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**FM DIRECTIONAL BROADCAST ANTENNA  
PROOF-OF-PERFORMANCE**

**MODEL JAHD 1/3 (3) DA**

**SERIAL NUMBER 12107**

**WCUL**

**Midlothian, VA**



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**DATE:** February 2, 2005

<b>ANTENNA GAIN</b>	<u>H-pol</u>	<u>V-pol</u>
relative	<b>0.93</b>	<b>0.93</b>
(dBd)	<b>(-0.30)</b>	<b>(-0.30)</b>

**FM ANTENNA FOR:**

STATION: **WCUL**

LOCATION: **Midlothian, VA**

MODEL NUMBER: **JAHD 1/3 (3) DA**

FREQUENCY & ERP: **98.9 MHz, 4.80 kW**

ANTENNA INPUT POWER: **5.14 kW**

ANTENNA BOOM HEADING: **See Dwgs**

RMS OF THE  
AZIMUTH PATTERNS:

Composite	H-pol	V-pol
<b>0.764</b>	<b>0.761</b>	<b>0.641</b>

**CERTIFICATION**

This certification, along with the accompanying antenna specification sheet, antenna mounting sketches, and azimuth and elevation patterns, certifies the construction and measurement of the *JAMPRO* FM CP antenna to the station's requirements, as measured at the *JAMPRO* antenna site in Sacramento, California. The following is an outline of construction methods, pattern measurements, installation requirements, recommended maintenance and equipment used.

**CONSTRUCTION**

Three CP FM panel antennas were used to create the required directional patterns. From experience and by repeated measurements, these panels were adjusted as to position until the final configuration was determined and the pattern requirements were met. A power dividing network and interconnecting cables were custom designed for this application. Measurements to establish their exact location are shown on the antenna mounting sketches.

**MEASUREMENT**

The full scale antenna was mounted on an exact duplicate of its final support at the station. We were careful to duplicate conduits, cables and anything peculiar to this mounting. This was then placed on a turntable at the *JAMPRO* antenna range. This directional antenna was used for receiving the radiation from a transmitting antenna that is elevated 25 feet above ground and located at a distance of 4,500 feet. This transmitting antenna is capable of transmitting either horizontal or vertical polarization. The frequency of the signal generator was accurately set to station frequency by use of a frequency counter. A spectrum analyzer was used to continuously measure field strength as the antenna under test was rotated. Field strength at each azimuth was then plotted.



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Station: **WCUL**

Model: **JAHD 1/3 (3) DA**

### **INSTALLATION**

The antenna must be installed in exactly the manner in which it was measured at the factory. This is shown in detail on the antenna mounting sketch, including the azimuth bearings of the elements. These directions must be verified by a surveyor at the site when installation is being completed. Good engineering practices should be followed in any details not covered by specific instructions.

### **MAINTENANCE**

Annual or regular inspection should be made on the antenna system. At this time, tightness of U-bolts, or other fastenings, should be routinely checked. Any deterioration of the antenna due to lightning, or other causes should be promptly repaired.

### **EQUIPMENT**

MODEL: -3000 WAVETEK SIGNAL GENERATOR, SERIAL #66479  
-8591E H.P. SPECTRUM ANALYZER, SERIAL #3308A01312, CAL'd 1/16/03  
-TUNED CAVITY DIPOLE

### **CONCLUSION**

In the development of this pattern, *JAMPRO* antennas, Inc. observed known requirements of the FCC, as stated on the station construction permit.

Gain figures and required input power to achieve station ERP, as well as other details, are found on the first page.

This certification, with its calculations were performed by J. Dane Jubera, B.S.E.E., Electrical Engineer, *JAMPRO* Antennas, Inc.

