

K1NQ 4 SQUARE ver2

This pcb can be used for 2 element or 4 element verticals.

Pin 1 of a component is square in all cases

For 2 element 1/4wv – 90 degree spacing, use J1 and J2 to antennas

Relays K1, K2, and K5 must be installed. K5 may be omitted by soldering a jumper wire across the Common and NC position of K5. Feed antenna thru J5, install proper L and C1 per the 2 element charts and switch the direction by applying +12V to pin 1 of J8. Capacitors and diodes for K3-K4 and K6 may be omitted. J9 is provided for use of RG8 coax to form capacitor C1. C1 can be formed by a fix RF type cap and a length of coax (J9) cut to the proper length. J2 is the default no power direction.

4SQ- place all components. A 180 electrical length of coax must be connected across J6 and J7. 12V must be applied to J8 pins 1 and 2. These pins are switched to steer the array. J8 Pin 3 is gnd. The PCB ground must be attached to the coaxial connector grounds. Use #14 wires for all connector center pins to PCB for J1-J9. The default position (no power) is in the direction of J4. In this case J1 (0) J2-J3 (90), J4 (180) degrees. See schematic for details

L and C1

There are 2 charts for 2 elements and 4SQ.

The antennas can be fed with 4 - 1/4 wave length of foam 75 or Foam 50 ohm coax. These lengths are electrically cut to the operating frequency. Polyethylene cable may not be long enough to reach. The 180 degree coax can be 50 or 75 ohms of any type to handle the power level. Generally, 75 ohm cable produces the easier realized values of L1 and C1 and 75 ohms produces less loss in this system.

If you use coax for C1, keep the coax length less than 1/10 of a wavelength you may parallel multiple pieces to achieve the desired capacitance value.

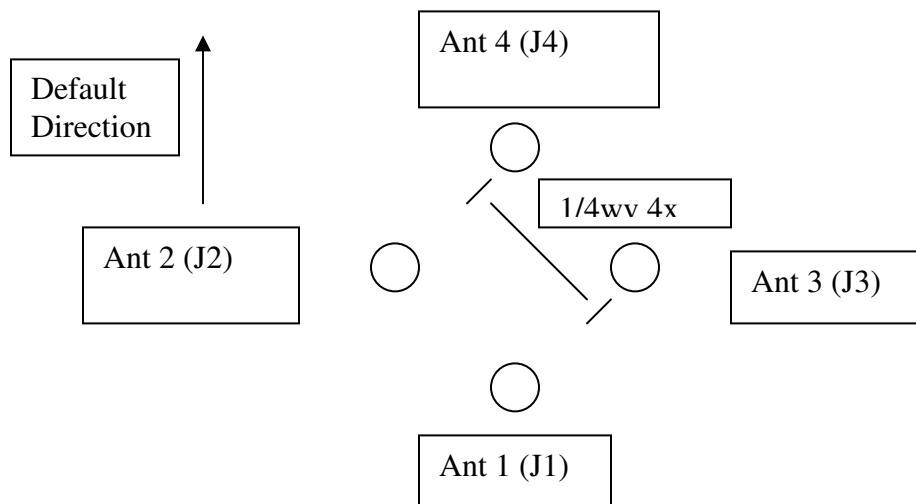
The feed line is assumed to be 50 ohms.

Use the chart to determine what values of L and C are required for a given band, 1/4 phase cable Z and the # of radials. If elevated radials are used assume 36 ohms for each 1/4 wave. In the case of 80m 4sq, 3.55 MHz, 75 ohm, elevated feed or 36 radials per vertical. L1 has 15 turns of #14 wire on a T200-2 core. For torroids, a turn consists of any time a wire passes thru the center of the core. C1 is 988 pf. 988 pf is not a common value. In this case you could use a 1000pf as long as it is close to 988 pf. This must be measured. The other options are to make C1 out of RG213 coax as an open ended stub. RG213 has 30.8 pf/foot. The cable length would be 32 feet. Since 32 feet is .175wv, use two 16 foot pieces in parallel. Keep the far end open circuit. Make sure you trim back the far end braids about 1" and coat the ends to prevent water and arcing. Alternative method would be to use a 500 pf fixed RF door knob cap and an additional length of RG213 to make up 988 pf. In this case, 15.84 feet. Your coax may vary, so check the PF/foot value.

