Unified Antenna Kit - User Guide – April 2023 V1.24

HEALTH AND SAFETY WARNING

DX Commander antenna kits are designed for hobby radio amateurs who 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 and smooth with file / emery paper where necessary.

BEFORE ASKING FOR SUPPORT PLEASE READ ALL OF THIS GUIDE

KITS ARE COLOUR CODED and specific nuances for building each of the antenna are included from there onwards.

WHAT IS A DX COMMANDER?

Essentially, the DX Commander antenna system comprises a number of wire element suspended under tension on a telescopic pole. Most elements are quarter wave. Some have longer fold-backs to compensate for lengths and other times the fold-backs assist us to tune for perfect harmonics for other bands. Some have a coil to “load” a long element and make them appear shorter.

KEEPING IT SIMPLE

Please remember that all we are doing is creating resonant lengths of copper wire, held rigid on a telescopic pole using shock-cord.

In the main, our element lengths will be quarter of a wavelength long (sometimes we can use a loaded up three quarters, giving us near 5/8 performance).

We can make this as difficult or as easy as we like but if you miss a bit of the user guide or don't understand something, remember this is just supposed to just work. And it will. The laws of physics won't change between Warwickshire and your place.

RADIALS

I get more questions about Radials than anything else so it is worth pointing out right now that even if you only fit some copper wire in say a 90-degree arc, the antenna will still work. I happen to be a bit of a perfectionist and supply you enough wire to get you on the air nicely – and to be delighted. We have proven beyond a shadow of doubt that the specific lengths of radial wire will NOT matter, what is more important is just getting SOME lengths of wire on the ground.

FLAT ROOF INSTALLATION

I genuinely never thought that a flat roof would accommodate a DX Commander system. However, although I have never tried this myself, many people have installed their DX Commander on flat roofs. Some are low to the ground, say on a garage roof – and some even on top of a large building – even several stories high! Apparently they work, but I can't support you if you have a technical question because I have not tried it myself or done the analysis.

Have fun and enjoy your new antenna.

Callum McCormick

Callum McCormick, February 2023
Founder – DX Commander

OVERVIEW

All DX Commander Antenna kits comprise everything you need apart from guying stakes:

- Telescopic pole
- Aluminium ground and driven plates
- Spreader Plates
- Antenna Wire
- SO239 Assembly
- Selection of fork crimps, shock cord, nuts, bolts, washers and nylon clamps
- Guying and Shock-Cord
- Other various components specific to the model

TELESCOPIC POLE

All DX Commanders have a snug fit telescopic pole assembly with a screw cap at the base.

Remove any packaging and lay the pole across some garden chairs or work-horses.

Carefully pull out each section and firmly lock into place with a strong, firm tug-and-twist action. Ensure that extended sections approximately come out the same length each. It is possible that one or two sections may need more force to fully extend.

Double check with tape-measure they are all extended approximately the same amount (Note Classic, Expedition and Rapide have smaller length end sections).

> ***NOTE**: With the 12.4 and 18m poles the lower, fatter sections can sometime need some extra effort to extend fully. Ask a friend to assist if necessary.*
>
> *In the event you pull out a section and you observe some unpainted fiberglass, do not be concerned - HOWEVER after you double check the length of each section, if it has clearly been extended too much, push it back in a little way before fitting the clamps. We need a reasonable amount overlap between sections for engineered stability.*

PLATE SETS

ALUMINIUM PLATES

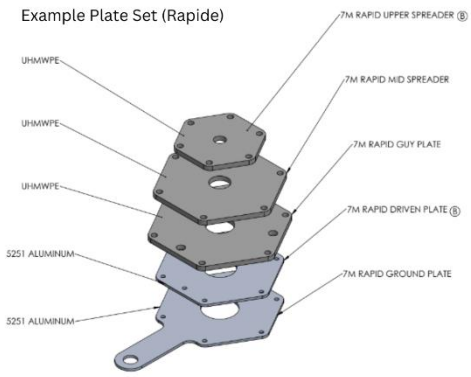
Ground Plate

Fit your SO239 Assembly to the ground plate and tighten the securing nut.

> ***NOTE**: You do not need the SO239 ground washer (if supplied). That may be discarded*

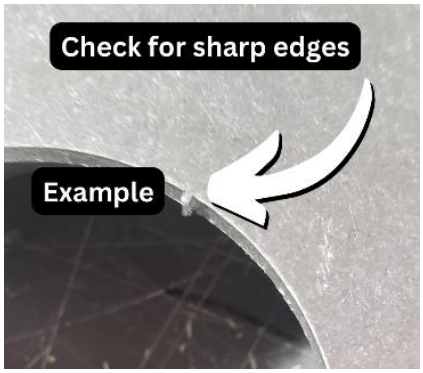
Unscrew bottom cap and fit the Ground Plate with the tab facing up the pole. Screw base cap back on firmly.

> ***NOTE:** Before you install the aluminium plates, it is easier to fit all the supplied bolts, washers and wingnuts to the aluminium plates (with the thread facing upwards).*



Driven Plate

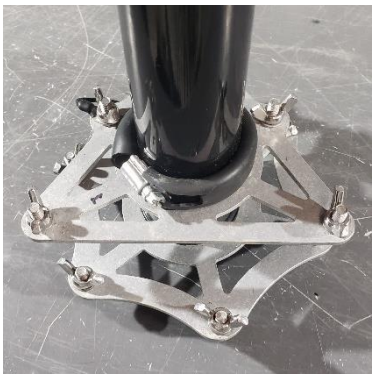
Slip the driven plate over the top of the pole, all the way to the bottom where it should sit snugly just above the plastic housing. We will fit a hose clamp here (next page). Secure the SO239 to the Driven Plate.



> ***NOTE**: Driven Plate might be a snug fit (by design). A file or some emery paper / sandpaper will smooth the inside of the plate to aid fitting if required. Do not force.*

Securing the Driven Plate

Fit the clamp just above the Driven Plate and pushing down as you tighten to ensure a snug fit. In the case of the hose-clamp arrangement (supplied into the middle of 2023), cut tubing to size, then cut a notch in the tubing for the screw assembly.



> ***Note**: Hose clamps have been depreciated and replaced with EzyClamps during 2023*

STAINLESS BOLTS, WASHERS AND WING NUTS

Fit the bolts to the driven and ground plates, thread facing upwards. Slip over a washer and screw on the stainless wing nuts.

> ***Note**: There is no direct engineering reason the threads must face upwards other than the fact that it is probably easier for maintenance in the future*

PLASTIC SPREADER PLATES

All plates have a different inside diameter hole. If you discover that two of the plates are the same size, something has gone wrong. Please let us know.

The plate with the largest inside hole slips over the pole first, and the plate with the smallest hole goes last. You will slide these into place so that each plate fits on every OTHER section, starting at the top of the second section from the largest diameter (bottom) section.

> ***NOTE**: These plates should be a snug fit – see later on this page for fitting tips*

STAY UP KIT

You will find specialist nylon (PA66 material) hose-clamps in the accessories kit. The screw threaded part needs to be pushed into the band and click. Fit **above** each join and cut remainder of the tab clean off. A lighter will smooth the edge where you cut it.

> ***Note**: Expedition Kits have wing-nuts and the remaining kits have 8mm Hex bolt heads. Clamps go JUST ABOVE each join to stop sections collapsing.*

Use all the clamps in the kit from fattest pole section to smallest pole section. You will eventually run out of clamps because the minimum bend radius of the clamps are 20mm (just under 1 inch) and not enough bend to go around the smallest sections. If you end up with a spare, just store it.

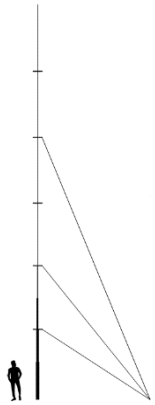
> **Note**: *Fit your clamps below each plate and above the join.*

- Video explaining these clamps here: https://youtu.be/Pu3HJBYzrIM
- Experience has shown that the smaller diameter sections, right at the top of the pole do not need clamping however a few wraps of tightly wound electrical tape can give you peace of mind for the remaining joins above.
- A zip tie here can give you what we call in the UK, “Belt and Braces” approach too.

Your support pole is now complete, all that remains is to snugly push each nylon plate down so that they now fit just above each clamp / join.

> If you find some plates are too tight, just rotate the plate whilst pushing down until they are very snug and don’t rotate easily. There is no need to use excessive force. In the event they genuinely don’t go down to the next join, do not worry (by design).
>
> Conversely, if you feel that the plate has too much wiggle-room, you can pad the pole out with one or two wraps of electrical tape so that the plate nests snugly and fit the clamp ABOVE the plate. Obviously, if using your DX Commander for temporary use, skip that part. It doesn’t matter.

TESTING YOUR ANTENNA POLE



Once you have all the clamps and plates installed, we recommend that you test your pole out so that you may gain experience in how the pole flexes and handles at your location.

Chose a spot at your location for the base of the pole, making sure you are aware of any obstructions, electrical wires and considering any health and safety you may need to be aware of.

> ***TIP:*** *Clear the area of pets - and people who are not directly helping you.*

Mark your chosen spot and place guy stakes at 120 degrees apart.

GUYING

Classic system (Rapide, Classic and Expedition)

Install three guy-stakes (not supplied) 120 degrees apart and approximately 1.2m (4-feet) away from the base of your proposed installation.

Cut the supplied paracord into three equal sections and secure to your guys stakes. Bring each of the three paracord lines towards the centre of your working area where the antenna will be.

Make a small loop just over half-way between the guy stake and the guy point will be. To confirm, this will be around 50cm / 2-feet from the guy plate.

Site the base of the antenna on the ground and lean it on your shoulder, reach down and grasp the first guy. Insert the end of the guy rope through one of the guy holes in the guy plate and pull it back down towards the loop you have just made. Place this return line through this little loop and tie off with a gentle half-hitch.

Repeat for the other two guys, then adjust where necessary. For fine-tuning the vertical appearance, you can simple relocate the base of the antenna a small amount.

