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S.O. 26868

Report of Test Scala CA2-FM

for

EDUCATIONAL MEDIA FOUNDATION

KKRO 91.5 MHz Redding, CA

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a Scala CA2-FM to meet the needs of KKRO and to comply with the requirements of the FCC construction permit, file number BPED-20080730AKP.

RESULTS:

The measured azimuth pattern for the Scala CA2-FM is shown in Figure 1. Figure 1A shows the Tabulation of the Vertical Polarization. Figure 1B shows the Tabulation of the FCC Composite Pattern. The calculated elevation pattern of the antenna is shown in Figure 3. Construction permit file number BPED-20080730AKP indicates that the Vertical radiation component shall not exceed 0.420 kW at any azimuth and is restricted to the following values at the azimuths specified:

50 - 80 Degrees T: 0.013 kW
300 - 330 Degrees T: 0.013 kW

From Figure 1, the maximum radiation of the Vertical component occurs at 189 Degrees T to 191 Degrees T. At the restricted azimuth of 50 - 80 Degrees T the Vertical component is 18.06 dB down from the maximum of 0.420 kW, or 0.007 kW. At the restricted azimuth of 300 - 330 Degrees T the Vertical component is 17.39 dB down from the maximum of 0.420 kW, or 0.008 kW.

The R.M.S. of the Vertical component is 0.488. The total Vertical power gain is 4.199. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.548. The R.M.S. of the measured composite pattern is 0.488. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.466. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

The Scala CA2-FM was mounted on a tower of precise scale to the Rohn 25 tower at the KKRO site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BPED-20080730AKP, a single level of the Scala CA2-FM was set up on the Howell Laboratories scale model antenna pattern measuring range. A scale of 4.5:1 was used.

SUPERVISION:

Mr. Surette was graduated from Lowell Technological Institute, Lowell, Massachusetts in 1973 with the degree of Bachelor of Science in Electrical Engineering. He has been directly involved with design and development of broadcast antennas, filter systems and RF transmission components since 1974, as an RF Engineer for six years with the original Shively Labs in Raymond, ME and for a short period of time with Dielectric Communications. He is currently an Associate Member of the AFCCE and a Senior Member of IEEE. He has authored a chapter on filters and combining systems for the latest edition of the CRC Electronics Handbook and for the 9th and 10th Editions of the NAB Handbook.

EQUIPMENT:

The scale model pattern range consists of a wooden rotating pedestal equipped with a position indicator. The scale model bay is placed on the top of this pedestal and is used in the transmission mode at approximately 20 feet above ground level. The receiving corner reflector is spaced 50 feet away from the rotating pedestal at the same level above ground as the transmitting model. The transmitting and receiving signals are carried to a control building by means of RG-9/U double shielded coax cable.

The control building is equipped with:

Hewlett Packard Model 8753 Network Analyzer
PC Based Controller
Hewlett Packard 7550A Graphics Plotter

The test equipment is calibrated to ANSI/NCSL Z540-1-1994.

TEST PROCEDURES:

The corner reflector is mounted so that the horizontal and vertical azimuth patterns are measured independently by rotating the corner reflector by 90 degrees. The network analyzer was set to 411.75 MHz. Calibrated pads are used to check the linearity of the measuring system. For example, 6 dB padding yields a scale reading of 50 from an unpadded reading of 100 in voltage. From the recorded patterns, the R.M.S. values are calculated and recorded as shown in Figure 1.

Respectfully submitted by:

