

Directional FM Antenna System

KKSE Auxiliary Broomfield, CO 92.5 MHz

June 12, 2023

Antenna Description

A custom-designed circular polarized FM antenna system was used to produce the directional azimuth pattern for KKSE-AUX Broomfield, CO 92.5 MHz, FIN 59972, FCC CP file number: 0000214181. The American Amplifier Technologies **FM-P-CP-M-1** antenna system consists of a circularly polarized antenna system mounted to a vertical structure. The antenna system is to be oriented to 113 degrees true north.

Description of Test Procedure

The test antenna consists of a full-scale circularly polarized antenna system mounted to a constructed structure that is identical to the final configuration. The structure and antenna system were mounted to a rotating platform. The platform is wooden, allowing the test antenna's center of radiation to be approximately 35 ft. above ground. All coaxial lines were properly grounded.

The antenna under test was the source antenna, terminated to the transmit port of the TR1300/1 2-Port Vector Network Analyzer. The VNA test instrument was set to 92.5 MHz.

A broadband log-periodic horizontally and vertically polarized antenna system was used to receive the emitted signals. The receive antenna system is located approximately 600 ft from the transmit antenna. The receive antenna is located at the same height above ground as the antenna under test. The receive antenna is terminated to the receive port of TR1300/1 2-Port Vector Network Analyzer. A gain reference was documented using a single dipole tuned to 92.5 MHz.

The antenna under test was rotated in a counterclockwise direction. The relative field strength was plotted using an HP PC-based computer system that documents the relative field strength of each azimuth degree angle. The computer system interfaces with the motorized platform and VNA test instrument, documenting the azimuth degree and relative field values. The system is calibrated to ANS/ISO/IEC 17025 standards.

Conclusions

The **FM-P-CP-M-1** single bay FM antenna system is to be mounted and oriented to 113 degrees true north. The antenna system should be installed in accordance with the provided installation drawing documents. No other antenna system or obstructions should be mounted within 10 ft of the antenna system. The antenna system orientation should be confirmed using a licensed surveyor.

The following figures are the results of the antenna proof of performance directional test procedure:

- Figure 1: Measured Vertical & Horizontal Azimuth Pattern with the FCC Composite
- Figure 2: Tabulation of the Horizontal Polarization for the Measured Azimuth Pattern
- Figure 3: Tabulation of the Vertical Polarization for the Measured Azimuth Pattern
- Figure 4: Tabulation of the Composite Polarizations for the Measured Azimuth Pattern
- Figure 5: Vertical Plane Relative Field Pattern
- Figure 6: Tabulation of Vertical Plane Relative Field
- Figure 7: Antenna Specifications
- Figure 8: Antenna Drawings

Figure #1 indicates the measured horizontal and vertical azimuth patterns do not exceed the FCC composite pattern at any azimuth. The FCC CP file number 0000214181 indicates that the power may not exceed 2.05 kilowatts at any azimuth. The power may not exceed 0.0724 kilowatts at azimuth degree 320. The measured azimuth pattern does not exceed 2.05 kilowatts at any azimuth. The measured azimuth pattern does not exceed 0.0724 kilowatts at azimuth degree 320.

The measured vertical relative field pattern RMS is greater than 85% of filed composite pattern. The measured composite pattern has an RMS that is 89.2 % of the filed composite pattern, as shown in Figure #1.



