Shively Labs
a division of Howell Laboratories,Inc.

- An Employee-Owned Company -

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S.O. 28449

Report of Test 6513-2-DA

for

CENTRAL EDUCATIONAL RADIO

New FM 88.3 MHz Doniphan, MO

OBJECTIVE:

The objective of this test was to demonstrate the directional characteristics of a 6513-2-DA to meet the needs of New FM and to comply with the requirements of the FCC construction permit, file number BNPED-20071017AKR.

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 Vertical Polarization for the Measured Azimuth Pattern
Figure 1D - Tabulation of the Measured Composite Azimuth Pattern
Figure 1E - Tabulation of the FCC Composite

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

Construction permit file number BNPED-20071017AKR indicates that the Vertical radiation component shall not exceed 11 kW at any azimuth and is restricted to the following values at the azimuths specified:

180 Degrees T: 0.390 kW

From Figure 1A, the maximum radiation of the Vertical component occurs at 324 Degrees T to 346 Degrees T. At the restricted azimuth of 180 Degrees T the Vertical component is 19.17 dB down from the maximum of 11 kW, or 0.133 kW.

The R.M.S. of the Vertical component is 0.741. The total Vertical power gain is 3.613. See Figure 4 for calculations. The R.M.S. of the FCC composite pattern is 0.844. The R.M.S. of the measured composite pattern is 0.741. Eighty-five percent (85%) of the original authorized FCC composite pattern is 0.717. Therefore this pattern complies with the FCC requirement of 73.316(c)(2)(ix)(A).

METHOD OF DIRECTIONALIZATION:

One bay of the 6513-2-DA was mounted on a tower of precise scale to the Fort Worth 36" face tower at the New FM site. The spacing of the antenna to the tower was varied to achieve the vertical pattern shown in Figure 1A. See Figure 2 for mechanical details.

METHOD OF MEASUREMENT:

As allowed by the construction permit, file number BNPED-20071017AKR, a single level of the 6513-2-DA 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 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:

Robert A. Surette
Director of Sales Engineering
S/O 28449
August 30, 2010

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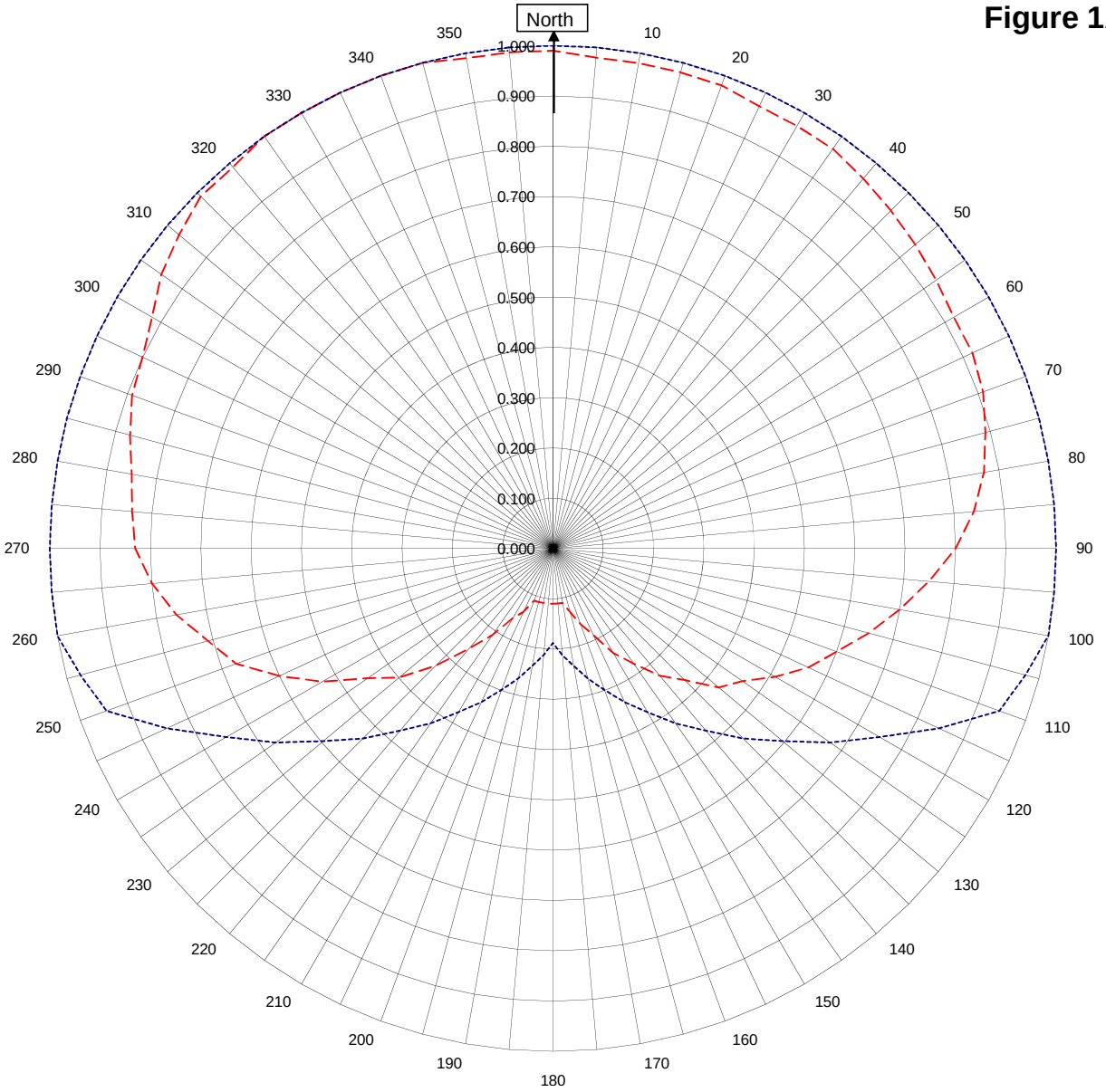
Figure 1A