Common 1/2 CATV hard-line is about 16.7 pf/foot

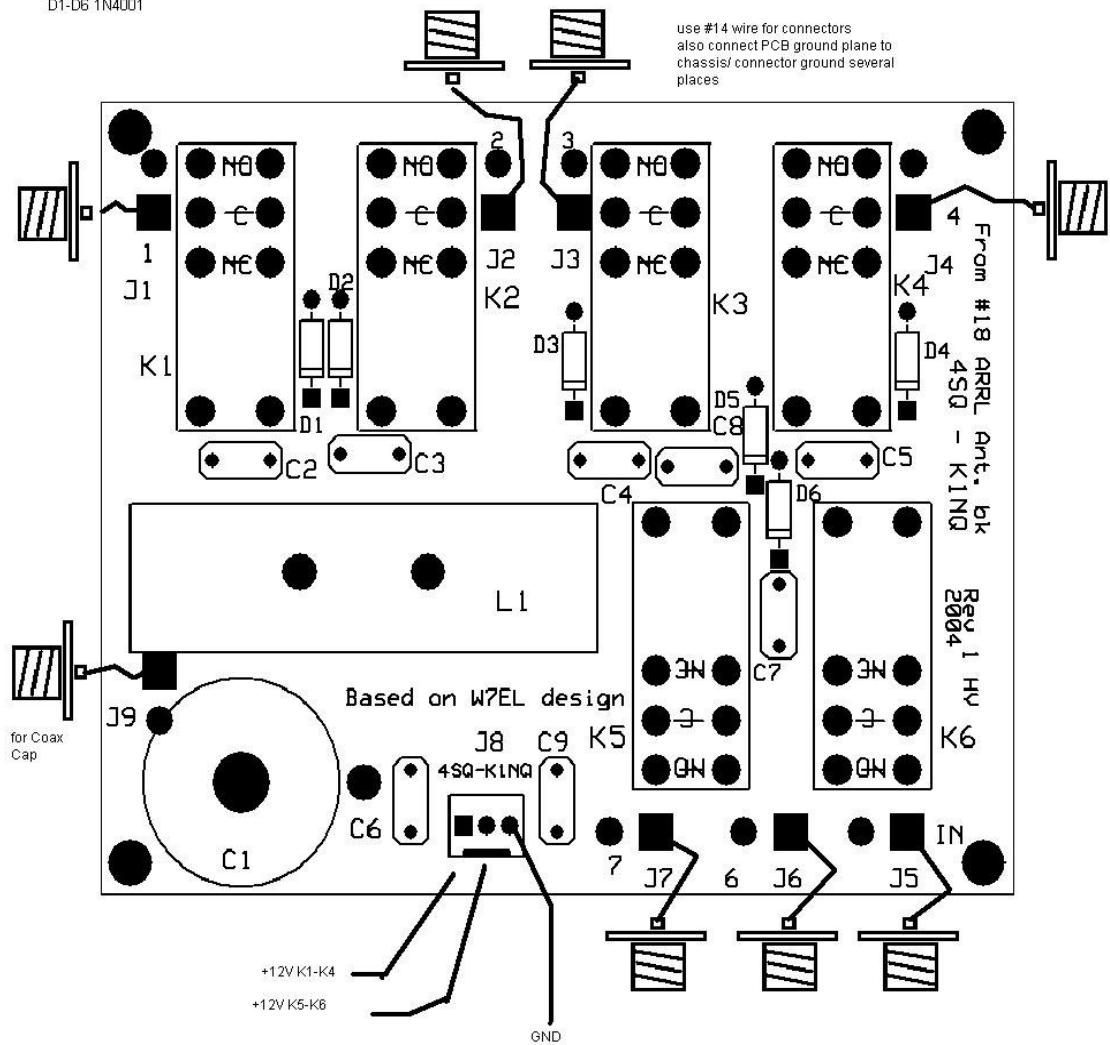
Another advanced option is to make up small jumpers to allow 80 CW or phone. You would need jumpers for the 180 degree coax phase line and the capacitor. You could pick SSB as default and add in for cw. You may adjust the 4 1/4 wv feeds as well. It is assumed that there is some method to adjust the verticals to proper Zin. Even without this, the antenna will still work on ssb. F/B will degrade and an external match may be required for VSWR at the input. As for Relays, there are many substitutions available. Look for high voltage capability. There are no MOV's on this PCB but they can be added across the dc inputs if desired. This unit is not designed to be hot switched at high power. Since about 1/2 the power will flow thru L1, a T200-2 can safely handle up to 800 watts in continuous duty. This unit should be able to easily handle 1500W CW or SSB. For RTTY, limit the power to the legal limit. A T157 core may be used at 1000w or less power. New turns calculations would be required. For High power, wrap the core with fiberglass or Teflon tape before winding. Teflon coated wire can also be used. Keep the assembled core at least 1/4 inch away from metal.

