

***Directional Antenna System
for
WFBE, Flint, Michigan***

December 2, 2009

Electronics Research Inc. is providing a custom fabricated antenna system that is specially designed to meet the FCC requirements and the general needs of radio station WFBE.

The antenna is the ERI model MP-6E-DA-HW configuration. The circular polarized system consists of 6 half-wavelength spaced bays using one driven circular polarized radiating element per bay and two horizontal parasitic elements placed one quarter wave above and below each bay and two vertical parasitic elements per bay. The antenna was mounted on the North 310 degrees East tower face with bracketry to provide an antenna orientation of North 310 degrees East. The antenna was tested on a Tapered tower, which is the structure the station plans to use to support the array. All tests were performed on a frequency of 95.1 megahertz, which is the center of the FM broadcast channel assigned to WFBE.

Pattern measurements were made on a sixty-acre antenna pattern range that is owned and operated by Electronics Research, Inc. The tests were performed under the direction of Thomas B. Silliman, president of Electronics Research, Inc. Mr. Silliman has the Bachelor of Electrical Engineering and the Master of Electrical Engineering degrees from Cornell University and is a registered professional engineer in the states of Indiana, Maryland and Minnesota.



Directional Antenna System Proposed For WFBE, Flint, Michigan

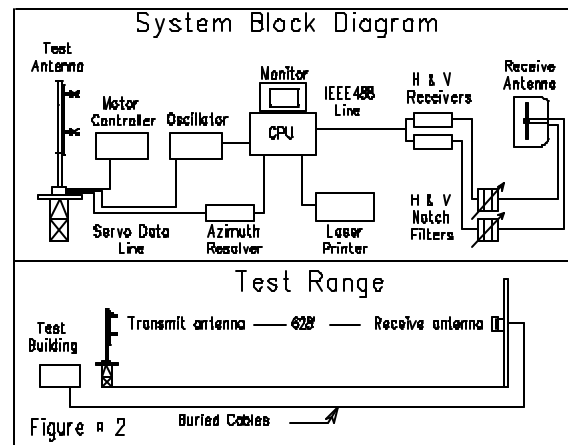
(Continued)

DESCRIPTION OF THE TEST PROCEDURE

The test antenna consisted of two bay levels of the circular polarized system with the associated horizontal parasitic elements. The elements and brackets that were used in this test are electrically equivalent to those that will be supplied with the antenna. A section of 3 1/8 inch o.d. rigid coaxial line was used to feed the test antenna, and a section of 3 1/8 inch o.d. rigid outer conductor only was attached above the test antenna. The lines were properly grounded during all tests.

The power distribution and phase relationship to the antenna elements was adjusted in order to achieve the directional radiation patterns for both horizontal and vertical polarization components.

The proof-of-performance was accomplished using a Tapered tower with identical dimension and configuration including all braces, ladders, conduits, coaxial lines and other appurtenances that are included in the actual aperture at which the antenna will be installed. The structure was erected vertically on a turntable mounted on a non-metallic building with the antenna centered vertically on the structure, making the center of



radiation of the test approximately 30 feet above ground. The turntable is equipped with a motor drive and a US Digital angle position indicator. The resolution of this angle position indicator is one-hundredth of a degree.

The antenna under test was operated in the transmitting mode and fed from a HP8657D signal generator. The frequency of the signal source was set at 95.1 MHz and was constantly monitored by a Rohde & Schwarz ESVD measuring receiver.

Directional Antenna System Proposed For WFBE, Flint, Michigan

(Continued)

A broadband horizontal and vertical dipole system, located approximately 628 feet from the test antenna, was used to receive the emitted test signals. The dipole system was mounted at the same height above terrain as the center of the antenna under test. The signals received by the dipole system were fed to the test building by way of two buried Heliax cables to a Rohde & Schwarz measuring receiver. This data was interfaced to a laser jet printer by means of a computer system. Relative field strength was plotted as a function of azimuth.

The measurements were performed by rotating the test antenna in a counter-clockwise direction and plotting the received signal on polar coordinated graph paper in a clockwise direction. Both horizontal and vertical components were recorded separately.

CONCLUSIONS

The circular polarized system consists of 6 half-wavelength spaced bays using one driven circular polarized radiating element per bay and two horizontal parasitic elements placed one quarter wave above and below each bay and two vertical parasitic elements per bay. The power distribution and phase relationship will be fixed when antenna is manufactured. Proper maintenance of the elements should be all that is required to maintain the pattern in adjustment.

The MP-6E-DA-HW array is to be mounted on the North 310 degrees East tower face of the Tapered tower at a bearing of North 310 degrees East. Blue prints provided with the antenna will show the proper antenna orientation alignment. The antenna alignment procedure should be directed by a licensed surveyor as prescribed by the FCC.