New FM Doniphan, MO

28449

August 30, 2010

Horizontal RMS	0.000
Vertical RMS	0.741
H/V Composite RMS	0.741
FCC Composite RMS	0.844

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

Antenna Model	6513-2-DA
Pattern Type	Directional Azimuth

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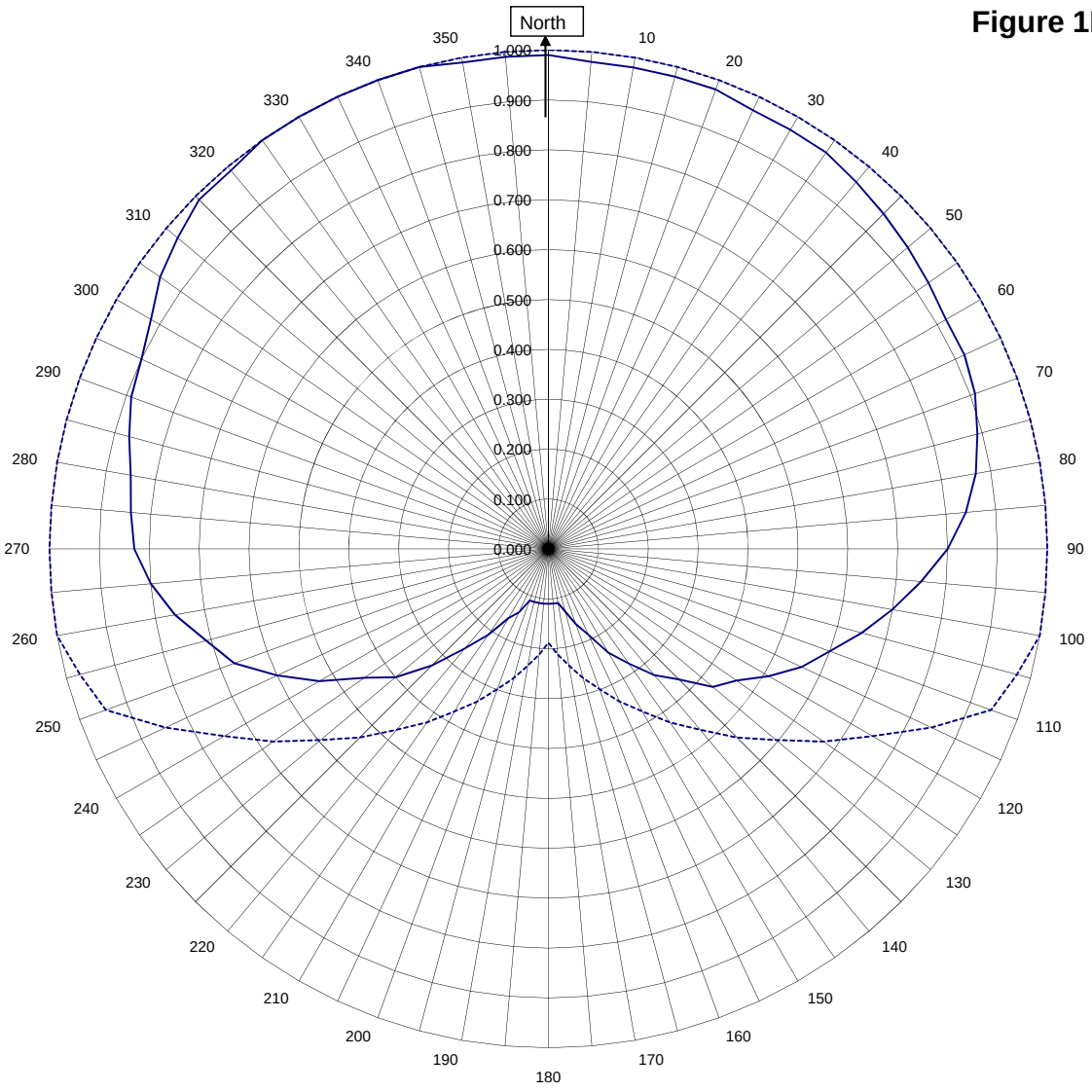
Figure 1B



