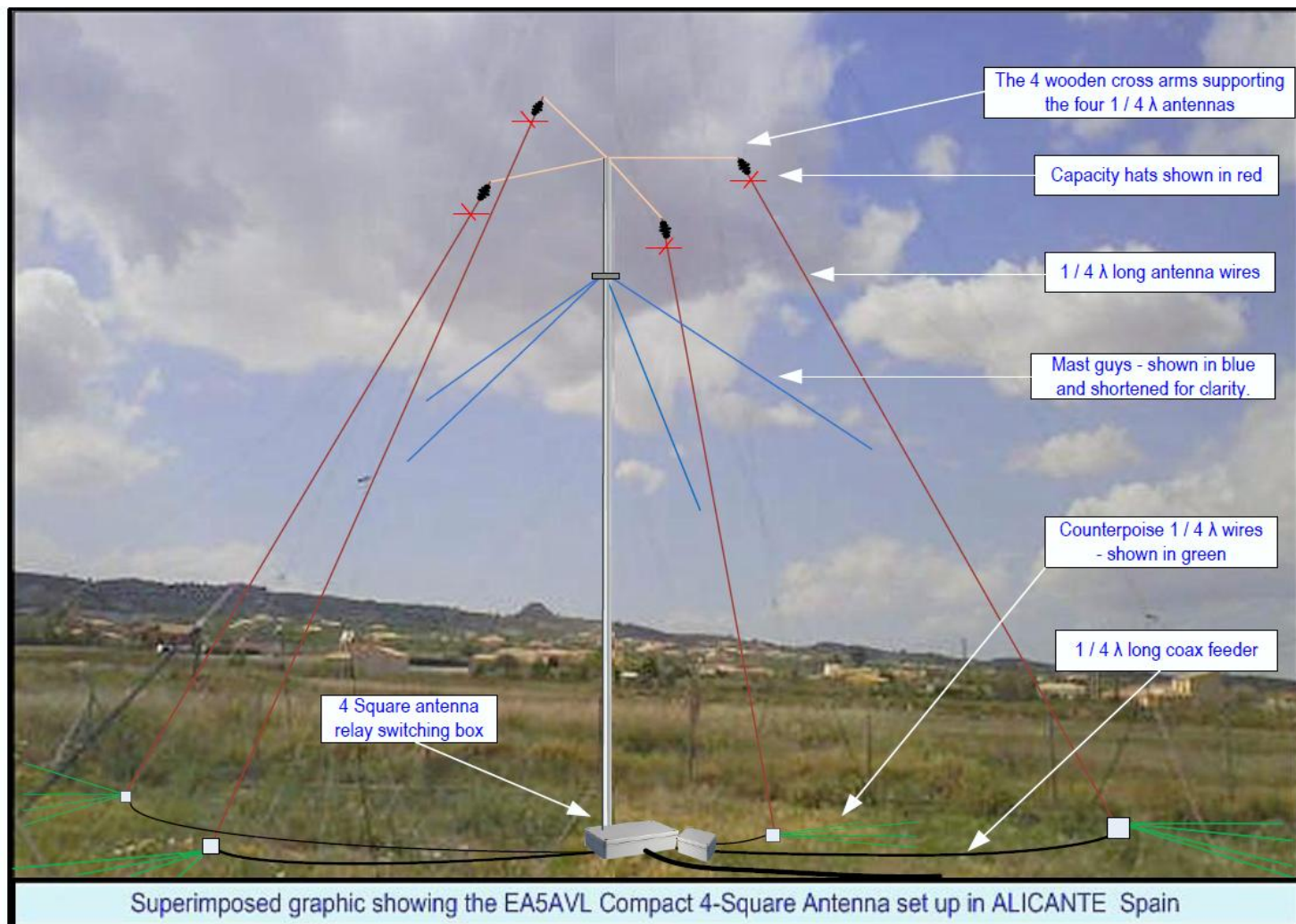


# 40m Compact 4-Square Antenna – EA5AVL



<http://www.rsars.org.uk/ELIBRARY/docsants.htm>



The EA5AVL 40M Compact 4-Square Antenna was designed to provide excellent DX communications on the 40m band, utilising readily available components and be relatively easy to construct. The antenna has been used very successfully over the 2007-2011 period during the sun spot minimum. DX contacts have been made regularly with EK3 Armenia, 7Z1 Saudi, VK6 Perth, K1 n Carolina, 5F6 Morocco, UB6 Staropol, YY6 Venezuela VO1 N. Foundland , ZF2 Cayman Is, PY7 Brazil, UN7 Kazakhstan, VE3 Toronto, CM3 Havana, YC6 Indonesia, AY1 Qatar to mention just a few.