Figure #1 represents the maximum value of either the horizontal or vertical component at any azimuth. The measured horizontal plane relative field pattern, for both the horizontal and vertical polarization components, is shown on Figure #2 attached. The actual measured pattern does not exceed the authorized FCC composite pattern at any azimuth. A calculated vertical plane relative field pattern is shown on Figure #3 attached. The power in the maximum will reach 34.000 kilowatts (15.315 dBk).

The power at North 130-150 degrees East does not exceed 7.500 kilowatts (8.751 dBk).

Directional Antenna System
Proposed For
WFBE, Flint, Michigan

(Continued)

The RMS of the vertically polarized horizontal plane component does not exceed the RMS of the horizontally polarized horizontal plane component.

The composite horizontal and vertical maximum relative field pattern obtained from the measured data as shown on Figure #1 has an RMS that is greater than 85% of the filed composite pattern.

The clear vertical length of the structure required to support the antenna is 40 feet 9 inches.

The directional antenna should not be mounted on the top of an antenna tower that includes a top-mounted platform larger than the cross-sectional area of the tower in the horizontal plane. No obstructions other than those that are specified by the blue prints supplied with the antenna are to be mounted within 75 ft. horizontally of the system. The vertical distance to the nearest obstruction should be a minimum of 10 ft. from the directional antenna. Metallic guy wires should be a minimum distance of forty feet horizontally from the antenna.

ELECTRONICS RESEARCH, INC.

A handwritten signature in black ink, appearing to read "Tom Scharf". The signature is fluid and cursive, with the first name "Tom" and last name "Scharf" clearly distinguishable.

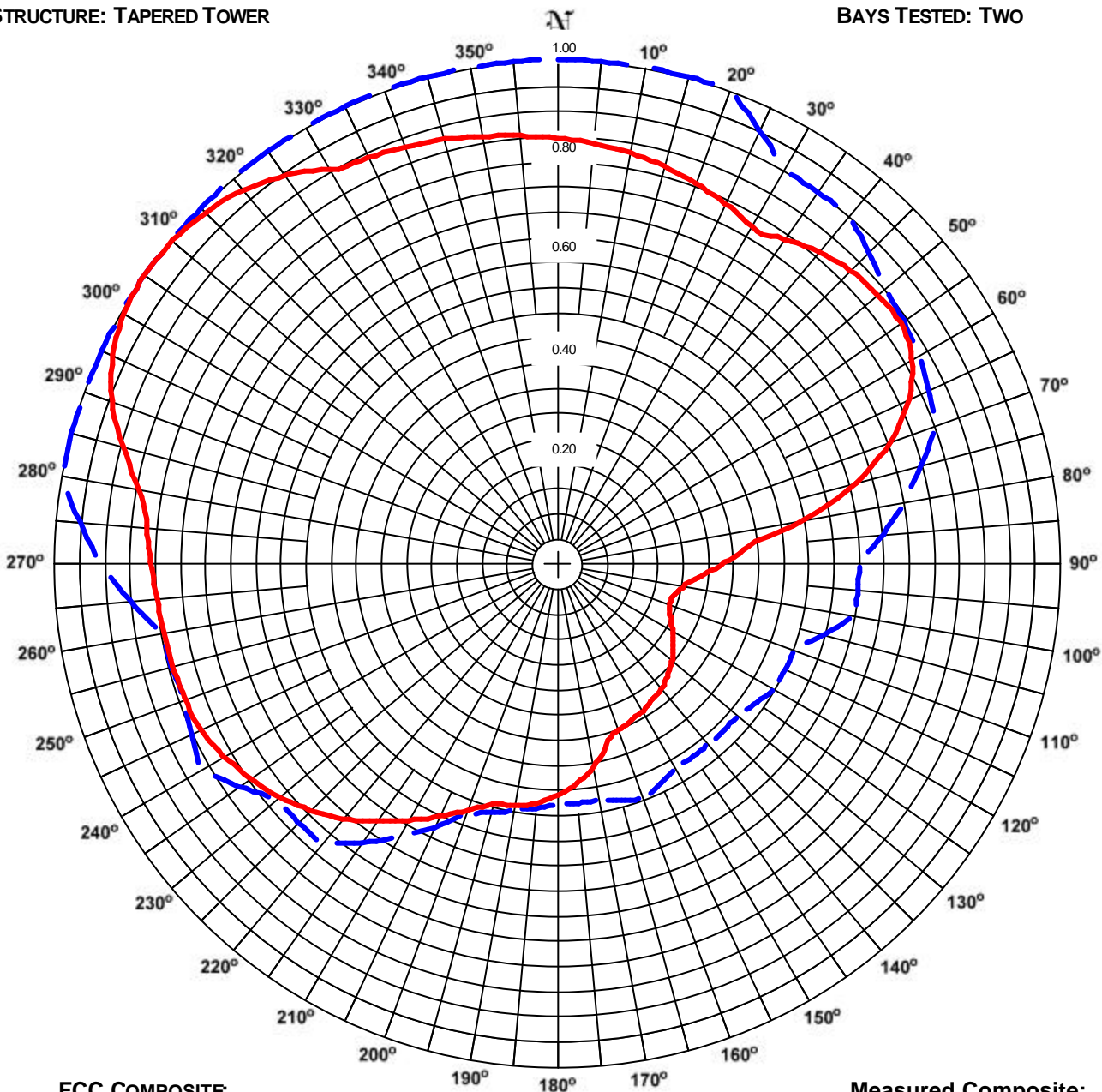
The Microsoft Word document on file electronically at Electronic Research, Inc. governs the specifications, scope, and configuration of the product described. All other representations whether verbal, printed, or electronic are subordinate to the master copy of this document on file at ERI.