EXECUTED THIS      2nd      DAY OF      February     , 2005

BY: \_\_\_\_\_

J. Dane Jubera, B.S.E.E. *JAMPRO* Antennas, Inc.



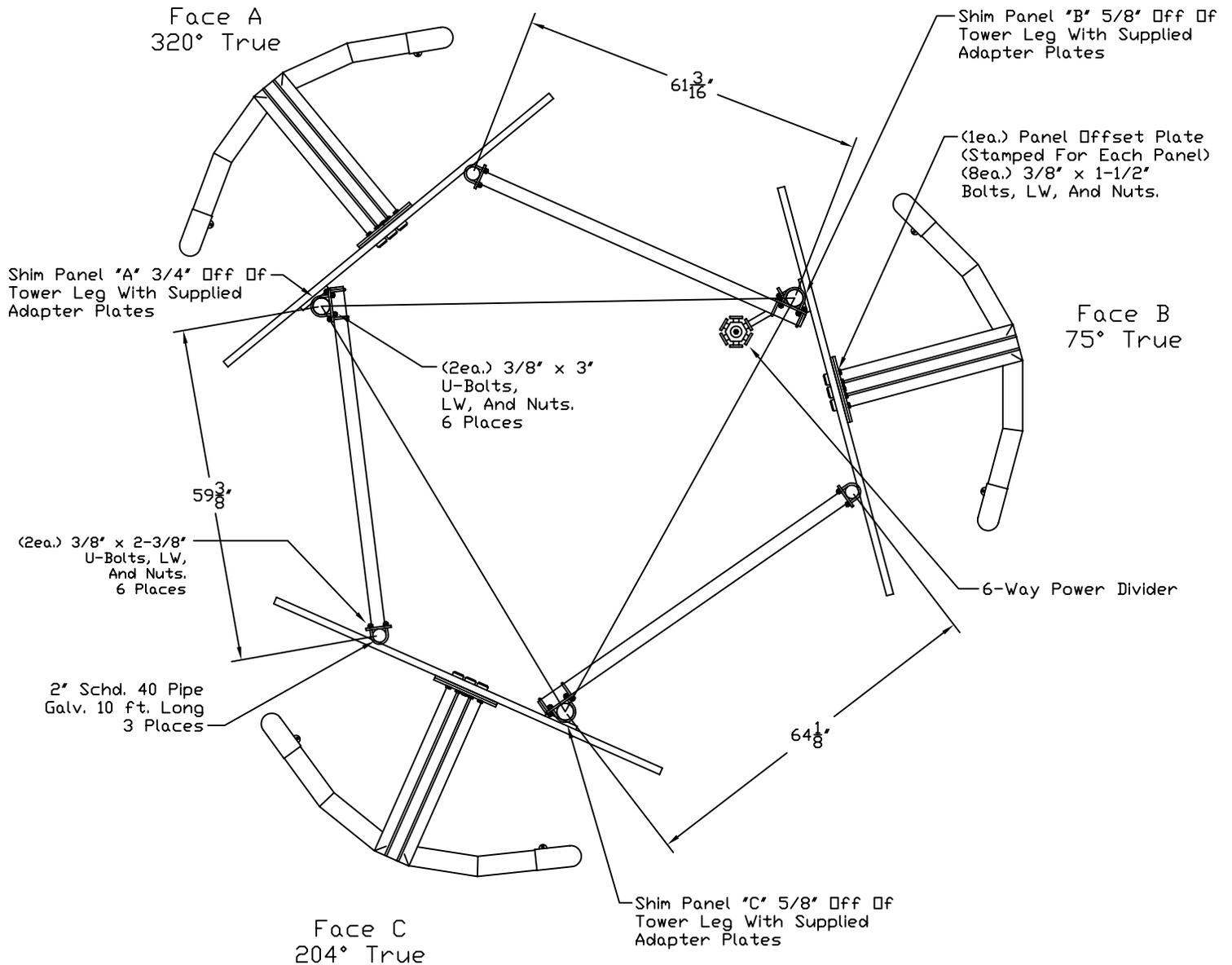
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# TOP VIEW

**NOTE:**  
 INSTALL ANTENNA AS SHOWN.  
 VSWR COULD BE AFFECTED IF  
 INSTALLED DIFFERENTLY.

STATION CHIEF ENGINEER TO  
 DETERMINE TOWER LEG TO  
 WHICH ANTENNA IS TO BE MOUNTED.