Robert A. Surette
Director of Sales Engineering
S/O 26868
August 18, 2008

Shively Labs

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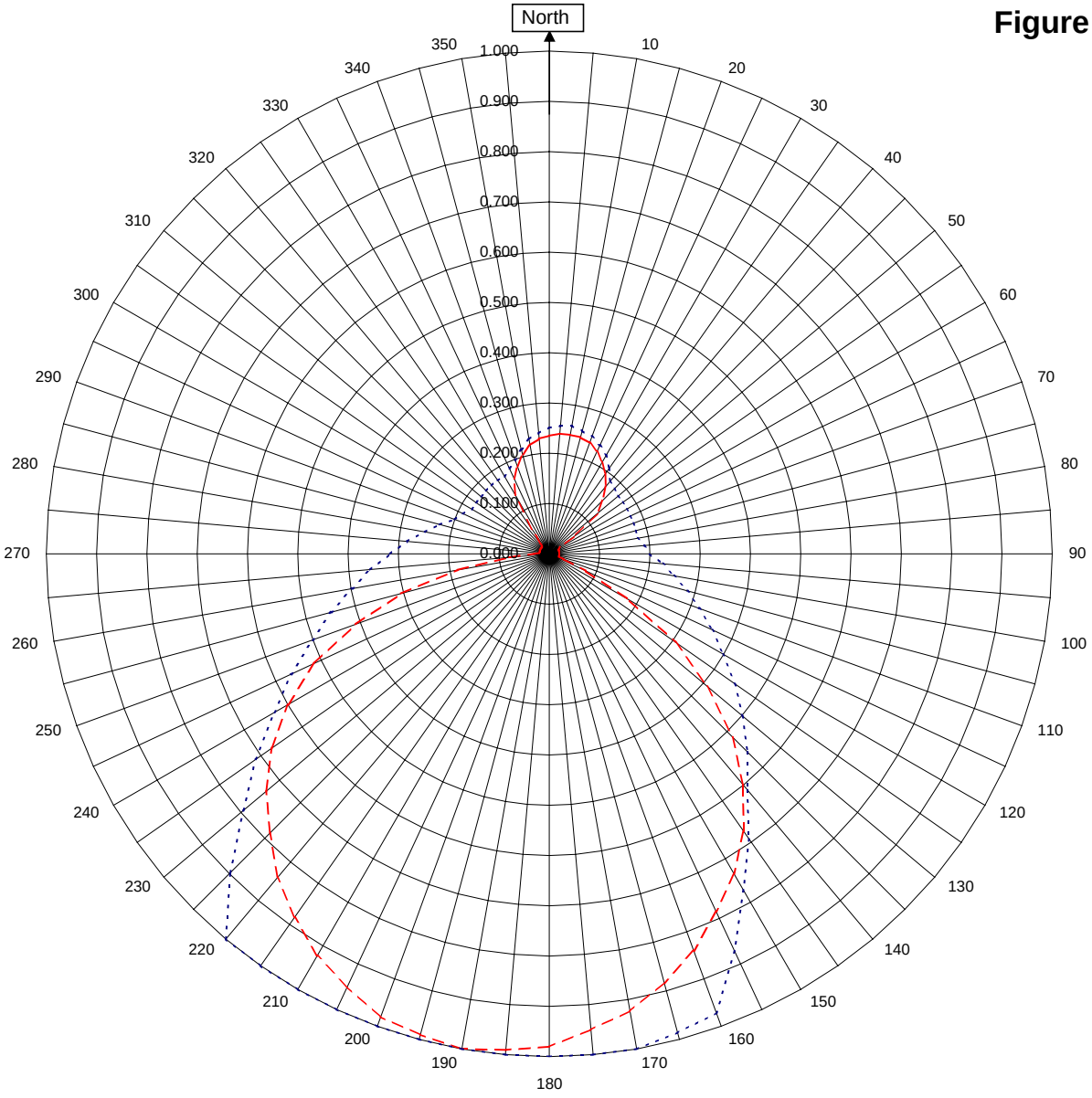
Figure 1



KKRO Redding, CA

26868

August 18, 2008

Horizontal RMS	0.000
Vertical RMS	0.488
H/V Composite RMS	0.488
FCC Composite RMS	0.548

Frequency	91.5 / 411.75 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Scala CA2-FM
Pattern Type	Directional Azimuth