*Lex EA5AVL*

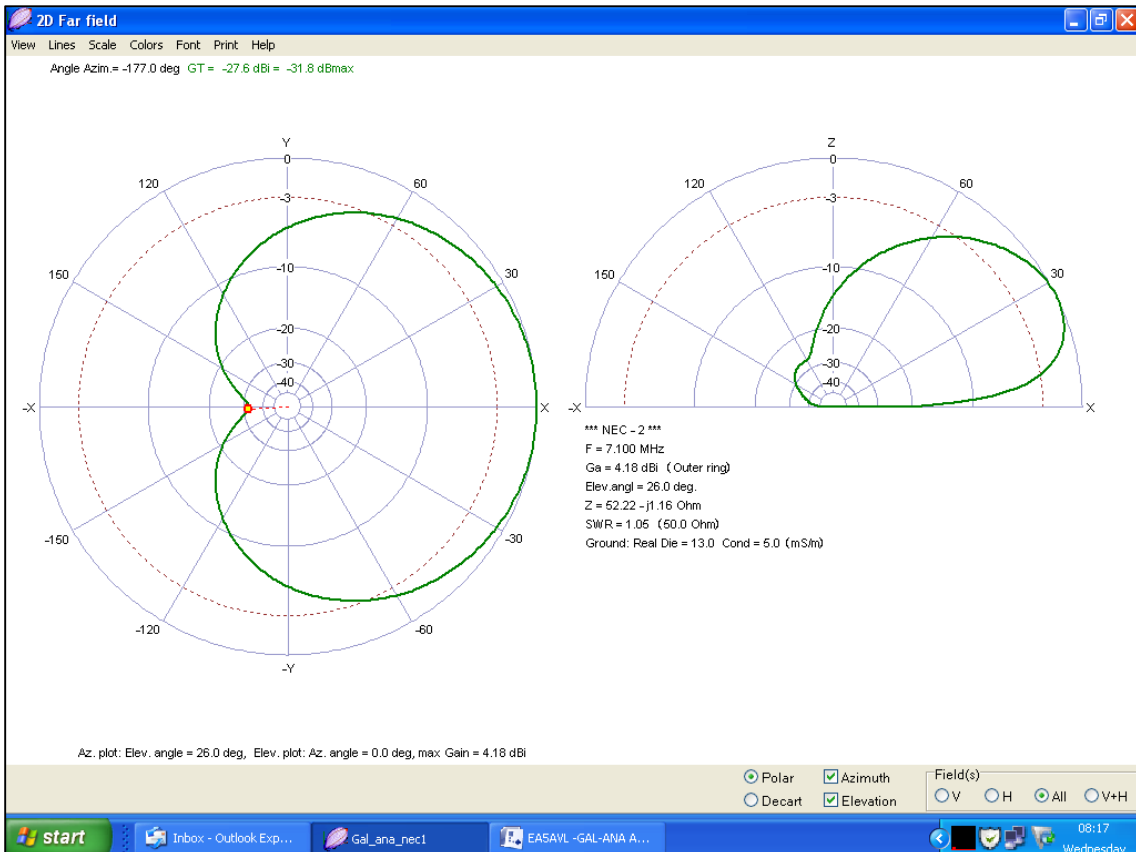
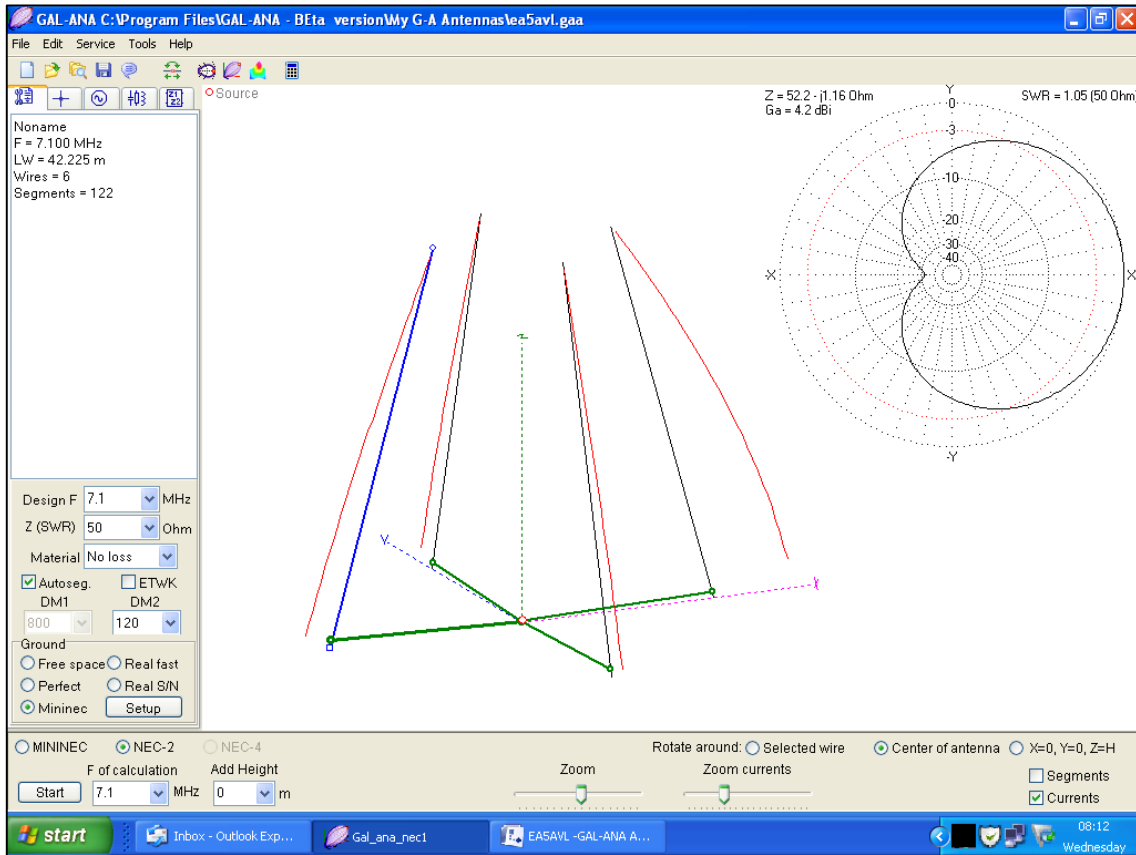
## NOTES