New FM Doniphan, MO

28449

August 30, 2010

_____H/VComposite RMS	0.741
……..FCC Composite RMS	0.844

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

Antenna Model	6513-2-DA
Pattern Type	Directional H/V Composite

Figure 1C

Tabulation of Vertical Azimuth Pattern
New FM Doniphan, MO

Azimuth	Rel Field	Azimuth	Rel Field
0	0.990	180	0.110
10	0.980	190	0.110
20	0.980	200	0.110
30	0.970	210	0.160
40	0.960	220	0.260
45	0.950	225	0.330
50	0.940	230	0.400
60	0.920	240	0.530
70	0.910	250	0.670
80	0.870	260	0.760
90	0.800	270	0.830
100	0.700	280	0.850
110	0.600	290	0.890
120	0.510	300	0.920
130	0.430	310	0.970
135	0.370	315	0.990
140	0.330	320	0.990
150	0.240	330	1.000
160	0.160	340	1.000
170	0.110	350	0.990

Figure 1D

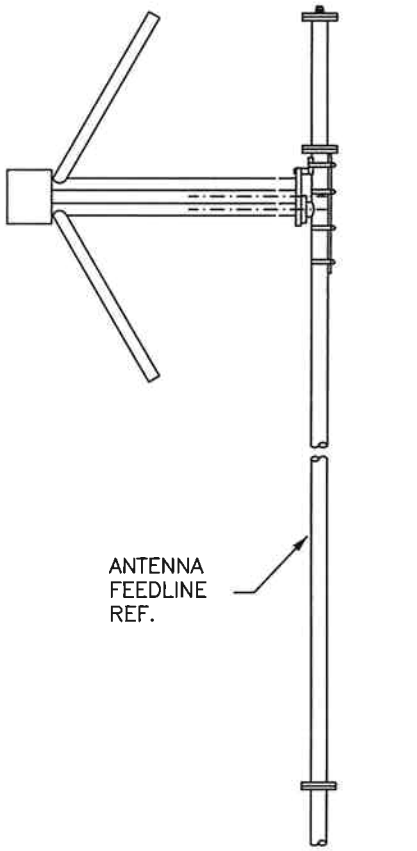
Tabulation of Composite Azimuth Pattern
New FM Doniphan, MO

Azimuth	Rel Field	Azimuth	Rel Field
0	0.990	180	0.110
10	0.980	190	0.110
20	0.980	200	0.110
30	0.970	210	0.160
40	0.960	220	0.260
45	0.950	225	0.330
50	0.940	230	0.400
60	0.920	240	0.530
70	0.910	250	0.670
80	0.870	260	0.760
90	0.800	270	0.830
100	0.700	280	0.850
110	0.600	290	0.890
120	0.510	300	0.920
130	0.430	310	0.970
135	0.370	315	0.990
140	0.330	320	0.990
150	0.240	330	1.000
160	0.160	340	1.000
170	0.110	350	0.990