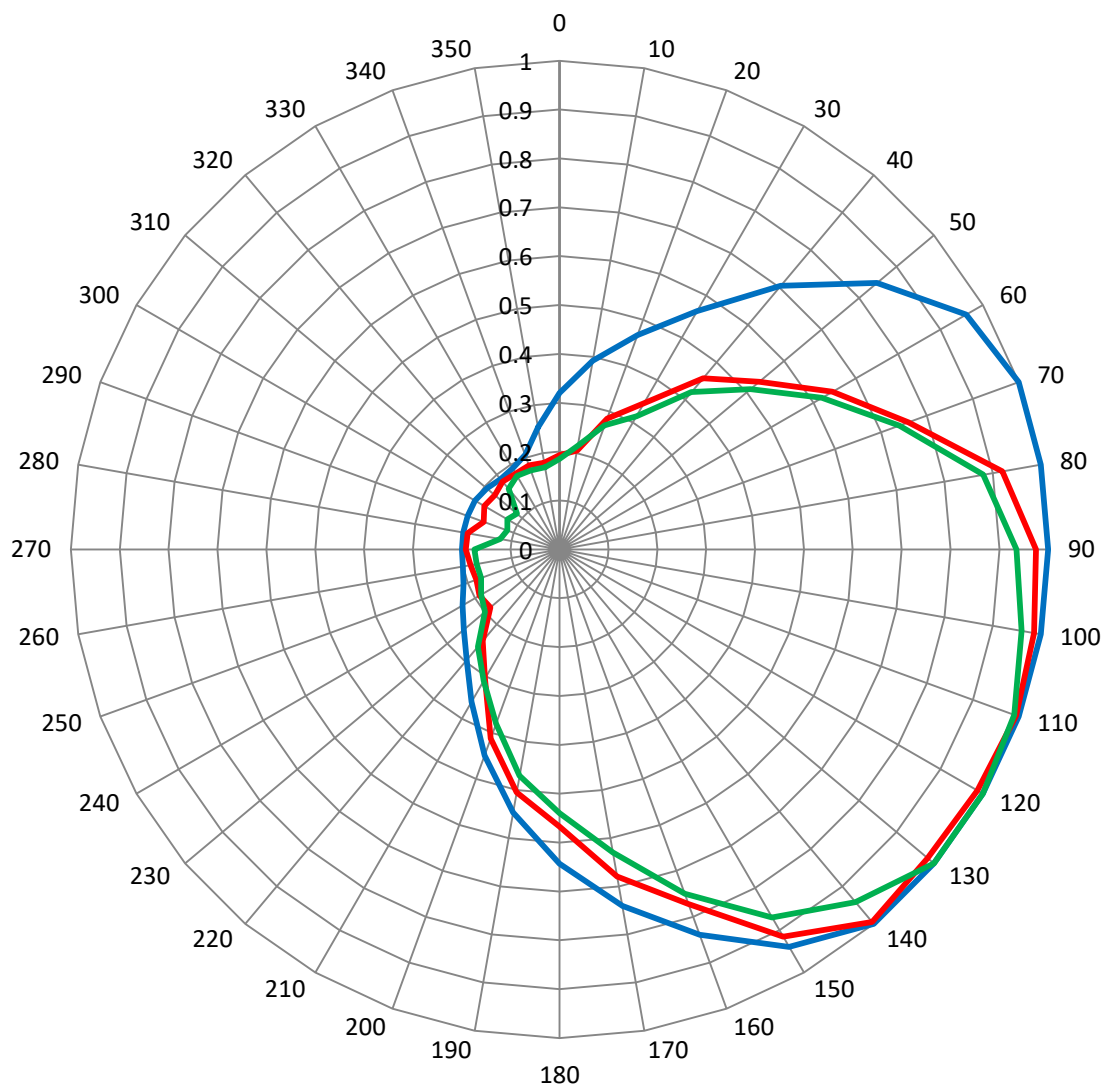
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Horizontal Plane Relative Field Pattern

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Figure 1

Relative Field Pattern



Horizontal RMS	0.551	—
Vertical RMS	0.570	—
Composite RMS	0.572	
FCC Composite RMS	0.641	—

Antenna Model	FM-P-CP-M-1
Pattern Polarization	Circular

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Figure 2

Tabulation of Horizontal Azimuth Field

Azimuth (°)	Relative Field
0	0.185
10	0.215
20	0.270
30	0.314
40	0.420
50	0.510
60	0.620
70	0.740
80	0.880
90	0.935
100	0.960
110	0.990
120	1.000
130	1.000
140	0.942
150	0.870
160	0.750
170	0.630
180	0.540
190	0.470
200	0.380
210	0.310
220	0.260
230	0.199
240	0.185
250	0.171
260	0.172
270	0.174
280	0.123
290	0.114
300	0.123
310	0.114
320	0.162
330	0.174
340	0.172
350	0.171