1. The cross arms can be oriented to any compass bearing to suit personal needs.
2. The four  $1/4 \lambda$  antenna wires are cut for the 7MHz band using the formula  $1/4 \lambda \text{ (feet)} = 234/F(\text{MHz})$ .  
For 7050 KHz this works out to be about 33' 3" feet (10.19m).  
Total wire require for antennas & counterpoises = 665 feet (202m)
3. The four  $1/4$  wavelength RG213 coax feeds (VF 0.66) are approx 6.7m (21' 11") tip to tip of the PL259 connectors.
4. Four stiff wire capacity hat spokes are fitted, each one being 0.31m (12") long.
5. A 1.22m (4' 0") copper earth rod at the mast base earth the relay box & capacitor box.
6. There is one anchoring point for each vertical, this could be a heavy brick or long tent peg – there is little tension in these wires.
7. The guy ropes are tensioned to support the whole mast.
8. No antenna matching unit required, no rotator required, immediate direction change, low wind resistance.

# 40m Compact 4-Square Antenna – EA5AVL

Model By Igor DL2KQ using GAL-ANA Beta version 0.3 Antenna Modelling Program

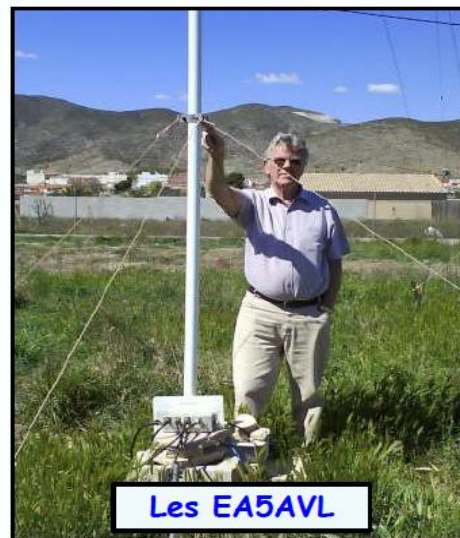
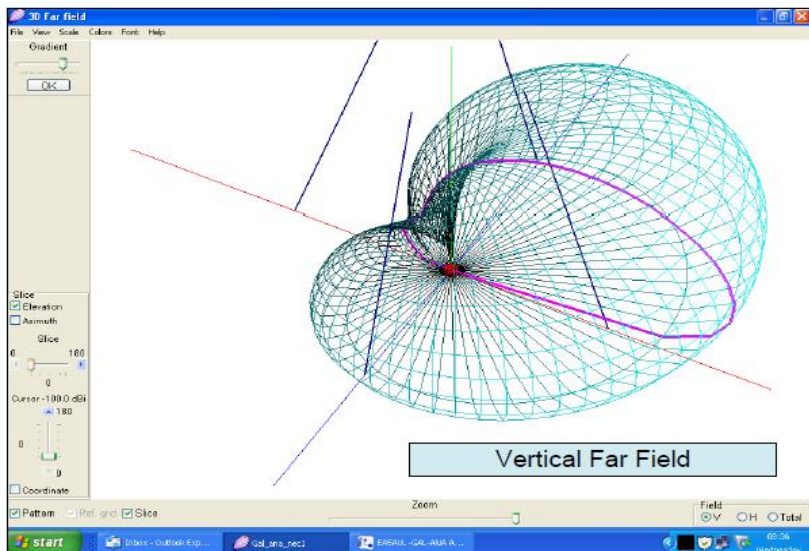
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Model By Igor DL2KQ using GAL-ANA Beta version 0.3 Antenna Modelling Program

