

DX COMMANDER

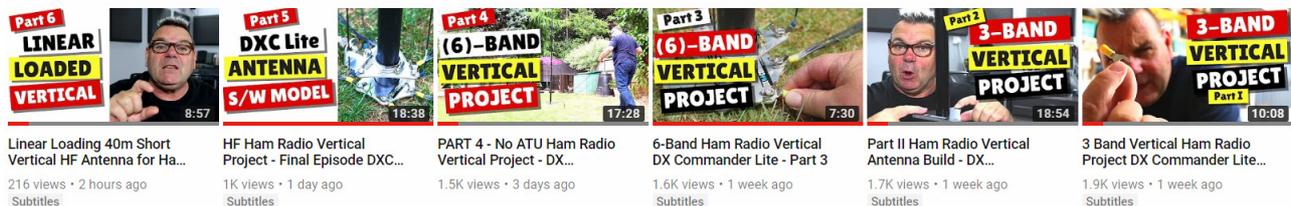
DX Commander Lite 7m Antenna System User Guide Version 1.0 August 2018

SAFETY NOTE

DX Commander antenna components are designed for hobby radio amateurs by Callum McCormick, M0MCX. Radio Amateurs pass exams where health and safety is included in the syllabus. Please be careful in your handling, erection and general usage of any DX Commander parts so that yourself, property or a third party in the vicinity of your antenna experiments remain safe. Note also that engineered parts may have some sharp edges so be careful before handling roughly with bare hands.

POWER RATING: Black option has 100W continuous. Natural Nylon QRO version has 1,500W continuous.

ASSUMPTIONS: This manual assumes you have watched the videos for the DXC LITE build on YouTube.



Overview: The antenna runs up to three vertical element on a single 7m pole with a single feedpoint and is similar in concept to a fan-dipole, but turning the “fan” 90 degrees on it’s axis and placing one side of the fan vertically. Each element resonates automatically. No other hardware other than coax is required.

Option a) Run three elements, 30m plus two-other bands (eg 30m, 20m and 17m). The 30m element gives a near match (almost a 5/8th) for 10m band (you will need a basic ATU for this) and a 1.25 wavelength for 6m (50MHz) band. Gain on 50MHz is not optimal, however there is a low angle lobe, achieving better than -5db, similar to a regular quarter wavelength radiator for low angles.

Option b) Run any three bands on 20m and above, saving height by making a circa 5m (20 feet) pole. Remove the last 2-sections of the 7m pole (by unscrewing the base) and place them upside down in the top of the pole at the 5m point. These will act perfectly as the housing for the upper spreader.

Option c) You may linear-load a 40m element by using up two of the element holes; making up a long element, going to the top of the pole and all the way back down (using a spare element slot in the plates). Stop at about 7.5cm (3 inches) before the bottom. This element will also give you a perfect match on 10m band at around 28.200 MHz. Large bandwidth means you will be able to operate from 28 through 28.5, delivering 5/8th performance. You will still have a spare slot for another element, say 20m or 17m (or any band you care for).

I design my antennas with the concept of not requiring an ATU, however even a rudimentary ATU will tune most of the bands, next to one of the designed elements. So for instance either the 30m or 40m systems that do tune in 10m band will also tune in 12m. Similarly, a 17m element will normally tune in 15m (and 20m too).

Parts list

1. DX Commander 7m Pole
2. Ground plate 3mm aluminium
3. Radiating Plate 3mm aluminium
4. Guy Plate - Engineered Nylon
5. Upper Spreader Plate - Nylon
6. Upper Double-Eye - Nylon
7. SO239 Assembly with flying lead
8. Appropriate qty 6mm stainless bolts
9. Appropriate qty Stainless wing nuts
10. Stainless Washers
11. Yellow fork connectors (radials)
12. Blue fork connectors (elements)
13. 1 Hose clamp
14. Small section aquarium tubing
15. Length 4mm shock cord
16. Long length paracord
17. Plastic "snap" Carabiners
18. Length glue lined shrinkwrap