ERI® *Horizontal Plane Relative Field Pattern*

Electronics Research, Inc. 7777 Gardner Rd. Chandler, In 47610 Phone (812) 925-6000 Fax (812) 925-4030 <http://www.eriinc.com/>

FIGURE NO: 1
STATION: WFBE
LOCATION: FLINT, MI.
ANTENNA: MP-6E-DA-HW
STRUCTURE: TAPERED TOWER

DATE: 11/20/2009
FREQUENCY: 95.1 MHz
ORIENTATION: 310° TRUE
MOUNTING: CUSTOM
BAYS TESTED: TWO



FCC COMPOSITE
RMS: 0.791
MAXIMUM: 1.000 @ 0° TRUE
MINIMUM: 0.470 @ 130° TRUE

Measured Composite:
RMS: 0.701
Maximum: 1.000 @ 304° True
Minimum: 0.238 @ 108° True

COMMENTS: COMPOSITE PATTERN: THIS PATTERN SHOWS THE MAXIMUM OF EITHER THE H OR V AZIMUTH VALUES. THIS PATTERN IS GREATER THAN 85% OF THE FCC FILED COMPOSITE PATTERN BPH-20070518ADJ.

ERI[®] *Horizontal Plane Relative Field List*

Electronics Research, Inc. 7777 Gardner Rd. Chandler, In 47610 Phone (812) 925-6000 Fax (812) 925-4030 <http://www.eriinc.com/>