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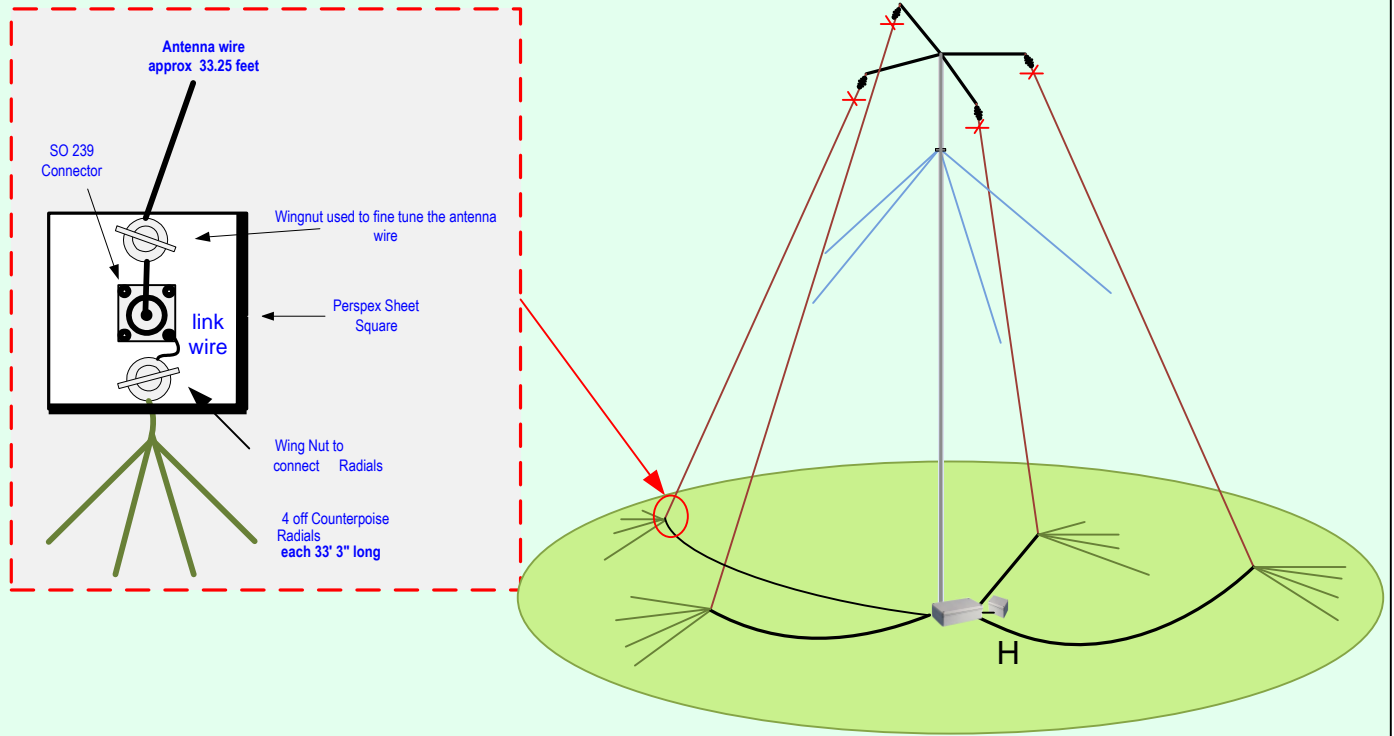