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Figure 3

Tabulation of Vertical Azimuth Field

Azimuth (°)	Relative Field
0	0.193
10	0.205
20	0.285
30	0.345
40	0.457
50	0.534
60	0.645
70	0.760
80	0.920
90	0.975
100	0.986
110	0.994
120	0.987
130	0.983
140	0.995
150	0.915
160	0.772
170	0.680
180	0.567
190	0.505
200	0.412
210	0.305
220	0.245
230	0.185
240	0.189
250	0.181
260	0.185
270	0.192
280	0.191
290	0.165
300	0.178
310	0.173
320	0.181
330	0.179
340	0.183
350	0.180

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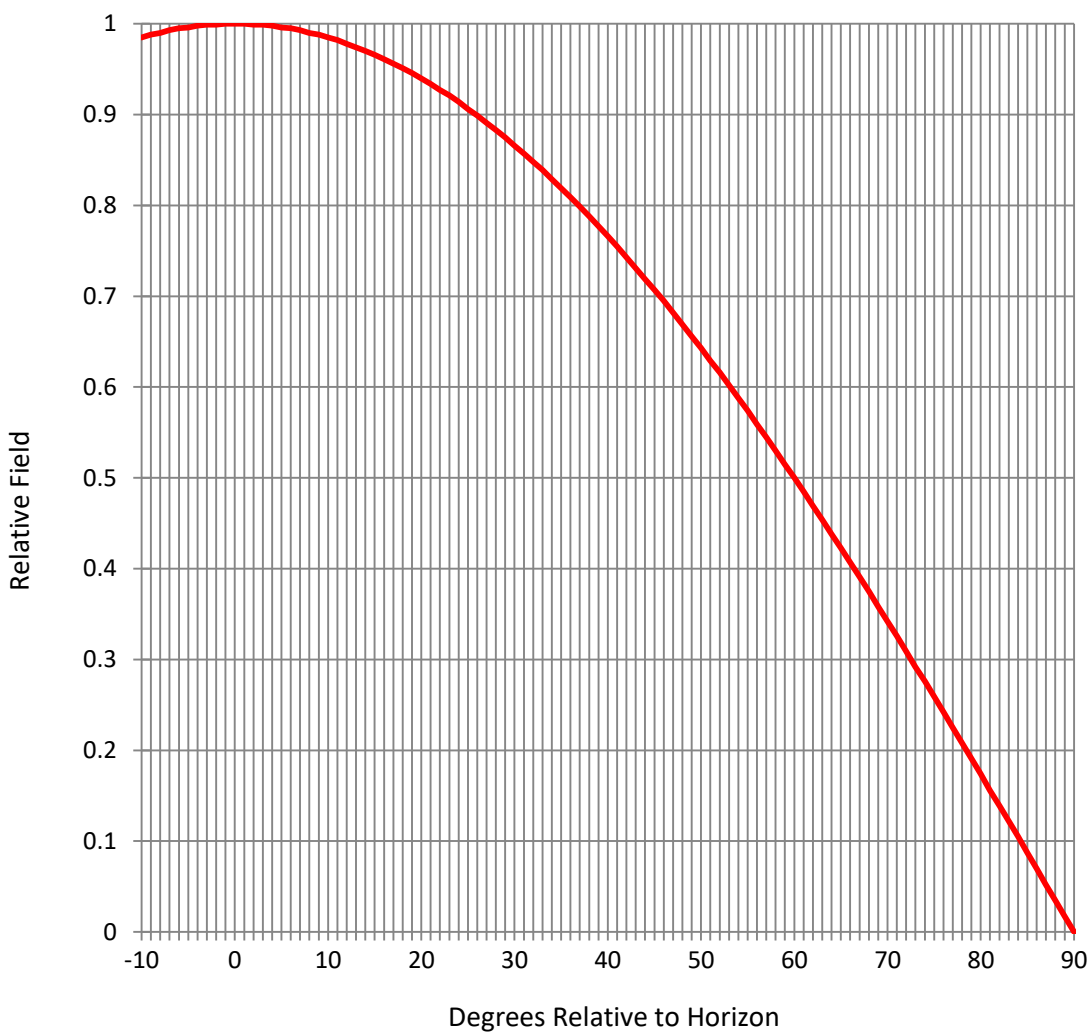
Figure 4