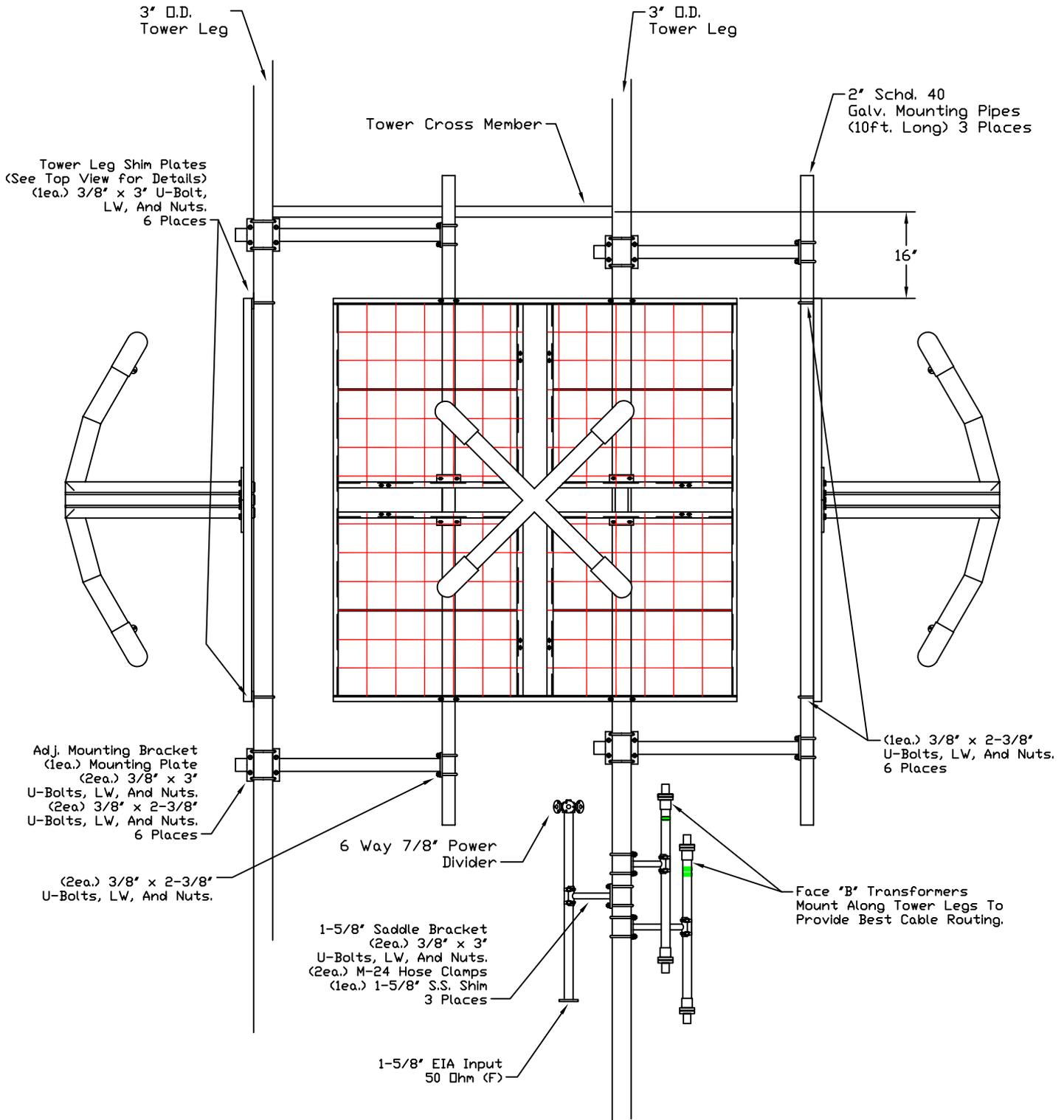


TITLE:  12107 TOP	JOB NO. 12107	ANTENNA MODEL: JAHD-1/3(3) DA	FREQ: 98.9 MHz	REV: 0
	DATE: 2/2/05	CUSTOMER: Harris	CALL SIGN: WCUL	SHEET: 2 of 4