# 40m Compact 4-Square Antenna – EA5AVL

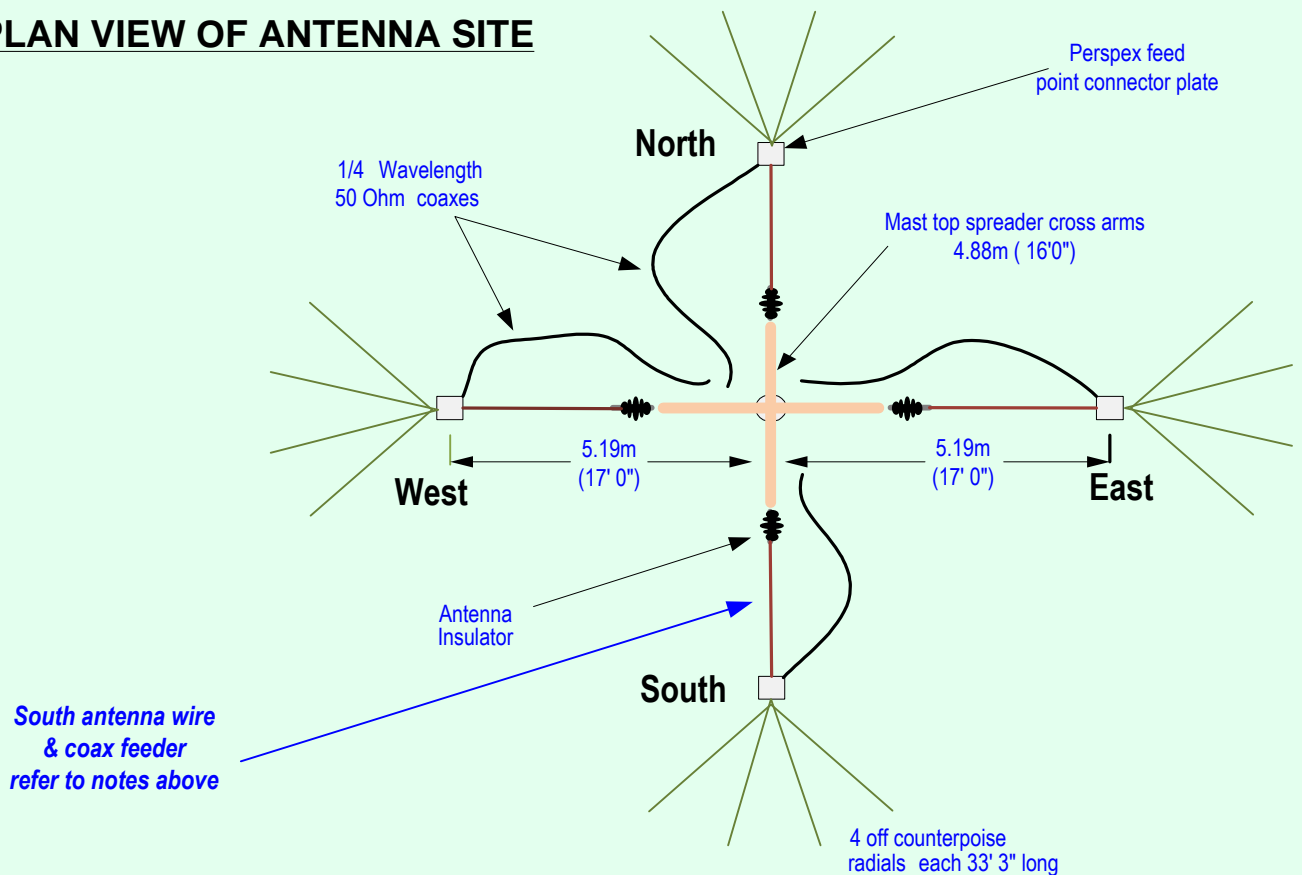


<http://www.rsars.org.uk/ELIBRARY/docsants.htm>

## PERSPEX FEED POINT CONNECTOR PLATE



## PLAN VIEW OF ANTENNA SITE

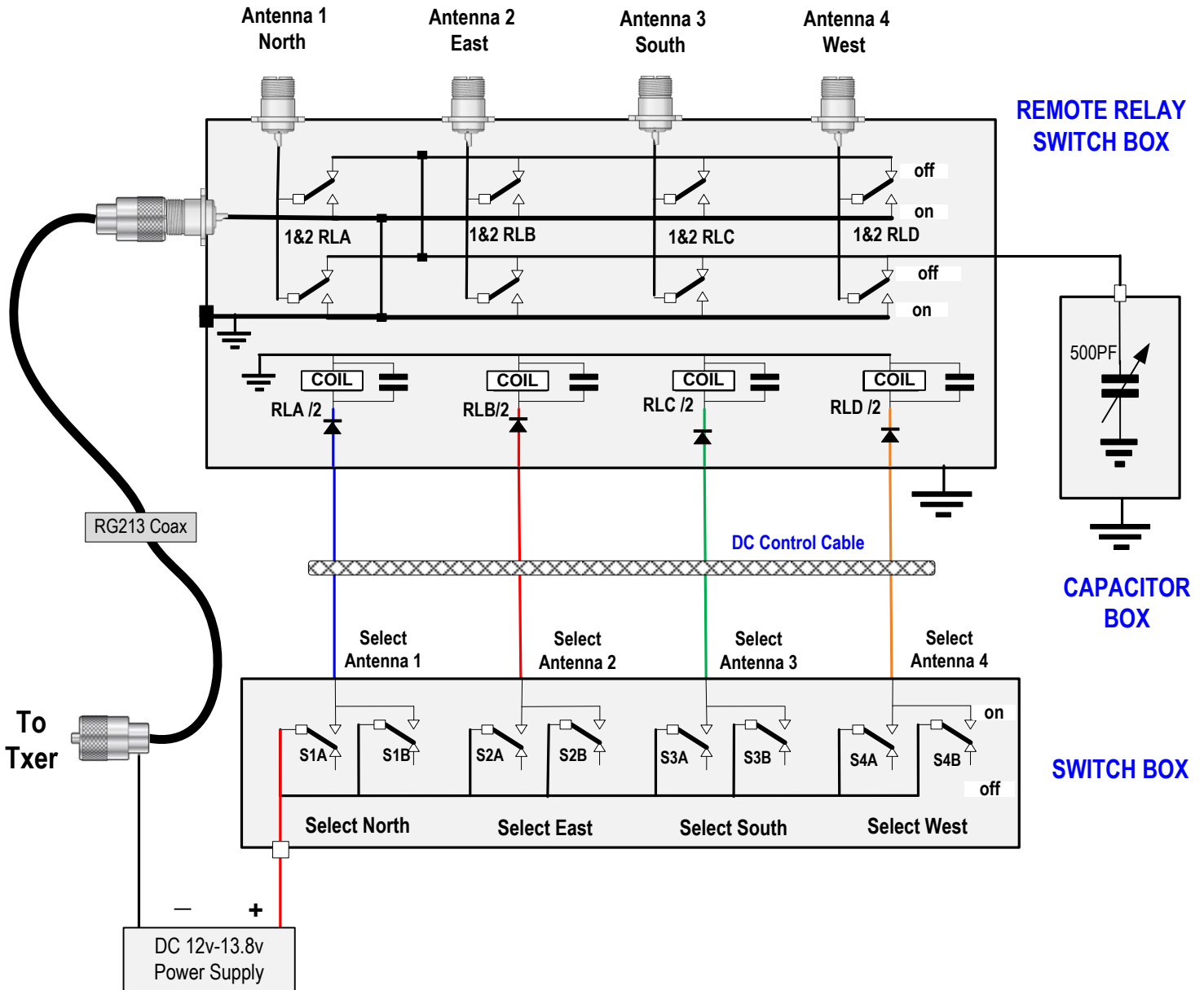


# 40m Compact 4-Square Antenna – EA5AVL



<http://www.rsars.org.uk/ELIBRARY/docsants.htm>

## EA5AVL Compact 4-Square 40m Antenna - CONTROL BOX CIRCUITS



### NOTES

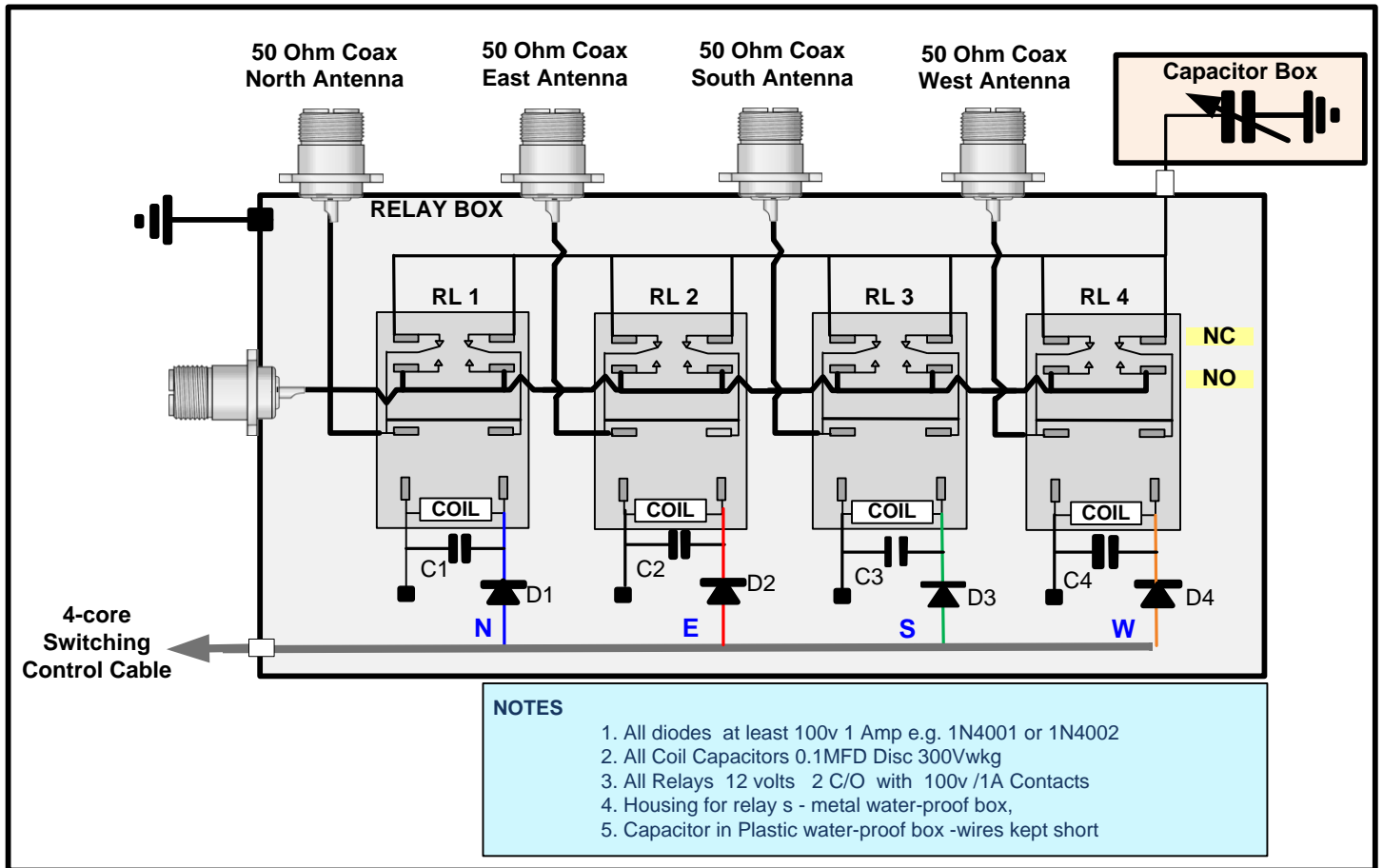
1. Both contacts of all switches and relays are wired in parallel to improve reliability of operation.
2. The relays are DPDT changeover with 12v coils, the clamping diodes are 1N1004 (100v 1A) and the capacitors are 0.1 MFD disc ceramic.
3. Coaxial cables to the antennas are earthed at the relay switch box and are 1/4 wavelength long.
4. The reflector tuning capacitor is an air-spaced variable from a domestic radio, 250+250 pF and both section are wired in parallel.
5. The negative of the power supply is connected to the coax braid connected to the antenna relay box
6. All switches are heavy duty toggle switches. For correct operation only one antenna is selected, the other 3 act as reflectors
7. The switches and relays are all shown in the OFF or non-operated positions. For correction operation of the antenna only operate one of the four switches to select the desired beam direction, the other three antennas Will behave like reflectors.