Disclaimer: Not for commercial use or profit. David Jordan, K1NQ, is not responsible for any damage by using this PCB or design. This is provided "As Is" without any warrantee and the user assumes all risks. As with any electronic device, high voltages, currents, and power may exist during the use of this device. The user is responsible for assembly, proper use, and must use proper caution when operating this circuit. Dangerous and deadly voltages and currents may exist when operating this device – use caution. If you are not familiar with the operation, construction, and installation of this device seek proper professional assistance. Use caution when working around this device or antennas as dangerous voltages and currents may be present. Do not attempt to adjust, repair, modify, or contact this device if RF power or lethal voltages, or DC control voltages are applied. This unit should be mounted in an enclosure that provides protection from RF fields, voltages, and current. This enclosure should also provide a means to safely ground the device.



C2-C9 .01UF
 D1-D6 1N4001

use #14 wire for connectors
 also connect PCB ground plane to
 chassis/connector ground several
 places



Omron G2R-1E-12 or Equiv or America Zettler AZ775-1C-12D or DE
 Diode IN4001 or Equ
 C2-C7 .01uF 50V

$N = 100 * \sqrt{RT(Luh/120)}$
 For T200 #2mix
 N = # of turns

L1 has ~ 1/2 TX power
 T200-2 core is rated for
 about 790 W @ 1 MHz
 Continuous or TX 1.6KW

