

# DX COMMANDER

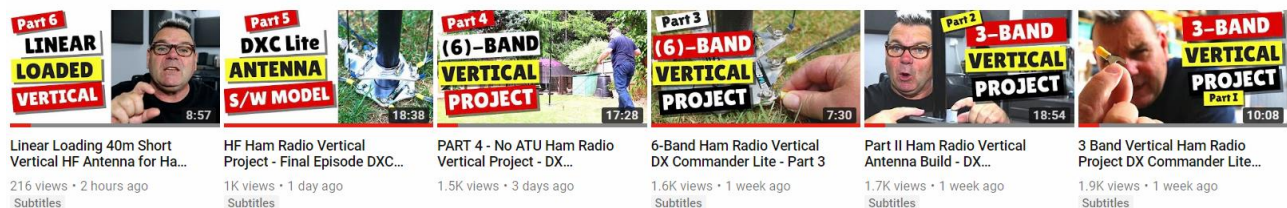
## DX Commander Lite 7m Antenna System User Guide Version 2.0 August 2020

### 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.

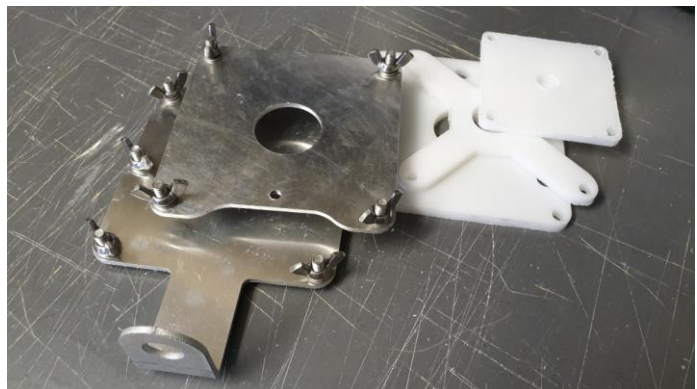
**POWER RATING:** As of early 2020. Natural Nylon QRO version has 1,500W continuous.

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



**Overview:** The antenna runs up to FOUR vertical elements 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 FOUR elements, 30m plus three other bands (eg 30m, 20m, 17m and say 10m). The 30m element gives a very close match to 50MHz, achieving better than -5db, low to the horizon, similar to a regular quarter wavelength radiator for DX.



**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 removing the two last sections. Keep these safe by inserting them temporarily upside-down in the top of the pole at the 5m point. These will act perfectly as the upper spreader holder.

**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). Coming back down the pole, Stop about 8 inches (200mm) below the guy point. Continue with some shock cord to a loop and connect that to opposite wing-nuts on the driven plate. Now.. due to some complicated law of physics on linear loading, this element will also give you a very good match just above (but not on) 17m (around 18.9MHz), 10m (around 27.8MHz) and almost perfect match on 6m bands. Your inboard ATU on your radio will easily tune both 17m and 10m with ease. Now you can still have two other bands. I use 20m and 15m where you will get a perfect match. To conclude, with this option, you will effectively have all the bands from 40m and up – although you may need your ATU function for 17m and 10m.



I have been using the 40m, 20m and 15m elements and using the other bands “bare-foot” with some great results recently. Yes, I really do use my own products!

## Parts list

1. DX Commander 7m Pole
2. Ground plate 3mm aluminium
3. Radiating Plate 3mm aluminium
4. Guy Plate - UHMWPE
5. Mid-Spreader - UHMWPE
6. Upper Spreader Plate - UHMWPE
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 (above driven plate)
14. Some tubing
15. Long length 4mm marine shock cord
16. Long length paracord (guying)
17. Plastic "snap" Carabiners
18. Length glue lined shrink-wrap

Please make yourself familiar with all the parts and satisfy yourself that all is present and correct. We take great care when Wendy and I pack these boxes so if something is missing, it's our fault. If we do make a mistakes, simply send an SMS / TXT message on the number that I showed on the order confirmation / shipping 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](http://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 tap 6mm holes, 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 called UHMWPE. This has good strength so that you should only see a small amount of bend as you tighten the guys up.
- Mid-spreader plate. This little "spinner" looking plate keeps the elements from moving about in the wind and keeps the SWR from fluttering. You can also attach smaller elements here.
- 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 and an SO239, hot glued and heat shrunk.

The hose clamp requires some clear 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 shock-cord extensions between end ends of the elements to an appropriate spreader. The holes on the upper spreaders are correctly sized to fit the carabiners.

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. 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 the element 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. On the other hand, you don't want your elements flapping around either.

Remember to make all your elements parallel. Don't cross them over on the way up.

## 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.

- 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 the 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)

**IMPORTANT NOTE:** If you do use 40m linear loading, reduce your 20m element by around 30cms (1 foot).

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?

As mentioned previously, configuring the assembly correctly, no ATU will be required on your chosen bands. 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 ATUs, 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!)

As discussed earlier, if you would like to try 40m band, we can linear-load it by going up to the top – and back down again. Initially, I discovered that depending on exactly how long or short you make this element, you can achieve resonance on 10m band at around 28MHz giving you easily 28 through 28.5MHz. Modelling suggests this is looking like a 5/8th for 10m. And you still have two spare elements for bands. If you do want 10m, (on this 40m element) you may need to make it resonate as high up on 40m as you dare, say 7.2MHz or higher. It will perform much like a 5/8<sup>th</sup> on 10m



### ADDING 80m as an Inverted L

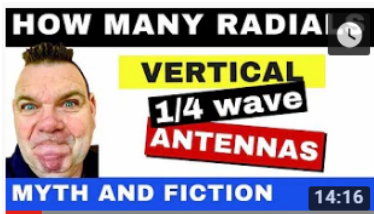
I've not attempted this on the DX Commander Lite since I believe the pressure of a sideways tensioned wire may be too much for the 7m pole. By all means try an Inverted L, but you may be stretching the physical limits. However, you may also find you get a great tune on 30m and 17m band!

### GLUE LINED SHRINK WRAP

Find a good quantity of this in your kit. You only need a small section per element to make your loop for the carabiner to connect to. Only fit properly once the elements are correctly sorted. 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 35% 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 lengths and connect them to the upper spreader and your elements. Aim for moderate tension else you may over-tension the fork connectors.

Solder blue fork connectors to the elements. 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 lug. 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 will never need to release these again.

Hammer thee guy stakes into the ground, 120 degrees apart from where the centre of the mast will end up, 120cms from the centre so your guys will be at around 45 degrees. 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 on 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 unless this is a permanent feature in your back-yard..

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. Clip the top carabiner to the upper spreader and the lower one to your element.

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.