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S.O. 33872

Report of Test: Scala CL-FM-2 (VRM/50 & HRM/50)-DA

for

WASATCH PUBLIC MEDIA

KCPW-FM 88.3 MHz SALT LAKE CITY, UT.

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a Scala CL-FM-2 (VRM/50 & HRM/50)-DA to meet the needs of KCPW-FM and to comply with the requirements of the FCC construction permit, file number BMPED-20160330ATI. This test characterizes only the radiation characteristics of the antenna when mounted on the tower as described. It does not represent or imply any guarantee of specific coverage which can be influenced by factors beyond the scope of this test.

RESULTS:

The following Figures are the results of the measurements from our pattern range:

Figure 1A - Measured Azimuth Pattern with the FCC Composite
Figure 1B - Measured Composite Azimuth Pattern with the FCC Composite
Figure 1C - Tabulation of the Horizontal Polarization for the Measured Azimuth Pattern
Figure 1D - Tabulation of the Vertical Polarization for the Measured Azimuth Pattern
Figure 1E - Tabulation of the Measured Composite Azimuth Pattern
Figure 1F - Tabulation of the FCC Composite

The calculated elevation pattern of the antenna is shown in Figure 3.

Construction permit file number BMPED-20160330ATI indicates that the Horizontal radiation component shall not exceed .45 kW at any azimuth and is restricted to the following values at the azimuths specified:

215 – 305 Degrees True: 0.028 kilowatts

From Figure 1A, the maximum radiation of the Horizontal component occurs at 73 Degrees True to 77 Degrees True. At the restricted azimuth of 215 to 305 Degrees True the Horizontal component is 17.92 dB down from the maximum of 0.45 kW, or 0.007

The R.M.S. of the Horizontal component is 0.433. The total Horizontal power gain is 2.801. The R.M.S. of the Vertical component is 0.453. The total Vertical power gain is 2.641. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.514. The R.M.S. of the measured composite pattern is 0.461. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.437. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One level of the Scala CL-FM (VRM/50 & HRM/50)-DA was mounted on a tower of precise scale to the Ronh-55 tower at the KCPW site. Both Scala CL-FM's were positioned on the tower, at the same azimuth, with the CL-FM HRM one wave-length above the CL-FM VRM. A two way equal power split was used, having equal phase and amplitude to each CL-FM. The spacing of the antenna to the tower was varied to achieve the horizontal and vertical pattern shown in Figure 1A. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BMPED-20160330ATI, a single level of the Scala CL-FM (VRM/50 & HRM/50)-DA was set up on the Shively Labs scale model antenna pattern measuring range. A scale of 4.5:1 was used.

EQUIPMENT:

The 4.5:1 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 4395-A Network Analyzer

PC Based Controller

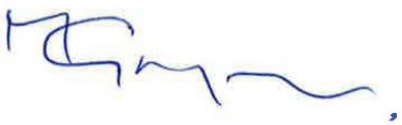
Output Standard Printer or 'pdf'

All testing is carried out in strict accordance with approved procedures under our ISO9001:2008.

TEST PROCEDURES:

The receiving antenna system is mounted so that the horizontal and vertical azimuth patterns are measured independently. The network analyzer was set to 397.35 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 1A.

Respectfully submitted by:



Martyn Gregory

Vice President, Shively Labs
S/O 33872
Date August 16, 2016

Shively Labs

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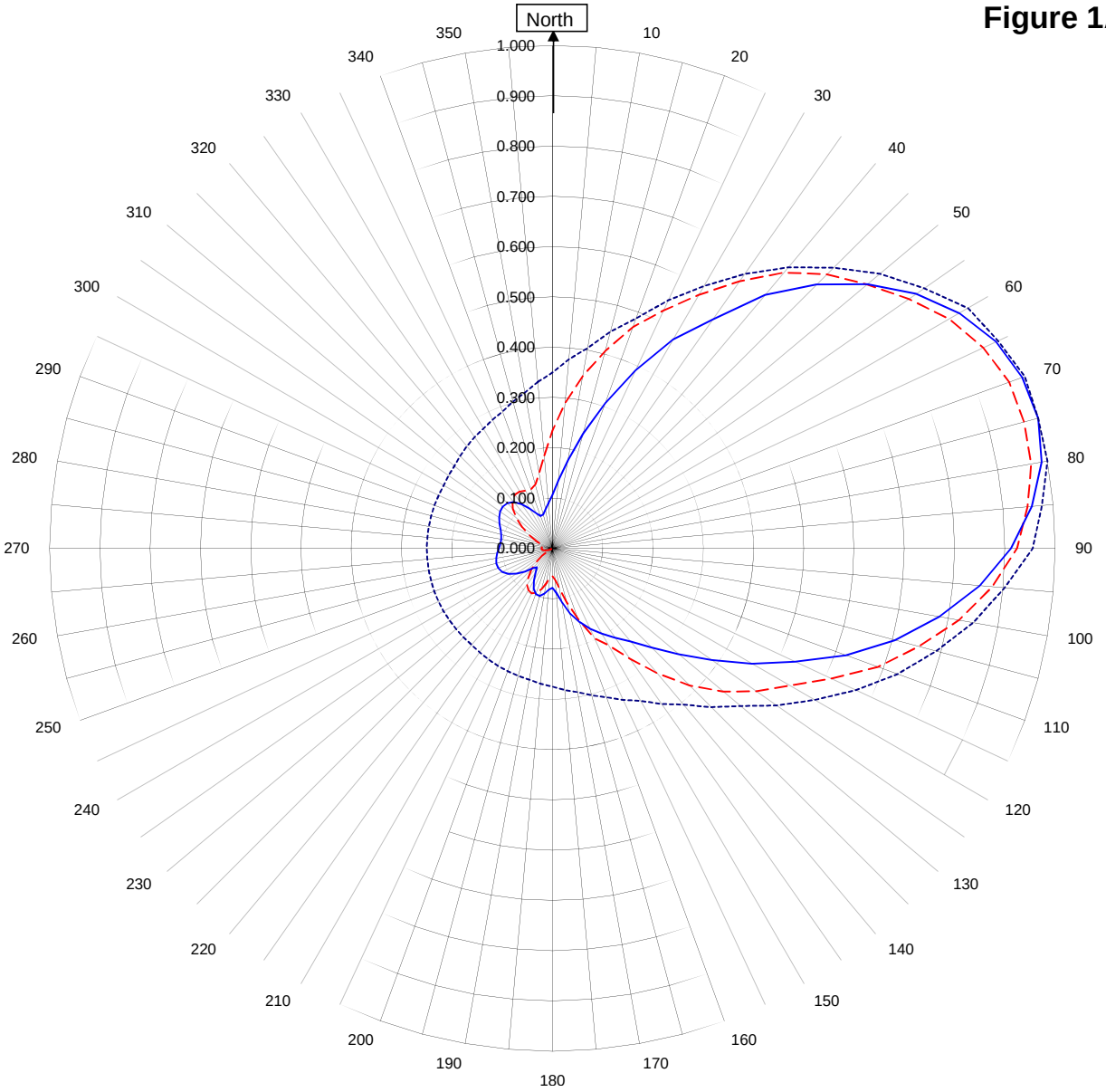
Figure 1A



KCPW SALT LAKE CITY, UT.

33872

August 16, 2016

Horizontal RMS	0.433
Vertical RMS	0.453
H/V Composite RMS	0.461
FCC Composite RMS	0.514

Frequency	88.3 / 397.35 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Scala CL-FM (VRM-50 & HRM-50)
Pattern Type	Directional Azimuth

