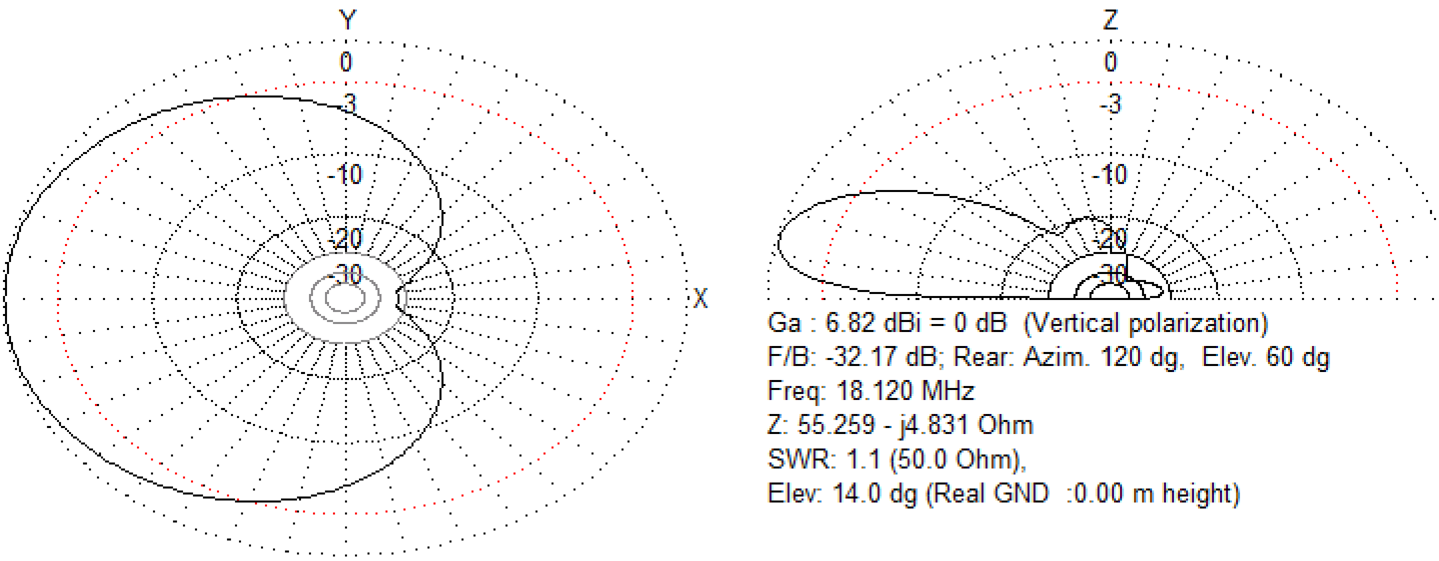
Vertical Dipole Antennas by F4BKV Vincent

Why using Vertical Dipoles: Everything starts in summer 2011, when i had to prepare antennas for the upcoming 2012 Pacific DXpedition (VP6T, TX6T, E51BKV, FK/F4BKV). I was always impressed by the strong signals VP6DX (Ducie Isl.) got with their VDA and I tried to make similar (but lighter) antennas that can be transported by a single man in his luggage. I got precious information from Cornelius DF4SA, the founder of Spiderbeam, and I was also helped by Jacques F6BEE for the calculations and modelisation part with MMANA-GAL software. It then took me a few days to get the first prototype assembled, the most challenging part was to find a solution to build the cross arms as light as possible. At the end, each antenna has a total weight of 1.5kg (including the 10m fiberglass pole). Below you will see some explanation on the performances and some indications on how to build it.

Performances and patterns: As with all other vertical antennas, you need a good ground to get the antenna working efficiently. VDA are no exception and based on my own experience, I would even say they are more sensitive to the near ground. In other cases, and to be more clear : If you do not plan to install your antenna near the sea water, then forget it and look for some other antenna designs. The VDA is performant ONLY near the sea water, and with the sea in the path to the DX. While in South Cook, I made an interesting experiment on the 28MHz band. My operating shack position was 100m away from the sea shore, and I decided to build the 28MHz VDA near the shack, in order to save coaxial lengh and reduce the loss in the cable. But after one day and poor results, i decided to move this VDA near the seashore and connect it with 100m of low-loss H155 coaxial cable. For sure, the loss in the coaxial was still higher than when the antenna was only 15m away, but the fact that the antenna position was on the sea shore gave me much better results on this band. So again, when I say this antenna is to be located at the sea shore, it's not only because photos are more beautiful with the sea in the background .. the salt water is playing a major role in the antenna radiation performance.

