

Comprehensive Technical Exhibit
Amendment to
Application for Modification of Construction Permit
NEW(FM) - Lakeside, Montana
KOFI, Inc.
January, 2012

Application for Modification of Construction Permit

The following engineering statement and attached exhibits have been prepared for **KOFI, Inc.** ("KOFI"), permittee of a new commercial FM station to serve Lakeside, Montana, and are in support of their amendment to application for modification of construction permit.¹

The purpose of this amendment is to provide additional information to the Commission regarding the environmental assessment of the facility. Specifically, concern was raised over the potential for the addition of the facility to the existing structure to result in a situation where the non-ionizing radiation levels at the base of the tower would exceed the uncontrolled environment condition of the applicable safety standard. The data contained in this amendment demonstrates that the facility would comply with the provisions of OET Bulletin 65.

In addition to the proposed Lakeside facility, the supporting structure also is utilized by FM station KZMN at Kalispell, Montana.² As discussed in the original modification application, the proposed facility would utilize a four bay Shively 6810 series antenna with full-wave spacing. The Commission's *FM Model* software package predicts a maximum power density at ground level of $9.64 \mu\text{W}/\text{cm}^2$ at a distance of 24 meters from the base of the tower.

The KZMN antenna is also a Shively 6810 series with 6-bays and full-wave spacing between the bays. The specific model number of the KZMN antenna is a 6810-6R-H/V. This particular antenna has a 70/30 ratio between the horizontal and vertical polarization components.

¹ The Facility ID for NEW at Lakeside, Montana is 183365. This construction permit was assigned to KOFI under FCC File No. BAPH-20111103AGQ. This submission seeks to amend the pending modification application under FCC File No. BMPH-20111115AHO.

² The Facility ID for KZMN(FM) at Kalispell, Montana is 35369.

The result is the facility operates with elliptical polarization. The horizontally polarized effective radiated power is 100 kW and the vertically polarized ERP is 43 kW.

The vertical plane radiation characteristics of the current KZMN antenna vary slightly from the standard 6810 model as a result of the elliptical polarization. Exhibit A-1 tabulates the relative field and relative power for the actual KZMN antenna and the stock 6810 antenna. As this tabulation demonstrates, the maximum variance in the relative power between the two patterns is less than 0.01.³ For the purposes of this amendment, the assumption will be made that the relative power from the actual antenna is 0.01 greater than the stock pattern at all depression angles. This results in a mathematically worst-case scenario for the facility for purposes of illustration.

For the horizontally polarized component, the assumed increase in relative power increases the effective radiated power of the facility to 101 kW for the purposes of this illustration. In the case of the vertically polarized component, the increase makes the illustrative effective radiated power 43.43 kW. These values can then be taken and plugged into the Commission's *FM Model* software package to determine a theoretical worst-case scenario.

For this calculation, the horizontal ERP is entered as 101000 Watts, while the vertical ERP is entered as 43000 Watts. A center of radiation of 84 meters AGL is utilized, and the antenna is selected as a 6-bay Shively 6810 with full-wave spacing. The resulting maximum power density from *FM Model* is $35.49 \mu\text{W}/\text{cm}^2$ at a distance of 28 meters from the tower base.

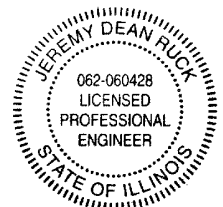
³ It should be noted that the difference in relative power tabulated was based on the relative power difference as determined by simple subtraction between the two different antenna models. This is not strictly the correct way to determine this value as it tends to exacerbate the differential. Rather, the relative power difference should have been determined by squaring the difference in the relative field values. For the purposes of this amendment where safety and environmental considerations are concerned, the extra margin is beneficial. The subsequent rounding up of the relative power between the two antennas winds up creating a worst-case scenario for the facility for purposes of illustration.

The location of the maximum predicted power density for KZMN is predicted to occur at a different location than that from the proposed new facility. For the purposes of this amendment, the assumption will be made that the maximum power density for both facilities occurs at all locations in the vicinity of the tower. The contributions from the two facilities add to create an aggregate worst-case power density of $45.1 \mu\text{W}/\text{cm}^2$. This value is considerably less than the upper limit of $200 \mu\text{W}/\text{cm}^2$ imposed by the uncontrolled environment condition of the applicable safety standard. Thus, the combination of the proposed facility and the existing KZMN facility is not predicted to result in a situation where the general population would be exposed to levels of non-ionizing radiation in excess of the applicable safety standards.