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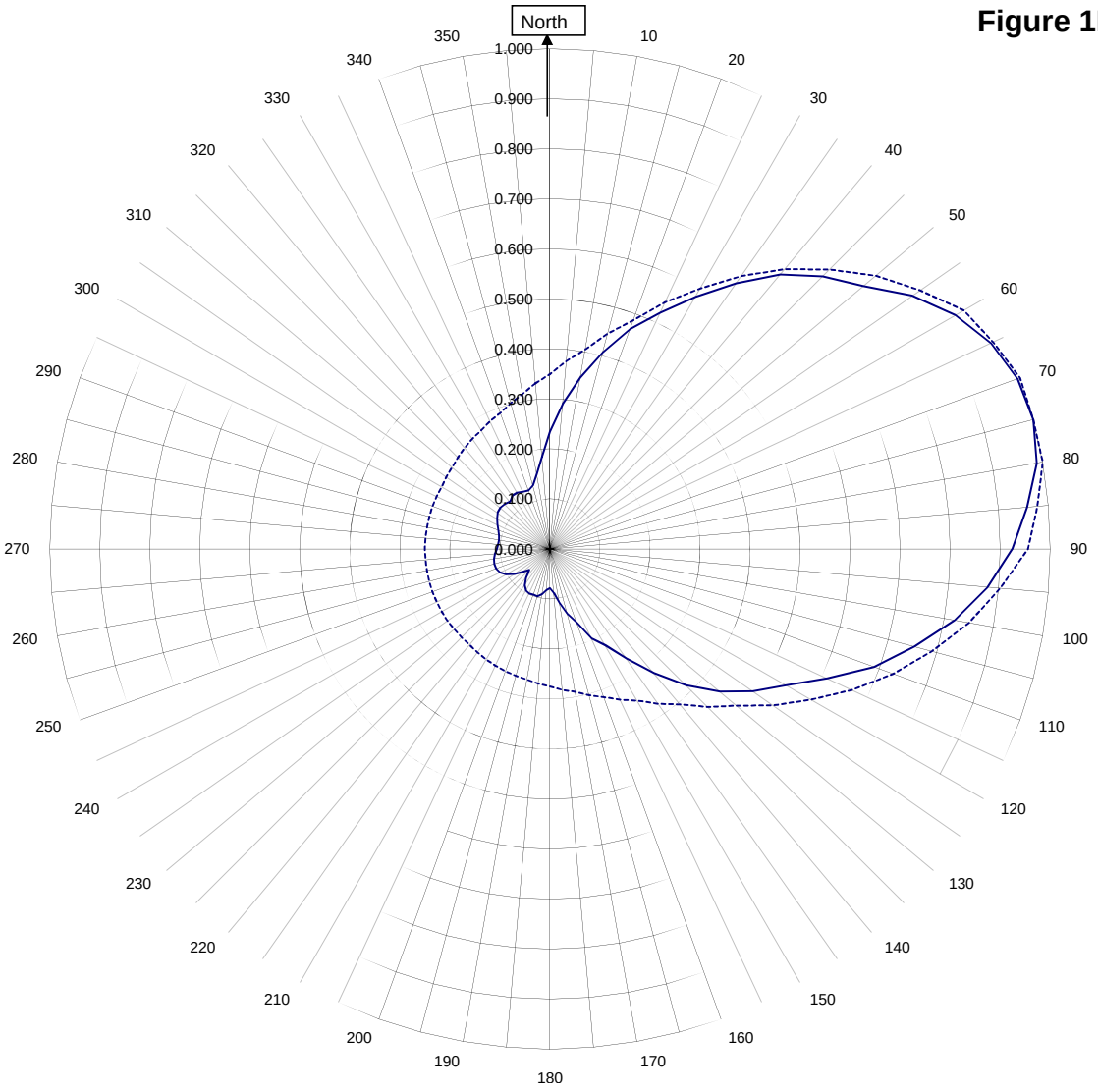
Figure 1B



KCPW SALT LAKE CITY, UT.

33872

August 16, 2016

_____H/VComposite RMS	0.461
……FCC Composite RMS	0.514

Frequency	88.3 / 397.35 mHz
Plot	Relative Field
Scale	4.5 : 1
	See Figure 2 for Mechanical Details

Antenna Model	Scala CL-FM (VRM-50 & HRM-50)
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Horizontal Azimuth Pattern
KCPW SALT LAKE CITY, UT.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.107	180	0.078
10	0.179	190	0.091
20	0.307	200	0.097
30	0.480	210	0.074
40	0.658	220	0.049
45	0.742	225	0.055
50	0.818	230	0.071
60	0.935	240	0.101
70	0.995	250	0.115
80	0.988	260	0.114
90	0.912	270	0.107
100	0.781	280	0.104
110	0.621	290	0.110
120	0.459	300	0.122
130	0.327	310	0.129
135	0.279	315	0.127
140	0.241	320	0.120
150	0.195	330	0.092
160	0.156	340	0.069
170	0.109	350	0.079