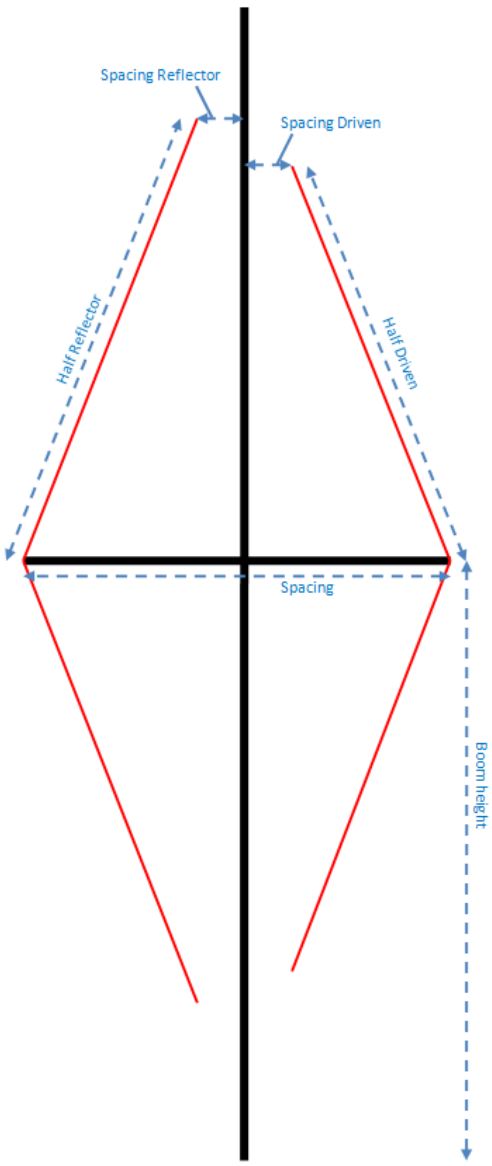


Radiation pattern example for 17m VDA

As you can see, the forward lobe is broad, and it's an advantage as you do not really need to turn the antenna, especially if you can get US/JA/EU in this main lobe. There is a very high attenuation at 180° and it's very sharp. I found it very useful, especially when you are on an island, because the antenna is directed to the open ocean and the attenuation is on the local noise (qrm/qrn etc ..) coming from the beach and houses located directly behind the antenna. In multi transmitter environment, it also reduces interferences between stations if the antennas are properly oriented. I was really surprised by this strong attenuation, both during my tests and also in actual operation during my trip (for example, in FK, the 180° was towards ZL and it was extermely difficult to contact them while I had no problem to work EU/JA/US, located 10000km further than ZL !). You can also notice the relatively low elevation angle (14°) of this antenna that takes advantage of the low angle of arrival of DX signals.

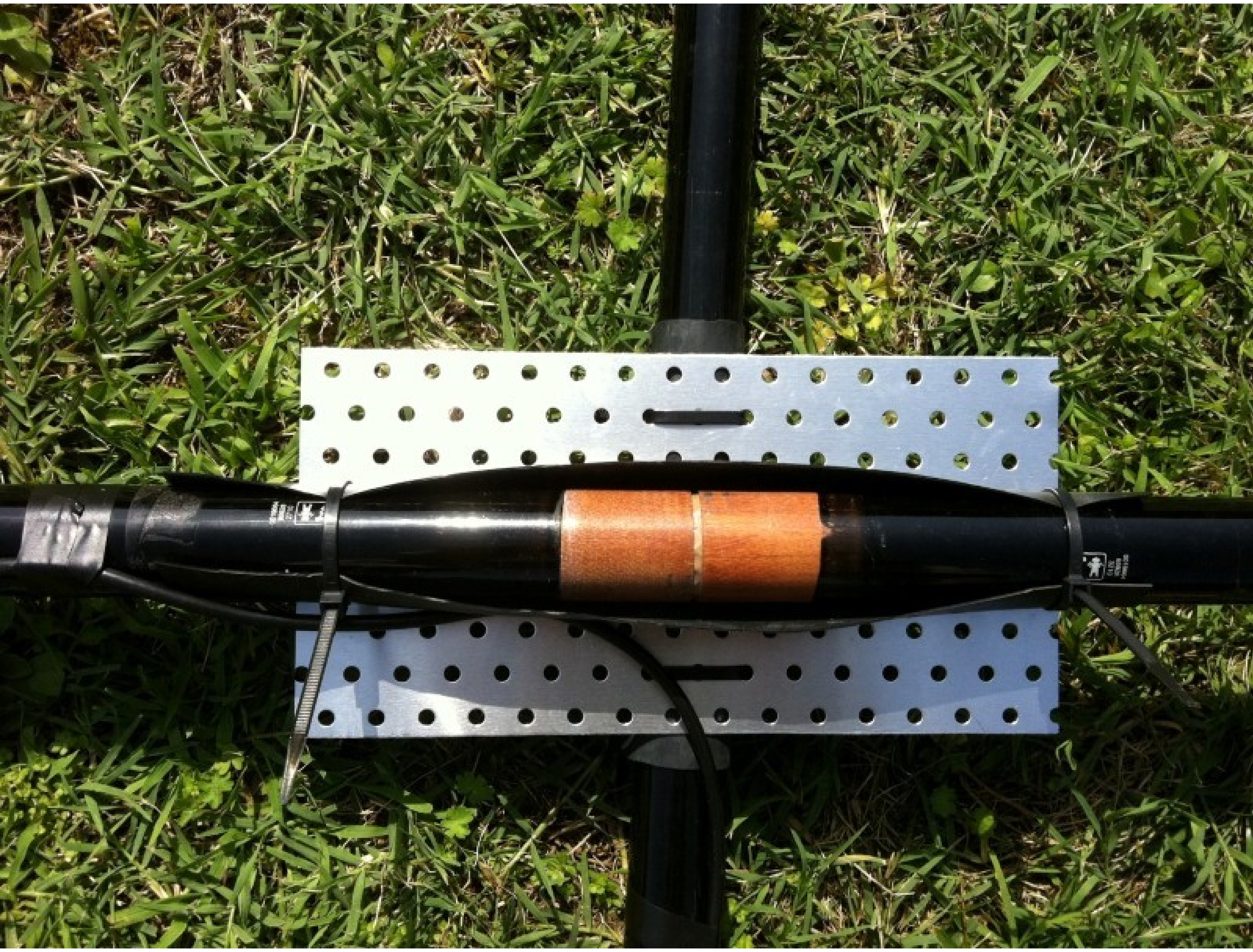
Dimensions (theorical): The following table summarizes the theorical dimensions of the antennas (in meters). Do not start to cut your wires from these values without knowing the velocity factor of your wire. For example, the *Spiderbeam CQ-532 stranded copper wire* has a velocity factor of about 0.96. It means that the following values have to be multiplied by 0.96 to get the real physical length of the wires.