In addition to the previously discussed Exhibit A-1, supporting documentation in the form of vertical patterns from Shively Labs has been included. The data for the standard 6810 antenna was gathered from the Shively website, while the vertical pattern data for the existing KZMN antenna was provided by their engineering department via email.

Affidavit

The preceding statement and attached exhibits have been prepared by me, or under my direction, and are true and accurate to the best of my belief and knowledge.



Above signature is digitized copy of actual signature
License Expires November 30, 2013

Jeremy D. Ruck, PE
January 12, 2012

Exhibit A-1 - Vertical Plane Pattern Comparison						
Facility: KZMN						
COR:		84	m AGL			
HPOL ERP:		100	kW			
VPOL ERP:		43	kW			
Antenna:		Shively 6810-6R-H/V				
Dep.	KZMN 6810-6R-H/V		Shively 6810-6			
θ	EREL	PREL	EREL	PREL	EREL DIFF	PREL DIFF
0	1.000	1.000	1.000	1.000	0.000	0.000
1	0.983	0.966	0.982	0.964	-0.001	-0.002
2	0.931	0.867	0.931	0.867	0.000	0.000
3	0.850	0.723	0.848	0.719	-0.002	-0.003
4	0.742	0.551	0.740	0.548	-0.002	-0.003
5	0.616	0.379	0.613	0.376	-0.003	-0.004
6	0.478	0.228	0.474	0.225	-0.004	-0.004
7	0.336	0.113	0.332	0.110	-0.004	-0.003
8	0.199	0.040	0.194	0.038	-0.005	-0.002
9	0.073	0.005	0.067	0.004	-0.006	-0.001
10	0.036	0.001	0.041	0.002	0.005	0.000
11	0.123	0.015	0.127	0.016	0.004	0.001
12	0.185	0.034	0.188	0.035	0.003	0.001
13	0.221	0.049	0.223	0.050	0.002	0.001
14	0.232	0.054	0.232	0.054	0.000	0.000
15	0.221	0.049	0.219	0.048	-0.002	-0.001
16	0.190	0.036	0.187	0.035	-0.003	-0.001
17	0.145	0.021	0.141	0.020	-0.004	-0.001
18	0.091	0.008	0.086	0.007	-0.005	-0.001
19	0.033	0.001	0.028	0.001	-0.005	0.000
20	0.023	0.001	0.029	0.001	0.006	0.000
21	0.073	0.005	0.078	0.006	0.005	0.001
22	0.114	0.013	0.117	0.014	0.003	0.001
23	0.142	0.020	0.144	0.021	0.002	0.001
24	0.156	0.024	0.157	0.025	0.001	0.000
25	0.156	0.024	0.155	0.024	-0.001	0.000
26	0.143	0.020	0.141	0.020	-0.002	-0.001
27	0.119	0.014	0.115	0.013	-0.004	-0.001
28	0.087	0.008	0.081	0.007	-0.006	-0.001
29	0.048	0.002	0.042	0.002	-0.006	-0.001
30	0.007	0.000	0.001	0.000	-0.006	0.000
31	0.033	0.001	0.040	0.002	0.007	0.001
32	0.070	0.005	0.076	0.006	0.006	0.001
33	0.101	0.010	0.105	0.011	0.004	0.001
34	0.123	0.015	0.127	0.016	0.004	0.001
35	0.137	0.019	0.139	0.019	0.002	0.001
36	0.141	0.020	0.141	0.020	0.000	0.000
37	0.135	0.018	0.133	0.018	-0.002	-0.001
38	0.121	0.015	0.117	0.014	-0.004	-0.001
39	0.098	0.010	0.093	0.009	-0.005	-0.001
40	0.070	0.005	0.063	0.004	-0.007	-0.001
41	0.038	0.001	0.030	0.001	-0.008	-0.001
42	0.003	0.000	0.006	0.000	0.003	0.000
43	0.032	0.001	0.041	0.002	0.009	0.001
44	0.065	0.004	0.074	0.005	0.009	0.001
45	0.095	0.009	0.103	0.011	0.008	0.002
46	0.120	0.014	0.127	0.016	0.007	0.002
47	0.139	0.019	0.144	0.021	0.005	0.001
48	0.152	0.023	0.155	0.024	0.003	0.001
49	0.158	0.025	0.159	0.025	0.001	0.000
50	0.156	0.024	0.155	0.024	-0.001	0.000
51	0.148	0.022	0.145	0.021	-0.003	-0.001
52	0.134	0.018	0.128	0.016	-0.006	-0.002
53	0.114	0.013	0.106	0.011	-0.008	-0.002