Figure 1a

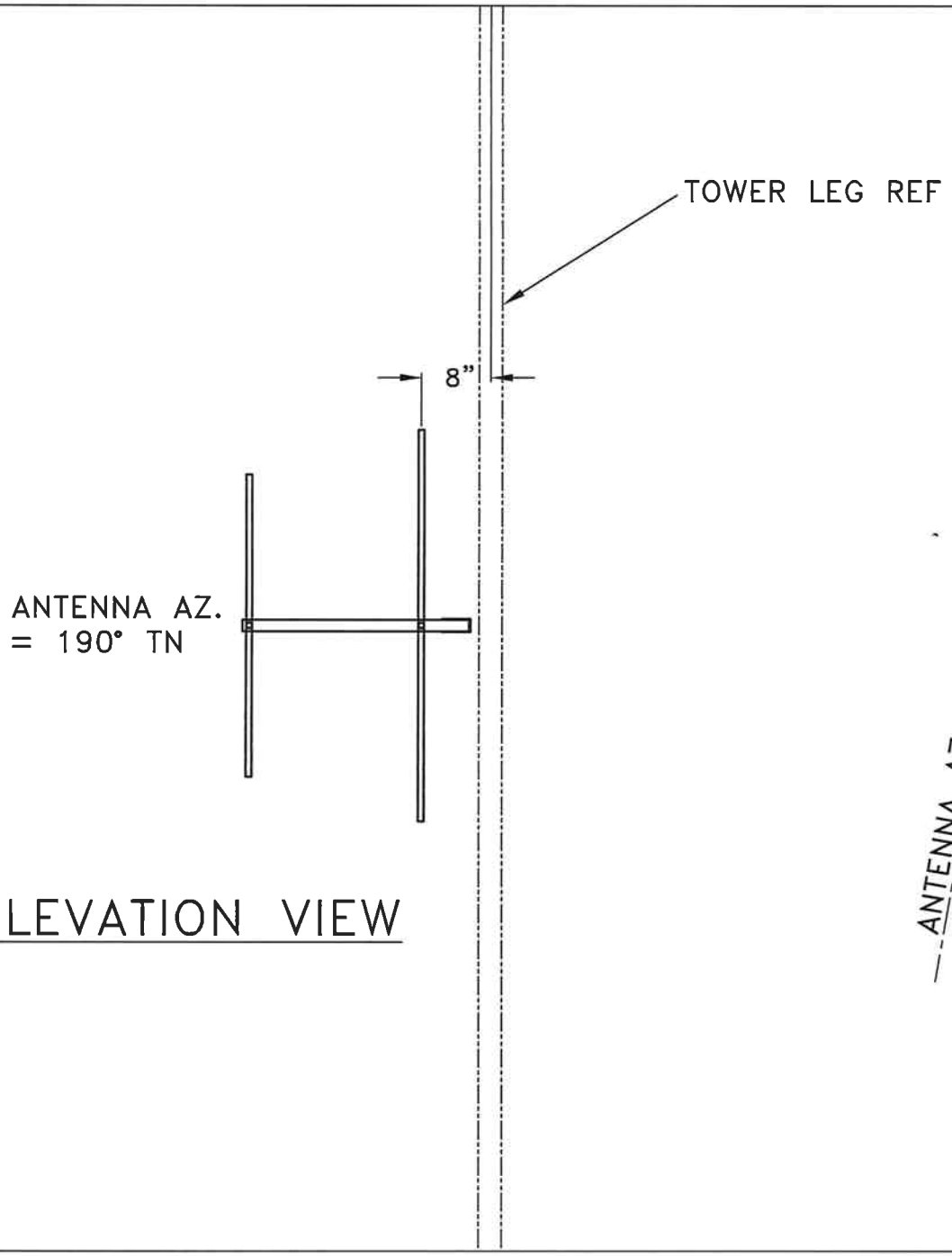
Tabulation of Vertical Azimuth Pattern
KKRO Redding, CA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.235	180	0.980
10	0.240	190	1.000
20	0.235	200	0.980
30	0.210	210	0.923
40	0.175	220	0.840
45	0.150	225	0.785
50	0.125	230	0.735
60	0.025	240	0.600
70	0.020	250	0.410
80	0.020	260	0.185
90	0.020	270	0.030
100	0.020	280	0.020
110	0.030	290	0.020
120	0.185	300	0.020
130	0.410	310	0.020
135	0.515	315	0.020
140	0.600	320	0.025
150	0.735	330	0.135
160	0.840	340	0.185
170	0.923	350	0.220