Station: WFBE
Location: Flint, MI.
Frequency: 95.1 MHz

Antenna: MP-6E-DA-HW
Orientation: 310° True
Tower: Tapered Tower

Figure: 1
Date: 11/20/2009
Reference: wfbe1m.fig

| Angle | Envelope | | | Polarization | Angle | Envelope | | | Polarization |
|-------|----------|-------|-------|--------------|-------|----------|-------|-------|--------------|
| | Field | kW | dBk | | | Field | kW | dBk | |
| 0° | 0.845 | 24.25 | 13.85 | Vertical | 180° | 0.464 | 7.31 | 8.64 | Horizontal |
| 5° | 0.836 | 23.78 | 13.76 | Vertical | 185° | 0.480 | 7.84 | 8.94 | Horizontal |
| 10° | 0.827 | 23.28 | 13.67 | Vertical | 190° | 0.490 | 8.17 | 9.12 | Horizontal |
| 15° | 0.816 | 22.67 | 13.55 | Vertical | 195° | 0.497 | 8.39 | 9.24 | Vertical |
| 20° | 0.803 | 21.93 | 13.41 | Vertical | 200° | 0.524 | 9.35 | 9.71 | Vertical |
| 25° | 0.788 | 21.10 | 13.24 | Vertical | 205° | 0.557 | 10.54 | 10.23 | Vertical |
| 30° | 0.771 | 20.21 | 13.06 | Vertical | 210° | 0.592 | 11.93 | 10.77 | Vertical |
| 35° | 0.786 | 21.00 | 13.22 | Horizontal | 215° | 0.629 | 13.45 | 11.29 | Vertical |
| 40° | 0.807 | 22.14 | 13.45 | Horizontal | 220° | 0.665 | 15.06 | 11.78 | Vertical |
| 45° | 0.822 | 22.96 | 13.61 | Horizontal | 225° | 0.696 | 16.47 | 12.17 | Vertical |
| 50° | 0.831 | 23.45 | 13.70 | Horizontal | 230° | 0.724 | 17.82 | 12.51 | Vertical |
| 55° | 0.832 | 23.54 | 13.72 | Horizontal | 235° | 0.748 | 19.01 | 12.79 | Vertical |
| 60° | 0.813 | 22.48 | 13.52 | Horizontal | 240° | 0.768 | 20.07 | 13.03 | Horizontal |
| 65° | 0.771 | 20.19 | 13.05 | Horizontal | 245° | 0.783 | 20.86 | 13.19 | Horizontal |
| 70° | 0.704 | 16.87 | 12.27 | Horizontal | 250° | 0.789 | 21.17 | 13.26 | Horizontal |
| 75° | 0.615 | 12.84 | 11.09 | Horizontal | 255° | 0.793 | 21.38 | 13.30 | Vertical |
| 80° | 0.501 | 8.54 | 9.31 | Horizontal | 260° | 0.796 | 21.52 | 13.33 | Vertical |
| 85° | 0.381 | 4.93 | 6.93 | Vertical | 265° | 0.800 | 21.78 | 13.38 | Vertical |
| 90° | 0.333 | 3.77 | 5.76 | Vertical | 270° | 0.809 | 22.23 | 13.47 | Vertical |
| 95° | 0.289 | 2.85 | 4.55 | Vertical | 275° | 0.820 | 22.87 | 13.59 | Vertical |
| 100° | 0.258 | 2.26 | 3.55 | Vertical | 280° | 0.847 | 24.42 | 13.88 | Horizontal |
| 105° | 0.241 | 1.97 | 2.95 | Vertical | 285° | 0.896 | 27.32 | 14.36 | Horizontal |
| 110° | 0.239 | 1.93 | 2.87 | Vertical | 290° | 0.943 | 30.22 | 14.80 | Horizontal |
| 115° | 0.247 | 2.08 | 3.18 | Vertical | 295° | 0.975 | 32.35 | 15.10 | Horizontal |
| 120° | 0.263 | 2.36 | 3.72 | Vertical | 300° | 0.995 | 33.63 | 15.27 | Horizontal |
| 125° | 0.281 | 2.68 | 4.28 | Vertical | 305° | 1.000 | 34.00 | 15.31 | Horizontal |
| 130° | 0.298 | 3.02 | 4.80 | Vertical | 310° | 0.998 | 33.86 | 15.30 | Horizontal |
| 135° | 0.312 | 3.32 | 5.21 | Vertical | 315° | 0.987 | 33.15 | 15.20 | Horizontal |
| 140° | 0.324 | 3.56 | 5.51 | Vertical | 320° | 0.968 | 31.86 | 15.03 | Horizontal |
| 145° | 0.331 | 3.72 | 5.71 | Vertical | 325° | 0.940 | 30.04 | 14.78 | Horizontal |
| 150° | 0.340 | 3.93 | 5.94 | Vertical | 330° | 0.903 | 27.73 | 14.43 | Horizontal |
| 155° | 0.347 | 4.08 | 6.11 | Vertical | 335° | 0.889 | 26.86 | 14.29 | Vertical |
| 160° | 0.354 | 4.27 | 6.30 | Vertical | 340° | 0.879 | 26.28 | 14.20 | Vertical |
| 165° | 0.377 | 4.82 | 6.83 | Horizontal | 345° | 0.871 | 25.81 | 14.12 | Vertical |
| 170° | 0.412 | 5.77 | 7.61 | Horizontal | 350° | 0.861 | 25.19 | 14.01 | Vertical |
| 175° | 0.441 | 6.61 | 8.20 | Horizontal | 355° | 0.852 | 24.66 | 13.92 | Vertical |

Polarization:
Maximum Field: 1.000 @ 304° True
Minimum Field: 0.238 @ 108° True
RMS: 0.701
Maximum ERP: 34.000 kW
Maximum Power Gain: 4.066 (6.092 dB)

Total Input Power: 8.361 kW

ERI® *Horizontal Plane Relative Field Pattern*

Electronics Research, Inc. 7777 Gardner Rd. Chandler, In 47610 Phone (812) 925-6000 Fax (812) 925-4030 <http://www.eriinc.com/>

FIGURE No: 2

STATION: WFBE

LOCATION: FLINT, MI.