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Voice: (916)383-1177  
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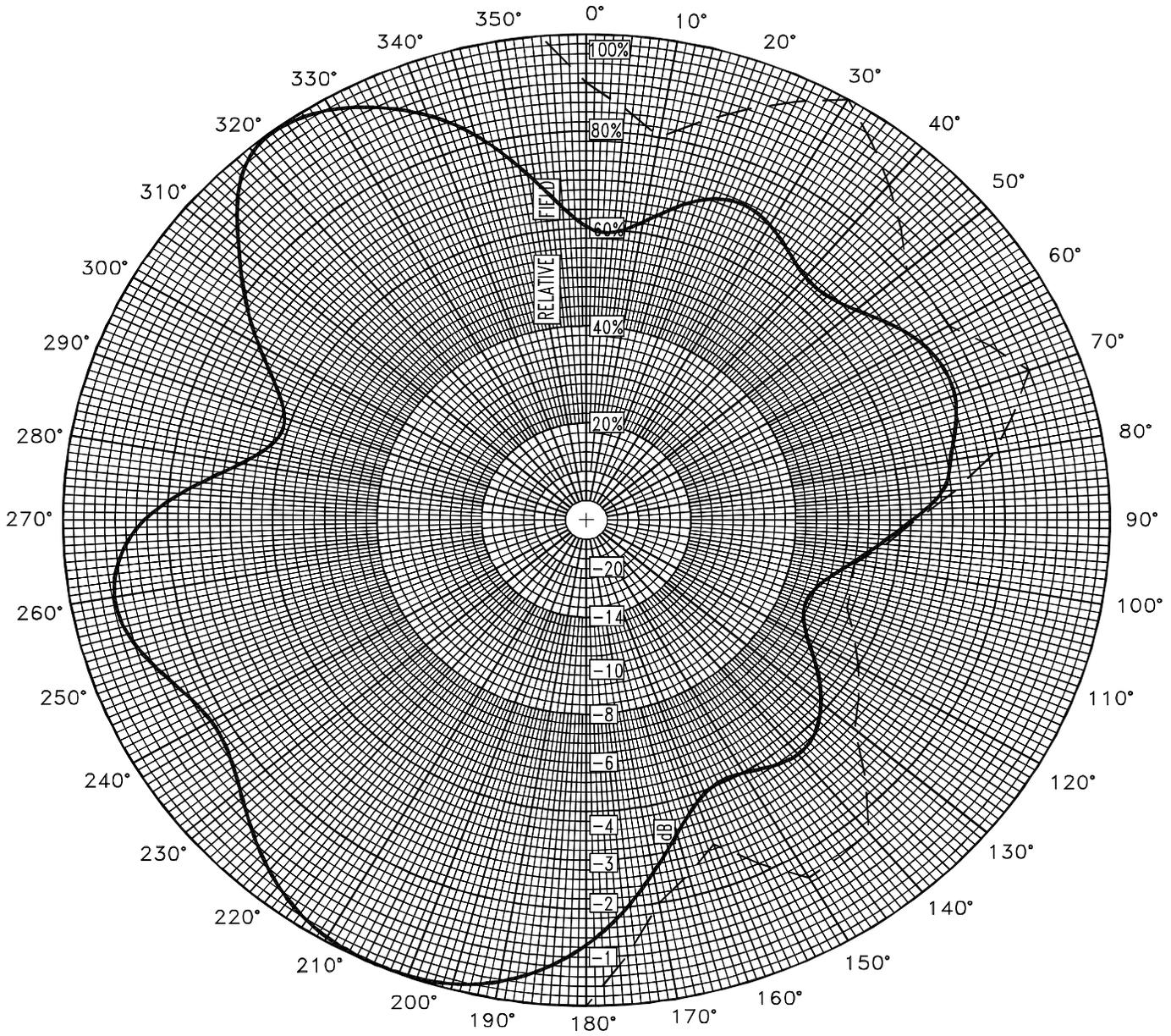


TITLE:  
 12107 Side

JOB NO.  
 12107  
 DATE:  
 2/2/05

ANTENNA MODEL:  
 JAHD-1/3(3) DA  
 CUSTOMER:  
 Harris

FREQ:  
 98.9 MHz  
 CALL SIGN:  
 WCUL  
 REV:  
 0  
 SHEET:  
 1 of 4



**Azimuth Pattern**

Customer: WCUL

Date: January 25, 2005

Frequency: 98.9 MHz

Type Number: JAHD 1/3 (3) DA

Notes:

COMPOSITE PATTERN ENVELOPE (H & V)



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WCUL ERP = 4.80 kW January 25, 2005