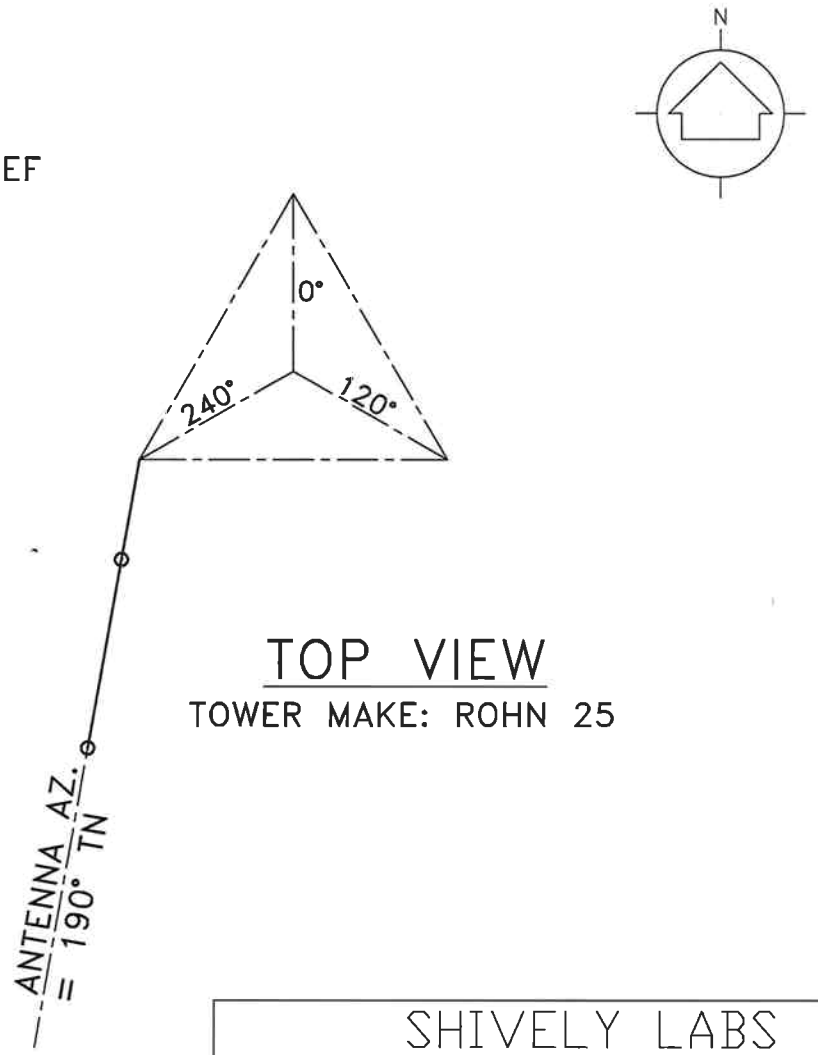
Figure 1b

Tabulation of FCC Directional Composite
KKRO Redding, CA

Azimuth	Rel Field	Azimuth	Rel Field
0	0.251	180	1.000
10	0.259	190	1.000
20	0.248	200	1.000
30	0.227	210	1.000
40	0.188	220	1.000
50	0.178	230	0.794
60	0.178	240	0.631
70	0.178	250	0.501
80	0.178	260	0.398
90	0.200	270	0.316
100	0.252	280	0.251
110	0.317	290	0.200
120	0.399	300	0.178
130	0.502	310	0.178
140	0.613	320	0.178
150	0.772	330	0.178
160	0.972	340	0.198
170	1.000	350	0.232