ANTENNA: MP-6E-DA-HW

STRUCTURE: TAPERED TOWER

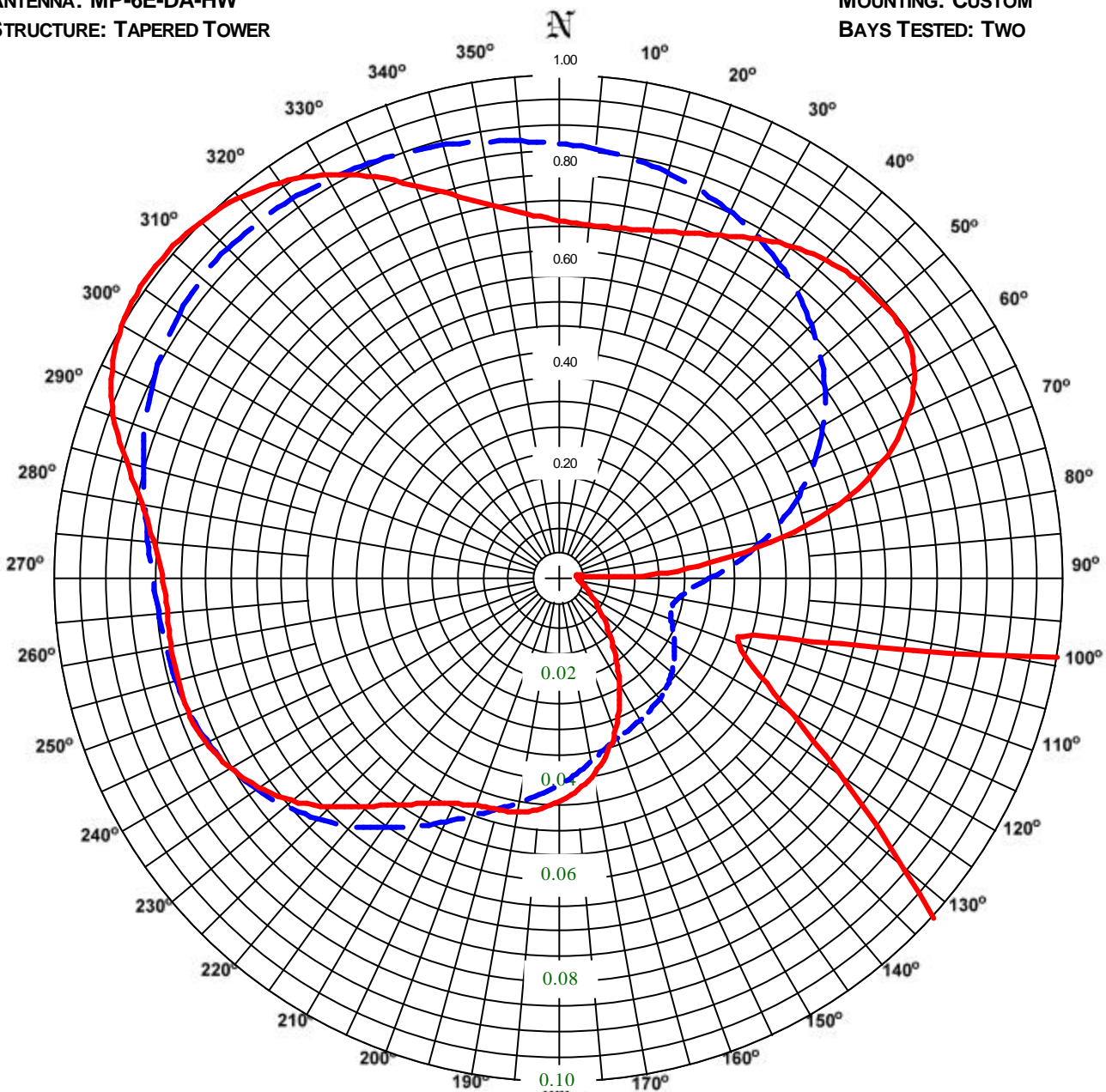
DATE: 11/20/2009

FREQUENCY: 95.1 MHz

ORIENTATION: 310° TRUE

MOUNTING: CUSTOM

BAYS TESTED: TWO



VERTICAL

RMS: 0.668

MAXIMUM: 0.915 @ 312° TRUE

MINIMUM: 0.238 @ 108° TRUE

10X Scale

Horizontal

RMS: 0.668

Maximum: 1.000 @ 304° True

Minimum: 0.038 @ 111° True

COMMENTS: MEASURED PATTERNS OF THE HORIZONTAL AND VERTICAL PATTERNS.

