Five Band Quad Construction Details.doc

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This document describes the detailed construction and measured SWR versus frequency performance of my five band cubical quad. The quad is constructed on a 30 foot long 3 inch diameter aluminum boom. The spacing between the four major quad spiders is 10 foot for the 20, 17, 15, and 12 MTR bands. An extra fifth quad spider is added to the boom for the 10 MTR driven element such that equal 5 foot spacing to the 10 MTR reflector and first director results. I used Cubex spiders and 13 foot single piece white fiberglass poles in the construction. The poles were covered with two coats of UV resistant gray paint to protect the resin in the poles from deterioration in the sun.

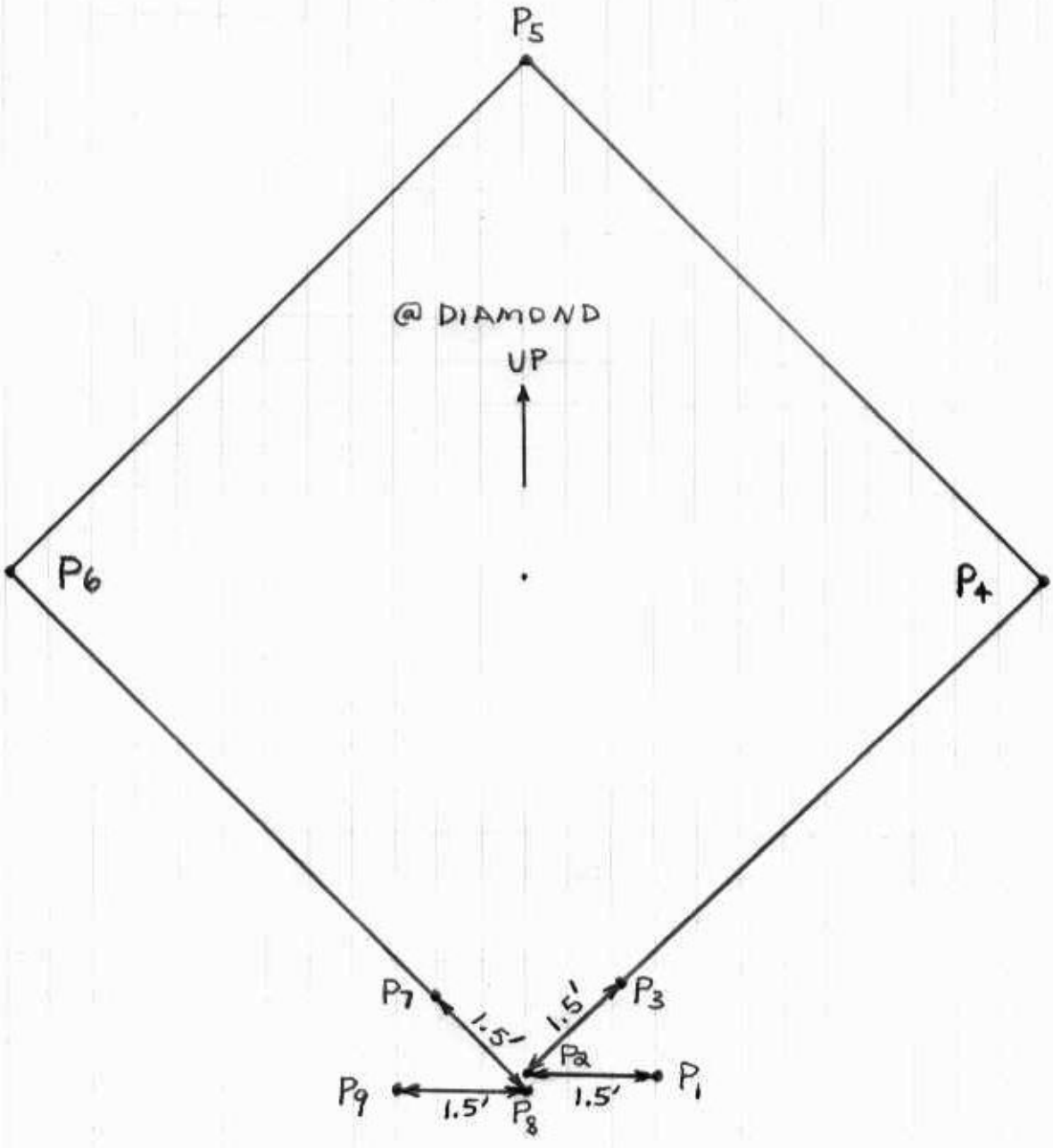
A MATLAB computer program named qdim.m was written to describe exactly where to drill the arm wire holes and where to mark the wires for cut points, solder points, measurement points, and arm hole points. Figures A and B show the point number nomenclature used in the computer output to mark driven and parasitic quad wires.