ELEVATION VIEW

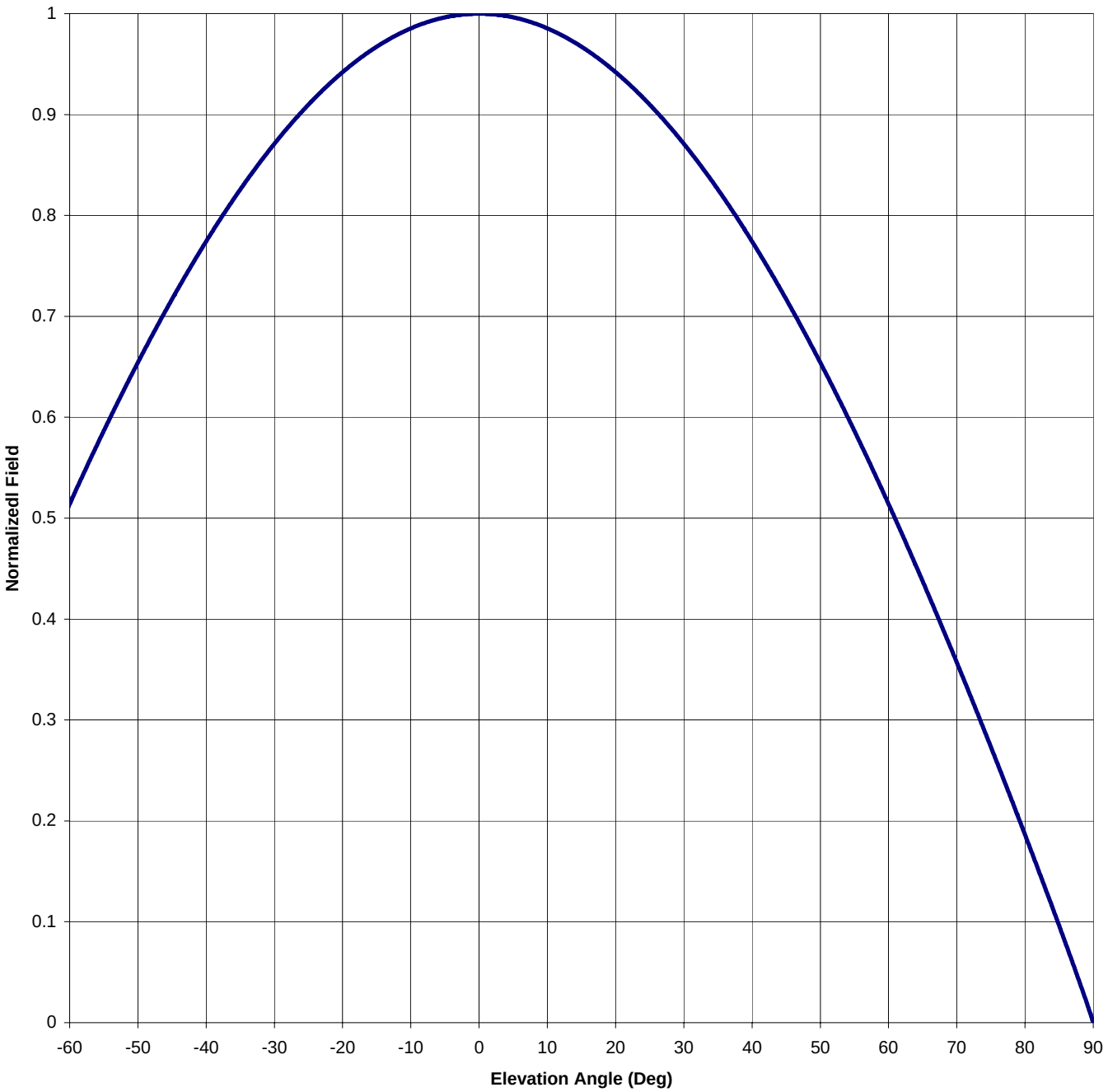


TOP VIEW

TOWER MAKE: ROHN 25

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 26868	FREQUENCY: 91.5 MHz	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY:
TITLE: KKRO, 91.5 MHz, REDDING, CA SCALA YAGI			
DATE: 8/19/08	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date: 8/18/2008**
Antenna Type:	**Scala CA2-FM**			
Station:	**KKRO**	**Beam Tilt**	**0**	
Frequency:	**91.5**	**Gain (Max)**	**4.199**	**6.232 dB**
Channel #:	**218**	**Gain (Horizon)**	**4.199**	**6.232 dB**
Figure:	**3**			



