

Directional FM Antenna System Proof of Performance

CP File Number 0000213726

WGCC Kendall, NY 90.7 MHz (FIN 23603)

February 1, 2024

Antenna Description

A custom-designed circular polarized FM antenna system was used to produce the directional azimuth pattern for FIN 23603 WGCC Kendall, NY 90.7 MHz, FCC CP file number: 0000213726. The Shively Labs **6815-2** FM antenna system consists of a circularly polarized antenna system mounted to a vertical structure. The antenna system elements are to be oriented to 95 degrees true north.

Description of Test Procedure

The test antenna consists of a 4.5 scaled 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 20 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 408.15 MHz ($408.15 = 90.7 \times 4.5$).

A broadband log-periodic horizontally and vertically polarized antenna system was used to receive the emitted signals. The receive antenna system is located approximately 56 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 408.15 MHz ($408.15 = 90.7 \times 4.5$).

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 **6815-2** single level FM antenna system is to be mounted and oriented to 95 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 0000213726 indicates that the power may not exceed 1.25 kilowatts at any azimuth. The power may not exceed 0.24 kilowatts at azimuth degree 240. The measured azimuth pattern does not exceed 1.25 kilowatts at any azimuth. The measured azimuth pattern does not exceed 0.24 kilowatts at azimuth degree 240.

The measured vertical relative field pattern RMS is greater than 85% of filed composite pattern. The measured composite pattern has an RMS that is 92.73 % of the filed composite pattern, as shown in Figure #1.

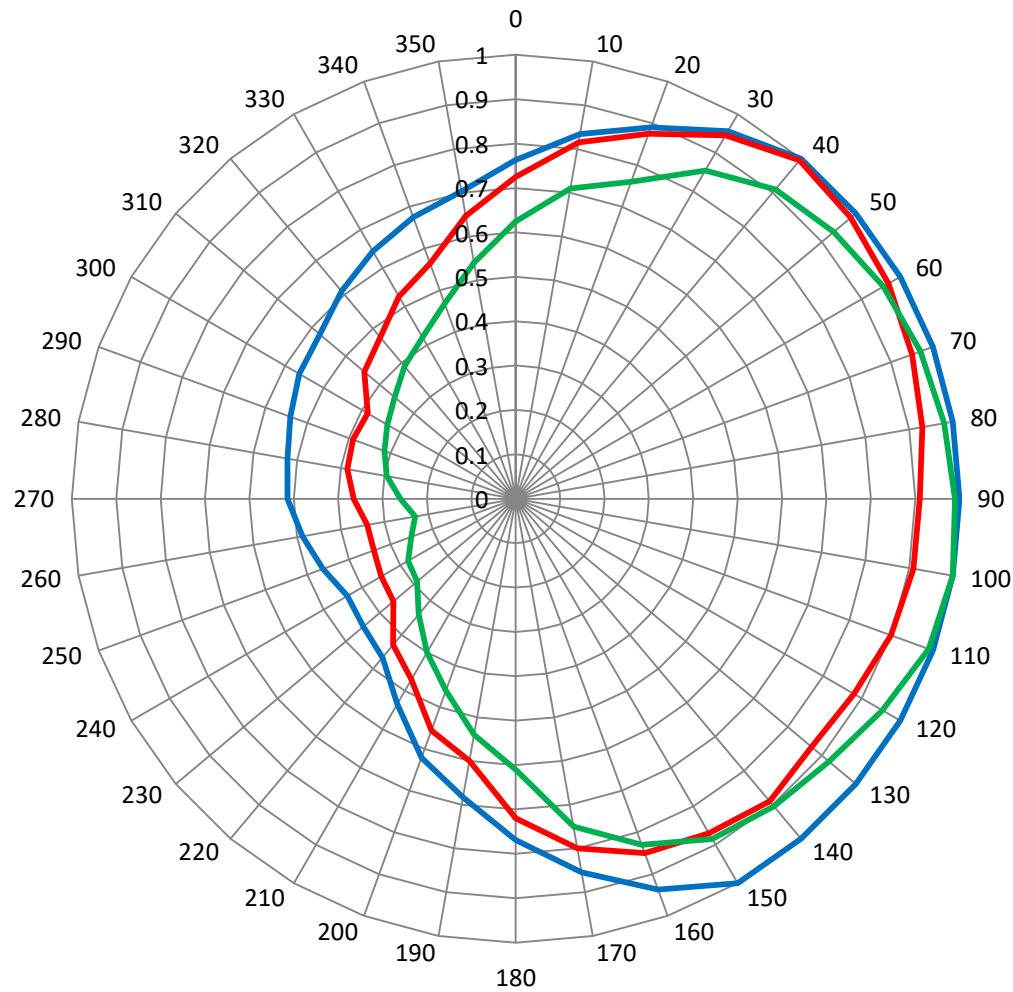
Horizontal Plane Relative Field Pattern

CP File Number: 00000213726 WGCC Kendall, NY 90.7 MHz

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Figure 1

Relative Field Pattern



Horizontal RMS	0.688	<div></div>
Vertical RMS	0.717	<div></div>
Composite RMS	0.735	
FCC Composite RMS	0.792	<div></div>