Please make yourself familiar with all the parts and satisfy yourself that all is present and correct. I take great care when I pack these boxes so if something is missing, it's my fault. If I do make a mistake, simply send an SMS /

TXT message on +44(0)7990 833490 and I'll sort it out. Remember to tell me your name. Yes, I appreciate you may be in Outer Mongolia - but I'll still sort it out! :)

In Detail

I have a user guide for the 10M pole which mirrors this 7m antenna pole. You can find the user guide on the m0mcx.co.uk website under User Guides.

Ground Plate is made from 3mm aluminium with a single bend for the SO239 assembly.

The radiating plate is also machine cut from 3mm aluminium. I personally tap 6mm holes. I degrease them and sometimes quickly pass a rough nylon scouring cloth over them to remove some of the worst sharp edges. It is possible to fit 6 radials per fork connector, achieving 30 radials in total which is more than ample. Alternatively, use less holes - and double up on fork-connectors.

The guy plate is made from a specialist Nylon material which has good strength so that you should only see a small amount of bend as you tighten the guys up.

The upper "micro" spreader fits at around the 5m point. These will hold your elements in place near the top.

The SO239 assembly comes with a flying lead. These are soldered to the SO239 before hot glue is applied.

The hose clamp requires tubing fitted. Cut to size. You will need to Unscrew the hose-clamp completely to fit.

The black plastic carabiner clips are for making up the extensions for paracord (and shock-cord), connecting your elements to the upper spreaders. The holes on the upper spreaders are correctly sized to fit the carabiners. Use about 15cms (6 inches) of shock cord per element and make the rest of the extension to your element with paracord. Connect the shock-cord to the paracord with "fishermans knot". Check Google for instructions on how to tie that, or check my YouTube video series on this antenna where I discuss this. BTW, 20m band doesn't need paracord. You can make up a small shock-cord assembly. It's quite short).



TIP: Connecting 40m or 30m element: I make a small loop about 100mm (4 inches) down from the upper spreader directly on the element. Use glue-lined shrinkwrap to keep this loop stable - and small enough so that it will still fit through the nylon plates. Adding a small section of shock-cord with a carabiner at each end will keep this element taught. You don't need paracord on this one. Continue the element right up to the top of the pole and back on itself. A small piece of the aquarium tube slipped over the end will keep stable.

Finally, don't over-tension everything. Your shock-cord should still have a little "give" left else you may over-stress the fork connectors and apply too much pressure on the pole.

ELEMENT PLACEMENT

There is enough spacing between elements to ignore any mutual coupling or specific element placement. You may place any element in any hole you wish.

ELEMENT LENGTHS

It turns out that the wire I use has a velocity factor of around 92.5% which is why we can cut the wire shorter than you imagine (whilst adding 6cms for the fold-over). All insulated wire has a velocity factor of similar percentage.

Using the maths, we can extrapolate all the bands (which you can tinker with depending on CW / SSB) however being full 1/4 wave elements, the bandwidth is huge and extremely forgiving. Accuracy might only be required for 12m and 10m, even then you will be achieving around 1MHz under 2:1 SWR.

- 10m – 2.5m + 6 cms foldback (for the heatshrink loop)
- 12m – 2.83 + 6 cm
- 15m - 3.26 + 6 cm
- 17m – 3.80m + 6 cm
- 20m – 4.88m + 6 cm
- 30m – 7.34m (+ little loop under 5m spreader - no foldover required, aquarium tubing holds in place)
- 40m – 13.5m (Length not too critical. Go to top of pole and back down to within 50mm (2") of bottom)

If in doubt, cut your element lengths longer and create longer foldbacks. Don't apply the glue-lined heatshrink until your element lengths are optimal. Further, your element lengths can vary depending on soil conductivity and other factors beyond the scope of this document or design. You will be able to determine why this is so with an SWR meter. My own experience though (in UK) seems to be just fine for all soil types.