180 deg Phase J6 -J7
 ANY IMPEDANCE

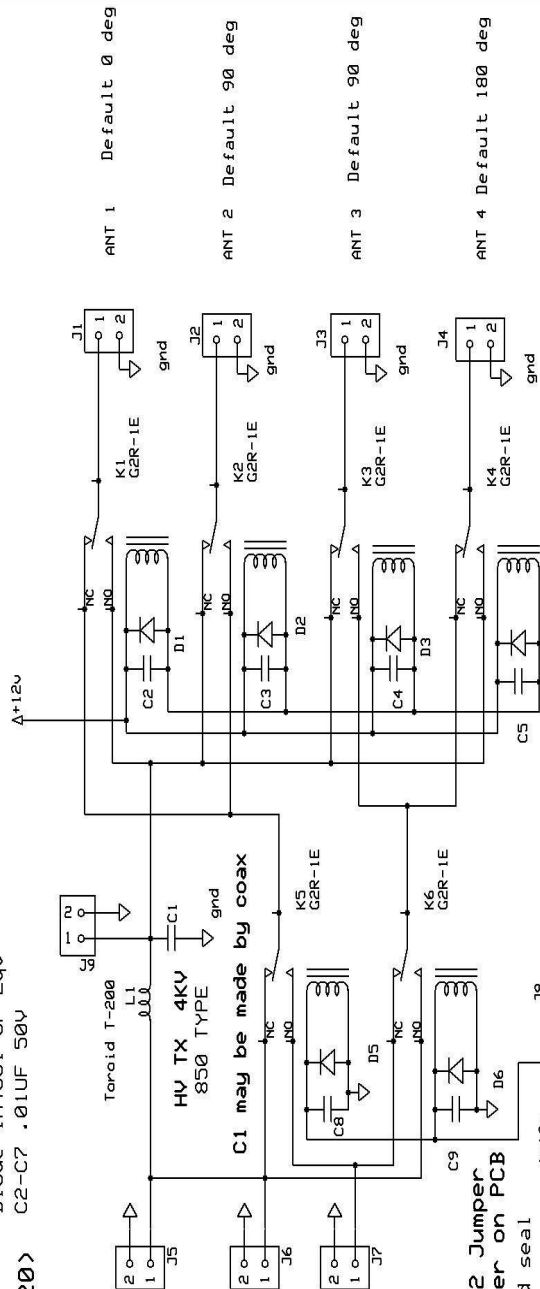
Example

you may use Fixed type
 850 type Hy TX cap (4KV+)
 Or a combination
 RG213 30.8 pf /foot
 L=2.87UH or 15.4 Turns
 choose 15 to round
 C=988pf use 1000pf
 or 32 feet RG8
 Leave far end open circuit and seal

W1-W2 Jumper
 solder on PCB

Freq	Radials	Coax 2 1/4"uv	Luh	C pf
7.100	perfect	50	.64	1110
7.100	16	50	.53	1274
7.100	perfect	75	1.43	494
7.100	16	75	1.19	566
3.55	perfect	50	1.27	2221
3.55	16	50	1.06	2549
3.55	perfect	75	2.87	988
3.55	16	75	2.38	1133
3.75	perfect	50	1.21	2102
3.75	16	50	1.00	2413
3.75	perfect	75	2.71	935
3.75	16	75	2.25	1072

Note Perfect - elevated radials or 20+ buried



ARRL 4SQ Control
 See Antenna Book #18 Chapter 8

For Use a 2 Element phased Control
 Attach antennas to Ant 1 & Ant 2
 Use relays K1, K2 and K5 only
 To Switch use J8 pin 1
 L1 and C1 must be calculated per
 antenna handbook Ch 8

NQ

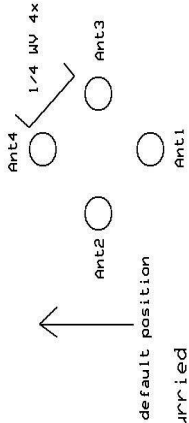
KING 4SQ

KING

Rev 3

10/5/2004

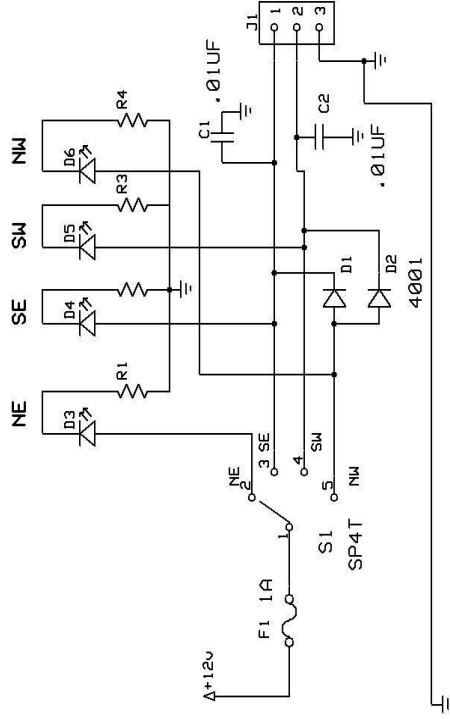
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4SQ CONTROL