Additional azimuths

65	0.973
85	0.957

Figure 1D

Tabulation of Vertical Azimuth Pattern
KCPW SALT LAKE CITY, UT.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.235	180	0.055
10	0.348	190	0.070
20	0.469	200	0.093
30	0.582	210	0.096
40	0.716	220	0.075
45	0.771	225	0.059
50	0.817	230	0.042
60	0.912	240	0.012
70	0.967	250	0.009
80	0.967	260	0.019
90	0.924	270	0.022
100	0.821	280	0.020
110	0.689	290	0.024
120	0.545	300	0.053
130	0.443	310	0.093
135	0.385	315	0.112
140	0.323	320	0.124
150	0.222	330	0.131
160	0.150	340	0.125
170	0.082	350	0.152

Additional azimuths:

65	0.945
85	0.948

Figure 1E

Tabulation of Composite Azimuth Pattern
KCPW SALT LAKE CITY, UT.

Azimuth	Rel Field	Azimuth	Rel Field
0	0.235	180	0.078
10	0.348	190	0.091
20	0.469	200	0.097
30	0.582	210	0.096
40	0.716	220	0.075
45	0.771	225	0.059
50	0.818	230	0.071
60	0.935	240	0.101
70	0.995	250	0.115
80	0.988	260	0.114
90	0.924	270	0.107
100	0.821	280	0.104
110	0.689	290	0.110
120	0.545	300	0.122
130	0.443	310	0.129
135	0.385	315	0.127
140	0.323	320	0.124
150	0.222	330	0.131
160	0.156	340	0.125
170	0.109	350	0.152

Additional azimuths:

65	0.973
85	0.957

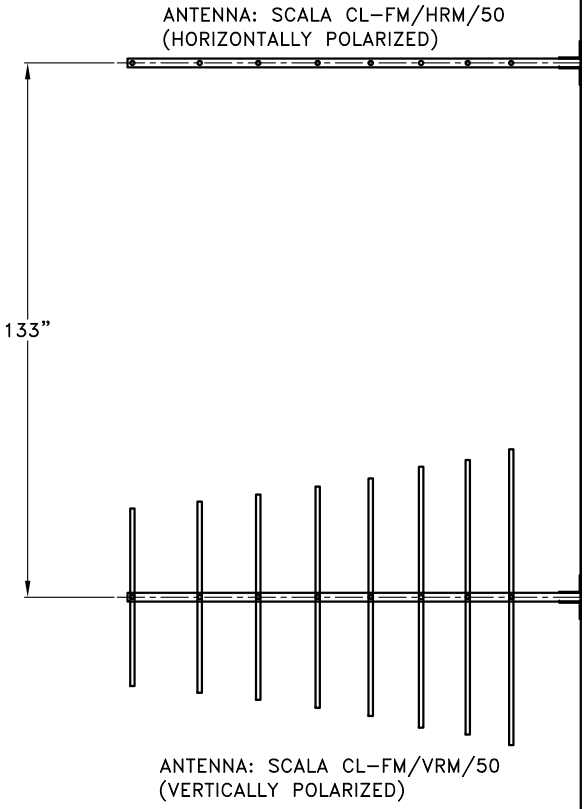
Figure 1F

Tabulation of FCC Directional Composite
KCPW SALT LAKE CITY, UT.