DO I NEED AN ATU?

By configuring the assembly correctly, no ATU will be required however, you can "stretch" one of the bands, often achieving an ATU match depending on the rig you are using. Some rigs have an amazing ATU, other less so. For instance, my TS990-s will tune almost anything but my TS-2000 is less forgiving. As I write this user guide, I am currently running 20m, 17m and 15m elements on the DXC Lite with the TS-2000 which is showing around 3:1 SWR on the 12m and 10m bands. The TS-2000 easily dials this mismatch out, giving me the whole of the upper HF bands to tinker with. Of interest, I can not tune 30m on the TS-2000 but I can on the TS-990s (in the configuration discussed above). If you need 30m on a regular basis, suggest you fit the dedicated element.

USING 30m ELEMENT ON 10m BAND (5/8th wave) and 6m band (1.25 wave)

According to the books, dipoles and verticals resonate on every odd harmonic. This means that according to the maths, our element tuned for 10.1 MHz should also be resonant on 30.3 MHz. It also means we'll have a tune on 50.5 Mhz. In practice, the resonance for these higher bands are a little higher but I enjoyed 6m without an onboard ATU and 10m with ATU. Good fun for FT8 mode. It all depends on precisely where the 30m element is tuned.

SHORTY FORTY 40m (with 10m band!)

If you would like to try 40m band, we can linear-load it. You will need to use up 2 x element slots. Go all the way to the top and fit a small loop, as you would on 30m band, just under the upper spreader and connect a small piece of shock cord here to keep a mild tension on the element. Go to the very top, through the metal loop and come back down again, using another element slot in the upper spreader. You can also make another loop here to attach the 40m to the upper spreader again, under the upper spreader. Now create a small loop at the very end of the element and you can attach this loop with paracord with a washer and butterfly nut to a spare element slot which you are heading back down towards. This way, everything remains under very light tension; both the upward and downward sections being held under mild tension by the upper spreader. You will find that depending on exactly how long or short you make this element, you will also achieve perfect resonance on 10m band at around 28.2MHz giving you easily 28 through 28.5MHz. Modelling suggests this is looking like a 5/8th for 10m. And you still have a spare element for another band.

ADDING 80m as an Inverted L

I've only ever attempted this on the DX Commander 10m All-Band-Vertical since I believe the pressure of a sideways tensioned wire may be too much for the 7m pole. By all means try an Inverted L, but you may be stretching the physical limits. You may also find you get a great tune on 30m and 17m band

GLUE LINED SHRINK WRAP

Find about 6 inches of this in your kit. You only need half an inch per element to make your loop for the carabiner. Only fit once the elements are correct – once fitted, they are a nightmare to get off. Alternatives to a genuine hot-air gun are: plumbers blow torch, low gas flame on kitchen hob, steam from a kettle or a lighter.

RADIALS

Your starter kit will give you around 75m of spare wire after you have built your elements (depending on which bands you wish). Use this to build up to 30 x 2.5m radials in 5 bunches of 6 radials. And of course, any cheap wire can be used in the future. Remember: Make the radials after you have made your elements. To give you more confidence, you may also enjoy my video:



How many ground radials do I really need for my ham radio vertical antenna system

DX Commander · 2.3K views · 3 months ago

HOW MANY RADIALS DO I NEED FOR MY VERTICAL? I am asked this question many times. I do not address "Raised Radials" ...

Subtitles

FOLDING BACK INSULATED WIRE

The last thing I wanted to mention is the topic of how much folding back elements on themselves has an affect on the tune of an element.

I have made some preliminary tests and although we are schooled by our teachers to fold back wire on itself to decrease the length of an element (say a dipole), I have discovered that the new length becomes a combination of the actual element length plus a proportion (around 40% I believe) of the fold-back, not all of it. So feel free to make quite a large foldover. You can always snip to suit without impacting efficiency.