Band	Spacing	Boom height	Half Driven	Half Reflector	Driven Spacing	Reflector Spacing
20	3.56	6.24	4.97	5.23	0.46	0.42
17	2.78	4.87	3.84	4.09	0.37	0.33
15	2.38	4.45	3.31	3.50	0.31	0.28
12	2.02	3.91	2.81	2.97	0.26	0.24
10	1.78	3.66	2.49	2.63	0.23	0.19



Construction:

Step 1: *X Cross mounting*



-The X cross mounting needs to be strong enough to resist moderate winds and as light as possible. For the boom, I used some telescopic parts of *Decathlon 6m fishing rods* (56cm length when collapsed, can be transported in a normal luggage). To attach both parts of the boom, I used a small 15cm pvc pipe with additional adhesive tape to ensure the pvc pipe diameter is just going inside the telescopic poles without loses. The plate used is made of aluminium, and with holes pre-drilled. I found it at the nearby DIY shop and it is very lightweight and strong enough. To fix the boom and the mast on the plate, I used *cable ties* and pieces of bike inner tubes. The piece of inner tube prevents the boom from spinning and slipping and it ensures a strong fixing. Total weight of the plate + cable ties + rubber bands is less than 120g. The boom telescopic poles is around 350g

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Step 2: *Dipole & coaxial cable mounting*

- The Dipole is made with *Spiderbeam CQ-532 stranded copper wire* and uses a *dipole central isolator* that allows direct connection of the PL-259 coaxial connector and cable. Several turns of adhesive tape are used to fix the isolator and coaxial cable on the boom, to ensure it will stay in place for the duration of the activity. The coaxial cable has to be kept horizontal along the boom to the mast, and then fixed vertically along the mast. Do not let the coaxial move by itself as it will distort the antenna performance. It has to be firmly fixed with tape along the boom and mast as described.

Step 3: *Reflector mounting*

- The reflector is also made with *Spiderbeam CQ-532 stranded copper wire* and fixed with adhesive tape to the boom at the middle (the reflector is made of one single piece of wire).

Step 4: *Guy wires*

- Guy wires can be made either at the boom crossing or above it (better). Only one layer of guying is enough and it will also help you in case you are alone to erect the antenna vertically. Since the antenna has a broad forward lobe, you will probably not need to turn it.

Step 5: *Upper side wires mounting*

- Each end of wire elements has to be prolongated by some 50/70cm of non conductive rope. this will allow to fix the rope to the mast while keeping antenna wire elements end at their correct spacing (see antenna design above). Do not bend it too strong, the mast has to be kept straigt

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Step 6: *Erecting antenna vertically*

- This can be easily done by one person and if the guy wires are properly fixed in advance (at least two of them) then you can put the antenna up alone. As often it will be installed on a beach, a good idea would be to dig a hole (at least 30cm deep) and then put the antenna mast inside. If you do so, remember to place the boom 30cm higher or the antenna may be too low.

Step 7: *Down side wires mounting*

- Fix the down side part of both driven and reflector wire elements to the mast. Like for the upper side, each end of wire elements has to be prolongated by some 50/70cm of non conductive rope. this will allow to fix the rope to the mast while keeping antenna wire elements end at their correct spacing (see antenna design above). By fixing the down side part after erecting the antenna, you can adjust it better to bend it correctly (if you fix them while the antenna is horizontal, it will probably be loosing once in vertical position). That's it !! Total mounting time is around 15 minutes (the initial construction and first mounting takes a bit longer of course).