Double-tie off your guys with more half-hitches: https://youtu.be/9fT8N0jWO5A

GUYING the Signature series

For larger systems (12.4 and 18m kits) guy at between 4m and 6m radius. The wide the radius, the less force you will need to apply to the guy points. Lay the pole down with the centre of the pole at the chosen spot facing AWAY from one of the guy stakes. We will call this guy stake (the one facing away from you) the “1st” guy and the remainder guy stakes (and guy lines) 2nd and 3rd guys.

For testing purposes, attach the three supplied guy lines to the third spreader plate using the larger holes on the spreader plate. I use a bowline knot here. YouTube has plenty of examples of how to tie this knot. Also here: https://youtu.be/9fT8N0jWO5A

Lay out the guy lines carefully and drape the 2nd and 3rd guys around your guy stakes opposite your 1st stake. The 1st guy wire should come back down the pole, freely towards the centre spot.

Make sure your guy lines are free to move around your 2nd and 3rd guy stakes as you erect the pole but on the other hand, do not snag.

Have an assistant hold the pole on the spot, and starting from half-way down the pole, lift the pole up. The centre of gravity is half-way down the fourth largest section towards the bottom.

> ***TIP**: You can make a pseudo hinge for tilting purposes out of any small diameter round pole (or tube) up to 50mm / 2-inches in diameter in either wood or metal and around 30cm / 12-inches long is ideal). Attach a small section of strong cord to the base of this tubing by drilling a through-hole near the end. Insert your cord and tie off a stopper knot.*
>
> *Unscrew the base of the Signature pole and remove the bottom rubber bung and screw the base back on. Insert the tube you have made (the end opposite the hole you drilled) into the Signature pole. Guy this tube opposite guy #1 (towards the direction of the pole which is laying down) not more than 30cm / 12-inches away from your target spot opposite guy #1.*
>
> *Now when you attempt to lift your completed antenna up, push away from this "stabilisation" guy the end of the pole should not lift up in the air more than a few cm / inches until the centre of gravity pushes it back down to the earth.*

Raise up the telescopic pole vertically (look behind you once or twice to make sure that guys #2 and #3 are not catching on anything). Once nearly vertical, lay it back down – taking note of where the guy lines stopped being dragged past the 2nd and 3rd guy stakes.

Make a temporary connection to the 2nd and 3rd guy stakes and repeat the erection again.

One you have a near-enough vertical system, you can make the final connection to the 1st guy stake and make appropriate adjustments to all three guy lines.

Now release the 1st guy stake and lay the pole back on the work-horses ready for radials and element installation.

You may wish to add more guys now and test appropriately.

KNOTS

We made a video about the knots we use here: https://youtu.be/9fT8N0jWO5A

6m, 4m and 2m VHF bands (All Kits)

It is likely you will get a tune on both 6m and 2m band (and in the UK, the 4m band too). A tune is not guaranteed - however a nudge of your ATU button will certainly bring in 6m and also deliver some useful and even surprising low-to-horizon gain. On 2m, there are some people on YouTube that have opened repeaters 50 miles away or so. But it was never designed as a VHF antenna.

MAKING ELEMENTS

DX Commander Unified Cutting Chart – do not consider the foldback, just cut as chart.

Expedition (m)	80m	60m	40m	30m	20m	17m	15m	12m	10m
Metric	See Notes	n/a	11.2	6.8	5.02	3.9	as 40m	2.88	2.6
Feet' / Inches"	-	-	36' 9	22' 4'	16' 5 5/8	12' 9 5/8	-	9' 5 3/8	8' 6 3/8
Create foldback loop of	-	-	none	6cm	20cm	6cm	-	6cm	6cm
Create Tension loop at			4.8 (15' 9")						

RAPIDE	80m	60m	40m	30m	20m	17m	15m	12m	10m
Metric	n/a	n/a	See notes	6.99	4.95	3.85	3.29	2.81	2.5
Feet' / Inches"	-	-	-	22' 11'	16' 3	12' 7 1/8	10' 9 1/2	9' 2 1/2	8' 2 3/8
Create foldback loop of	-	-	-	6cm	20cm	6cm	6cm	6cm	6cm

CLASSIC	80m	60m	40m	30m	20m	17m	15m	12m	10m
Metric	See Notes	n/a	11.15	6.8	5.02	3.89	as 40m	2.84	2.5
Feet' / Inches"	-	-	36' 7	22' 4'	16' 5 5/8	12' 9 1/8	-	9' 3 3/4	8' 2 3/8
Create foldback loop of	-	-	none	6cm	20cm	6cm	-	6cm	6cm

SIGNATURE 9	80m	60m	40m	30m	20m	17m	15m	12m	10m
Metric	See Notes	n/a	11.55	6.94	5.78	3.86	as 40m	2.83	2.5
Feet' / Inches"	-	-	37' 10 3/4	22' 9	19'	12' 9 1/4	-	9' 3 1/2	8' 2 3/8
Create foldback loop of	-	-	none	6cm	104cm	6cm	-	6cm	6cm

SIGNATURE 12.4	80m	60m	40m	30m	20m	17m	15m	12m	10m
Metric	22.5	n/a	9.48	uses 80m	4.95	3.9	3.29	8.31	8.4
Feet' / Inches"	73' 10	-	31' 1	-	16' 3	12' 9 5/8			
Create foldback loop of	none	-	6cm	-	6cm	6cm	6cm	36cm	140cm

Sig 18	80m	60m	40m	30m	20m	17m	15m	12m	10m
Metric	22.23	13.02	9.87	6.88	4.97	3.86	as 40m	-	-
Feet' / Inches"	72' 11	42' 9	32' 5	22' 7	16' 3 3/4	12' 8	-	-	-
Create foldback loop of	7.2m (23' 8)	6cm	6cm	6cm	6cm	6cm	-	-	-

NOTE
6cm = 2.36 inches
20cm = 7.9 inches

NOTE: Scroll to later build pages for additional tips / notes per build - later in document

* Metric to Imperial Conversion: https://www.rapidtables.com/convert/length/meter-to-inch.html

Feel free to have the confidence to cut your elements precisely to the cut chart. Adding too much length to your element will just give you more tuning work later. And in any case, it is extremely easy to add a small length of wire.

If you feel that you do want to add a little bit more to your element length, then add it to the foldback – not the overall length – then simple cut the foldback for best tune.

> ***TIP**: Converting from scientific metric lengths to imperial feet & inches: If you need to convert from metric to feet / inches, google phrases like "convert 8.4m to feet and inches". Alternatively, as a hobby scientist, perhaps invest in a dual imperial / metric tape measure.*

INSTALLING FORK CONNECTORS TO ELEMENTS

Each element will require a fork connector at the base.

> Cut your element according to the cut chart. This really is a CUT chart, so measure and cut (ignore fold-over for time being).

Cut 20mm (3/4 inch) of glue lined heat shrink and slip that over the end of the element.

Trim 12mm (½ inch) of insulation from each element. Twist and bend over each trimmed end (just to pad it out a tiny bit) and place inside the barrel of a fork connector and crimp.

> ***NOTE**: before we had fancy crimp tools, we used a pair of regular old (blunt!) side cutters to make a good squashed connection here before optionally soldering.*

Don't worry if you have not got a soldering iron, crimping this hard will be suffice and the glue lined heat shrink will keep out moisture / corrosion.

Slip over the small section of glue lined heat shrink (that you have already placed on the element) and slip this down, right over the barrel of the fork and heat with gas hob / lighter or hot air gun.

> ***NOTE Labelling your elements:** The author happens to know the order of the colours of the rainbow so I identify 10m with red, 12m with orange etc. You can buy multi-coloured 3M Electrical tape packs for this. I labelled my elements with a small "flash" of tape about 120mm (6-inches) from the Driven Plate.*
>
> *Alternatively, you can buy small "number cubes" that children might make up for bracelets. These are literally pennies on Amazon / eBay etc and make your installation look great.*
>
> ***Tip:** Mark your elements somehow else you can get confused in the field.*

RADIALS

Please remember to make your elements **FIRST** before making up your radials else you may use up too much wire from the kit.

As a rule of thumb (and depending on ground), 1 wavelength of radial wire at the lowest frequency of operation (cut to almost any random length[s]) laid out in a radial pattern will achieve only 1.6dB less than 120 radials of ¼ wavelength radials.

2 wavelengths of radials will give you 0.4dB more than 1 wavelength.

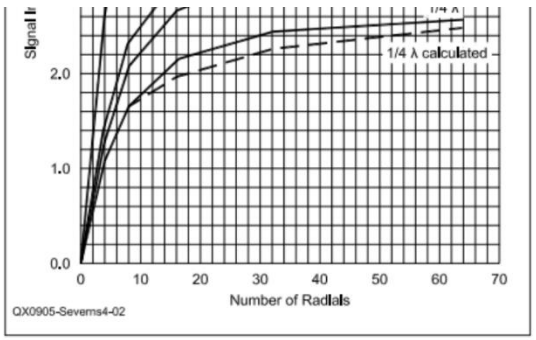


Figure 2 — Typical improvement in signal as ¼ λ radials are added to the basic ground system (a single ground stake).

Of interest, cutting the radials down from 1/4 wavelength to 1/8 wavelength BUT doubling the number has almost zero effect on efficiency. Same amount of wire, just more of them (science experiment courtesy of Rudy Severns N6LF).

To clarify, say we want to operate on 40m band. We can compare one wavelength of wire (40m) and cut that into say 8 equal sections, each 5m long – this is only 0.4dB less than 16 pieces of wire of same length.

Source: https://rudys.typepad.com/files/qex-ground-systems-part-4.pdf (Page 4)

After making your elements, and with the spare wire, make up your radials according to ANY LENGTH that fits your location. This means some can be smaller and some can be longer. It really doesn't matter.

Suggest fitting 4 radials per fork connector. For most systems, radials between 3m and 5m will be suffice. For a large system, using say 200m of wire, here are some examples:

Number Radials	Length (m)	Number Forks
9	22.2	3
16	12.5	4
20	10.0	5
24	8.3	6
28	7.1	7
32	6.3	8

This is really up to you. Aim for more shorter radials rather than less longer ones. For Expedition and regular Classic kits and Signature 9, radials of around 3m in bunches of 4 works just fine.