Antenna Mfg.: Shively Labs
Antenna Type: Scala CA2-FM
Station: KKRO
Frequency: 91.5
Channel #: 218
Figure: 3

Beam Tilt 0
Gain (Max) 4.199
Gain (Horizon) 4.199

Date: 8/18/2008
6.232 dB
6.232 dB

Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field	Angle of Depression (Deg)	Relative Field
-90	0.000	-44	0.729	0	1.000	46	0.705
-89	0.021	-43	0.741	1	1.000	47	0.693
-88	0.040	-42	0.752	2	0.999	48	0.680
-87	0.059	-41	0.763	3	0.999	49	0.667
-86	0.078	-40	0.774	4	0.998	50	0.654
-85	0.096	-39	0.785	5	0.996	51	0.641
-84	0.114	-38	0.796	6	0.995	52	0.628
-83	0.133	-37	0.806	7	0.993	53	0.614
-82	0.151	-36	0.816	8	0.991	54	0.600
-81	0.168	-35	0.826	9	0.988	55	0.586
-80	0.186	-34	0.835	10	0.985	56	0.572
-79	0.204	-33	0.845	11	0.982	57	0.558
-78	0.221	-32	0.854	12	0.979	58	0.544
-77	0.239	-31	0.862	13	0.975	59	0.529
-76	0.256	-30	0.871	14	0.971	60	0.514
-75	0.273	-29	0.879	15	0.967	61	0.499
-74	0.290	-28	0.887	16	0.963	62	0.484
-73	0.307	-27	0.895	17	0.958	63	0.469
-72	0.324	-26	0.903	18	0.953	64	0.453
-71	0.341	-25	0.910	19	0.948	65	0.437
-70	0.357	-24	0.917	20	0.942	66	0.422
-69	0.373	-23	0.924	21	0.936	67	0.406
-68	0.390	-22	0.930	22	0.930	68	0.390
-67	0.406	-21	0.936	23	0.924	69	0.373
-66	0.422	-20	0.942	24	0.917	70	0.357
-65	0.437	-19	0.948	25	0.910	71	0.341
-64	0.453	-18	0.953	26	0.903	72	0.324
-63	0.469	-17	0.958	27	0.895	73	0.307
-62	0.484	-16	0.963	28	0.887	74	0.290
-61	0.499	-15	0.967	29	0.879	75	0.273
-60	0.514	-14	0.971	30	0.871	76	0.256
-59	0.529	-13	0.975	31	0.862	77	0.239
-58	0.544	-12	0.979	32	0.854	78	0.221
-57	0.558	-11	0.982	33	0.845	79	0.204
-56	0.572	-10	0.985	34	0.835	80	0.186
-55	0.586	-9	0.988	35	0.826	81	0.168
-54	0.600	-8	0.991	36	0.816	82	0.151
-53	0.614	-7	0.993	37	0.806	83	0.133
-52	0.628	-6	0.995	38	0.796	84	0.114
-51	0.641	-5	0.996	39	0.785	85	0.096
-50	0.654	-4	0.998	40	0.774	86	0.078
-49	0.667	-3	0.999	41	0.763	87	0.059
-48	0.680	-2	0.999	42	0.752	88	0.040
-47	0.693	-1	1.000	43	0.741	89	0.021
-46	0.705	0	1.000	44	0.729	90	0.000
-45	0.717			45	0.717		

S.O. 26868 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

KKRO 91.5 MHz Redding, CA

Scala CA2-FM

Elevation Gain of Antenna 1

V RMS 0.488

Vertical Azimuth Gain equals $1/(RMS)^2$ 4.199

***Total Vertical Power Gain is the Elevation Gain Times the Azimuth Gain**

Total Vertical Power Gain **4.199**

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ERP divided by Vertical Power Gain equals Antenna Input Power

0.42 kW ERP Divided by V Gain 4.199 Equals **0.100** kW Antenna Input Power