ERI[®] *Horizontal Plane Relative Field List*

Electronics Research, Inc. 7777 Gardner Rd. Chandler, In 47610 Phone (812) 925-6000 Fax (812) 925-4030 <http://www.eriinc.com/>

Station: WFBE
Location: Flint, MI.
Frequency: 95.1 MHz

Antenna: MP-6E-DA-HW
Orientation: 310° True
Tower: Tapered Tower

Figure: 2
Date: 11/20/2009
Reference: wfbe1m.fig

| Angle | Horizontal | | | Vertical | | | Angle | Horizontal | | | Vertical | | |
|-------|------------|-------|--------|----------|-------|-------|-------|------------|-------|-------|----------|-------|-------|
| | Field | kW | dBk | Field | kW | dBk | | Field | kW | dBk | Field | kW | dBk |
| 0° | 0.691 | 16.25 | 12.11 | 0.845 | 24.25 | 13.85 | 180° | 0.464 | 7.31 | 8.64 | 0.431 | 6.32 | 8.00 |
| 5° | 0.684 | 15.92 | 12.02 | 0.836 | 23.78 | 13.76 | 185° | 0.480 | 7.84 | 8.94 | 0.452 | 6.93 | 8.41 |
| 10° | 0.686 | 16.02 | 12.05 | 0.827 | 23.28 | 13.67 | 190° | 0.490 | 8.17 | 9.12 | 0.472 | 7.58 | 8.80 |
| 15° | 0.695 | 16.43 | 12.16 | 0.816 | 22.67 | 13.55 | 195° | 0.494 | 8.30 | 9.19 | 0.497 | 8.39 | 9.24 |
| 20° | 0.710 | 17.14 | 12.34 | 0.803 | 21.93 | 13.41 | 200° | 0.500 | 8.49 | 9.29 | 0.524 | 9.35 | 9.71 |
| 25° | 0.731 | 18.18 | 12.60 | 0.788 | 21.10 | 13.24 | 205° | 0.515 | 9.01 | 9.55 | 0.557 | 10.54 | 10.23 |
| 30° | 0.758 | 19.56 | 12.91 | 0.771 | 20.21 | 13.06 | 210° | 0.539 | 9.88 | 9.95 | 0.592 | 11.93 | 10.77 |
| 35° | 0.786 | 21.00 | 13.22 | 0.751 | 19.17 | 12.83 | 215° | 0.573 | 11.16 | 10.48 | 0.629 | 13.45 | 11.29 |
| 40° | 0.807 | 22.14 | 13.45 | 0.728 | 18.01 | 12.55 | 220° | 0.616 | 12.92 | 11.11 | 0.665 | 15.06 | 11.78 |
| 45° | 0.822 | 22.96 | 13.61 | 0.702 | 16.77 | 12.25 | 225° | 0.667 | 15.11 | 11.79 | 0.696 | 16.47 | 12.17 |
| 50° | 0.831 | 23.45 | 13.70 | 0.675 | 15.50 | 11.90 | 230° | 0.710 | 17.14 | 12.34 | 0.724 | 17.82 | 12.51 |
| 55° | 0.832 | 23.54 | 13.72 | 0.644 | 14.10 | 11.49 | 235° | 0.744 | 18.81 | 12.74 | 0.748 | 19.01 | 12.79 |
| 60° | 0.813 | 22.48 | 13.52 | 0.608 | 12.57 | 10.99 | 240° | 0.768 | 20.07 | 13.03 | 0.766 | 19.97 | 13.00 |
| 65° | 0.771 | 20.19 | 13.05 | 0.569 | 11.02 | 10.42 | 245° | 0.783 | 20.86 | 13.19 | 0.780 | 20.69 | 13.16 |
| 70° | 0.704 | 16.87 | 12.27 | 0.527 | 9.44 | 9.75 | 250° | 0.789 | 21.17 | 13.26 | 0.789 | 21.16 | 13.25 |