# 40m Compact 4-Square Antenna – EA5AVL

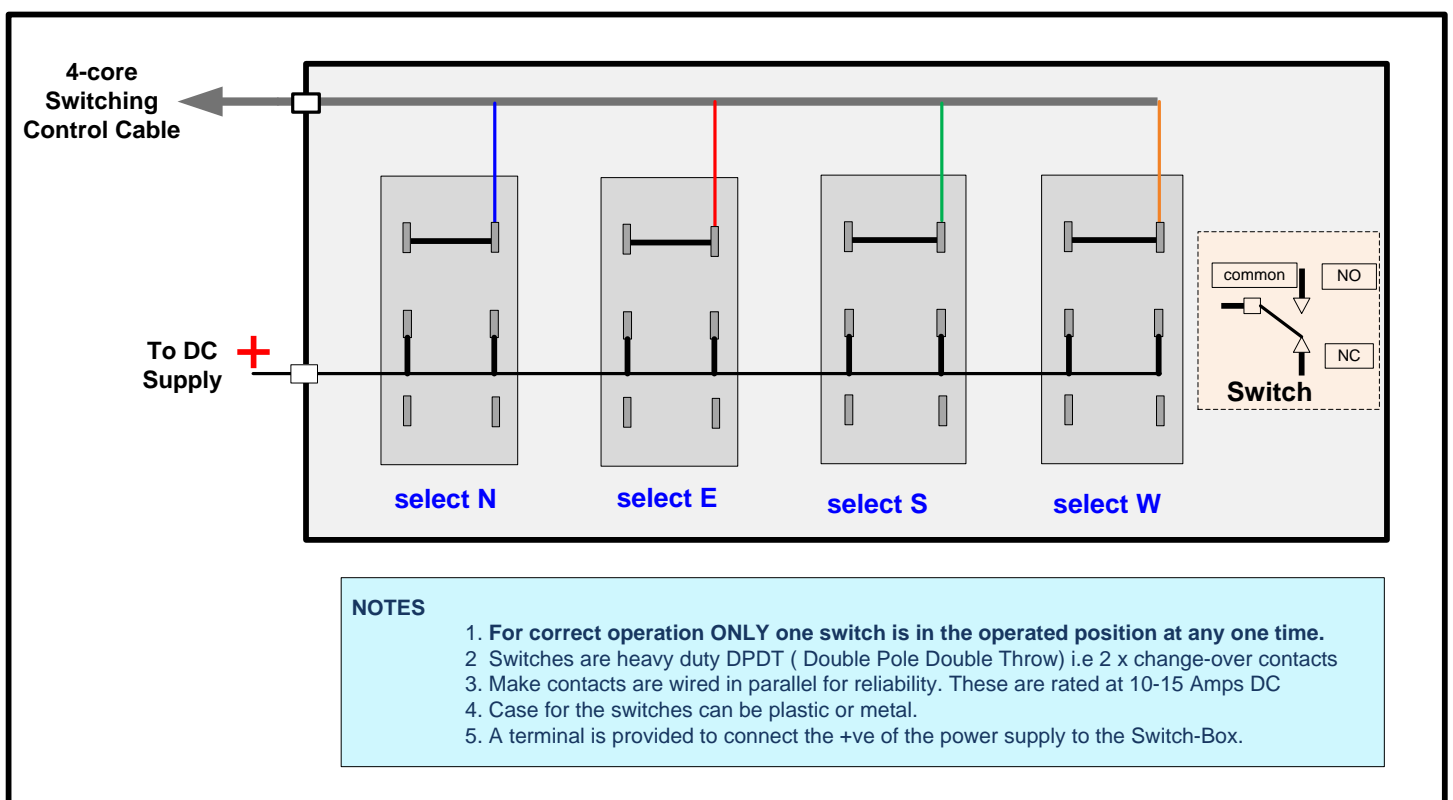


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## RELAY BOX WIRING



## SWITCH BOX WIRING



# 40m Compact 4-Square Antenna – EA5AVL



<http://www.rsars.org.uk/ELIBRARY/docsants.htm>

## TECHNICAL SPECIFICATION

Front to back ratio: 25/30dB  
Forward gain: 5dB  
Polarisation: vertical  
Band: 7MHz  
Power: 1Kw +  
SWR: 1:1 @ centre frequency  
Bandwidth: 700 KHz @ SWR 1.5:1 points