The dimensions are based on diamond shaped quad elements with driven elements fed at the bottom of the diamond. The dimensions of the parasitic quad elements could also be used for square quad elements. I used #12 hard drawn bare copper wire for all elements. The key to getting 10 year life out of the wires is to prevent wire contact with the fiberglass. If the wire is run through the fiberglass holes expect only a five year life since the fiberglass will rub a notch in the wire and it will break. One inch diameter Delrin rod drilled, epoxyed, and cotter pinned to the arm tips was used to prevent 20 meter wire contact with the fiberglass. A Delrin cylindrical sleeve was cotter pinned to the fiberglass to prevent 17 MTR wire contact with the fiberglass. A 3 inch piece of Teflon spaghetti was use on all corner hole supports of the 15, 12, and 10 MTR wires. A piece of insulated tie wire and some Dow 738 silicone sealant was used to hold all wires in place at the corners. Insert the spaghetti into the arm hole before snaking the wire through the spaghetti.

The actual measured SWR versus frequency plots for my quad on the 20, 17, 15, 12, and 10 MTR bands are shown after the dimensions. The 15 MTR quad dimensions given in this paper are about 0.46% shorter than the quad that I constructed to move the SWR curve up an extra 100 KHz. Otherwise, the dimension given are exactly what I used.