Check out the video: https://youtu.be/mdqFyWGOOQE

FITTING FORK CONNECTORS TO RADIALS

Cut all your radials in bunches of four, trim approximately 30mm (1 ¼ inch) of insulation from each radial. Twist these 4 bare copper strands LIGHTLY together and then slip over around 25mm (1-inch) of glue lined heat shrink.

Place your twisted together radials inside the barrel of a fork connector and crimp.

> ***NOTE**: before we had fancy crimp tools, we used a pair of regular old (blunt!) side cutters to make a good (squashed) connection here before optionally soldering.*

Heat up the fork connector with your soldering iron by adding a small blob of solder here. Let cool for a few seconds and slip over the small section of glue lined heat shrink that you have already placed on this radial set. Place this right over the barrel of the connector and heat with gas hob / lighter or hot air gun.



Construction of set of 4 x radials

INSTALLING RADIALS

Lay your radials out neatly on your ground, ideally in an equidistance pattern from your centre spot.

For permanent installation, DX Commander recommends 50mm / 2-inch biodegradable ground pins which are often available from golf shops (also from the DX Commander Store), pinning the elements to soft ground every 1m-1.2m (3 to 4 feet).

We made a video about radial pins: https://youtu.be/scDXKNJs7i4

Wooden dowels or other lawn pins are available, be creative.

In practice and with some care, children and pets can still play out immediately after installation. Radials may also be laid on concrete, decks or hard surfaces with no ill effect (other than aesthetics).

Consider that in time, you will wish to tilt your antenna over for tuning, maintenance or for storm protection. You can either:

a) Leave some wiggle-room for your radials, near the base of the antenna, to allow for tilting over and the disturbance that will have at the base of the antenna - and the potential for the radials to be pulled out the ground or

b) Disconnect the radials before tilting over.

ELEMENT FOLDBACKS

You will notice in the cut chart that we fold some elements over by 6cm (2 ¼ inches) and some other cases by 20cm or even more (these lengths are included in the cut chart – don't add more).

Do that now and secure the folded-over loop with some electric tape on a TEMPORARY basis.

When you make your loop, leave 15mm (¾ inch) "hole" at the top of each loop to allow you to push a shock cord knot through in the field. For now though, use electric tape.

- ***Remember:*** *Replace all the electric tape after checking the SWR curves with glue-lined heat shrink (supplied)*

SHOCK CORD

All elements are secured with shock cord between the end of the element and the next available plastic spreader.

We supply 4mm Marlow Dyneema genuine marine shock cord which stretches to 200% length. In real-world use for our purposes, we are aiming for a stretch of around 175% initially which holds our elements just tight enough. This may be increased once tuning is complete.

NOTE*: It is important you understand a simple stopper knot, sometimes called a double-overhand knot. Please practice on a small piece of shock cord before proceeding.*

TIP: *If you don't over-tighten these knots, you can easily undo them before final tune.*

Evolution of a Stopper knot

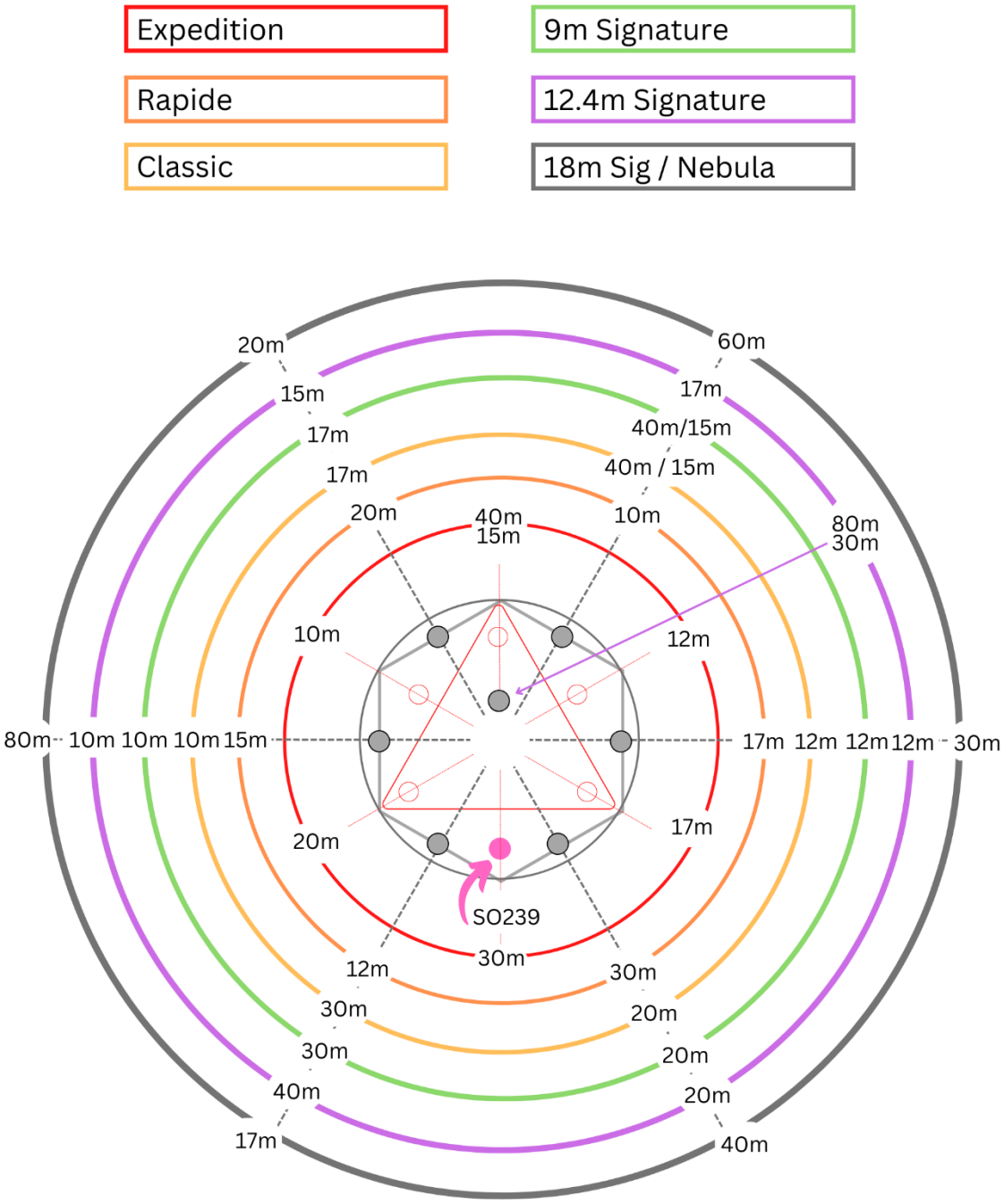
Some people prefer a figure-of-eight knot however the knot shown is preferable because it makes a better "lump" and in practice holds the element very well.

TIP: *A double over-hand ("stopper") knot is just a regular knot with one extra turn.*

INSTALLING ELEMENTS

***Note**: Before you check ANY tuning, you MUST install every element since they will affect each other slightly. Small increments of tune will have no effect on another element – but if the element is completely missing, you can accidentally tune up incorrectly.*

- **IMPORTANT:** Ensure all your plates are rotated to match their hole patterns so that all elements will end up totally parallel to each other (and plates right way up).



***NOTE:** Before you read the following: Check the notes further down this page for 30m and 40m elements.*

One at a time, connect an element fork-connector under the wing-nut on the driven plate and run it up the pole, threading up each spreader plate hole. Take the hank of Marlow Dyneema shock-cord and tie a stopper knot on the end. Thread the cord through the hole you have just made at the end of the element and then tension the shock-cord through the next available spreader plate.

Tension and tie off with a gentle stopper knot. You may re-tension these all these later in the build once you have confidence that the element is the correct size.

Leave a tail of 75mm / 3-inches and then cut the shock-cord, leaving you with the remainder of the hank for the next element.

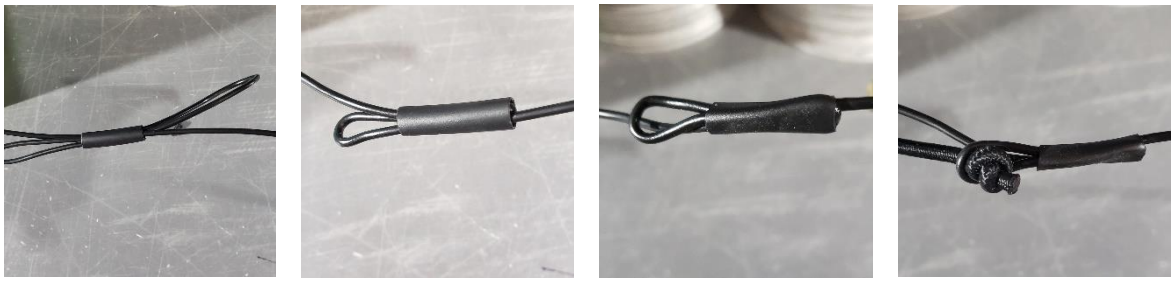
> ***Tip**: Do not waste the shock-cord by cutting into random sections, instead use it up gradually for each element. In the event that you do want to make an extension one day, you can use some 550 paracord cord and tie it to the shock-cord using a "fishermans" knot. This webpage explains it nicely: https://www.netknots.com/rope_knots/fishermans-knot*

IMPORTANT MID-WAY TENSIONING LOOPS

For longer elements, more than 5m in length (that's longer than 20m band), make an intermediate "tension" loop mid-way between the driven plate and the end of the element. In most cases, this will be around the 2nd spreader.

The idea of this intermediate tensioning point is to keep your elements nicely balanced in tension when the wind blows. Repeat again for 60m and 80m elements (if you have them).