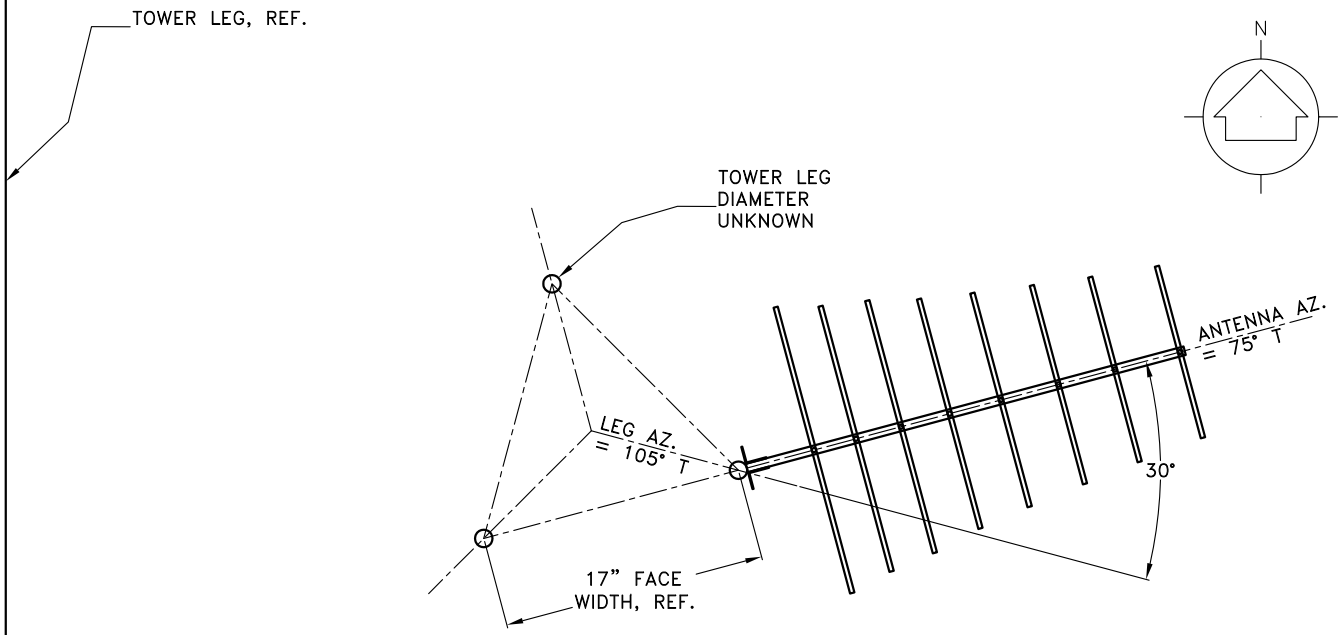
Azimuth	Rel Field	Azimuth	Rel Field
0	0.350	180	0.275
10	0.405	190	0.265
20	0.487	200	0.260
30	0.602	210	0.255
40	0.730	220	0.250
50	0.850	230	0.250
60	0.955	240	0.250
70	1.000	250	0.250
80	1.000	260	0.250
90	0.955	270	0.250
100	0.850	280	0.250
110	0.730	290	0.250
120	0.602	300	0.250
130	0.487	310	0.255
140	0.405	320	0.265
150	0.350	330	0.275
160	0.315	340	0.290
170	0.290	350	0.315

Additional azimuths:

65	1.000
85	1.000



ELEVATION VIEW

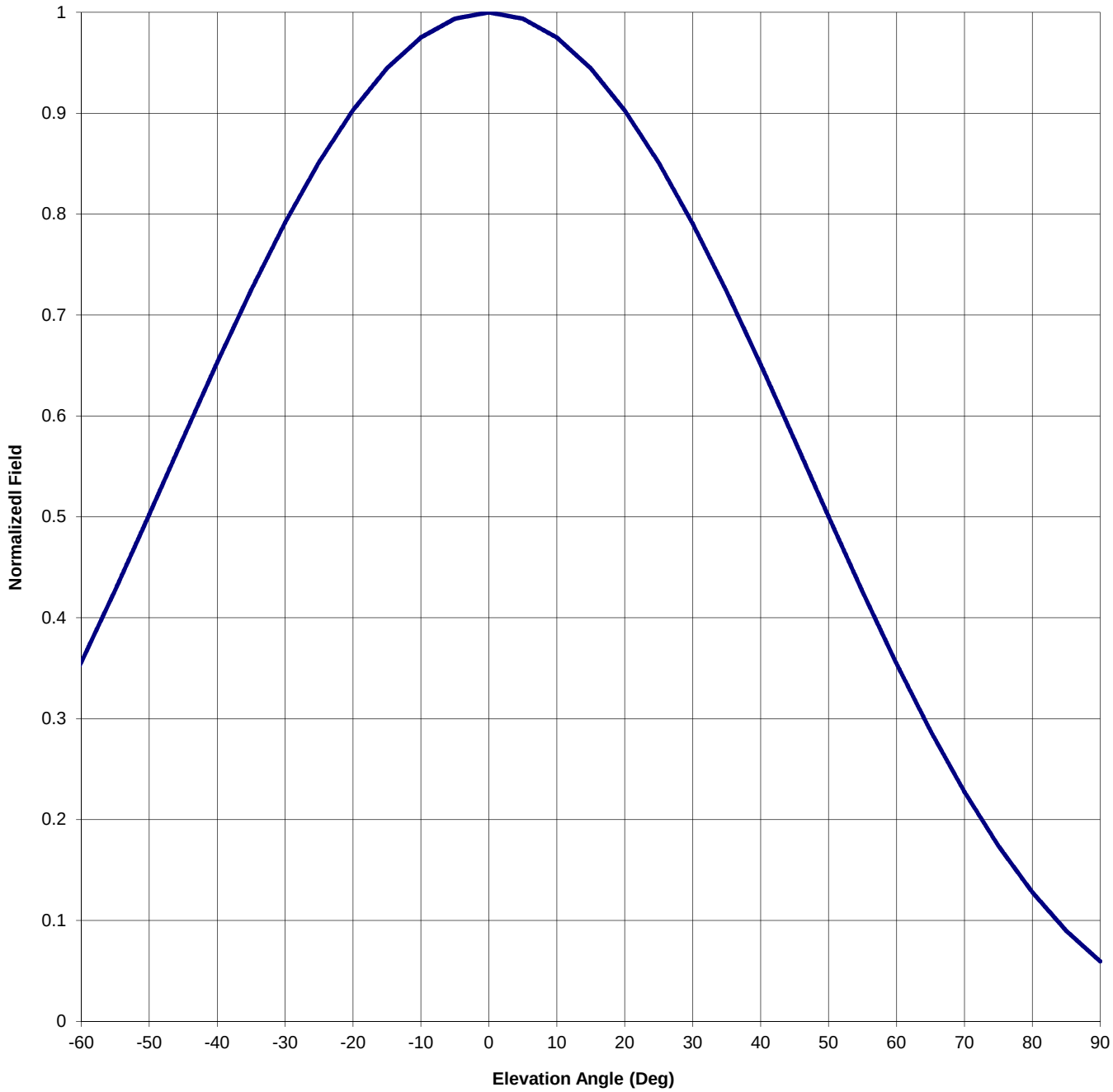


TOP VIEW

TOWER MAKE:
ROHN 55

SHIVELY LABS A DIVISION OF HOWELL LABORATORIES INC.,BRIDGTON, MAINE			
SHOP ORDER: 33872-1	FREQUENCY: 88.3 MHz	SCALE: N.T.S.	DRAWN BY: ASP APPROVED BY:
TITLE: SCALA LOG PERIODIC ANTENNA SYSTEM			
DATE: 8-16-16	FIGURE 2		

Antenna Mfg.:	**Shively Labs**			**Date:**	**8/17/2016**
Antenna Type:	**Scala CLFM (V&H RM)**				
Station:	**KCPW-FM**	**Beam Tilt**	**0**		
Frequency:	**88.3**	**Gain (Max)**	**2.801**	**4.473**	**dB**
Channel #:	**202**	**Gain (Horizon)**	**2.801**	**4.473**	**dB**
Figure:	**Figure 3**				



Antenna Mfg.: Shively Labs **Date:** 8/17/2016

Antenna Type: Scala CLFM (V&H RM)