FIG A QUAD DRIVEN ELEMENT WIRE MARKS

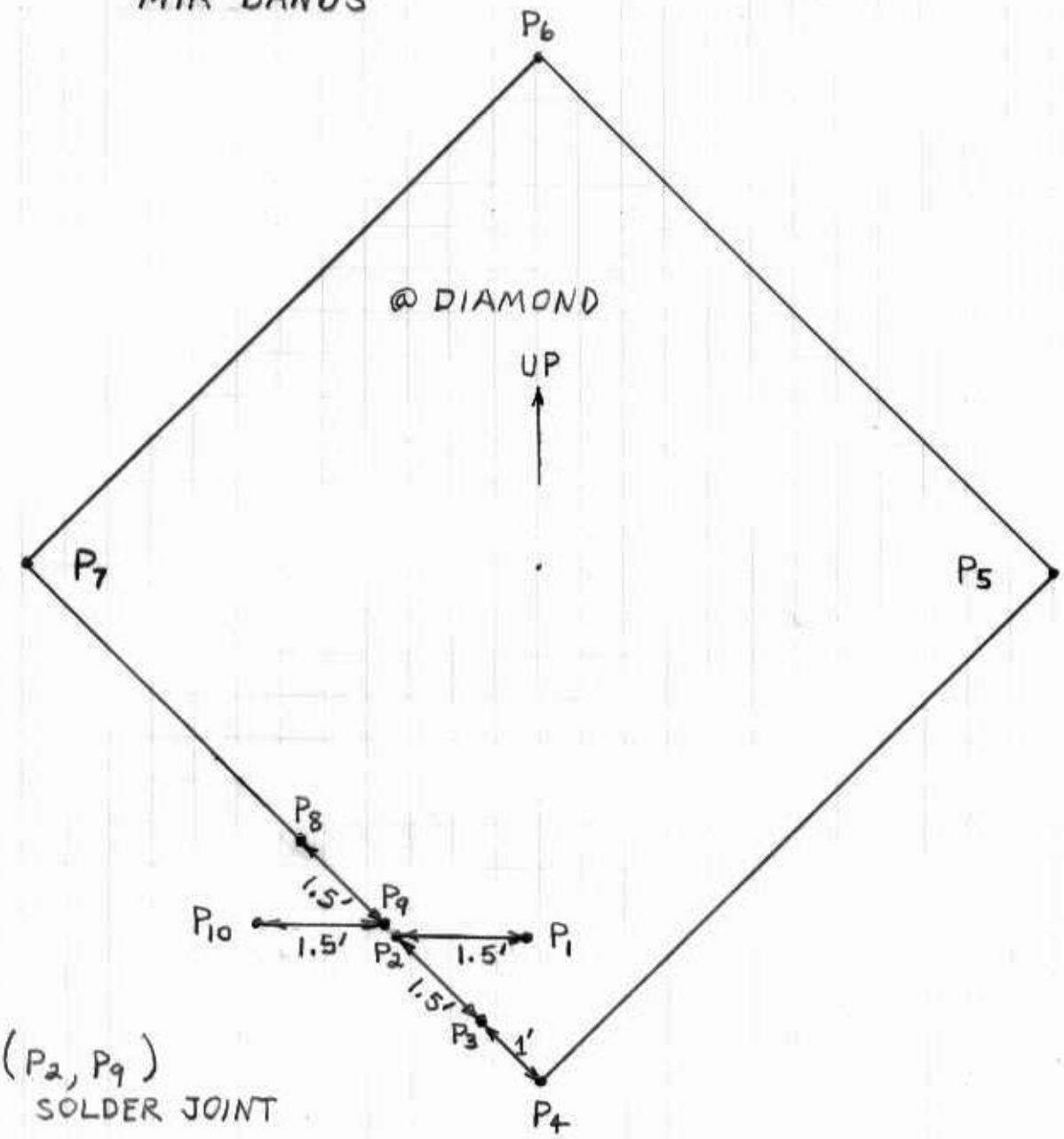
FOR THE 20, 17, 15, 12, AND 10 MTR BANDS



COAX FEED TO (P_2, P_8)

FIG B

QUAD DIRECTOR AND REFLECTOR ELEMENT WIRE MARKS FOR THE 20, 17, 15, 12 AND 10 MTR BANDS



The run output for quad construction dimensions from computer program qdim.m follows:

```
>> qdim

FIVE BAND QUAD FIBERGLASS POLE BUTT END TO WIRE HOLE
DIMENSIONS

Opposing Quad Arm Pair Butt End Separations In Inches=3.875
Number of -1/16 inch butt to wire hole increments allowed for slack=3


Wire Holes From Pole Butt Ends For Spider Number 1 (Reflectors 20 to 10 MTRS)

 BAND    FT     INCHES    1/16th INCH FRACTION

 20       12       7          9/16
 17        9       9          9/16
 15        8       3         15/16
 12        7       1          2/16
 10        6       2          8/16

Wire Holes From Pole Butt Ends For Spider Number 2 (Driven El 20 to 12, 10 1ST DIR)

 BAND    FT     INCHES    1/16th INCH FRACTION

 20       12       3          2/16
 17        9       6          1/16
 15        8       0         15/16
 12        6      10          9/16
 10        5      10         11/16