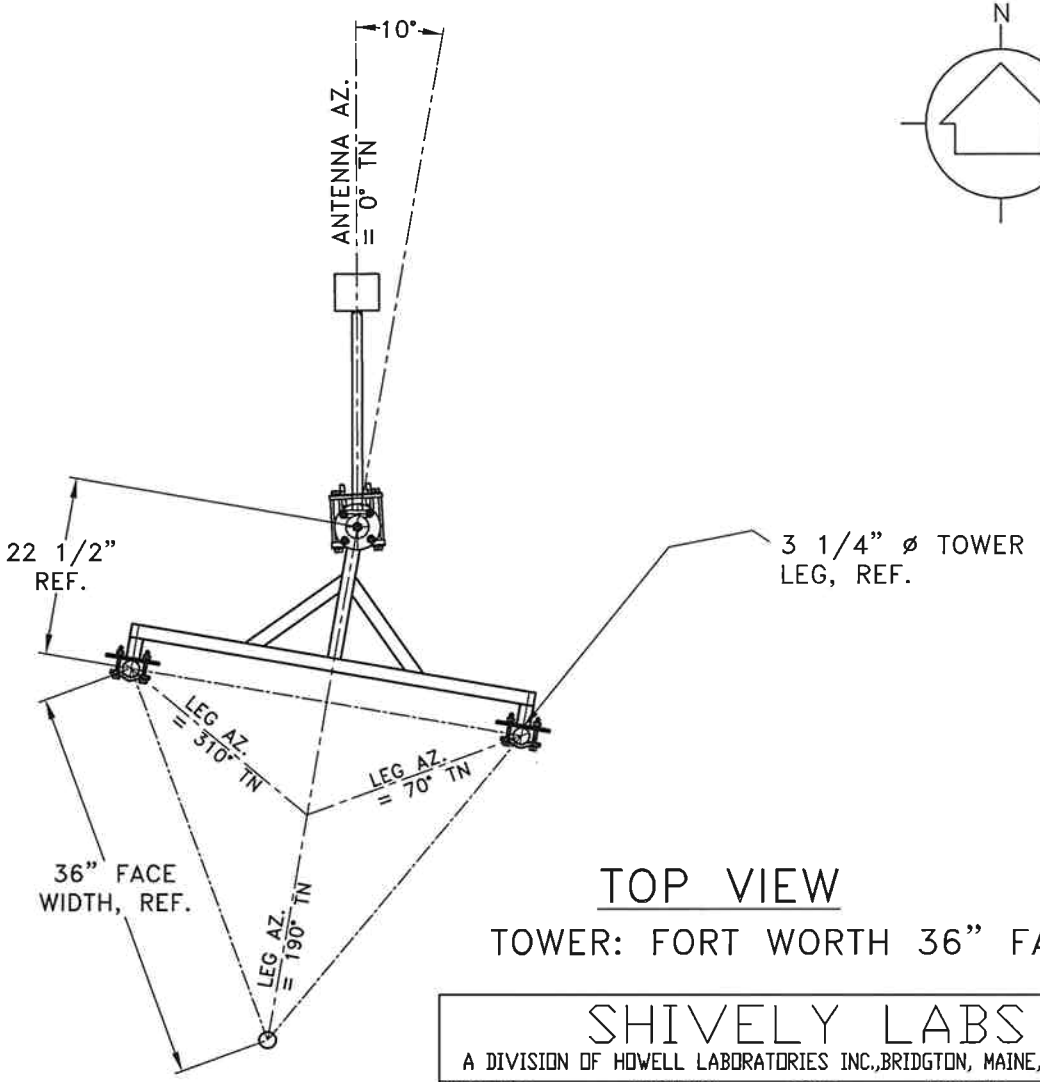
Figure 1E

Tabulation of FCC Directional Composite
New FM Doniphan, MO

Azimuth	Rel Field	Azimuth	Rel Field
0	1.000	180	0.188
10	1.000	190	0.237
20	1.000	200	0.299
30	1.000	210	0.376
40	1.000	220	0.473
50	1.000	230	0.596
60	1.000	240	0.750
70	1.000	250	0.944
80	1.000	260	1.000
90	1.000	270	1.000
100	1.000	280	1.000
110	0.944	290	1.000
120	0.750	300	1.000
130	0.596	310	1.000
140	0.473	320	1.000
150	0.376	330	1.000
160	0.299	340	1.000
170	0.237	350	1.000