## $\lambda / 4 = 234 / F(\text{MHz})$ feet

MHz	Imperial	Metres
6.900 MHz	33 ft - 11 ins	10.34
6.950 MHz	33ft - 7.0 ins	10.24
7.000 MHz	33 ft - 5.5 ins	10.2
7.050 MHz	33 ft - 2.5 ins	10.12
7.100 MHz	32 ft - 11.5 ins	10.05
7.150 MHz	32 ft - 9.0 ins	9.98
7.200 MHz	32 ft - 6.0 ins	9.91
7.250 MHz	32 ft - 3.0 ins	9.83

## EA5AVL 4-SQUARE ANTENNA NOTES

1. Wire :- plastic coated will reduce the calculated wires lengths slightly. Also the antenna wires will be shorter than normal due to inter-capacitive effects between the other elements of the antenna etc.
2. 15cm ( 6 ins) will alter the alter the antenna frequency by 100 KHz. Remember it is much easier to remove than to add wire to an antenna. Remove some wire to increase the antenna resonance frequency, conversely add wire to lower the frequency.
3. Use 50 Ohm coaxial cable suitable for the transmitter power levels to be used i.e. RG-8X for power levels up to 400watts and RG213 over 400watts.
4. The mast is made from a non-electrically conducting material such as wood, but if metal should be insulated from the ground and be cut to be a non-resonant length. All guy ropes should be made of nylon or polypropylene so that the antenna tuning is not affected. The tension for supporting the mast is in the guys not the antenna wires.
5. The cross arms of the spreaders are made from alloy tubing and wooden broom handles. The top can be made to swivel so that any compass direction can be set to suit DX requirements.
6. The four top insulators should be chosen to suit the power rating of the antenna.
7. The Perspex feed point connector plate is made from a 6mm (0.25ins) thick sheet or similar plastic material. Stainless steel wing nuts and washers should be used to secure the antenna wires and ground plain wires.
8. The 1.5 metre earth rods are required for the relay box and the plastic capacitor box.

# 40m Compact 4-Square Antenna – EA5AVL



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## TUNING THE 4-SQUARE ANTENNA

1. The four wire vertical elements must be pruned to within a few hertz of each other (same SWR).
2. The top spacing is 4.88m (16 feet) - 1/8 wavelength and the bottom spacing is 10.36m (34 feet) or -1/4 wavelength.
3. The variable capacitor tunes the reflectors. This is quite sharp and noticeable when listening on extended headphones by the antenna. This is very important for best performance.
4. Connect the four identically cut 1/4 wavelength 50 Ohms coaxes from the relay box to the four antenna feed points.

## METHODS OF TUNING

5. With the 4 wire antenna erected, tune each vertical element on either 7050 KHz for UK or 7100KHz for the USA. Temporary connections using an electricians nylon connector block makes the adjustment easier.
6. An antenna analyser or SWR meter is required, and the 500pF capacitor should be set to 3/4 meshed before adjusting any wire lengths. **Do not alter any lengths until later !**

## TUNING THE ANTENNA - REFLECTORS

### Method A.

7. Place a an MFJ-259B analyser (or signal generator) 33m (100ft) away from the antenna, and using a short wire radiate a low power signal on either 7050 KHz for UK or 7100KHz for the USA.
8. Use a long length of twin flex extend the headphones of the transceiver to the capacitor box by antenna mast base
9. At the shack set the receiver to the signal frequency and select CW with a fast AGC setting.
10. Using the 4- way Control Switch Box select the antenna element which is farthest away from the MFJ signal source.
11. Adjust the receiver for a steady S7 signal. With the extended headphones, listen for a null in the signal level while adjusting the 500pf capacitor. Ignore any static or other stray signals or noises. The null will be quite noticeable and the receiver should show a smaller reading, S1 or S2.

### Method B.

12. Listen to ARRL CW practice transmission, weekdays, W1AW, USA 7045.50KHz – 2300-0100Z. Use the NULL procedure as in "A" above.
13. There is also an SSB Net , Canadian , on 7063KHz daily at 2300-2400Z called "The Sand Box Net" – pick the net controller and only use his signal – ignore any other noises.
14. Performing the reflector tuning during darkness is probably best – i.e. .during " DX time" and less local noise and the nut cases!

The antenna is intended for DX working and is not suited for short haul i.e. around UK, but with patience and attention to detail you will be very pleased with the results.

## **VSWR RESULTS AFTER TUNING ALL THE ANTENNA ELEMENTS**

**~ indicates reading not quite 1.1**

FREQUENCY MHz	SWR	SWR	SWR	SWR
	A1 NORTH	A2 EAST	A3 SOUTH	A4 WEST
<b>6.900</b>	1.2	1.15	1.1	1.15
<b>6.905</b>	1.15	1.1	1.1~	1.1
<b>7.000</b>	1.1~	1.1~	1.1~	1.1~
<b>7.050</b>	1.125	1.1~	1.1	1.1
<b>7.100</b>	1.2	1.175	1.2	1.1
<b>7.150</b>	1.25	1.2	1.2	1.15
<b>7.200</b>	1.3	1.25	1.25	1.175
<b>7.250</b>	1.3	1.3	1.3	1.2
<b>7.300</b>	1.3	1.3	1.3	1.275
	Res Freq 7.000	Res Freq 7.000	Res Freq 6.975	Res Freq 7.000