FIRST-TIME ASSEMBLY

Make up your element lengths according to the table on page 2. Don't use shrink-wrap (yet). Initially, use electrical tape for the loops so you can make easy adjustments. Glue lined heatshrink is difficult to remove whilst you are testing. Once you have made up your element lengths and fitted the fork connectors and top loops, prepare some shock cord and paracord assemblies and clip them to the upper spreader and your elements. Aim for moderate tension with your Fisherman's Knot else you may over-tension the fork connectors. Do not over-tighten the knot at this point in case you need to make a small length adjustment. Afterwards, you can tidy the knot up.

Solder blue fork connectors to the wire. Trim around 12.5mm (half inch) of insulation, twist wires together and then fold in half to make a 6mm / 1/4 inch mini-solder log. Crimp this element end to the fork connector. Alternatives to a crimp tool: Vice, Pliers, hammer etc. Now solder.

Use a 10mm spanner and screw in the 6mm bolts, facing upwards. Completely tighten all the bolts in the appropriate holes for the ground and radiating plate. You may never need to release these again.

Hammer three guy stakes into the ground, 120 degrees apart from where the centre of the mast will end up, 120cms from the centre. I use the guy plate on the ground as a 120 degree template. Fit paracord to each guy stake and drop these by your feet, where the pole will be mounted.

Unscrew the end-cap and fit the ground plate to the base. Replace cap. Be careful the elements don't all fall out the back of the tube! Slip over your driven plate and hose clamp (with tubing) to stop the driven plate from coming too loose. Then slip over your guy plate and upper spreader.

Extend the pole in your working area and test-erect. I find that resting the upright pole on my shoulder is easiest and I can connect the guy ropes to the guy point very simply. Adjust to suit. Once fitted, release one guy point and lay the pole on the ground. Make sure the pole is FULLY erect and the friction fit is solid to your liking. Being a light pole, you shouldn't need to tape the joints.

Using the washers and wing nuts, fit the elements to the driven plate and thread each element through an appropriate hole in the guy and spreader plates.

Make up an appropriate sized section of paracord with a carabiner - and a small (150mm / 6 inches) section of shockcord with a carabiner to allow you to connect your elements to the upper spreader. Suggest you do not make your Fisherman's Knot too tight in case you need to make an adjustment. Perhaps leave an inch or so of spare end here that you can trim afterwards. Clip the top carabiner to the upper spreader and the lower one to your paracord. It doesn't matter if the shock cord is at the top of the assembly or the bottom.

If you wish to use a 30m element, make a small loop in your 30m element, approximately 10mm (4 inches) down from the upper spreader. Use a matching section of shock-cord here with a carabiner at both ends (upper spreader and loop). I detail this in the videos.

Raise the whole pole vertically and check you have moderate to low tension on the wires to keep them from blowing about too much. Guy off the whole assembly and connect the rest of the radials.

Tip: When dropping your antenna for adjustment purposes, you will find that quickly removing the radials is really easy otherwise, you'll get flustered whilst standing on your radials and trying to lower and raise the antenna!

And finally, to get the antenna perfectly straight (for OCD lovers out there). Once the guys are taught, you can just shuffle the base around rather than changing guy tension.

Finally, if you want a half-decent calculator for SWR adjustment, try this free spreadsheet I made for you:

<https://www.m0mcx.co.uk/quick-swr-calculator-for-vertical-and-dipole-ham-radio-antennas/>

Permanent Mounting Thoughts

Although I never designed this for permanent use, the pure joy of using it encourages us to hunt down solutions to the issue. Try it - but you may want to lower the antenna if a gale is forecast though.

Accident?

It can go wrong sometimes. It's only a thin walled fibreglass tube. As an "apprentice", I broke a few trying out new ideas. However, rather than me making a profit out of your loss, I do a lifetime "at cost" replacement. So if it breaks for any reason, I'll get a replacement to you "at cost". You only pay shipping. Just contact me for details.