| 75° | 0.615 | 12.84 | 11.09 | 0.481 | 7.85 | 8.95 | 255° | 0.787 | 21.08 | 13.24 | 0.793 | 21.38 | 13.30 |
| 80° | 0.501 | 8.54 | 9.31 | 0.431 | 6.32 | 8.01 | 260° | 0.784 | 20.88 | 13.20 | 0.796 | 21.52 | 13.33 |
| 85° | 0.370 | 4.65 | 6.68 | 0.381 | 4.93 | 6.93 | 265° | 0.782 | 20.79 | 13.18 | 0.800 | 21.78 | 13.38 |
| 90° | 0.257 | 2.24 | 3.50 | 0.333 | 3.77 | 5.76 | 270° | 0.790 | 21.23 | 13.27 | 0.809 | 22.23 | 13.47 |
| 95° | 0.167 | 0.94 | -0.25 | 0.289 | 2.85 | 4.55 | 275° | 0.812 | 22.42 | 13.51 | 0.820 | 22.87 | 13.59 |
| 100° | 0.101 | 0.34 | -4.64 | 0.258 | 2.26 | 3.55 | 280° | 0.847 | 24.42 | 13.88 | 0.835 | 23.72 | 13.75 |
| 105° | 0.058 | 0.11 | -9.42 | 0.241 | 1.97 | 2.95 | 285° | 0.896 | 27.32 | 14.36 | 0.853 | 24.76 | 13.94 |
| 110° | 0.039 | 0.05 | -12.85 | 0.239 | 1.93 | 2.87 | 290° | 0.943 | 30.22 | 14.80 | 0.872 | 25.84 | 14.12 |
| 115° | 0.041 | 0.06 | -12.51 | 0.247 | 2.08 | 3.18 | 295° | 0.975 | 32.35 | 15.10 | 0.887 | 26.77 | 14.28 |
| 120° | 0.049 | 0.08 | -10.80 | 0.263 | 2.36 | 3.72 | 300° | 0.995 | 33.63 | 15.27 | 0.900 | 27.52 | 14.40 |
| 125° | 0.065 | 0.14 | -8.48 | 0.281 | 2.68 | 4.28 | 305° | 1.000 | 34.00 | 15.31 | 0.908 | 28.06 | 14.48 |
| 130° | 0.086 | 0.25 | -5.99 | 0.298 | 3.02 | 4.80 | 310° | 0.998 | 33.86 | 15.30 | 0.914 | 28.40 | 14.53 |
| 135° | 0.114 | 0.44 | -3.56 | 0.312 | 3.32 | 5.21 | 315° | 0.987 | 33.15 | 15.20 | 0.914 | 28.38 | 14.53 |
| 140° | 0.148 | 0.74 | -1.29 | 0.324 | 3.56 | 5.51 | 320° | 0.968 | 31.86 | 15.03 | 0.910 | 28.15 | 14.49 |
| 145° | 0.188 | 1.21 | 0.81 | 0.331 | 3.72 | 5.71 | 325° | 0.940 | 30.04 | 14.78 | 0.904 | 27.82 | 14.44 |
| 150° | 0.235 | 1.88 | 2.74 | 0.340 | 3.93 | 5.94 | 330° | 0.903 | 27.73 | 14.43 | 0.896 | 27.31 | 14.36 |
| 155° | 0.287 | 2.80 | 4.47 | 0.347 | 4.08 | 6.11 | 335° | 0.857 | 25.00 | 13.98 | 0.889 | 26.86 | 14.29 |
| 160° | 0.335 | 3.81 | 5.81 | 0.354 | 4.27 | 6.30 | 340° | 0.807 | 22.16 | 13.46 | 0.879 | 26.28 | 14.20 |
| 165° | 0.377 | 4.82 | 6.83 | 0.367 | 4.59 | 6.61 | 345° | 0.765 | 19.90 | 12.99 | 0.871 | 25.81 | 14.12 |
| 170° | 0.412 | 5.77 | 7.61 | 0.386 | 5.07 | 7.05 | 350° | 0.732 | 18.21 | 12.60 | 0.861 | 25.19 | 14.01 |
| 175° | 0.441 | 6.61 | 8.20 | 0.408 | 5.67 | 7.54 | 355° | 0.707 | 17.00 | 12.31 | 0.852 | 24.66 | 13.92 |