Wire Holes From Pole Butt Ends For Spider Number 3 (1ST DIR 20 to 12, 2ND DIR 10)

 BAND    FT     INCHES    1/16th INCH FRACTION

 20       12       0          9/16
 17        9       4          0/16
 15        7      11          1/16
 12        6       9          1/16
 10        5      10         15/16
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Wire Holes From Pole Butt Ends For Spider Number 4 (2ND DIR 20 to 12, 3RD DIR 10)

BAND	FT	INCHES	1/16th INCHES
20	12	0	9/16
17	9	4	0/16
15	7	11	2/16
12	6	9	1/16
10	5	10	15/16

NON DRIVEN ELEMENT WIRE MARK POINTS FOLLOW

QUAD SPIDER NUMBER=1 20 MTR REF

(p9-p2) in FT=72.6055 ELEMENT LENGTH in FT=72.6055

PT#	FT	INCH	1/16th INCH UNITS (NUMBER OF)
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	23	1	13
6	41	3	10
7	59	5	7
8	73	7	4
9	75	1	4
10	76	7	4

QUAD SPIDER NUMBER=1 17 MTR REF

(p9-p2) in FT=56.5816 ELEMENT LENGTH in FT=56.5816

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	19	1	12
6	33	3	8
7	47	5	4
8	57	7	0
9	59	1	0
10	60	7	0

QUAD SPIDER NUMBER=1 15 MTR REF

(p9-p2) in FT=48.2423 ELEMENT LENGTH in FT=48.2423

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	17	0	12
6	29	1	7
7	41	2	3
8	49	2	15
9	50	8	15
10	52	2	15

QUAD SPIDER NUMBER=1 12 MTR REF