Tabulation of Composite Azimuth Field

Azimuth (°)	Relative Field
0	0.193
10	0.215
20	0.285
30	0.345
40	0.457
50	0.534
60	0.645
70	0.760
80	0.920
90	0.975
100	0.986
110	0.997
120	1.000
130	1.000
140	0.995
150	0.915
160	0.772
170	0.680
180	0.567
190	0.505
200	0.412
210	0.310
220	0.260
230	0.199
240	0.189
250	0.181
260	0.185
270	0.192
280	0.191
290	0.165
300	0.178
310	0.173
320	0.181
330	0.179
340	0.183
350	0.180

Vertical Plane Relative Field Pattern

Figure 5



Antenna Model: FM-P-CP-M-1	Beam tilt: 0 degrees
Station: KKSE-AUX	Maximum Gain: 1.548 (1.897 dB)
Frequency: 92.5 MHz	Horizontal Plane Gain: 1.548 (1.897 dB)

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Figure 6

Tabulation of Vertical Plane Relative Field

Degree	Relative Field	Degree	Relative Field	Degree	Relative Field	Degree	Relative Field	Degree	Relative Field
-10	0.985	11	0.982	32	0.848	53	0.602	74	0.276
-9	0.988	12	0.978	33	0.839	54	0.588	75	0.259
-8	0.990	13	0.974	34	0.829	55	0.574	76	0.242
-7	0.993	14	0.970	35	0.819	56	0.559	77	0.225
-6	0.995	15	0.966	36	0.809	57	0.545	78	0.208
-5	0.996	16	0.961	37	0.799	58	0.530	79	0.191
-4	0.998	17	0.956	38	0.788	59	0.515	80	0.174
-3	0.999	18	0.951	39	0.777	60	0.500	81	0.156
-2	0.999	19	0.946	40	0.766	61	0.485	82	0.139
-1	1.000	20	0.940	41	0.755	62	0.469	83	0.122
0	1.000	21	0.934	42	0.743	63	0.454	84	0.105
1	1.000	22	0.927	43	0.731	64	0.438	85	0.087
2	0.999	23	0.921	44	0.719	65	0.423	86	0.070
3	0.999	24	0.914	45	0.707	66	0.407	87	0.052
4	0.998	25	0.906	46	0.695	67	0.391	88	0.035
5	0.996	26	0.899	47	0.682	68	0.375	89	0.017
6	0.995	27	0.891	48	0.669	69	0.358	90	0.000
7	0.993	28	0.883	49	0.656	70	0.342		
8	0.990	29	0.875	50	0.643	71	0.326		
9	0.988	30	0.866	51	0.629	72	0.309		
10	0.985	31	0.857	52	0.616	73	0.292		

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Frequency: 92.5 MHz	Horizontal Plane Gain: 1.548 (1.897 dB)

Figure 7

Antenna Specifications

Antenna Model: FM-P-CP-M-1
Station: KKSE-AUX
Frequency: 92.5 MHz
Beam tilt: 0 degrees
Maximum Gain: 1.548 (1.897 dB)
Horizontal Plane Gain: 1.548 (1.897 dB)
Number of bays: 1
Antenna Length: 12 ft
Aperture length required: 20 ft
Orientation of system: 113 degrees true
Maximum ERP: 2.05 kW
Total Antenna Input Power: 1.324 kW

Antenna Drawings

Figure 8