RESISTORS 4X 1/4w 390 for 12V system

LED'S 4X 5MM 3.2V



12 or 24V depending
on relay volatge

DIODES 1N4001 OR EQ1Y

If 24V use 1K resitors

NQ	
4SQ Controller	
K1NQ	1
Rev 1.0	11/8/2004

4 SQ BOM

qty	PN	source	cost	total
1	PCB 3.2x 3.9"	K1NQ	18	18
6	American Zettler AZ755-1C-12D	onlinecomponents.com	2.44	14.64
alternative	Omron G2R-1E-DC-12	mouser electronics	3.79	
alternative	Omron G2R-1E-DC-12	onlinecomponents.com	3.74	
7	SO239 Bulk head 0501-RC	mpja.com	0.65	4.55
1	(SO239) FOR COAX CAPACITOR	mpja.com		0
10	Cap .01uf 50V (buy 10 for better price)	mpja.com	0.12	1.2
	Cap PN 546 CM			0
6	1N4002 DIODE PN 5212 DI	mpja.com	0.05	0.3
alternative	Box die cast (should fit) 121231-lm	mpja.com	12.95	
1	Die cast AL box 1590C	oselectronics.com	11.6	11.6
1	Misc hardware,		1	1
1	t-200 #2 core	oselectronics.com		0
4	Spacer AL #6 1/4" sp614	oselectronics.com	0.36	1.44
1	Torriod T200-2	oselectronics.com	6.5	6.5
Option	Cap HV 850 style			
			TOTAL	59.23

Control Box

1	Rotary switch 5 pso 30-15205	oselectronics.com	1.9	1.9
5	resistor 430 ohm 1/4 W RQ430	oselectronics.com	0.05	0.25
4	LED red 5mm 75-4220	oselectronics.com	0.2	0.8
1	Fuse holder FH90-783	oselectronics.com	1.5	1.5
1	fuse 1 amp FSC1	oselectronics.com	0.22	0.22
2	1N4002 DIODE PN 5212 DI	mpja.com		0
2	Cap .01uf 50V (buy 10 for better price)	mpja.com	0.12	0.24
1	box PB160	oselectronics.com	3.3	3.3
1	pointer Knob KN-7114	oselectronics.com	0.065	0.065
1	terminal board 3 contacts 15-73	oselectronics.com	1.3	1.3
			TOTAL	9.575

MiSC

1	Cap RG RG 213 or EQIV 1
1	Coax 180 degree
4	Coax 90 electrical degree

2 ELEMENT 90 DEGREE SPACING 1/4 Wv Verticals

Use 36 or more for elevated feed

freq	radials	antenna z	1/4wv feed Z	xser	xsh	T200-2 turns	L uh	C pf
14.175	4	65	75	70.3	-93.8	8.0	0.8	120
14.175	8	54	75	81.5	-114.8	9.0	0.9	98
14.175	16	45	75	93.8	-140.6	9.0	1.1	80
14.175	36 or more	36	75	110.3	-181.5	10.0	1.2	62
14.175	4	65	50	31.3	-41.7	5.0	0.4	269
14.175	8	54	50	36.2	-51	6.0	0.4	220
14.175	16	45	50	41.7	-62.5	6.0	0.5	180
14.175	36 or more	36	50	49	-80.6	7.0	0.6	139
7.1	4	65	75	70.3	-93.8	11.0	1.6	239
7.1	8	54	75	81.5	-114.8	12.0	1.8	195
7.1	16	45	75	93.8	-140.6	13.0	2.1	160
7.1	36 or more	36	75	110.3	-181.5	14.0	2.5	124
7.1	4	65	50	31.3	-41.7	8.0	0.7	538
7.1	8	54	50	36.2	-51	8.0	0.8	440
7.1	16	45	50	41.7	-62.5	9.0	0.9	359
7.1	36 or more	36	50	49	-80.6	10.0	1.1	278
3.8	4	65	75	70.3	-93.8	16.0	2.9	447
3.8	8	54	75	81.5	-114.8	17.0	3.4	365
3.8	16	45	75	93.8	-140.6	18.0	3.9	298
3.8	36 or more	36	75	110.3	-181.5	20.0	4.6	231
3.8	4	65	50	31.3	-41.7	10.0	1.3	1005
3.8	8	54	50	36.2	-51	11.0	1.5	822
3.8	16	45	50	41.7	-62.5	12.0	1.7	670
3.8	36 or more	36	50	49	-80.6	13.0	2.1	520
3.55	4	65	75	70.3	-93.8	16.0	3.2	478
3.55	8	54	75	81.5	-114.8	17.0	3.7	391
3.55	16	45	75	93.8	-140.6	19.0	4.2	319
3.55	36 or more	36	75	110.3	-181.5	20.0	4.9	247
3.55	4	65	50	31.3	-41.7	11.0	1.4	1076
3.55	8	54	50	36.2	-51	12.0	1.6	880
3.55	16	45	50	41.7	-62.5	12.0	1.9	718
3.55	36 or more	36	50	49	-80.6	14.0	2.2	557
1.825	4	65	75	70.3	-93.8	23.0	6.1	930
1.825	8	54	75	81.5	-114.8	24.0	7.1	760
1.825	16	45	75	93.8	-140.6	26.0	8.2	621
1.825	36 or more	36	75	110.3	-181.5	28.0	9.6	481
1.825	4	65	50	31.3	-41.7	15.0	2.7	2092
1.825	8	54	50	36.2	-51	16.0	3.2	1711
1.825	16	45	50	41.7	-62.5	17.0	3.6	1396
1.825	36 or more	36	50	49	-80.6	19.0	4.3	1083