> ***Note:** This very small loop as a percentage of wavelength and has almost zero impact on your tune, do not worry.*



Steps to create a mid-way tensioning loop

> ***Tip**: Do not over-tension your elements (yet) allow for a little bit of extra stretch of shock cord for final tensioning. You can test this by grasping a knot above the spreader place and simply pulling up. Make sure you can still pull up. This is JUST IN CASE we need to make an element smaller during any tuning you may wish to make.*
>
> *Once the antenna is complete, you can pull up hard on the stopper knot, above the plate and re-tie the knot for a very secure, tensioned antenna.*

TUNING

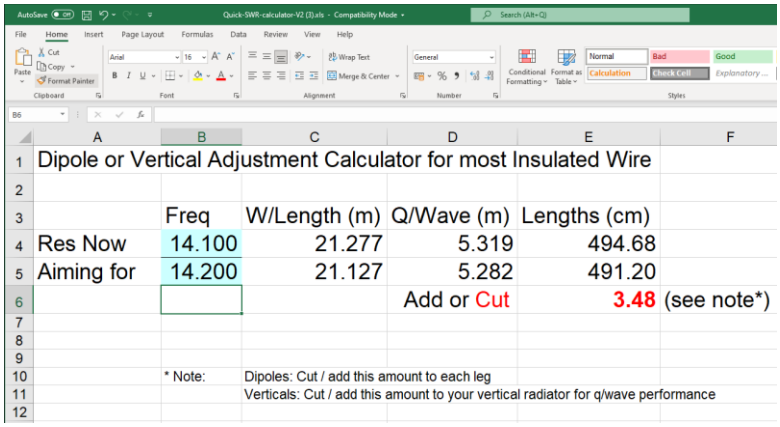
Some people get confused if they should shorten or lengthen their antenna. In simple terms, if your antenna has best tune too LOW, then it's generally too LONG. If it tunes too high, it's too short.

> ***TIP:*** *If you remember that LONG and LOW both start with letter L, you will not forget* 😊

To assist us with tuning, we created a very simple SWR cut chart calculator found here:

SWR Calculator

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



	A	B	C	D	E	F
1	Dipole or Vertical Adjustment Calculator for most Insulated Wire					
2						
3		Freq	W/Length (m)	Q/Wave (m)	Lengths (cm)	
4	Res Now	14.100	21.277	5.319	494.68	
5	Aiming for	14.200	21.127	5.282	491.20	
6				Add or Cut	3.48	(see note*)
7						
8						
9						
10		* Note:	Dipoles: Cut / add this amount to each leg			
11			Verticals: Cut / add this amount to your vertical radiator for q/wave performance			
12						

Rather than use the calculator, for ¼ wave elements, this guide will assist:

- To change 17m band by 100kHz, cut or lengthen by 2cm / ¾ inch
- To change 15m band by 100kHz, cut or lengthen by 1.5cm / ½ inch

NOTE: For elements that have a long fold-over, you can adjust the fold-over rather than the total element length. Fold-overs have less effect on the tune than might be expected.

Therefore, instead of shortening or lengthening the 40m element by (say) 100mm / 4-inches you can instead adjust the length of the fold-over by between two and three times that amount for roughly the same effect.

Obviously, for elements that only have a 6cm fold-over, you are wise just to undo the fold-over and add/remove the amount required then re-create the 6cm fold-over again.

FINAL TUNE

Once your elements are perfect:

a) replace all your electrical tape with glue-lined heat-shrink
b) fully tighten up the shock cord to almost maximum tension – probably around 180%

Expedition

40m and 15m is catered for on a single element which goes to the top of the pole and then comes back down around 2m / 6-feet (normally less).

We used to supply small sections of clear tubing to assist with holding the element in place. In almost EVERY case, people lost them.

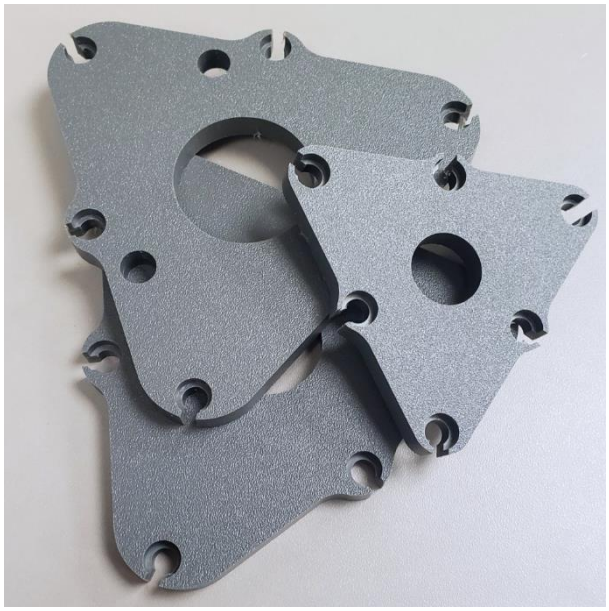
Customers reported they all reverted to using electrical tape for short portable operations. If you want to try this out, you can buy a small piece of ¼ inch / 6mm aquarium tubing on ebay for pennies.

Guy the Expedition at the first guy point. Holes have been created for this purpose. Just let it "sway" in the wind. As long as the guys hold, you will find the antenna happily bends in the breeze.

Plastic Element Spreaders: Now in grey, the holes in spreader plates have "speed-slots" to fit your elements, rather than threading them through in the field.

To stop your elements popping back out again, we recommend you use a small section of glue lined heat-shrink, just where the element slots in here.

Pull up on the shock cord to allow the element to pop in and stay put during your activation.



You will note that spreader plates are a one-way fit.

Use spreader plates with the countersunk hole facing upwards, towards the sky.

This will hold your stopped knot in place and stop it pinging out.

We made a video about the speed-slots here: https://youtu.be/6vJLHinSnCs?t=116

80m: Some people report success with a 19.5m long (64 feet) element as an Inverted L (as on the All-Band-Vertical Classic). We suggest you start your "inversion" at the 5m Upper-Spreader point. Note, you will get a lot of bend on the pole in this configuration. It might not look pretty, it'll still work :)

30m: The pole is not suitable for running another spreader high up (like the Classic), instead for 30m, you will have secure some shock-cord with a stopper knot to some electrical tape and connect the element to that. Actually, this was the original design for the Classic

6m: It is likely you will get a tune on both 6m and 2m band. A tune is not guaranteed however a nudge of your ATU button will certainly bring this in. Some useful low-to-horizon gain. On 2m, there are some people on YouTube that have opened repeaters 50 miles away or so. But it was never designed as a VHF antenna.

REPEATABILLITY: In practice, you will need to extend the tube out about the same amount as you did when you built the antenna in the first place. So make sure you know what tension to apply to each section. Make sure that the distance between the bottom of the element and the upper-spreader remains constant. A firm twist and pull will be required to friction fit. Practice makes perfect. If you have an inexperienced assistant, you can show them.

RADIALS: Suggest you make up radials not more than around 3m in length in bunches of 4. The reason for 4 is that when you deploy, you will find that one hand can easily grasp 2 radials and the other hand, another 2 radials and they will easily drape out along the ground. No need to be fussy, just drop them on the ground.

VIDEO

This video shows how Tom and Callum built Tom's Expedition for Tom's trip around Isle of Arran in 2022.
https://youtu.be/xyiI3AGWmM4

Note: *It doesn't show how we now make the stopped knots and also the new speed-plates.*

Rapide

The Rapide is extremely easy to build, it's very light and ideal as a first antenna or for those with HOA restrictions or maybe have a different solution for 40m band. It sports quarter wave elements for 6 bands: 30m, 20m, 17m, 15m, 12m and 10m and it works beautifully.

The build video is here:

https://youtu.be/8dJcm_ax3Uk

Adding 40m

With a small amount of effort, you can convert 30m into a 40m element with a loading coil half-way between the driven plate and the first guy / spreader plate. This is a permanent change:

1. 40m Region 1 (7.00 to 7.200 MHz) Wrap 14 turns of wire just below the white band on the pole (about 24cm up from the base) then continue to top and come back down 60cm. This assumes your pole is 6.5m long.
2. 40m Region 2 (say you need 7.200 to 7.300 MHz) Wrap 13 turns of wire just below the white band on the pole (about 24cm up from the base) then continue to top and come back down 130cm. This assumes your pole is 6.5m long

Fine tuning can be made by cutting or adding wire to the fold-back element at the very top. Bear in mind that each turn of the coil is around 220 kHz change. So if your best SWR is at 7.22 MHz, removing one turn will centre you at 7.00 MHz

Remember that fold-backs have less effect than you might imagine so if you need to adjust the element by let us say 100mm / 4 inches, if you are adjusting the fold-over, double it.

A video showing the coil is here:

https://youtu.be/f291TJa-nQM

Note: *Make the centre of your little coil half-way between the driven plate and the first Spreader Plate.*

With the 40m mod, there is a slightly different cut chart to compensate for the loading coil:

- 10m 2.65m
- 12m 3.04m
- 15m 3.21m
- 17m 3.81m
- 20m 4.78 m
- 40m 10.03m

To keep things neat, you can use a loop on your element and a length of shock-cord to tidy up the wire to-and-from the coil.

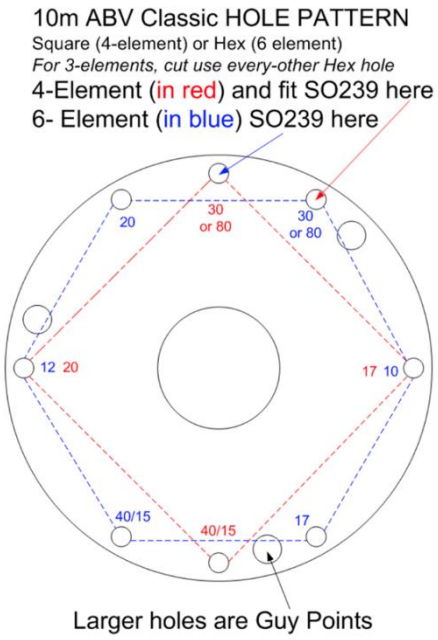
Picture shows a plastic carabiner however exchange that for a stopper knot and a loop on the shock cord (as we do on the Signature 9 Tuning Tips (page 19)

We have never tested 80m on this antenna however with some effort, it might be possible as an inverted L, as per the design of the Classic (next page).