JAHD 1/3 (3) DA

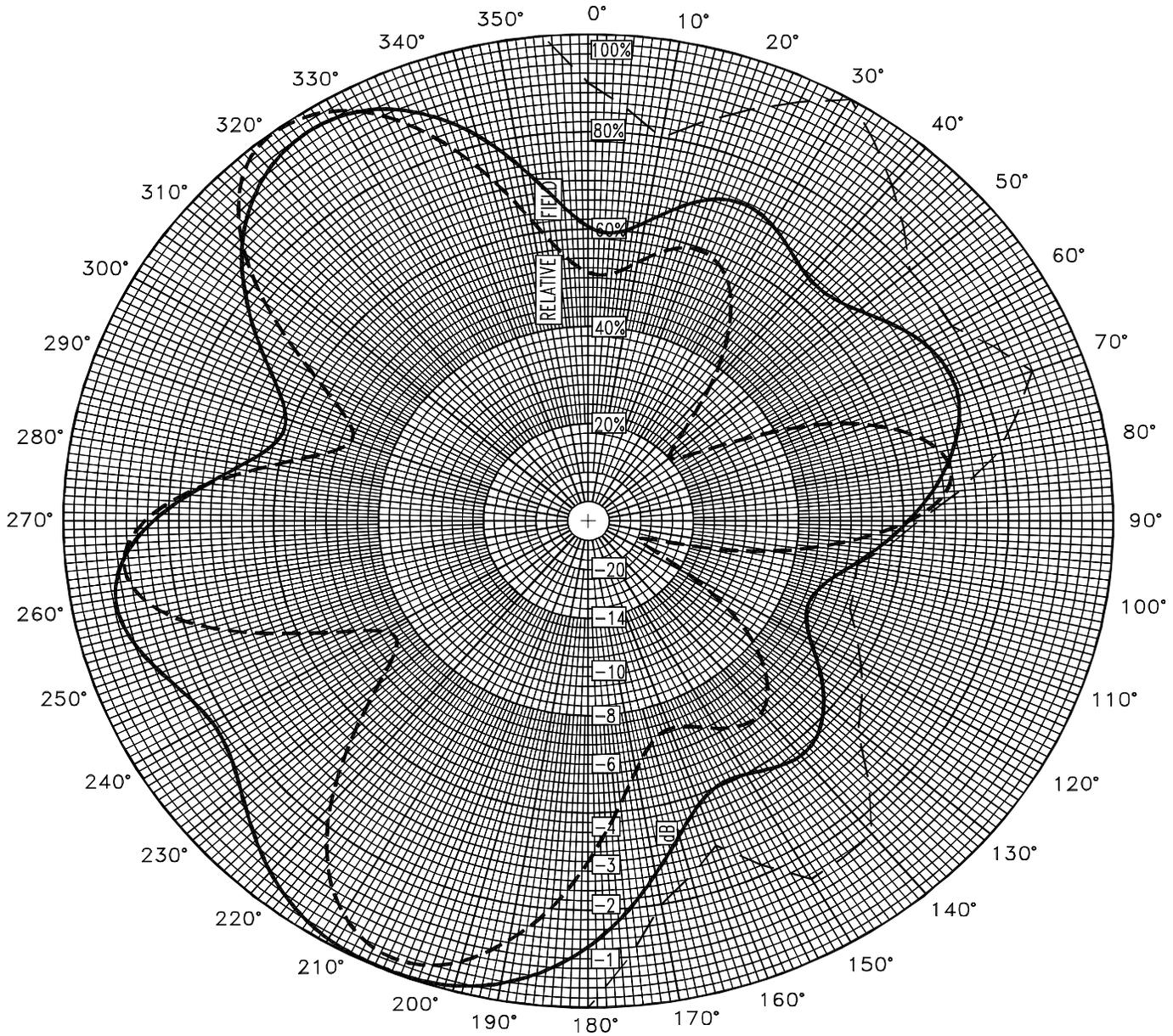
TABULATION OF RELATIVE FIELD

COMPOSITE MEASURED PATTERN (H & V)

<u>BEARING</u>	<u>FIELD</u>	<u>ERP</u> <u>(kW)</u>	<u>dBk</u>
0	0.597	1.71	2.34
10	0.623	1.86	2.70
20	0.709	2.41	3.83
30	0.705	2.38	3.77
40	0.649	2.02	3.06
50	0.672	2.17	3.36
60	0.739	2.62	4.18
70	0.754	2.73	4.36
80	0.705	2.39	3.78
90	0.625	1.88	2.73
100	0.515	1.27	1.05
110	0.451	0.97	-0.11
120	0.487	1.14	0.56
130	0.588	1.66	2.20
140	0.634	1.93	2.86
150	0.600	1.73	2.37
160	0.615	1.81	2.59
170	0.739	2.62	4.19
180	0.880	3.72	5.70
190	0.969	4.50	6.54
200	1.000	4.80	6.81
210	0.995	4.76	6.77
220	0.946	4.29	6.33
230	0.864	3.58	5.54
240	0.825	3.27	5.14
250	0.881	3.72	5.71
260	0.922	4.08	6.10
270	0.855	3.51	5.45
280	0.667	2.14	3.30
290	0.606	1.77	2.47
300	0.727	2.54	4.05
310	0.867	3.61	5.58
320	1.000	4.80	6.81
330	0.980	4.61	6.64
340	0.892	3.82	5.82
350	0.742	2.64	4.22