(p9-p2) in FT=41.2461 ELEMENT LENGTH in FT=41.2461

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	15	3	12
6	25	7	8
7	35	11	3
8	42	2	15
9	43	8	15
10	45	2	15

QUAD SPIDER NUMBER=1 10 MTR REF

(p9-p2) in FT=36.2462 ELEMENT LENGTH in FT=36.2462

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	14	0	12
6	23	1	8
7	32	2	3
8	37	2	15
9	38	8	15
10	40	2	15

QUAD SPIDER NUMBER=2 10 MTR DIR1

(p9-p2) in FT=34.4588 ELEMENT LENGTH in FT=34.4588

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	13	7	6
6	22	2	12
7	30	10	2
8	35	5	8
9	36	11	8
10	38	5	8

QUAD SPIDER NUMBER=3 20 MTR DIR1

(p9-p2) in FT=69.3058 ELEMENT LENGTH in FT=69.3058

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	22	3	15
6	39	7	13
7	56	11	12
8	70	3	11
9	71	9	11
10	73	3	11

QUAD SPIDER NUMBER=3 17 MTR DIR1

(p9-p2) in FT=53.9723 ELEMENT LENGTH in FT=53.9723

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	18	5	15
6	31	11	13
7	45	5	12
8	54	11	11
9	56	5	11
10	57	11	11

QUAD SPIDER NUMBER=3 15 MTR DIR1

(p9-p2) in FT=45.9399 ELEMENT LENGTH in FT=45.9399

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	16	5	13
6	27	11	10
7	39	5	7
8	46	11	4
9	48	5	4
10	49	11	4

QUAD SPIDER NUMBER=3 12 MTR DIR1

(p9-p2) in FT=39.344 ELEMENT LENGTH in FT=39.344

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	14	10	1