The build video does not demonstrate the new clamps and it also shows the old-style carabiners which are no longer used (see earlier in document).

Classic

The 10m Classic extends to between 9.2 and 9.3m tall (overall length not important) with a number of options.



Option 1: Run all 6 elements as quarter-waves in a naturally resonant manner giving you 40m, 30m, 20m, 17m, 15m (as a ¾ off the 40m element), 12m and 10m. The 40m element gives a good match somewhere near the 6m band. The 30m element also resonates around 50 MHz. In this configuration, you will also get a near tune on 4m and 2m – and even 70cms but the radiation pattern for 70cms will not be conducive for anything other than short walkie-talkie type chatter

Option 2: You can exchange the 30m element for an 80m element. See the 80m section later in this document

Option 3: Build any 3 or 4 element antenna for the bands of your choice. The hole spacing on plates cater for this

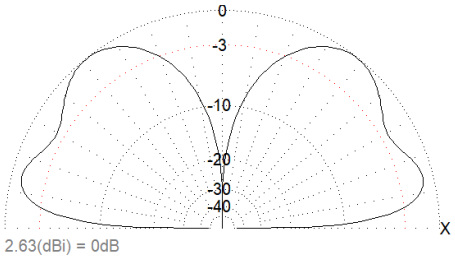
The plate sets have hole patterns for equidistance elements to cater for either 2, 3, 4 or 6 elements. A twin-holed upper spreader is included as to connect 40m and 30m.

Exchanging 30m for 80m

Simply cut an element 19.5m long (64 feet) and replace the 30m element. Run this up to the Upper Spreader (where 20m connects to). Attach a tensioning loop about 120mm / 8-inches below the spreader plate and make up a small shock-cord extension for strain relief. Take this new element to the nearest tree and tune (cut) to suit. See SWR Calculator on page 15.

Tuning 40m

Your 40m element will go to the top of the pole and back down again by around 2m/6-feet (normally less). Remember that fold-backs have less effect than you might imagine on tuning so if you need to adjust the element by let us say 100mm / 4 inches, if you are adjusting the fold-over, just double that to 200m / 8-inches.



Your 40m element will also give you the 15m band as a pseudo 5/8 similar to the picture shown.

This build video does not demonstrate the new clamps and it also shows the old-style carabiners which are no longer used (see earlier in document).

SIGNATURE 9

The Signature 9 extends to between 9.0 and 9.1m in total length. It is designed as a guy-less system and is supplied with a ground post for holding the antenna upright.

We made a video showing the ground post installation here: https://youtu.be/17ZWLkZqt0k

It is up to you whether you use a concrete mix or just let the earth settle (depending on your ground conditions). Remember that in the event of a total loss or relocation, you will probably have to dig the concrete "lump" out.

Like the Classic, this antenna is primarily designed for 40m-10m with bonus band on 6m (normally slight ATU will be required on 6m). It may also work on 4m and 2m too, depending on a few factors including the actual tune of 40m and 30m elements along with ground conditions. Because the Signature 9 is intentionally a tiny bit smaller in overall length to the Classic, the cut chart is a little different.

Working on garden chairs or perhaps some temporary workhorses, with the ground plate by unscrewing the bottom clamp, removing the rubber bung, fit the ground plate and screw the base back on. The base will not be required for permanent mounting but it will be handy to keep it on for the time being.

Slide the driven plate into place all the way down the pole, snugly into place and fit the clamp to top it raising up. Remember to fit the SO239 assembly (supplied). Fit the remainder of the 4 plastic plates: larger hole obviously goes first, smaller hole at top.

Fit the clamps above each join and twist and turn each of the spreader plates snugly as far as they will go. Cut the spare ends of the clamps.

There is no clamp by the upper spreader and one is not required. Only wrap three or four turns of electrical tape here. There is very little tension pulling down here (although the upper spreader should be under tension).

Cut your elements according to the cut chart and fit the fork connectors, as previously discussed.

Screw all bolts into the holes on the alloy plates, add washers and lightly thread on the wing-nuts. Screw your elements under each fork connector, as per the circular diagram earlier in this guide. Pull your elements one at a time up the pole.

For 10m, 12m and 17m, you will create a 6cm foldback on each cut element, you will fit some shock-cord between the element foldback and the next available spreader plate, creating stopper knots on each component as discussed earlier. 20m, 30m and 40m have longer foldbacks.

On 30m and 40m, before you tension the top of the element, create an intermediate tensioning point on the 2nd plastic spreader plate. This was discussed earlier and shown in the video.

On 30m, create your foldback according to the chart and tension at the upper / top spreader. For 40m, do the same but continue right to the very top and come back down the pole after going through the hole and head back through the top spreader plate - almost roughly opposite where the top of the 30m element stops. Use tape to secure.

SIGNATURE 9 Continued

40m TIP: Tension the extreme top of the 40m element by slightly bending the last two sections of fiberglass pole as if you were creating a very mild bow – like a bow and arrow. Take the element through the top hole and secure right away with tape whilst you have this mild bow effect – and at the same time secure the return element to the same place. This has the effect of creating just the right tension.

The return element needs to be opposite itself – so that the element going up – is opposite the element coming back down the pole. You can keep these stable with tape. This is important due to the precise amount of linear loading we are applying to the top of the mast. This has very little effect on 40m band, but quite a lot on the 15m band.

Tape the element going up - and down around the join between the two top fiberglass sections and also halfway in between, so you should have stability approximately every 45cm / 18 inches via electrical tape.

Finally, tape the very end of the 40m element - where it should approximately end up where the 30m element comes up. The exact dimensions are not too important because returns have very little effect on the tune (when compared to overall lengths).

Before fitting your ground radials, you may consider whether you really need the screw base on the ground plate. We have discovered it is easier to unscrew the base cap and keep out of harms way for another day.

The ground plate can then be slipped over the pole and connected to your radials. Simply slipping your completed Signature 9 over the ground post and connecting the SO239 wing nut is all that is required. Do the same for removing the antenna for maintenance / storms.

80m: We have yet to test this on 80m however there is absolutely no reason why you cannot remove the 30m element and replace with an 80m element, exactly as the Classic. Read that section in the Classic section earlier in this document and decide.

Incidentally, if you do change to 80m, 30m will still work, but you will have to “nudge” your ATU button since it is likely best tune will be around 1 MHz higher at around 11 MHz

Speedy removal: Simply undo the SO239 assembly and pull the Signature 9 off the base. It’s extremely easy and works just fine for making tuning changes etc.

There is a build video here which will assist: https://youtu.be/_4HwWUDCTgU

Calibration Coils for 40m and 15m bands

In the main, the tuning for 40m and 15m works "out the box". Testing is done in our R&D antenna field at Holly Farm. This is where the cut charts are created and tested – almost all customers have a similar experience as we do but you MAY need to independently tune 15m from 40m and visa versa.

Depending on ground conditions and other variables that we are not privy to, it is possible that once you find the perfect tune for 40m band, 15m band might not in the right place for you.

> **NOTE: If you are an "ATU" user and don't care about the perfect tune, then you can skip this section, however the whole essence of DX Commander is a "no-tune" antenna system so you do not need an ATU at all. For 100W stations with ATUs, it doesn't matter.**

This could be an enormously complex document to do with end-effect on harmonics however there is a multiplier at work here. We are looking for a harmonic multiplier of just under three (3). So that if you multiply say 7.2MHz by 2.95, we end up with 21.24MHz (perfect considering wide bandwidth).

It's important to note that a straight 40m vertical with no loading at all has a harmonic multiplier of just over 3 to give us a harmonic resonance again at around 21.8MHz. However, by slightly loading the very top of the element via the foldover, the multiplier normally changes to around 2.95 (perfect).

It is possible that this multiplier can cause issues depending on various ground conditions, the multiplier may be too great or not enough. For instance one customer's multiplier was 2.85 which meant his 15m resonance way towards 20MHz.

All we need to know therefore is that top loading makes the multiplier less and base loading makes the multiplier more.

Two solutions to increase or decrease this multiplier follow:

> ***IMPORTANT:*** *Before you start, make sure to create a spreadsheet or notepad that shows you your current SWR charts from 1.5:1 SWR through resonance and back to 1.5:1 the other side for both bands.*

Let us assume that you have tuned your 40m element to best resonance at 7.2MHz. Upon checking the 15m band, you find EITHER it is resonant too low or too high in the band, this is what to do:

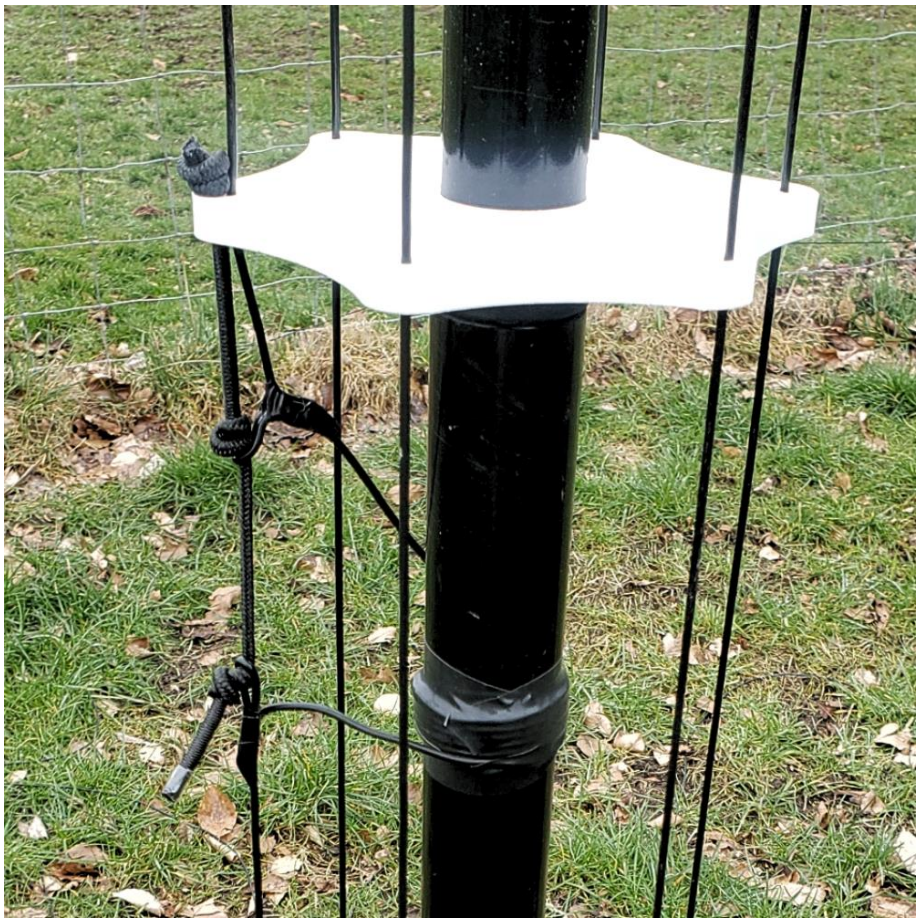
15m resonant too high (we need to reduce the multiplier)

> Remove the top of the 40m element so it is still connected to the very Upper Spreader but you have a length to play with. Wind a small coil of around 6-8 turns about 50mm / 2-inches above the very top spreader, closely spaced. Then tape it up and put the 40m element back in place. Test and adjust appropriately.