SIDE VIEW



TOP VIEW

TOWER: FORT WORTH 36" FACE

ANTENNA HEADING 0° TRUE NORTH

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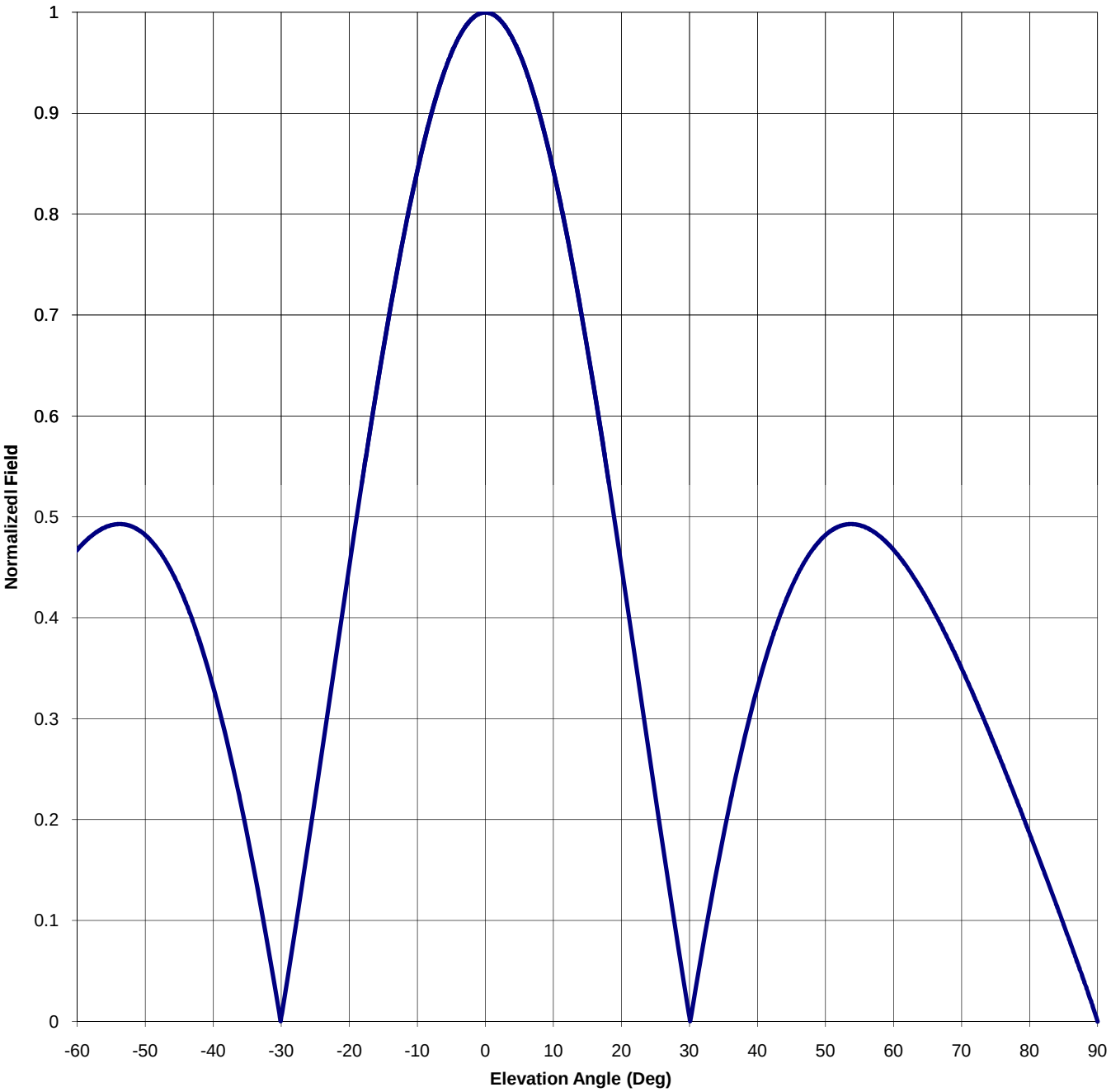
SHOP ORDER:	FREQUENCY:	SCALE:	DRAWN BY: ASP
28449	88.3 MHz.	N.T.S.	APPROVED BY:

TITLE: MODEL 6513-2-DIRECTIONAL ANTENNA FM STATION

DATE:	
8/27/10	FIGURE 2

Antenna Mfg.:	**Shively Labs**			**Date: 8/30/2010**
Antenna Type:	**6513-2-DA**			
Station:	**New FM**	**Beam Tilt**	**0**	
Frequency:	**88.3**	**Gain (Max)**	**3.613**	**5.579 dB**
Channel #:	**202**	**Gain (Horizon)**	**3.613**	**5.579 dB**
Figure:	**3**			



Antenna Mfg.: Shively Labs
Antenna Type: 6513-2-DA
Station: New FM
Frequency: 88.3
Channel #: 202
Figure: 3

Beam Tilt 0
Gain (Max) 3.613
Gain (Horizon) 3.613

Date: 8/30/2010
5.579 dB
5.579 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	0.414	0	1.000	46	0.444
-89	0.021	-43	0.397	1	0.998	47	0.456
-88	0.040	-42	0.377	2	0.993	48	0.467
-87	0.059	-41	0.355	3	0.985	49	0.475
-86	0.078	-40	0.331	4	0.974	50	0.482
-85	0.096	-39	0.306	5	0.959	51	0.487
-84	0.114	-38	0.278	6	0.942	52	0.491
-83	0.133	-37	0.249	7	0.921	53	0.492
-82	0.150	-36	0.218	8	0.898	54	0.493
-81	0.168	-35	0.185	9	0.872	55	0.492
-80	0.186	-34	0.150	10	0.843	56	0.489
-79	0.203	-33	0.114	11	0.812	57	0.486
-78	0.221	-32	0.076	12	0.779	58	0.481
-77	0.238	-31	0.036	13	0.743	59	0.475
-76	0.255	-30	0.004	14	0.706	60	0.467
-75	0.271	-29	0.046	15	0.667	61	0.459
-74	0.288	-28	0.089	16	0.626	62	0.450
-73	0.304	-27	0.133	17	0.584	63	0.440
-72	0.320	-26	0.177	18	0.540	64	0.429
-71	0.335	-25	0.223	19	0.496	65	0.417
-70	0.350	-24	0.268	20	0.451	66	0.405
-69	0.365	-23	0.314	21	0.406	67	0.392
-68	0.379	-22	0.360	22	0.360	68	0.379
-67	0.392	-21	0.406	23	0.314	69	0.365
-66	0.405	-20	0.451	24	0.268	70	0.350
-65	0.417	-19	0.496	25	0.223	71	0.335
-64	0.429	-18	0.540	26	0.177	72	0.320
-63	0.440	-17	0.584	27	0.133	73	0.304
-62	0.450	-16	0.626	28	0.089	74	0.288
-61	0.459	-15	0.667	29	0.046	75	0.271
-60	0.467	-14	0.706	30	0.004	76	0.255
-59	0.475	-13	0.743	31	0.036	77	0.238
-58	0.481	-12	0.779	32	0.076	78	0.221
-57	0.486	-11	0.812	33	0.114	79	0.203
-56	0.489	-10	0.843	34	0.150	80	0.186
-55	0.492	-9	0.872	35	0.185	81	0.168
-54	0.493	-8	0.898	36	0.218	82	0.150
-53	0.492	-7	0.921	37	0.249	83	0.133
-52	0.491	-6	0.942	38	0.278	84	0.114
-51	0.487	-5	0.959	39	0.306	85	0.096
-50	0.482	-4	0.974	40	0.331	86	0.078
-49	0.475	-3	0.985	41	0.355	87	0.059
-48	0.467	-2	0.993	42	0.377	88	0.040
-47	0.456	-1	0.998	43	0.397	89	0.021
-46	0.444	0	1.000	44	0.414	90	0.000
-45	0.430			45	0.430		

S.O. 28449 Figure 4

VALIDATION OF TOTAL POWER GAIN CALCULATION

New FM 88.3 MHz Doniphan, MO

Model 6513-2-DA

Elevation Gain of Antenna 1.984

V RMS 0.741

Vertical Azimuth Gain equals $1/(RMS)^2$ 1.821

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

Total Vertical Power Gain **3.613**

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ERP divided by Vertical Power Gain equals Antenna Input Power

11 kW ERP Divided by V Gain 3.613 Equals **3.044** kW Antenna Input Power