6	24	8	1
7	34	6	2
8	40	4	2
9	41	10	2
10	43	4	2

QUAD SPIDER NUMBER=3 10 MTR DIR2

(p9-p2) in FT=34.5721 ELEMENT LENGTH in FT=34.5721

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	13	7	11
6	22	3	7
7	30	11	2
8	35	6	14
9	37	0	14
10	38	6	14

QUAD SPIDER NUMBER=4 20 MTR DIR2

(p9-p2) in FT=69.291 ELEMENT LENGTH in FT=69.291

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	22	3	14
6	39	7	12
7	56	11	10
8	70	3	8
9	71	9	8
10	73	3	8

QUAD SPIDER NUMBER=4 17 MTR DIR2

(p9-p2) in FT=53.9723 ELEMENT LENGTH in FT=53.9723

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	18	5	15
6	31	11	13
7	45	5	12
8	54	11	11
9	56	5	11
10	57	11	11

QUAD SPIDER NUMBER=4 15 MTR DIR2

(p9-p2) in FT=45.9765 ELEMENT LENGTH in FT=45.9765

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	16	5	15
6	27	11	14
7	39	5	13
8	46	11	11
9	48	5	11
10	49	11	11

QUAD SPIDER NUMBER=4 12 MTR DIR2

(p9-p2) in FT=39.344 ELEMENT LENGTH in FT=39.344

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	14	10	1
6	24	8	1
7	34	6	2
8	40	4	2
9	41	10	2
10	43	4	2

QUAD SPIDER NUMBER=4 10 MTR DIR3

(p9-p2) in FT=34.5795 ELEMENT LENGTH in FT=34.5795

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	5	0	0
5	13	7	12
6	22	3	8
7	30	11	3
8	35	6	15
9	37	0	15
10	38	6	15