SIGNATURE 9 Continued

15m resonant too low (increase the multiplier)

Remove the 40m element completely, right back to the fork connector and remove all tensioning loops.



Make a small tensioning loop around 5 inches under the base spreader plate (the bottom one with the three holes for optional guying). Wind 5 turns to make a coil around the pole here and make another tensioning loop and use some shock cord to so we can elegantly continue the element up the pole.

Re-tension with loops and chock-cord and test.

Once your adjustment coils are fitted, check the tuning against your chart you made earlier and adjust the foldback of the 40m band appropriately. It is likely you will need to cut some off.

Use the SWR CALCULATOR on M0MCX.co.uk to check cut chart.

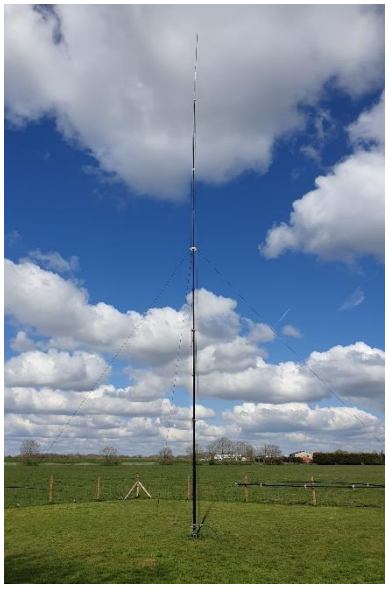
Keep making notes. Don't guess – learn from what the data is telling you.

12.4 Signature

All elements are effectively ¼ wave in length with some caveats:

- 80m is a loaded ¼ wave antenna with a coil of around 100 turns located at around 8m (26 feet) up the pole. The placement of this coil determines the next harmonic. The higher up the pole the coil is, the lower the frequency of the harmonic. In our case, we have chosen to tune 30m band (10.1 MHz), delivering an exceptional far-field plot.
- 12m and 10m tune on a top loaded ¾ wave element, giving us close to 5/8 pattern.

***NOTE**: It so happens that ¾ wave elements (or loaded 5/8 elements) give a superb match to 50 ohms whilst at the same time delivering around 2dB of additional gain low to the horizon when measured against a ¼ wave (normally). At around 24 MHz (with this antenna) we have harmonics from the low band elements (and the coil) trying to interfere with the tune of the 12m and 10m ¼ wave elements. By making our 12m and 10m elements into loaded ¾ wave elements, we eliminate that problem, masking the low-band harmonics so we can tune 12m and 10m exactly where we need them to be whilst also getting an excellent far-field pattern.*



This antenna is designed for permanent mounting, clear of people and other obstructions. It is designed for guying. 3 x 10m (30 feet) paracord guy wire is supplied.

The 80m element uses the connection point off-set "inside" hole, opposite the SO239.

Screw the 80m element fork-connector in place with the wingnut on the driven plate. Take your element to the first guy-plate, making one turn around the pole on the way up before pushing the element through the centre hole on the first guy plate.

> ***NOTE**: Like a halyard on a yacht mast that makes a "ting, ting, ting" noise when at anchor, this mild turn around the pole eliminates element rattle.*

Repeat this mild twist up the pole to the next spreader plate – and again to the 3rd spreader plate.

Once you reach the 3rd spreader plate, do not go through the small hole near the centre, instead move out to one of the holes on the outside rim of the plate, actually opposite 40m.

Stop at around 7.7m up from the driven plate and mark the pole with a single wrap of electrical tape in preparation of making the loading coil.

BEFORE we make this coil, we need to support this element with some shock cord. The author is pedantic about making things not only work well – but look attractive too, whilst at the same time creating less waste.

With this in mind, use some shock cord to prepare a length with a single stopper knot at one end, then make another stopper knot around 15cm (8-inches) away (which we will use to support the other end of the slack that comes off the top of the coil)

12.4 Signature Continued

***NOTE**: The reason for these two knots is because of the coil and the element needs to be kept stable so a) we need to tension the element as it comes up the pole and b) to tension the element as it continues up to the top of the pole.*

Back to our 80m element, make a small 6cm (2 ¼ inch) loop here and secure temporarily with electrical tape. See picture (next page).

> ***Tip**: Good idea here to release the shock cord from the 40m, 12m and 10m element to give you some working area to create your coil.*

Top of coil showing Slack

Bottom of coil showing Slack

Slip the first stopper knot inside this loop you just made and stretch the shock cord back up to a hole in the hexagonal spreader above and tension. The 80m element is now tensioned.

Keep this shock cord in place temporarily and create some extra slack in the element of around 50mm / 2-inches immediately before the coil we are about to make.

Now can start to wind the coil (remember to keep some slack between the element and the first turn of the coil).

> ***NOTE**: Now RELEASE the stopper knot else the shock cord will interfere with the coil making!*

Wind up the remaining end of the 80m element into a manageable hank of wire and carefully wind the coil around the tube here according to the chart below. Suggest you secure the first turn with a couple of wraps of electrical tape.

> ***NOTE**: It is extremely handy to have a partner to assist here as you wind the coil. You do not need a skilled operator to assist, just someone prepared to go round-and-around the pole.*

COIL CHART for BEST tune on 75m/80m

- 3.65 MHz 111 turns
- 3.75 MHz 99 turns
- 3.85 MHz 86 turns
- 3.95 MHz 73 turns

Using the coil chart above - and aiming for best tune of let's say 3.75 MHz, we would create 99 turns on our coil then secure with some more electrical tape to keep the coil from coming undone.

Now we can re-fit the shock cord back to the lower loop by pushing the knot through the element loop at the base of the coil.

Create some slack in your wire, just above the coil now - and place it just BELOW the 2nd knot in the shock cord (this is the knot we created that was 15cm / 8-inches away from the first support knot).

We can secure this loop with some Electrical tape again. We will replace all the Electrical tape loops in the later with heat shrink.

Now continue up the pole towards the final small hexagonal plate. Make another tensioning loop here, by forming a Z shape in your element and creating a loop. Make up around 30cm / 12-inches of shock cord and tension this last spreader plate to your 80m element. This very top tensioning is really only for aesthetic purposes.

80m tension (right) to very top spreader

Staying opposite the 40m element, continue to the very top of the pole, through the loop and come back down again. It doesn't matter right now where this comes back down the pole. We will use this fold-back later for fine tuning. Cut the spare foldback to within 30cm / 1-foot of the 5th spreader.

Tape the element to the pole to make tidy.

> ***TIP**: It is easier to fit the shock cord before you pass the element through the hole (pull the shock cord away to create a gap for the element).*

80m tuning

Removing 4 turns of the coil will move the best tune UP 30kHz (say from 3.80 MHz to 3.83 MHz). Removing approximately 1 metre / 3-feet of wire on the foldback changes the tune by 77kHz. Therefore, to move the BEST tune from say 3.8 MHz to just over 3.9 MHz you will remove 4 turns and 1m of wire off the foldback. Feel free to mix-and-match the coil turns and the foldback length to achieve desired result.

12.4 Signature Continued

30m Tuning

You will notice VERY small changes to the 30m band when you change the tune 80m. In testing, it was extremely minor and did not affect the 1.5:1 SWR curve (this is already substantial on 30m anyway).

For completeness in this manual, the placement of the coil determines the absolute harmonic to run 10.1 MHz on the 80m element. There should be no reason to change anything. However, if absolutely required, lowering the coil on the pole, raises the frequency very slightly and visa-versa. If you really need to do this (unlikely) you should not need to move this coil more than about 75mm / 3 inches.

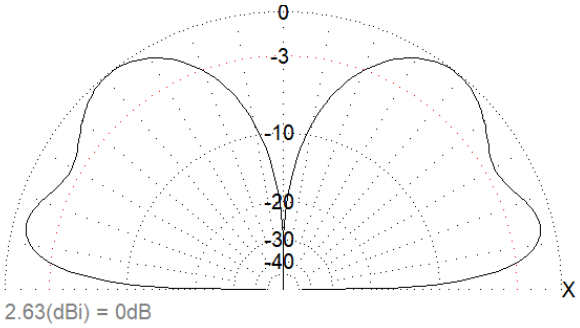
12m and 10m tuning

Both of these elements can be tuned by changing the amount of foldback. However, we need to use a factor of *around* 3 (when compared to a ¼ wave element) because longer foldbacks only change the tune by around a third of desired amount.