Relative fields at other azimuths:

45	0.649	225	0.905
135	0.623	315	0.950



**Azimuth Pattern**

Customer: WCUL Date: January 25, 2005  
 Frequency: 98.9 MHz Type Number: JAHD 1/3 (3) DA  
 Notes: MEASURED PATTERN IN FULL SCALE  
 ——— HPOL    ..... VPOL    - - - - LIMITS



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WCUL ERP = 4.80 kW January 25, 2005

JAHD 1/3 (3) DA

TABULATION OF MEASURED FIELDS

BEARING	HORIZONTAL POLARIZATION		VERTICAL POLARIZATION	
	FIELD	ERP(kW)	FIELD	ERP(kW)
0	0.597	1.71	0.505	1.22
10	0.623	1.86	0.540	1.40
20	0.709	2.41	0.600	1.73
30	0.705	2.38	0.550	1.45
40	0.649	2.02	0.375	0.68
50	0.672	2.17	0.185	0.16
60	0.739	2.62	0.340	0.55
70	0.754	2.73	0.585	1.64
80	0.699	2.35	0.705	2.39
90	0.612	1.80	0.625	1.88
100	0.515	1.27	0.375	0.68
110	0.451	0.97	0.070	0.02
120	0.487	1.14	0.240	0.28
130	0.588	1.66	0.430	0.89
140	0.634	1.93	0.520	1.30
150	0.600	1.73	0.495	1.18
160	0.615	1.81	0.450	0.97
170	0.739	2.62	0.520	1.30
180	0.880	3.72	0.705	2.39
190	0.969	4.50	0.880	3.72
200	1.000	4.80	0.975	4.56
210	0.995	4.76	0.940	4.24
220	0.946	4.29	0.775	2.88
230	0.864	3.58	0.525	1.32
240	0.825	3.27	0.440	0.93
250	0.881	3.72	0.685	2.25
260	0.922	4.08	0.880	3.72
270	0.837	3.36	0.855	3.51
280	0.667	2.14	0.635	1.94
290	0.606	1.77	0.465	1.04
300	0.727	2.54	0.610	1.79
310	0.867	3.61	0.865	3.59
320	0.949	4.33	1.000	4.80
330	0.962	4.44	0.980	4.61
340	0.892	3.82	0.840	3.39
350	0.742	2.64	0.630	1.91
<b>MAXIMUM FIELDS:</b>				
205	1.000	4.80		
325			1	4.80
<b>MINIMUM FIELDS:</b>				
110	0.451	0.97		
110			0.07	0.02