Exhibit A-1 - Vertical Plane Pattern Comparison						
Facility: KZMN						
COR:		84	m AGL			
HPOL ERP:		100	kW			
VPOL ERP:		43	kW			
Antenna:		Shively 6810-6R-H/V				
Dep.	KZMN 6810-6R-H/V		Shively 6810-6			
θ	EREL	PREL	EREL	PREL	EREL DIFF	PREL DIFF
54	0.089	0.008	0.080	0.006	-0.009	-0.002
55	0.061	0.004	0.049	0.002	-0.012	-0.001
56	0.030	0.001	0.017	0.000	-0.013	-0.001
57	0.003	0.000	0.018	0.000	0.015	0.000
58	0.037	0.001	0.052	0.003	0.015	0.001
59	0.070	0.005	0.086	0.007	0.016	0.002
60	0.103	0.011	0.119	0.014	0.016	0.004
61	0.134	0.018	0.150	0.023	0.016	0.005
62	0.162	0.026	0.179	0.032	0.017	0.006
63	0.188	0.035	0.204	0.042	0.016	0.006
64	0.210	0.044	0.226	0.051	0.016	0.007
65	0.230	0.053	0.245	0.060	0.015	0.007
66	0.246	0.061	0.260	0.068	0.014	0.007
67	0.258	0.067	0.271	0.073	0.013	0.007
68	0.267	0.071	0.279	0.078	0.012	0.007
69	0.273	0.075	0.284	0.081	0.011	0.006
70	0.275	0.076	0.286	0.082	0.011	0.006
71	0.275	0.076	0.284	0.081	0.009	0.005
72	0.272	0.074	0.280	0.078	0.008	0.004
73	0.267	0.071	0.274	0.075	0.007	0.004
74	0.259	0.067	0.265	0.070	0.006	0.003
75	0.250	0.063	0.255	0.065	0.005	0.003
76	0.239	0.057	0.243	0.059	0.004	0.002
77	0.226	0.051	0.229	0.052	0.003	0.001
78	0.212	0.045	0.215	0.046	0.003	0.001
79	0.197	0.039	0.200	0.040	0.003	0.001
80	0.182	0.033	0.184	0.034	0.002	0.001
81	0.166	0.028	0.167	0.028	0.001	0.000
82	0.149	0.022	0.150	0.023	0.001	0.000
83	0.131	0.017	0.132	0.017	0.001	0.000
84	0.114	0.013	0.114	0.013	0.000	0.000
85	0.096	0.009	0.096	0.009	0.000	0.000
86	0.077	0.006	0.078	0.006	0.001	0.000
87	0.059	0.003	0.059	0.003	0.000	0.000
88	0.040	0.002	0.040	0.002	0.000	0.000
89	0.020	0.000	0.021	0.000	0.001	0.000
90	0.000	0.000	0.000	0.000	0.000	0.000