- To change 12m band by 100kHz, cut or lengthen foldback 3.6cm / 1.3 inches
- To change 10m band by 100kHz, cut or lengthen foldback 2.5cm / 1-inch

***NOTE**: Not wishing to confuse you but alternatively, you can just slip the foldback a small amount (12mm / ½ inch at a time) rather the cut / extend the 12m and 10m elements. Less foldback will lower the frequency and more foldback (less element length) will raise the frequency.*

***NOTE (2)**: The lengths of the 12m and 10m elements look on the surface to be pretty odd. This is because there are harmonics buried in the system lower down the frequency spectrum which "poke" though, interfering with the tunes of 12m and 10m. These element lengths give us a great match to 50 ohms whilst maintaining a superb far-field pattern and good DX potential.*



Example linear loaded element on 10m/12m bands far-field plot

TIPS

Once completely satisfied with your tuning, neatly slice away all your electrical tape on all your element loops with a sharp blade and replace with supplied heat shrink. This includes the loop before and after the coil you made earlier.

Also, you can now re-tension each shock cord length by slightly over-tightening each length and tie a new stopper knot (see picture below). No need to tension to absolute maximum, just enough.

12.4 Signature

Continued

Tidy 80m

You may also like to use some spare shock cord to connect the very end of your 80m element, back down the last 2-sections of pole to the top spreader, using one of the spare holes next to the 40m element shock cord connection (picture below right).

You can maintain tension on the 80m element on the way “up” by tensioning the element past the last two sections, bending the pole similar to a bow (and arrow) and taping the very end tightly and neatly as picture (lower left). Don’t over-tension this, just and no-more is fine.

In any case, you can use tape to neatly hold the UP and RETURN of 80m opposite each other (see example picture below).

18m Sig / Nebula

IMPORTANT: The 18m pole is heavy. In the unlikely event that one section has been "overground" at the factory as an oversight, it is possible that it may extend too far and not have enough overlap between sections. Please double check that each section has pulled out enough – and also not too far - and adjust appropriately when you fit the EzyClamps.

The Nebula Signature 18 runs 6 quarter wave elements for 80m, 60m, 40m, 30m, 20m and 17m. The 15m band can be catered for by the 40m element. In testing, 12m and 10m were also resonant.

> ***NOTE**: Perfect resonance on 10m or 12m is not guaranteed. In testing, these were well under 1.5:1 across a lot of the band and quite workable however harmonics can sometimes be fickle and more testing is required before we can guarantee what is going on here.*

- **This is a large antenna. Please take care and think it through anything before erecting.**

You are recommend to use multiple guying points with a radius of at least 5m.

PLATE FITMENT

In practice, it probably doesn't matter if you fit your spreader plate above or below the clamp assembly. In recent testing with the new batch of poles, the first two plates from the bottom will have difficulty in sliding down the last 100mm / 4-inches to the next join. So attach your clamps just above the section join on the fiberglass pole here with plates above.

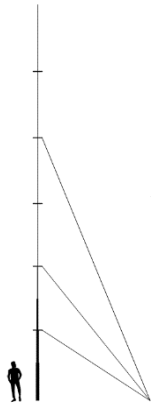
Some plates can be a tight squeeze. Don't force. They stop when they stop. Better than rotating in the breeze. Tighter fit is good.

Plate 3, 4 and 5 will right down to the join (in recent tests) so you may fit the clamps above the plate here using an 8m socket.

> ***Tip:** You can sometimes push a nylon plate lower down by tapping with your hand as if smacking a ketchup bottle. Or you can heat it up in very hot water for 2-minutes.*

GUYING

In the kit, you will find some 2mm Mastrant guy cord which is low-stretch, high performance guy line. Use a radius of at least 5m for each of the three guying stakes (not supplied – but any angle-iron would do for this depending on the ground).



For ease of assembly, I used Spreader Plate #1 and Spreader Plate #3 for testing. In the field, I would still keep guy #1 but I suggest installing the main tension guys at #2 and #4 for highest wind protection. In the diagram shown, there are guys at #1, #2 and #4 (#1 being the lowest plate and shortest guy wire/cord).

I recommend you do a test erection of your pole in the field without any elements just to get the feel of the system and the weight. You can walk the pole up by hand easily. You just want to make sure the base of the pole doesn't walk away.

I made a simple home-brew hinge for mine however there is a work-around to a hinge by using some guy lines tied on to the plastic housing between the ground and driven plate. Use some extra guy stakes to create dual "stops" around 60cm / 2 feet away from the "hinge" point, in the direction

of the lowered mast at 90 degrees to each other. These will act as your “second man” so as you walk the pole up, the base will remain in one place.

ELEMENTS

- Cut the elements as per cut chart earlier in the document.

For the record, here is the adjustment chart if you wanted to drop down to CW or move the frequency up a bit depending on your country frequency allocation.

- 80m changing the frequency of the linear loaded return is not same as changing the overall length. However, a 50cm change on the return leg of the 80m element will move frequency up or down around 50kHz.
- 60m 12cm will move resonance by 50 kHz
- 40m 6.5cm changes the resonant frequency by 50kHz
- 20m 1.75cm required for change of 50kHz
- 17m 1cm achieves a change of 50kHz

80m notes:

Go to the top of the pole and come back down the other side adding some tape at the join between the very top section and the second section down, as picture. Then separate the return element so that it comes down towards the next available spreader. You can tension this spreader "upside down" here to keep the element from flopping about in the breeze.

80m WITH 11m and 10m band:

To achieve great resonance on 11m and 10m, cut a longer element and close-fold-back the remainder and treat this as a single long element. Ignore the fact that it's linear loaded. You will not need to worry about the detailed instructions about coming back down the pole. It becomes just one element.

To clarify, you will need to cut a piece of DX10 wire of 24.70m long and fold the element back on itself when you reach the top.

> ***Note**: It should be pointed out that in hindsight, perhaps I shouldn't give you an option on the 80m element - and just tell you which way to go with it, however to be frank, I don't know which I prefer either!*

ELEMENT PLACEMENT

I have not experimented with other placement scenarios apart from the one discussed earlier on the multi-coloured chart. I suggest you follow my lead.

Further, remember to fit all your plates in the same hole-pattern layout all the way up the pole. You can check this when fitting the plates. The pole will be horizontal, so I suggest you make sure they have all the guy points and holes in the same plane. If you fit them incorrectly, you can have a scenario where one of your guy points is in the wrong place (I speak from experience!).

For confidence, I fitted mine so that I could always see three holes at the top (when the pole was lying down) and that all the plates were the right way around.

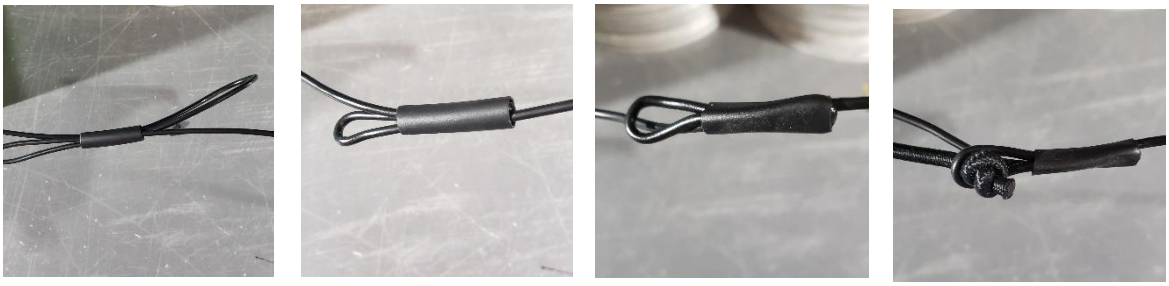
***Tip**: Use a Sharpie or perhaps a label printer to mark all the positions on the Driven Plate, Spreaders and elements. I have previously pulled the wrong element up through the Guy Plate and even connecting to the wrong place on the Upper Spreaders. Eventually, you will have a random set of wires and it won't work. Perhaps colour coding might be a good idea so that 40m holes and elements are red, all 20m are yellow etc..*

40m and 15m

If you need 15m, cut your element length slightly too long for 40m (actually 11.06m). Go "up" 9.2m and come back down close-spaced for the remainder. Connect the shock-cord to the natural loop that will form when you fold-back the element. Also make up an intermediate loop at around where the 20m element ends regardless.

This should tune perfectly on 40m and also give you a tune at about 21.10 MHz on a wide-bandwidth. You can cut the fold-over shorter and move the 15m up in frequency. It now starts behaving similar to a 5/8th wave.

Tip: For tensioning all these long elements, remember to add tensioning points at around 5m and 10m points with loops and shock-cord. 80m will need a further tensioning point nearer the top.



Tensioning loops

FINAL THOUGHTS

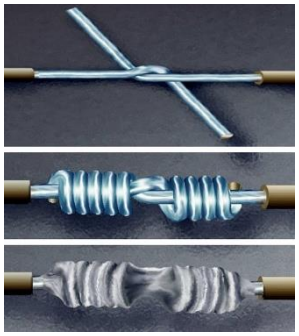
With other DX Commander kits, the pole is not the expensive component **BUT** with the Nebula antenna, the pole is half the price of the kit. It is a very expensive part for me to buy and in turn supply you. Please take care. Although it appears to be VERY strong (I was surprised at its strength), anything can fail if used incorrectly. Think about what you are doing on the one hand – but be brave on the other. More than anything, really think about what you are doing and understand the risks and anticipate what might go wrong.

VIDEO

The following video is extremely out of date from around 2019 or 2020, showing use of plastic carabiners and stainless clamps however the overall idea of the video is correct. We will be making another video of this build shortly in the new house style.

https://youtu.be/TG-HgWdb7js

FAQ / IMPORTANT NOTES FOR ALL BUILDS



Joining DX10 wire. I often join two pieces of wire in the field. Strip back 25mm (1-inch) of wire on each piece of wire and twist them together tightly. Then slip over a longer section of the glue-lined heat shrink and seal. You will find that you have made a perfect, maintenance-free connection that stops moisture and oxygen corroding the wire. Seems strong enough too. No need to solder.

- Image from https://makezine.com/article/technology/computers-mobile/how-to-splice-wire-to-nasa-standards/

Do not rush the build. A tiny mistake can take lots more time to correct. Take your time, enjoy the build. I suggest giving yourself two or three days to think about what you are achieving. You will have a real sense of achievement when it comes together, particularly when you start working DX stations you have never heard before. But please DO NOT RUSH.

Stop before you do anything which means you cannot revert back to Plan A.