| | | |
|----------------------------|--------------------------|--------------------------|
| Polarization: | Horizontal | Vertical |
| Maximum Field: | 1.000 @ 304° True | 0.915 @ 312° True |
| Minimum Field: | 0.038 @ 111° True | 0.238 @ 108° True |
| RMS: | 0.668 | 0.668 |
| Maximum ERP: | 34.000 kW | 28.467 kW |
| Maximum Power Gain: | 4.066 (6.092 dB) | 3.405 (5.321 dB) |

Total Input Power: 8.361 kW



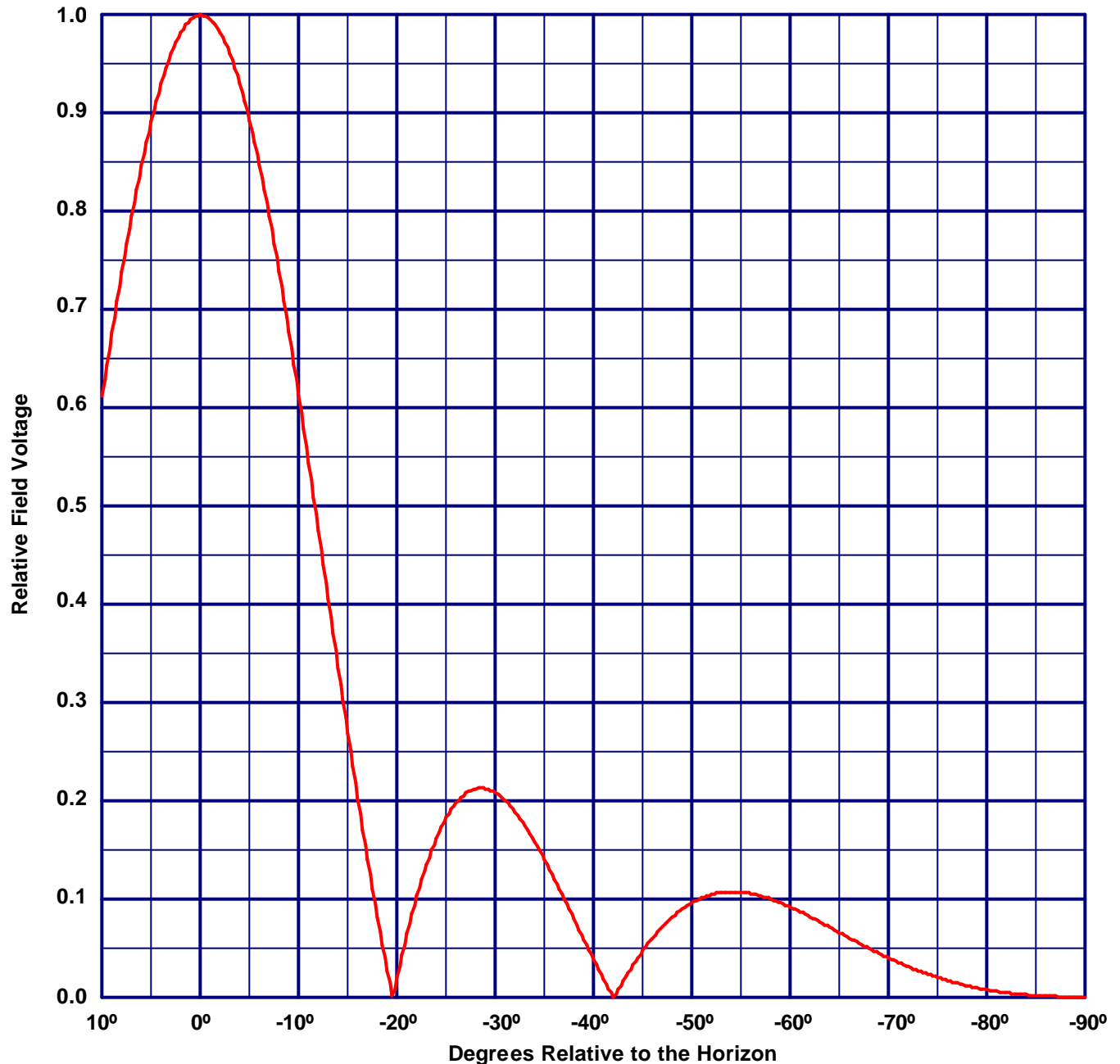
Vertical Plane Relative Field Pattern

WFBE, Flint, MI, 95.1 MHz

Figure#: 3

Date: 11/20/2009

A 6 level, .5 wave-length spaced LP-6E-DA-HW directional antenna with 0° beam tilt, 0% null fill and a H/V maximum power ratio of 1.194



Vertical Polarization Gain:

Maximum: 3.405 (5.321 dB)

Horizontal Plane: 3.405 (5.321 dB)

Horizontal Polarization Gain:

Maximum: 4.066 (6.092 dB)

Horizontal Plane: 4.066 (6.092 dB)

Directional Antenna System for WFBE, Flint, Michigan

(Continued)

ANTENNA SPECIFICATIONS

| | |
|-----------------|-------------|
| Antenna Type: | MP-6E-DA-HW |
| Frequency: | 95.1 MHz |
| Number of Bays: | Six |

MECHANICAL SPECIFICATIONS

| | |
|---|------------|
| Mounting: | Custom |
| System length: | 34 ft 4 in |
| Aperture length required: | 40 ft 9 in |
| Orientation: | 310° true |
| Input flange to the antenna 3 1/8 " female. | |

ELECTRICAL SPECIFICATIONS

(For directional use)

| | |
|--------------------------------|------------------------|
| Maximum horizontal ERP: | 34.000 kW (15.315 dBk) |
| Horizontal maximum power gain: | 4.066 (6.0923 dB) |
| Maximum vertical ERP: | 28.467 kW (14.543 dBk) |
| Vertical maximum power gain: | 3.405 (5.321 dB) |
| Total input power: | 8.361 kW (9.222 dBk) |