Shively Labs®

Antenna Mfr.: Shively Labs

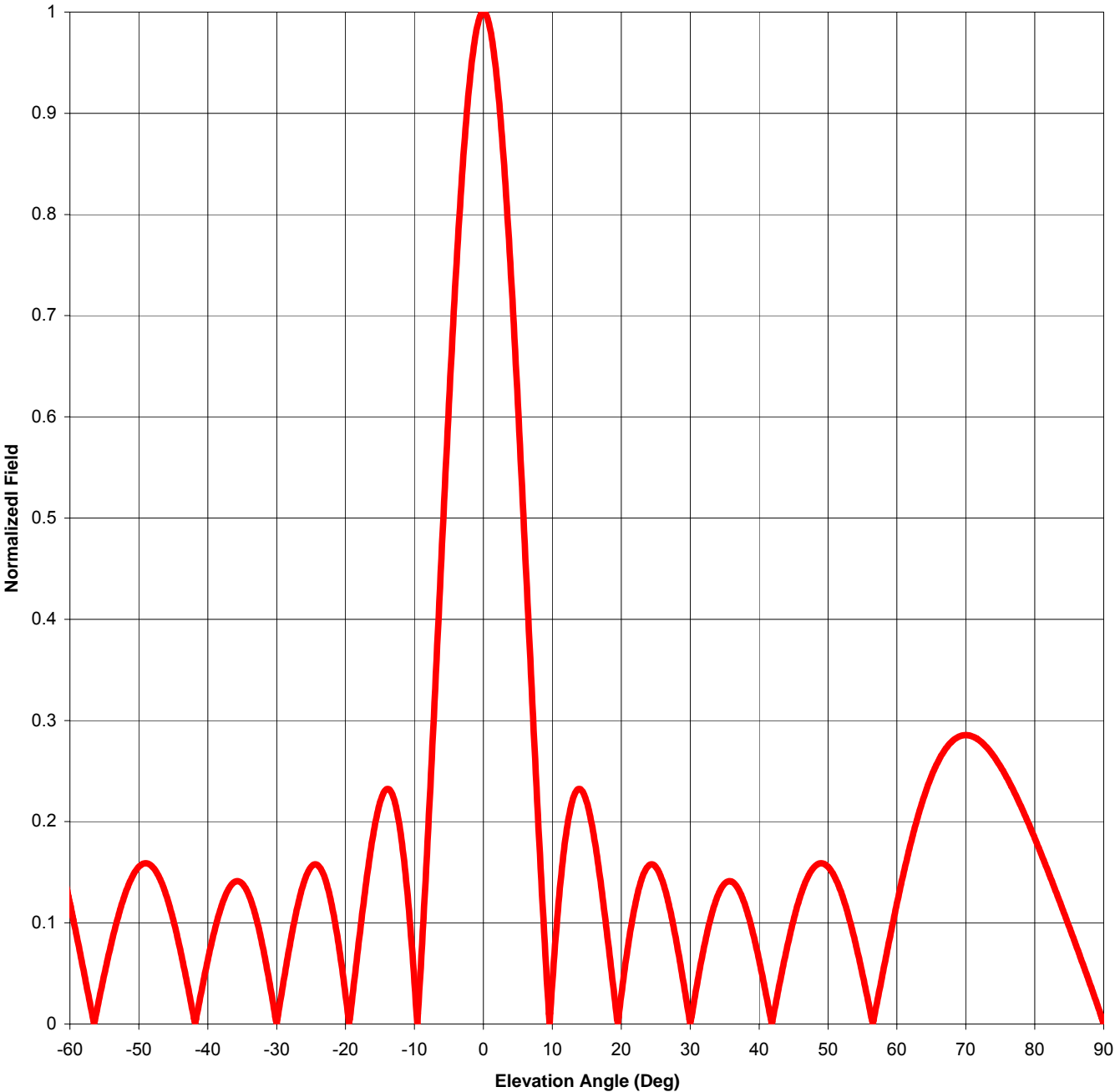
Date: 12/30/2004

Antenna Type: 6014, 6015, 6510, 6513, 6600, 68xx 6-Bay, full-wave-spaced

Frequency: 98.1

6014, 6015, 68xx Gain (Max) 3.32 5.22 dB

6510, 6513, 6600 Gain (Max) 6.44 8.22 dB



Elevation Pattern Tabulation, Sidemount 6-Bay Antennas, Full-Wave-Spaced

Includes Models 6014, 6015, 66xx series except 6602B, 65xx series, 68xx series except 6812B & 6832.