DRIVEN ELEMENT WIRE MARK POINTS FOLLOW

QUAD SPIDER NUMBER=2 20 MTR DRIV

(p8-p2) in FT=70.4615 DRIVEN ELEMENT LENGTH in FT=70.5072

[DE-(p8-p2)] in 1/16th inch units=9 Remember p2 and p8 at pole center

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	20	0	15
5	37	8	7
6	55	4	0
7	71	5	9
8	72	11	9
9	74	5	9

QUAD SPIDER NUMBER=2 17 MTR DRIV

(p8-p2) in FT=54.8704 DRIVEN ELEMENT LENGTH in FT=54.9336

[DE-(p8-p2)] in 1/16th inch units=12 Remember p2 and p8 at pole center

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	16	2	2
5	29	10	15
6	43	7	11
7	55	10	7
8	57	4	7
9	58	10	7

QUAD SPIDER NUMBER=2 15 MTR DRIV

(p8-p2) in FT=46.7332 DRIVEN ELEMENT LENGTH in FT=46.8049

[DE-(p8-p2)] in 1/16th inch units=14 Remember p2 and p8 at pole center

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	14	1	11
5	25	10	1
6	37	6	8
7	47	8	13
8	49	2	13
9	50	8	13

QUAD SPIDER NUMBER=2 12 MTR DRIV

(p8-p2) in FT=39.9652 DRIVEN ELEMENT LENGTH in FT=40.0448

[DE-(p8-p2)] in 1/16th inch units=15 Remember p2 and p8 at pole center

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	12	5	6
5	22	5	8
6	32	5	10
7	40	11	9
8	42	5	9
9	43	11	9

QUAD SPIDER NUMBER=5 10 MTR DRIV

(p8-p2) in FT=35.1264 DRIVEN ELEMENT LENGTH in FT=35.1857

[DE-(p8-p2)] in 1/16th inch units=11 Remember p2 and p8 at pole center