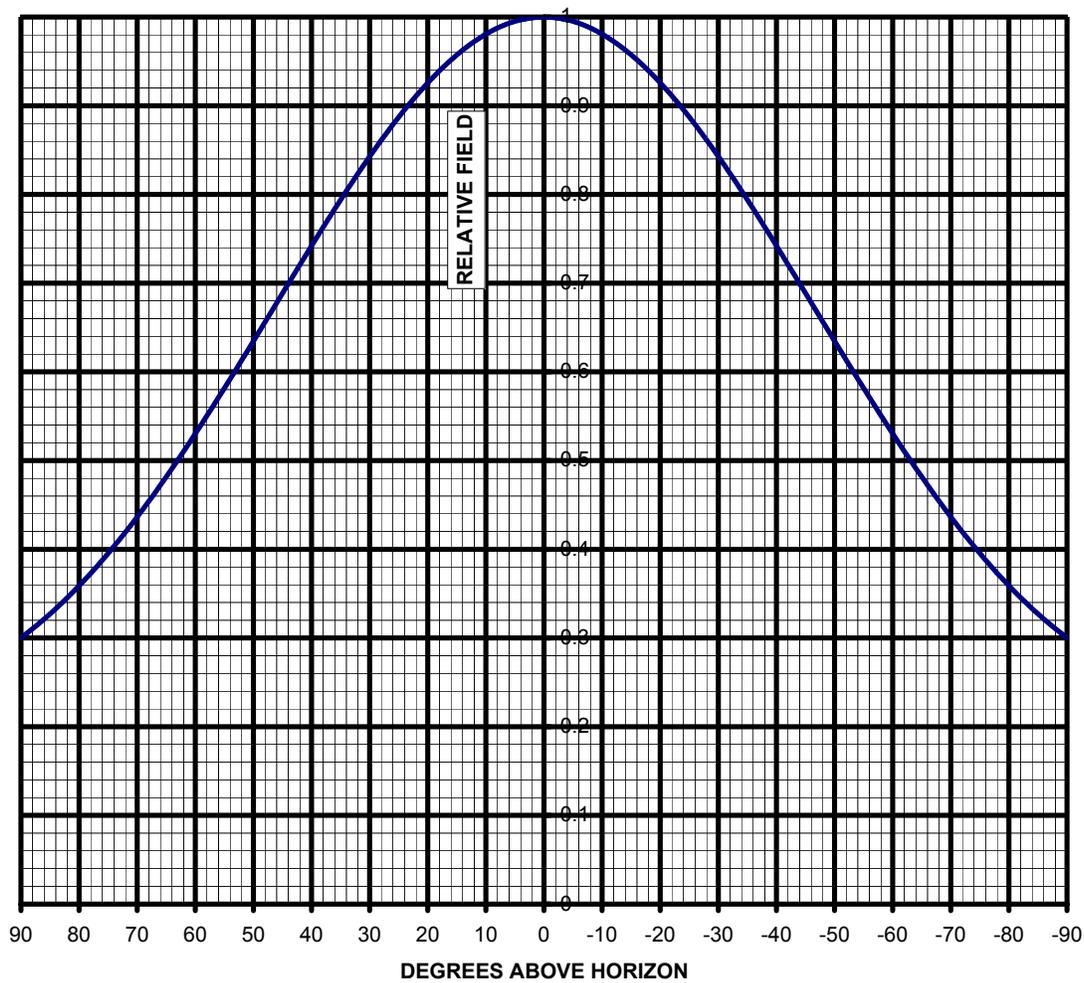


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### PLOT OF ELEVATION PLANE PATTERN

**STATION:** WCUL    98.9 MHz    JAHD 1/3 (3) DA    1.00 lambda spacing





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### TABULATION OF ELEVATION PLANE PATTERN

**STATION:** WCUL 98.9 MHz JAHD 1/3 (3) DA 1.00 lambda spacing

<u>ELEVATION</u> <u>ANGLE</u>	<u>RELATIVE</u> <u>FIELD</u>	<u>ELEVATION</u> <u>ANGLE</u>	<u>RELATIVE</u> <u>FIELD</u>	<u>ELEVATION</u> <u>ANGLE</u>	<u>RELATIVE</u> <u>FIELD</u>
10	0.981	-25	0.887	-60	0.530
9	0.984	-26	0.879	-61	0.520
8	0.988	-27	0.870	-62	0.510
7	0.991	-28	0.861	-63	0.501
6	0.993	-29	0.852	-64	0.491
5	0.995	-30	0.843	-65	0.482
4	0.997	-31	0.833	-66	0.472
3	0.998	-32	0.824	-67	0.463
2	0.999	-33	0.814	-68	0.454
1	1.000	-34	0.804	-69	0.445
0	1.000	-35	0.794	-70	0.436
-1	1.000	-36	0.784	-71	0.428
-2	0.999	-37	0.774	-72	0.420
-3	0.998	-38	0.763	-73	0.411
-4	0.997	-39	0.753	-74	0.403
-5	0.995	-40	0.742	-75	0.395
-6	0.993	-41	0.732	-76	0.388
-7	0.991	-42	0.721	-77	0.380
-8	0.988	-43	0.710	-78	0.373
-9	0.984	-44	0.699	-79	0.366
-10	0.981	-45	0.689	-80	0.359
-11	0.977	-46	0.678	-81	0.352
-12	0.972	-47	0.667	-82	0.346
-13	0.968	-48	0.656	-83	0.339
-14	0.963	-49	0.645	-84	0.333
-15	0.957	-50	0.635	-85	0.327
-16	0.952	-51	0.624	-86	0.321
-17	0.946	-52	0.613	-87	0.316
-18	0.939	-53	0.603	-88	0.310
-19	0.933	-54	0.592	-89	0.305
-20	0.926	-55	0.582	-90	0.300
-21	0.919	-56	0.571		
-22	0.911	-57	0.561		
-23	0.903	-58	0.550		
-24	0.895	-59	0.540		