Station: KCPW-FM **Beam Tilt** 0

Frequency: 88.3 **Gain (Max)** 2.801 4.473 dB

Channel #: 202 **Gain (Horizon)** 2.801 4.473 dB

Figure: Figure 3

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	0.059	-44	0.593	0	1.000	46	0.561
-89	0.066	-43	0.608	1	0.999	47	0.546
-88	0.072	-42	0.623	2	0.997	48	0.531
-87	0.078	-41	0.638	3	0.996	49	0.515
-86	0.084	-40	0.653	4	0.995	50	0.500
-85	0.090	-39	0.667	5	0.994	51	0.485
-84	0.097	-38	0.682	6	0.990	52	0.471
-83	0.105	-37	0.696	7	0.986	53	0.456
-82	0.113	-36	0.710	8	0.983	54	0.441
-81	0.120	-35	0.725	9	0.979	55	0.426
-80	0.128	-34	0.738	10	0.975	56	0.412
-79	0.137	-33	0.752	11	0.969	57	0.397
-78	0.146	-32	0.765	12	0.963	58	0.383
-77	0.156	-31	0.778	13	0.957	59	0.369
-76	0.165	-30	0.792	14	0.951	60	0.355
-75	0.174	-29	0.804	15	0.944	61	0.341
-74	0.185	-28	0.816	16	0.936	62	0.328
-73	0.196	-27	0.828	17	0.928	63	0.315
-72	0.206	-26	0.840	18	0.919	64	0.301
-71	0.217	-25	0.852	19	0.911	65	0.288
-70	0.228	-24	0.862	20	0.903	66	0.276
-69	0.240	-23	0.872	21	0.892	67	0.264
-68	0.252	-22	0.883	22	0.882	68	0.252
-67	0.265	-21	0.893	23	0.872	69	0.240
-66	0.277	-20	0.903	24	0.861	70	0.228
-65	0.289	-19	0.911	25	0.851	71	0.217
-64	0.302	-18	0.920	26	0.839	72	0.206
-63	0.316	-17	0.928	27	0.827	73	0.195
-62	0.329	-16	0.936	28	0.815	74	0.185
-61	0.343	-15	0.945	29	0.803	75	0.174
-60	0.356	-14	0.951	30	0.791	76	0.165
-59	0.370	-13	0.957	31	0.777	77	0.156
-58	0.385	-12	0.963	32	0.764	78	0.146
-57	0.399	-11	0.969	33	0.750	79	0.137
-56	0.413	-10	0.975	34	0.737	80	0.128
-55	0.428	-9	0.979	35	0.723	81	0.120
-54	0.443	-8	0.983	36	0.709	82	0.113
-53	0.458	-7	0.986	37	0.694	83	0.105
-52	0.473	-6	0.990	38	0.680	84	0.097
-51	0.487	-5	0.994	39	0.666	85	0.090
-50	0.502	-4	0.995	40	0.651	86	0.084
-49	0.518	-3	0.996	41	0.636	87	0.078
-48	0.533	-2	0.998	42	0.621	88	0.072
-47	0.548	-1	0.999	43	0.606	89	0.066
-46	0.563	0	1.000	44	0.591	90	0.059
-45	0.578			45	0.576		

S.O. 33872 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

KCPW	SALT LAKE CITY, UT.
MODEL	Scala CL-FM (VRM-50 & HRM-50)

Elevation Gain of Antenna 0.55

Horizontal RMS value divided by the Vertical RMS value equals the Horiz. - Vert. Ratio

H RMS 0.433036 V RMS 0.453476 H/V Ratio 0.955

Elevation Gain of Horizontal Component 0.525

Elevation Gain of Vertical Component 0.576

Horizontal Azimuth Gain equals $1/(RMS)^2$. 5.333

Vertical Azimuth Gain equals $1/(RMS/Max\ Vert)^2$. 4.585

Max. Vertical 0.971

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

Total Horizontal Power Gain = **2.801**

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

Total Vertical Power Gain = **2.641**

==========

ERP divided by Horizontal Power Gain equals Antenna Input Power

0.45 kW ERP Divided by H Gain 2.801 equals 0.161 kW H Antenna Input Power

Antenna Input Power times Vertical Power Gain equals Vertical ERP

0.161 kW Times V Gain 2.641 equals 0.424 kW V ERP

Maximum Value of the Vertical Component squared times the Maximum ERP equals the Vertical ERP

(0.971)^2 Times 0.45 Equals 0.424 kW Vertical ERP

NOTE: Calculating the ERP of the Vertical Component by two methods validates the total power gain calculations