Antenna Model	6815-2
Pattern Polarization	Circular

Figure 2

Tabulation of Horizontal Azimuth Field

Azimuth (°)	Relative Field
0	0.625
10	0.710
20	0.760
30	0.854
40	0.910
50	0.935
60	0.956
70	0.970
80	0.980
90	0.990
100	1.000
110	0.990
120	0.954
130	0.921
140	0.905
150	0.885
160	0.830
170	0.750
180	0.610
190	0.540
200	0.460
210	0.400
220	0.340
230	0.290
240	0.280
250	0.250
260	0.230
270	0.260
280	0.295
290	0.315
300	0.334
310	0.356
320	0.390
330	0.420
340	0.468
350	0.540

Figure 3

Tabulation of Vertical Azimuth Field

Azimuth (°)	Relative Field
0	0.725
10	0.815
20	0.875
30	0.946
40	0.995
50	0.985
60	0.970
70	0.950
80	0.930
90	0.910
100	0.910
110	0.900
120	0.880
130	0.870
140	0.890
150	0.870
160	0.850
170	0.800
180	0.720
190	0.600
200	0.556
210	0.470
220	0.430
230	0.360
240	0.350
250	0.340
260	0.340
270	0.365
280	0.385
290	0.390
300	0.385
310	0.445
320	0.475
330	0.526
340	0.564
350	0.647