PT#	FT	INCH	1/16th INCH UNITS
1	1	0	0
2	2	6	0
3	4	0	0
4	11	2	14
5	20	0	7
6	28	10	0
7	36	1	8
8	37	7	8
9	39	1	8

>>

swr1.doc

10-20-05 swr plots

Figures 1 to 5 show the measured SWR versus frequency plot for the 20, 17, 15, 12, and 10 MTR bands for my five band quad.

FIG 1 20 MTR QUAD SWR PLOT

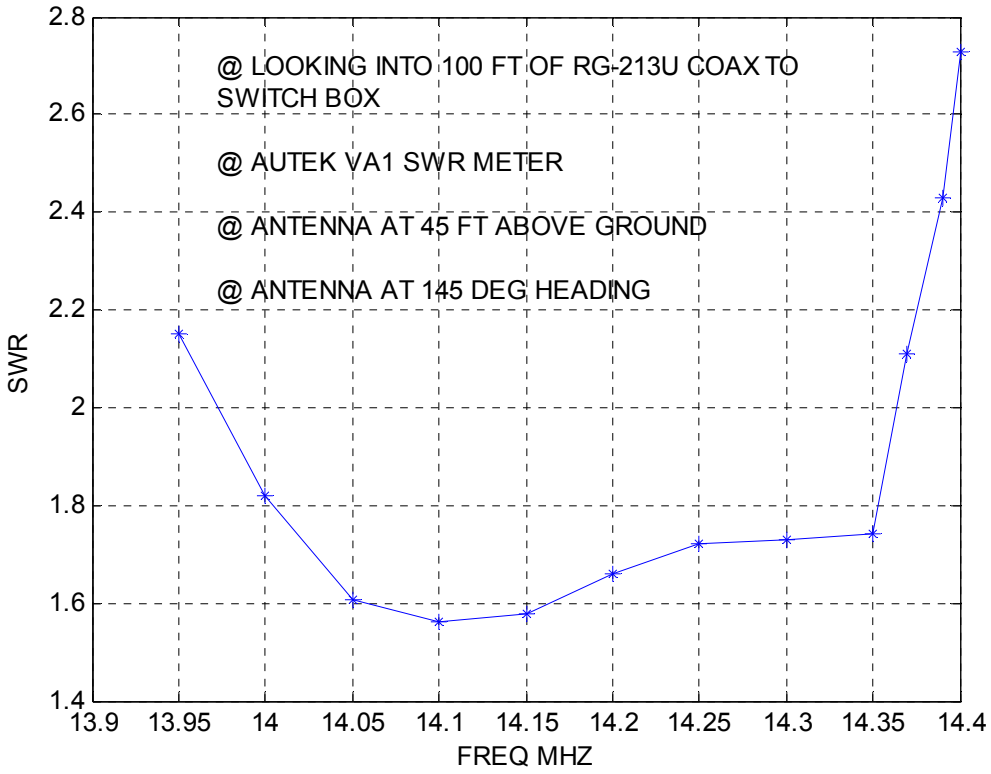


FIG 2 17 MTR QUAD SWR PLOT

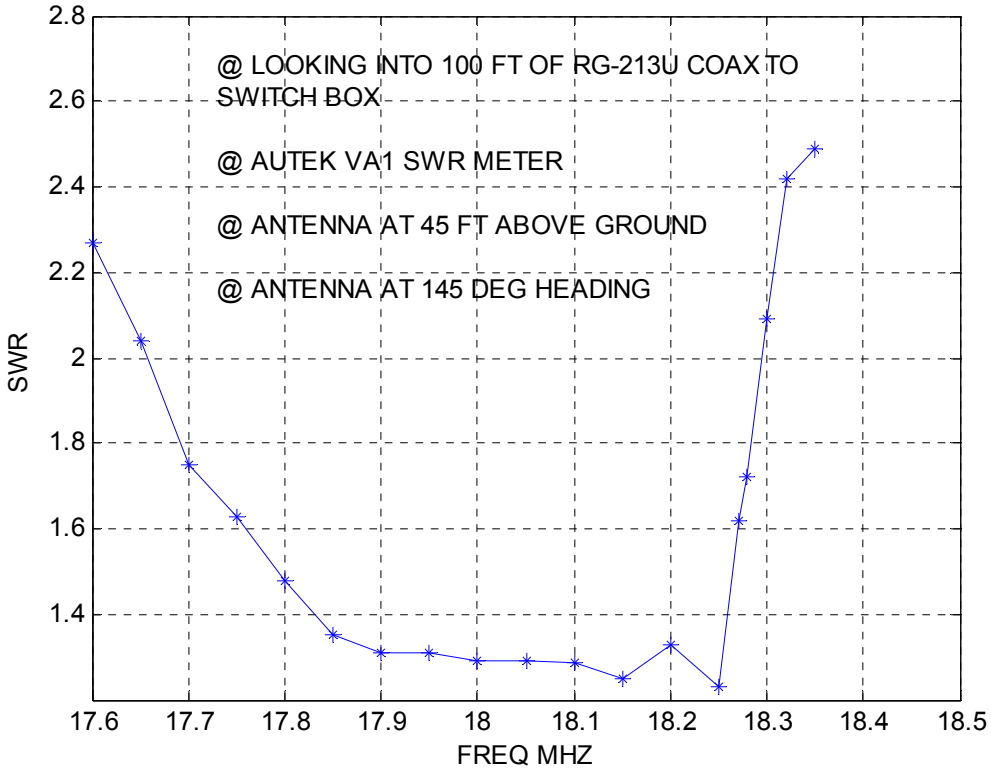


FIG 3 15 MTR QUAD SWR PLOT

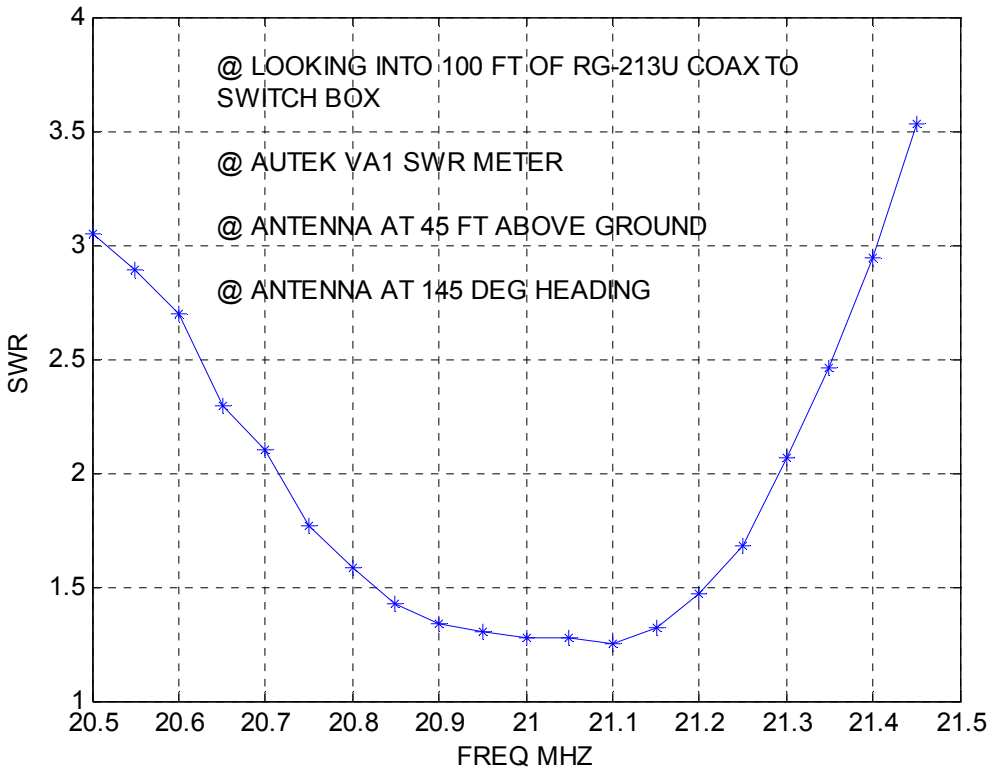
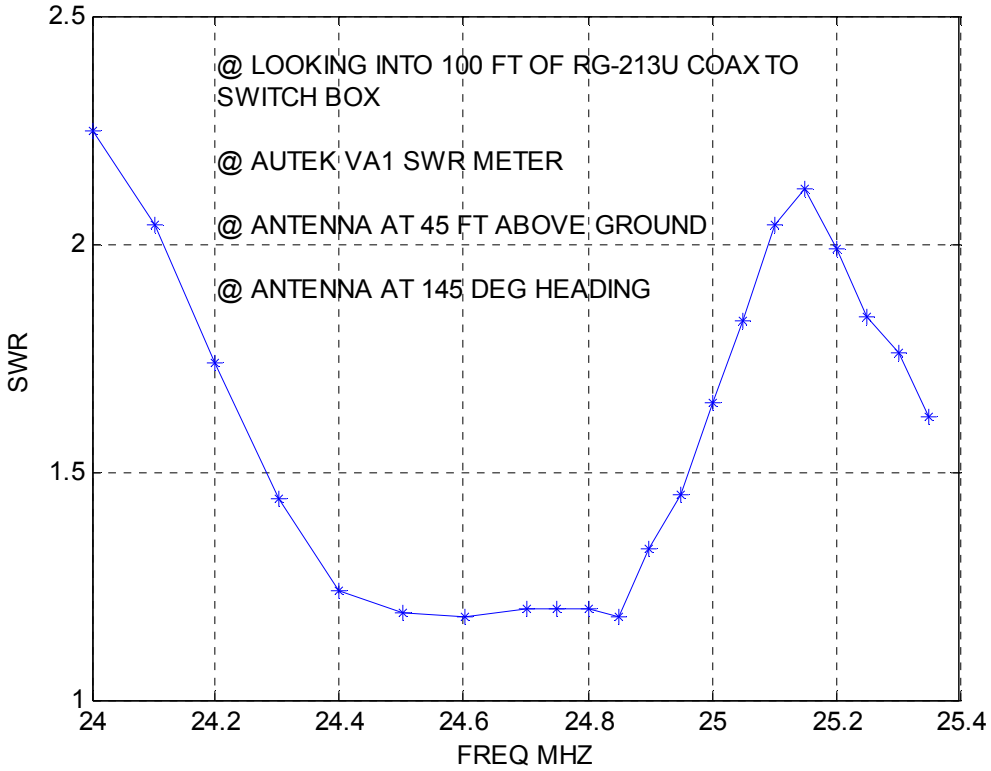
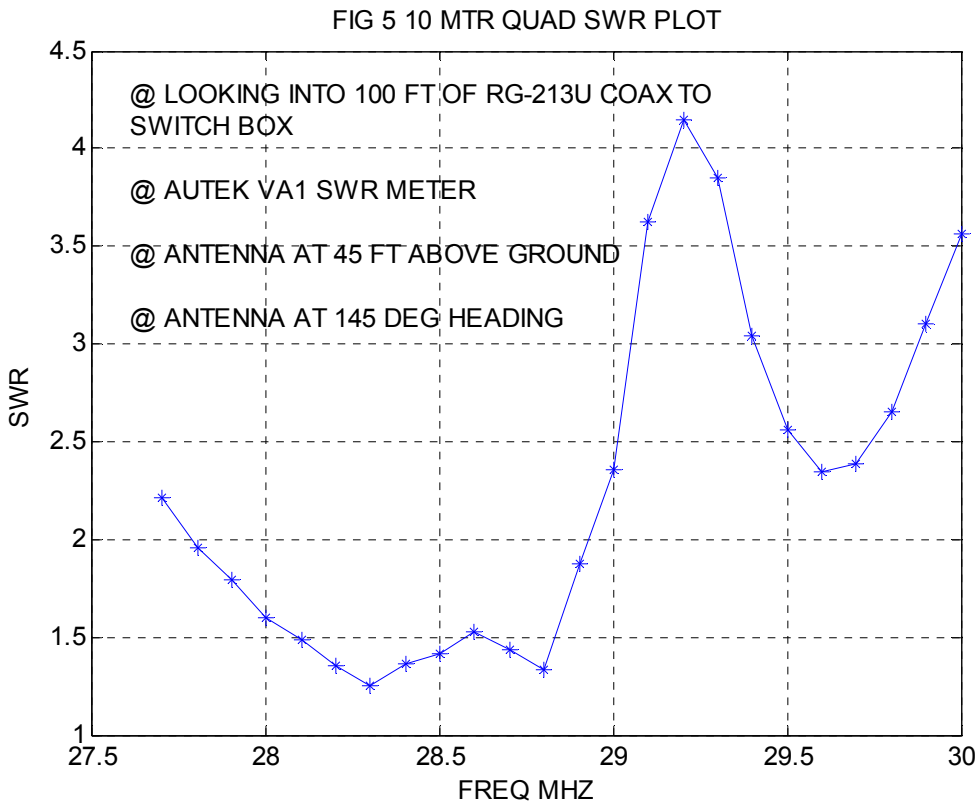


FIG 4 12 MTR QUAD SWR PLOT





The coax feed design for the five band quad is shown in Table 1 which gives the coax feed line lengths to a mast mounted WX0B Rat Pack remote coax switch box. The switch box shorts the unused feed lines to ground. This feed line design is important to prevent interactions between driven and non driven quad sections that can degrade the gain, front to back ratio, and SWR of the antenna. Any length of RG213U can be used from the switch box to the shack.

Table 1 Five Band Quad Coax Feed Design

Freq Mhz	RG213 Ft	RG11U Ft
14.1740	20.4640	0
18.1180	17.7110	0
21.2240	16.3130	0
24.9400	8.5638	6.5152 (Quarter wave Q section match at feed point)
28.4000	22.2200	0