If you don't understand something, drop me a Whatsapp message. My number is on the email confirmation. The discord server is open 24 hours a day and there are also folks there who will be keen to assist. See below.

Support: See the "antenna support" channel over on Discord. Many people extremely keen to help (and like all user-supported forums, there's plenty of people who want to help but are not quite sure what the answer is!). Tip here: drop a photo of your installation in your message and what you think your issue is. There are some bright people there who really enjoy helping out. You can "tag" me in the post to force me to read the issue.

Server location is https://discord.io/dxcommander

Knots: If you can't tie them, either find someone who show you find a good knot channel.

The 4 knots I most often use are:

Bowline to connect the guy lines to the guy plates

Alpine Butterfly knots to create a pulley near the guy point

Stopper Knots (double overhand knots) for shock-cord ends

Fishermans Knots which is ideal for joining cord

A superb resource for knots is this one: https://www.animatedknots.com/

If you are using this near salt-water, you may observe ANYTHING can start corroding. Salt water is VERY corrosive; however we have almost removed all parts in the kit that can corrode other than the aluminium plates and fork connectors. To help in this regard, connectors and other metal parts may be squirted, brushed or have applied a variety of product: WD40, Vaseline, silicon grease, WaxOil

etc. This will stop oxygen getting to connectors. Actually, I often use Vaseline on SO239 threads. It works for me.

Protecting the ends of elements: for the connoisseur antenna builder, perhaps protect the very end of your elements with glue-lined heatshrink by adding a small amount to the end of the loop you made. You can do this with radials too. This will stop capillary action from sucking water up the copper strands. Does it matter? Probably not!

Once completely satisfied with your tuning, remember to neatly slice away all your electrical tape on all your element loops with a sharp blade and replace with supplied heat shrink.

You can solve the untidy look of the woven material coming loose on your shock cord ends with a quick blast of a blow-torch or lighter / match.

Coffee: I know you will want to get this in the air as soon as possible but I don't want you to have an accident or worse.. If you get stuck, go and make a coffee and have a think about it.

The best storm protection is to lay your antenna down - however if you have regular high-winds, it is recommended you invest in more guy lines. In the event you have an accident, we do a pole-only replacement at cost. Get in touch with us to discuss.

Do not over-tension any of your guy lines particularly top ones if using multiple guys. The tighter your guy lines are, the greater the downward pull will be on your antenna, potentially causing a number of undesirable results.

When the wind blows hard, you may see one of the guy lines looking a tiny bit loose. This is normal.

Glue lined heat-shrink can easily be removed by carefully slitting the heat-shrink down the middle with a sharp knife.

Inspect your installation every 6-months for early warning signs of inappropriate wear or element damage etc. Most accidents occur during gales – and in 90% of the cases, the guy lines were worn.

UV Protection: In practice, the older style UHMWPE plastic plates could be affected. At the time of writing, we almost exclusively moved over to a hardened marine UV plastic. But if you do have the UHMWPE plates (they have a sort of oiled-like feel to them). You can add some UV Protection with 303 UV Spray which is available world-wide. This stops the plates from cracking in very hot / direct UV sun. If necessary, in extreme UV climates, make a diary entry every 8-weeks to do this.

Waterproofing connectors: I always use Vaseline on the SO239 and PL259s threads and then I coat the whole connection assembly with a dollop of petroleum jelly on my installations. I repeat every few years and I have never had a water ingress failure or corrosion even with sea water and/or extreme temperatures (hot and cold)

Dismantling: After a DX Commander has been up for a long period of time, you may find some of the sections appear to be locked solid.

> To cure this, dribble very hot water over the larger section, near the join and wait, then dribble more. Do this until the larger section becomes hot. Then put your telescopic pole horizontal and tap the very end with a rubber mallet or block of wood. Start lightly! Eventually, it will give way.

In the event that you wish to take your telescopic pole down and relocate (or use for a field day for instance), it will be quite obvious that you need to remove the elements. The holes on the plastic spreaders are intentionally small and now that the elements have heat shrink applied they may be a tight squeeze to pull back through the holes. In testing they do come back through the holes though. Leave the shock cord and stopper knots in place attached to the spreader plates though. There is no use in removing them as well.

Dismantling 12.4m Signature: The 80m element should only cause you an issue in the event you applied heat shrink to the VERY END of the element to keep it tidy with shock cord to the last spreader plate. With the heat shrink in place, it will not pull back through the top loop. In which case, carefully slice the heat shrink down the middle between the element and small fold-back and it will peel away.

As stated above, you may need two-people to "break the seal" between each section with one person twisting one way – and another person pushing and twisting in the opposite direction.

You will also need to think about how the 80m element comes back through all the holes in the spreader plates because if you just start pulling from the bottom, they will definitely get stuck where you made (for instance) the loop for the coil supports. You will need to thread the very end of the 80m back down first. Frankly, if you are that keen on taking this to a Field-Day, I am sure you will work it out because the procedure might take a whole new user-guide including the coil dismantling! (If you really want to do this, perhaps use a small diameter tube and build the coil on that – and slip it over the pole with some small connectors?).

SWR: If your SWR is completely wrong, then obviously something else is wrong, not normally the laws of physics. May I suggest before you start to fix the issue, create a table and measure where the resonance is currently. Say it's resonant at 6.85 MHz (unlikely) and your 3:1 SWR starts at say 6.65 and ends at 7.15. Tabulate your data so that when you make a change, you can see clearly what has happened. If you seek support, I will ask for this anyway

Tip: Also check the SWR meter on your radio (if you have one) actually in the shack, SWR decreases with coax length and you might discover that either a) your analyser or patch lead was playing up or b) the problem went away.

QRO: We have tested DX10 wire at 1,600W for 65 seconds a couple of years ago on 14 MHz. It worked fine but we had ONE user report an issue on 28 MHz at 1.5kW on FT8. Basically, the end of the element melted. In testing, we have observed the same effect (only on 28 MHz).

We ran some tests and have created a work-around for very high power RTTY and FT8 type users for 10m band:

Rather than fold-over your loop, you will need to create a closed-loop system so that the end of the loop folds back and reconnects to the element.

Based on say a 6cm fold-over, this work-around will have the effect of REDUCING your element size by about 2-3cm (about 1-inch). Therefore, you may in this instance, increase the overall length to compensate very slightly – around 25mm / 1-inch.

So rather than doing your fine-tuning at the “loop” end, we suggest cutting your element literally in half and splicing on or reducing the size of your element right in the middle.

Remember, with the tension we use on the shock-cord, a simple wireman’s join is suffice. Seal the join with some left-over glue-lined heat-shrink. Solder optional.

However, we have to say that you will need to be sinking a LOT of power on continuous duty modes to see anything like the problem this user had. We have often tested 1.5kW and only seen the issue on 28 MHz.

For completeness, we also tried a tiny nylon thimble and that worked well too. However, a basic loop and no thimble is suffice.

The ideal thimble size will have a width of not more than 6mm and a cable guide of around 2mm. You will need to connect the shock-cord to the thimble with knot or even a cable tie. They are available in the UK for around £0.22 each. In US dollars, that’s around $2 for 10.

Replacement Shock-Cord: We can supply you with extra shock cord however you may also be able to source locally. Make sure you source “marine” quality (ideally from a yacht supply accessories store). You can source Marlow (Dyneema jacket) 4mm shock-cord in USA and other countries, else just find a very good quality version – just maybe not an eBay supplier from unknown source.

Radial Wire: Sure, we can sell you more DX10 and it is lovely wire, we know. But you can easily lay any wire on the ground. I knew one operator who spent ages stripping down some old CAT5 ethernet cable and laid all those down. Why not!

Chicken Wire as radials: Beware, I have heard of 2 operators who regretted this because eventually the chicken wire started rusting and all they could hear in their headphones was clicks and pops as the oxygen atoms jumped around making iron oxide!

Ground Conditions: This is a big topic, but it is important to note that twice in the few years, we have noticed a change in best tune when moving from an excellent ground to an average ground. It is unlikely you will ever observe this. However, allow us to discuss this briefly for completeness.

Case #1: Testing right by the sea. We tuned a prototype DX Commander antenna when the tide was out. A few hours later, the tide came in, whipping up a salt spray onto the grass (literally right by the sea). The grass outside the property was coated in this fine salt water and the tune on all element changed a percent or two. The difference on 40m band was around 150 kHz. For instance, the tune went from 7.15 down to I think 6.95, a fall of around 200kHz. And proportionally less on 20m band, etc.

Case #2: When we were building and testing the Signature 9, we originally built the antenna right in the middle of our test field that has an excellent radial system, 360 degrees around the antenna. When we moved the antenna to its new home, only 8m away, we used the same number of radials as a regular customer might use (100m in total radial length) and the tune went up, roughly the same proportional as we experienced by the sea, this time say from 7.2 MHz to 7.4 MHz (and only around 100KkHz on 20m band). So we lengthened all the elements a small amount.

These are important notes because in the event you substantially increase your radial field, you will find that your elements might be a tiny bit too long and you may have to shorten them (but only by a small factor – don’t worry!).

Wind survival: I sometimes wonder where manufacturers get wind survival numbers from because hiring a wind-tunnel for full scale destructive wind tests on antennas would be cost prohibitive (by a large amount!). Instead, we run a computer model. It so happens that the wind survival is greater that we need for almost any user in nearly any circumstance. However, everything eventually breaks. Trees come down, roofs blow off and bridges fail. Fences are not insurable due to the same problem. One of the issues is that wind speed and gusts happen at different heights and different gust cycles can make something else break, not necessarily the pole (guy lines snap, trees fall on antennas etc).

> In conclusion: A lower wind speed but high gusting (at just the right – or wrong time) can have detrimental effect on the antenna. We recommend that if a genuine storm is forecast, simply lay it down. Having guys that are not too tight can also assist. Genuine 550 paracord is nice because it has a small amount of flex.

Remember, this isn't supposed to be difficult. All we are making is resonant lengths of wire and stringing them vertically with a small ground mat for radials. Enjoy your antenna and keep it simple.

Good luck!
73
Callum 😊