Relative Field at 0° Depression = 1.000

Degrees	Rel. Field
1	0.982
2	0.931
3	0.848
4	0.740
5	0.613
6	0.474
7	0.332
8	0.194
9	0.067
10	0.041
11	0.127
12	0.188
13	0.223
14	0.232
15	0.219
16	0.187
17	0.141
18	0.086

Degrees	Rel. Field
19	0.028
20	0.029
21	0.078
22	0.117
23	0.144
24	0.157
25	0.155
26	0.141
27	0.115
28	0.081
29	0.042
30	0.001
31	0.040
32	0.076
33	0.105
34	0.127
35	0.139
36	0.141

Degrees	Rel. Field
37	0.133
38	0.117
39	0.093
40	0.063
41	0.030
42	0.006
43	0.041
44	0.074
45	0.103
46	0.127
47	0.144
48	0.155
49	0.159
50	0.155
51	0.145
52	0.128
53	0.106
54	0.080

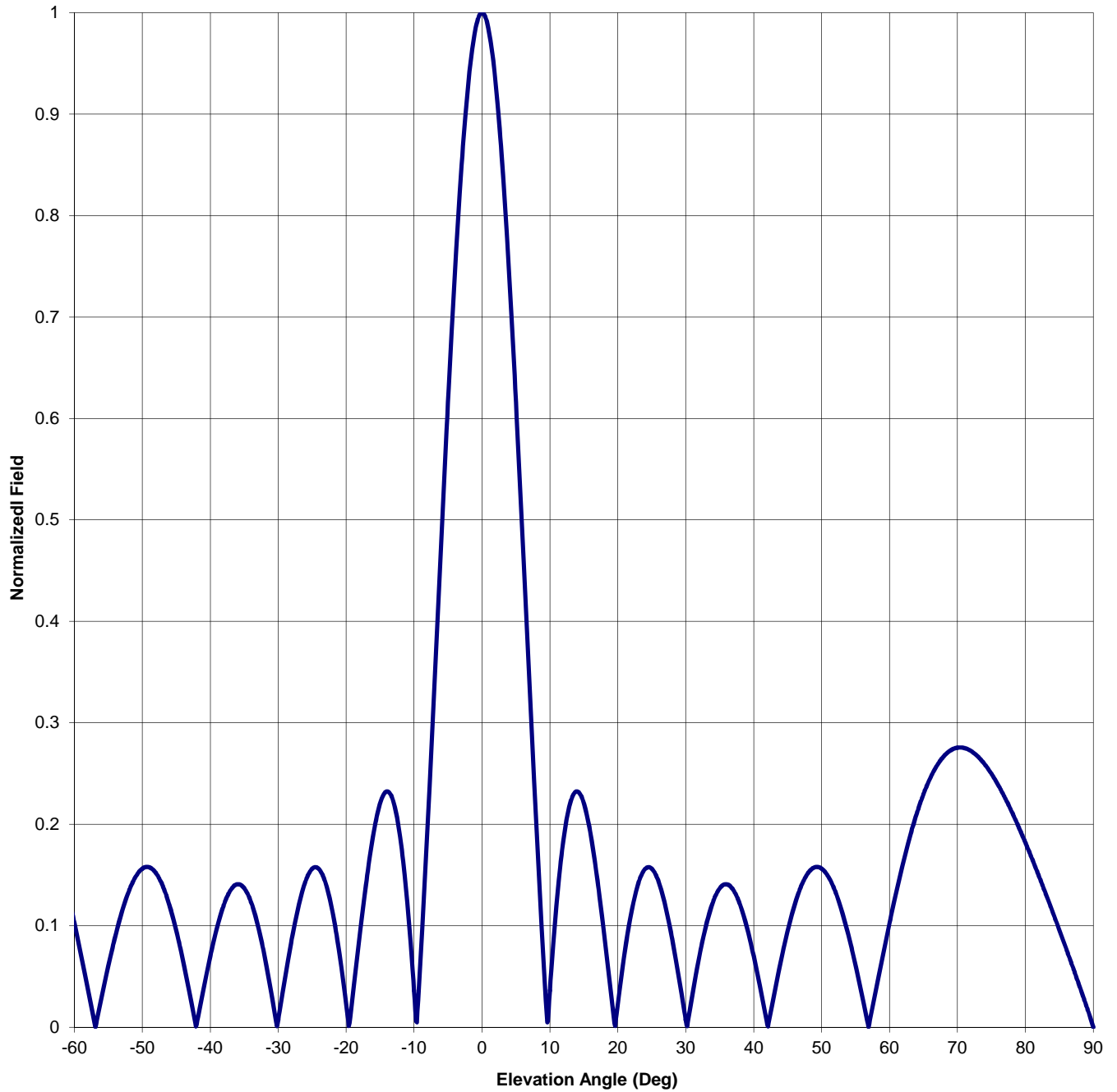
Degrees	Rel. Field
55	0.049
56	0.017
57	0.018
58	0.052
59	0.086
60	0.119
61	0.150
62	0.179
63	0.204
64	0.226
65	0.245
66	0.260
67	0.271
68	0.279
69	0.284
70	0.286
71	0.284
72	0.280