4 ELEMENT 90 DEGREE SPACING 1/4 Wv Verticals (4SQ)

Use 36 or more for elevated feed

freq	radials	antenna z	1/4wv feed Z	xser	xsh	T200-2 turns	L uh	C pf
14.175	4	65	75	38.5	-30.9	6.0	0.4	364
14.175	8	54	75	45.4	-35.2	7.0	0.5	319
14.175	16	45	75	53.1	-39.6	7.0	0.6	284
14.175	36 or more	36	75	63.9	-45.4	8.0	0.7	247
14.175	4	65	50	17.1	-13.17	4.0	0.2	853
14.175	8	54	50	20.2	-15.6	4.0	0.2	720
14.175	16	45	50	23.6	-17.6	5.0	0.3	638
14.175	36 or more	36	50	28.4	-20.2	5.0	0.3	556
7.1	4	65	75	38.5	-30.9	8.0	0.9	726
7.1	8	54	75	45.4	-35.2	9.0	1.0	637
7.1	16	45	75	53.1	-39.6	10.0	1.2	566
7.1	36 or more	36	75	63.9	-45.4	11.0	1.4	494
7.1	4	65	50	17.1	-13.17	6.0	0.4	1703
7.1	8	54	50	20.2	-15.6	6.0	0.5	1438
7.1	16	45	50	23.6	-17.6	7.0	0.5	1274
7.1	36 or more	36	50	28.4	-20.2	7.0	0.6	1110
3.8	4	65	75	38.5	-30.9	12.0	1.6	1356
3.8	8	54	75	45.4	-35.2	13.0	1.9	1190
3.8	16	45	75	53.1	-39.6	14.0	2.2	1058
3.8	36 or more	36	75	63.9	-45.4	15.0	2.7	923
3.8	4	65	50	17.1	-13.17	8.0	0.7	3182
3.8	8	54	50	20.2	-15.6	8.0	0.8	2686
3.8	16	45	50	23.6	-17.6	9.0	1.0	2381
3.8	36 or more	36	50	28.4	-20.2	10.0	1.2	2074
3.55	4	65	75	38.5	-30.9	12.0	1.7	1452
3.55	8	54	75	45.4	-35.2	13.0	2.0	1274
3.55	16	45	75	53.1	-39.6	14.0	2.4	1133
3.55	36 or more	36	75	63.9	-45.4	15.0	2.9	988
3.55	4	65	50	17.1	-13.17	8.0	0.8	3406
3.55	8	54	50	20.2	-15.6	9.0	0.9	2875
3.55	16	45	50	23.6	-17.6	9.0	1.1	2549
3.55	36 or more	36	50	28.4	-20.2	10.0	1.3	2221
1.825	4	65	75	38.5	-30.9	17.0	3.4	2824
1.825	8	54	75	45.4	-35.2	18.0	4.0	2479
1.825	16	45	75	53.1	-39.6	20.0	4.6	2203
1.825	36 or more	36	75	63.9	-45.4	22.0	5.6	1922
1.825	4	65	50	17.1	-13.17	11.0	1.5	6625
1.825	8	54	50	20.2	-15.6	12.0	1.8	5593
1.825	16	45	50	23.6	-17.6	13.0	2.1	4958
1.825	36 or more	36	50	28.4	-20.2	14.0	2.5	4319