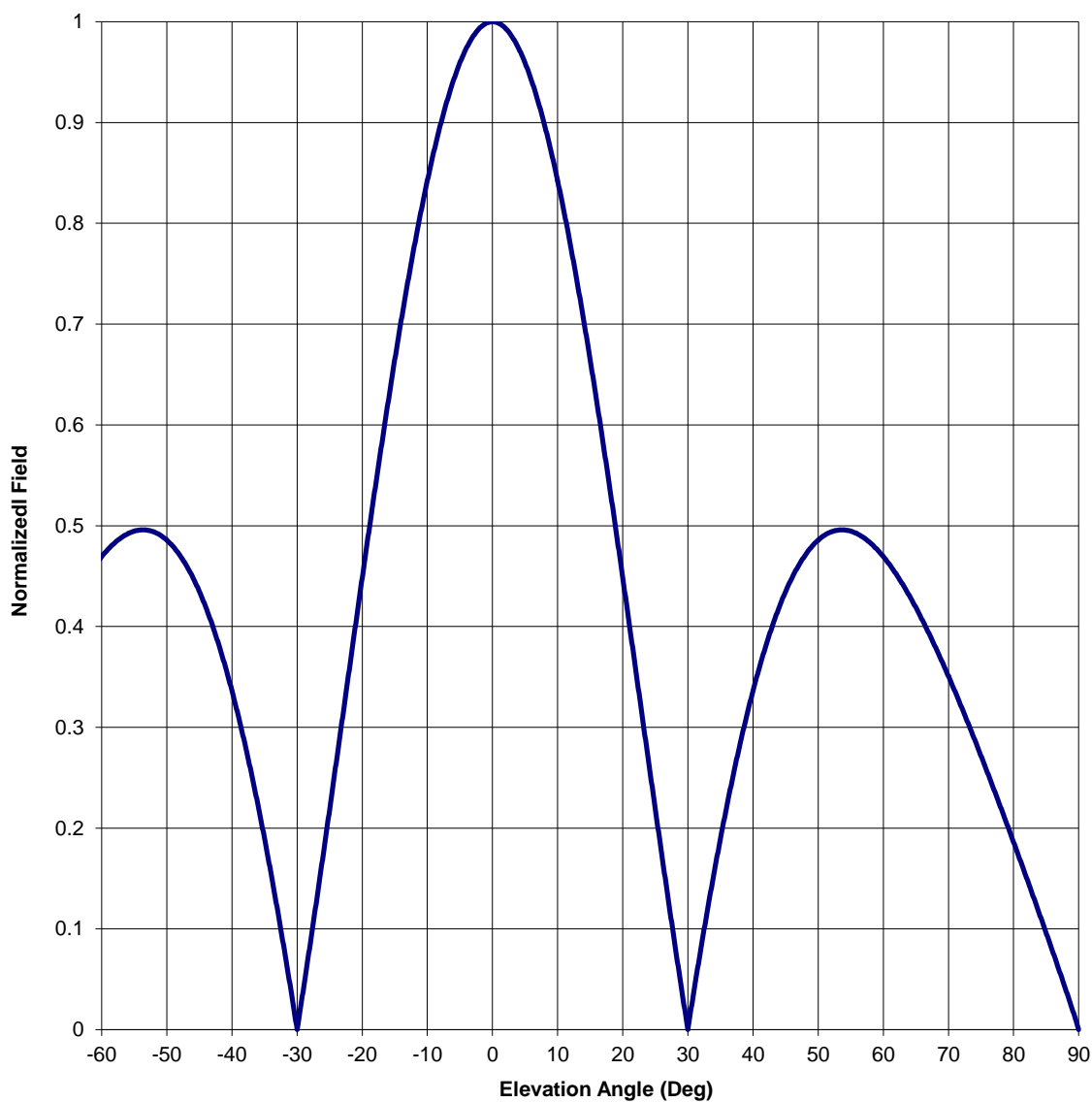
Figure 4

Tabulation of Composite Azimuth Field

Azimuth (°)	Relative Field
0	0.725
10	0.815
20	0.875
30	0.946
40	0.995
50	0.985
60	0.970
70	0.970
80	0.980
90	0.990
100	1.000
110	0.990
120	0.954
130	0.921
140	0.905
150	0.885
160	0.850
170	0.800
180	0.720
190	0.600
200	0.556
210	0.470
220	0.430
230	0.360
240	0.350
250	0.340
260	0.340
270	0.365
280	0.385
290	0.390
300	0.385
310	0.445
320	0.475
330	0.526
340	0.564
350	0.647

Vertical Plane Relative Field Pattern

Figure 5



Antenna Model: 6815-2	Beam tilt: 0 degrees
Station: WGCC	Maximum Gain: 2.092 (3.206 dB)
Frequency: 90.7 MHz	Maximum Gain: 2.092 (3.206 dB)



Tabulation of Vertical Plane Relative Field

Figure 6

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	0.419	0	1.000	46	0.449
-89	0.021	-43	0.401	1	0.998	47	0.461
-88	0.040	-42	0.381	2	0.993	48	0.471
-87	0.059	-41	0.360	3	0.985	49	0.479
-86	0.078	-40	0.336	4	0.974	50	0.486
-85	0.096	-39	0.311	5	0.959	51	0.491
-84	0.114	-38	0.283	6	0.942	52	0.494
-83	0.133	-37	0.254	7	0.921	53	0.496
-82	0.151	-36	0.223	8	0.897	54	0.496
-81	0.168	-35	0.190	9	0.871	55	0.495
-80	0.186	-34	0.155	10	0.842	56	0.492
-79	0.204	-33	0.119	11	0.811	57	0.488
-78	0.221	-32	0.081	12	0.777	58	0.483
-77	0.238	-31	0.041	13	0.742	59	0.477
-76	0.255	-30	0.000	14	0.704	60	0.469
-75	0.272	-29	0.042	15	0.665	61	0.461
-74	0.288	-28	0.085	16	0.624	62	0.452
-73	0.304	-27	0.129	17	0.581	63	0.442
-72	0.320	-26	0.173	18	0.538	64	0.430
-71	0.336	-25	0.219	19	0.493	65	0.419
-70	0.351	-24	0.264	20	0.448	66	0.406
-69	0.365	-23	0.311	21	0.403	67	0.393
-68	0.380	-22	0.357	22	0.357	68	0.380
-67	0.393	-21	0.403	23	0.311	69	0.365
-66	0.406	-20	0.448	24	0.264	70	0.351
-65	0.419	-19	0.493	25	0.219	71	0.336
-64	0.430	-18	0.538	26	0.173	72	0.320
-63	0.442	-17	0.581	27	0.129	73	0.304
-62	0.452	-16	0.624	28	0.085	74	0.288
-61	0.461	-15	0.665	29	0.042	75	0.272
-60	0.469	-14	0.704	30	0.000	76	0.255
-59	0.477	-13	0.742	31	0.041	77	0.238
-58	0.483	-12	0.777	32	0.081	78	0.221
-57	0.488	-11	0.811	33	0.119	79	0.204
-56	0.492	-10	0.842	34	0.155	80	0.186
-55	0.495	-9	0.871	35	0.190	81	0.168
-54	0.496	-8	0.897	36	0.223	82	0.151
-53	0.496	-7	0.921	37	0.254	83	0.133
-52	0.494	-6	0.942	38	0.283	84	0.114
-51	0.491	-5	0.959	39	0.311	85	0.096
-50	0.486	-4	0.974	40	0.336	86	0.078
-49	0.479	-3	0.985	41	0.360	87	0.059
-48	0.471	-2	0.993	42	0.381	88	0.040
-47	0.461	-1	0.998	43	0.401	89	0.021
-46	0.449	0	1.000	44	0.419	90	0.000
-45	0.435			45	0.435		

Figure 7

Antenna Specifications

Antenna Model: 6815-2R-EF
Station: WGCC
CP File Number: 0000213726
Frequency: 90.7 MHz
Beam tilt: 0 degrees
Maximum Gain: 2.092 (3.206 dB)
Horizontal Plane Gain: 2.092 (3.206 dB)
Vertical Plane Gain: 1.926 (2.846 dB)
Number of bays/levels: 2
Antenna Length: 19.69 ft
Aperture length required: 40 ft
Orientation of system: 95 degrees true
Maximum ERP: 1.25 kW
Total Antenna Input Power: 0.597 kW