Degrees	Rel. Field
73	0.274
74	0.265
75	0.255
76	0.243
77	0.229
78	0.215
79	0.200
80	0.184
81	0.167
82	0.150
83	0.132
84	0.114
85	0.096
86	0.078
87	0.059
88	0.040
89	0.021
90	0.000

Antenna Mfg.: Shively Labs
Antenna Type: 6810-6R-H/V
Station: KZMN
Frequency: 103.9
Channel #: 280
Figure: 52251

Date: 1/9/2012

Beam Tilt	0	
Gain (Max)	4.590	6.619 dB
Gain (Horizon)	4.590	6.619 dB



Antenna Mfg.: Shively Labs

Date: 1/9/2012

Antenna Type: 6810-6R-H/V

Station: KZMN

Beam Tilt 0

Frequency: 103.9

Gain (Max) 4.590

6.619 dB

Channel #: 280

Gain (Horizon) 4.590

6.619 dB

Figure: 52251

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	0.065	0	1.000	46	0.120
-89	0.020	-43	0.032	1	0.983	47	0.139
-88	0.040	-42	0.003	2	0.931	48	0.152
-87	0.059	-41	0.038	3	0.850	49	0.158
-86	0.077	-40	0.070	4	0.742	50	0.156
-85	0.096	-39	0.098	5	0.616	51	0.148
-84	0.114	-38	0.121	6	0.478	52	0.134
-83	0.131	-37	0.135	7	0.336	53	0.114
-82	0.149	-36	0.141	8	0.199	54	0.089
-81	0.166	-35	0.137	9	0.073	55	0.061
-80	0.182	-34	0.123	10	0.036	56	0.030
-79	0.197	-33	0.101	11	0.123	57	0.003
-78	0.212	-32	0.070	12	0.185	58	0.037
-77	0.226	-31	0.033	13	0.221	59	0.070
-76	0.239	-30	0.007	14	0.232	60	0.103
-75	0.250	-29	0.048	15	0.221	61	0.134
-74	0.259	-28	0.087	16	0.190	62	0.162
-73	0.267	-27	0.119	17	0.145	63	0.188
-72	0.272	-26	0.143	18	0.091	64	0.210
-71	0.275	-25	0.156	19	0.033	65	0.230
-70	0.275	-24	0.156	20	0.023	66	0.246
-69	0.273	-23	0.142	21	0.073	67	0.258
-68	0.267	-22	0.114	22	0.114	68	0.267
-67	0.258	-21	0.073	23	0.142	69	0.273
-66	0.246	-20	0.023	24	0.156	70	0.275
-65	0.230	-19	0.033	25	0.156	71	0.275
-64	0.210	-18	0.091	26	0.143	72	0.272
-63	0.188	-17	0.145	27	0.119	73	0.267
-62	0.162	-16	0.190	28	0.087	74	0.259
-61	0.134	-15	0.221	29	0.048	75	0.250
-60	0.103	-14	0.232	30	0.007	76	0.239
-59	0.070	-13	0.221	31	0.033	77	0.226
-58	0.037	-12	0.185	32	0.070	78	0.212
-57	0.003	-11	0.123	33	0.101	79	0.197
-56	0.030	-10	0.036	34	0.123	80	0.182
-55	0.061	-9	0.073	35	0.137	81	0.166
-54	0.089	-8	0.199	36	0.141	82	0.149
-53	0.114	-7	0.336	37	0.135	83	0.131
-52	0.134	-6	0.478	38	0.121	84	0.114
-51	0.148	-5	0.616	39	0.098	85	0.096
-50	0.156	-4	0.742	40	0.070	86	0.077
-49	0.158	-3	0.850	41	0.038	87	0.059
-48	0.152	-2	0.931	42	0.003	88	0.040
-47	0.139	-1	0.983	43	0.032	89	0.020
-46	0.120	0	1.000	44	0.065	90	0.000
-45	0.095			45	0.095		