



**SYSTEMS WITH RELIABILITY, LP**  
BROADCAST ANTENNAS AND TRANSMISSION LINE

**PATTERN CERTIFICATION**  
**DIRECTIONAL FM ANTENNA**  
**WYSZ**  
**July 18, 2017**

<b>Call Sign</b>	:	WYSZ
<b>Location</b>	:	Maumee, OH
<b>Frequency</b>	:	89.3 MHz
<b>Channel</b>	:	207A
<b>Antenna Model</b>	:	FMEC/3-PLUS-DA
<b>Maximum Antenna Gain</b>		
<b>Horizontal</b>	:	<b>3.035 / 4.822 dB</b>
<b>Vertical</b>	:	<b>3.035 / 4.822 dB</b>

**ANTENNA DESCRIPTION**

A custom designed FMEC/3-PLUS-DA antenna was fabricated to conform to the prescribed directional azimuth pattern. The antenna consists of three (3) circularly polarized, cross-V dipole radiating elements full-wave spaced mounted to a 54" (INCH) face tower. The antenna points 180 degrees from true north.

**DESCRIPTION OF TEST PROCEDURE**

The test antenna consisted of a single third-scale bay. The antenna was mounted to a third-scale pipe, which was mounted to a third-scale pole by use of third-scale brackets identical to those shipped with the final, full-scale antenna. For testing, the entire third-scale model was then mounted atop a 20' (foot) high platform, and all feed cables were properly grounded. Horizontal and vertical readings were taken. The desired directional pattern was obtained by adjusting the distance between the tower and the antenna, and modifying the direction of the azimuth heading.

**DESCRIPTION OF TEST PARAMETERS AND EQUIPMENT**

Horizontal and vertical pattern readings were taken by mounting a source antenna - a vertical/horizontal dipole, Cavity Back Resonator (CBR) antenna bay - approximately 100' (feet) from the third-scale antenna model. The source antenna's height was adjusted to achieve a uniform field at the third-scale test antenna location. The CBR antenna was operated in receive mode, at frequency 267.9 MHz. The third-scale test antenna was then rotated clockwise in order to achieve 360° (degree) pattern readings. A gain reference was taken using a dipole tuned to 267.9 MHz. Nowhere did the received signal, or resultant documentation, exceed a maximum to minimum ratio of 15dB (decibels).

## TEST RESULTS

The attached calculations verify that the **RMS** value of this antenna is **85.5%** of the **RMS** value of the pattern authorized in the related FCC file **BMPED-20160613AAX**. The vertical component **RMS** value is **0.650**. The horizontal component **RMS** value is **0.750**. The circular polarized component **RMS** value is **0.797**.

Azimuth and elevation plots and associated tabulations of this antenna are included with this package.

Measured vertical polarized directivity:	2.368 / 3.74 dB
Measured horizontal polarized directivity:	1.776 / 2.49 dB
Measured circular polarized pattern directivity:	1.576 / 1.98 dB

Gain in each polarization was calculated using the following relation:

**GAIN** = Azimuth Directivity x Power Ratio Between Polarizations x Elevation Directivity

Using this relationship along with ratio measured at our testing facilities:

V-Pol. Gain = (2.36831)(.4285)(2.991)	= 3.035 / 4.822 dB
H-Pol. Gain = (1.77559)(.5715)(2.991)	= 3.035 / 4.822 dB

## INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **67.66 meters (221.99 ft.)** above ground level. The antenna aperture is **22.03 feet**. No other antennas are to be mounted within **10 feet** of the antenna. No other obstructions other than those specified by original drawings supplied are to be mounted at the same level as the antenna. The antenna is to be oriented **180 degrees** from true North.

The system's orientation and the mounting details are described in the following drawings:

DRAWING NO.	TITLE
2085D00	ELEVATION
2085D01	ANTENNA ORIENTATION
2085D02	MOUNTING PIPE INSTALLATION
2105A10	TEST RANGE SCHEMATIC

The antenna elevation is shown on **DWG. 2085D00**. The antenna elements shall be aligned at the same heading as in **DWG. 2085D01**. This will ensure that the antenna is oriented properly at **180** degrees from true North. **DWG. 2085D02** shows the mounting pipe installation. The test range schematic **DWG. 2105A10** shows the mounting configuration of the antenna setup on our range.

## DOCUMENT EXHIBITS

The following exhibits are included as part of this Certificate of Compliance:

<b>Exhibit 1</b>	Circular Polarized Azimuth Pattern Field Strength Tabulations (Composite)
<b>Exhibit 2</b>	Measured Horizontal Polarized Azimuth Pattern Measured Field Strength Tabulations (Horizontal)
<b>Exhibit 3</b>	Measured Vertical Polarized Azimuth Pattern Measured Field Strength Tabulations (Vertical)
<b>Exhibit 4</b>	Elevation Pattern Elevation Tabulations
<b>Exhibit 5</b>	Antenna Data Sheet
<b>Exhibit 6</b>	RMS Calculations
<b>Exhibit 7</b>	Drawings

## TEST EQUIPMENT

<b>Network Analyzer</b>	:	Hewlett Packard Model # 8753C Serial Number: 08753 – 69138
<b>Computer</b>	:	Pentium 3, 450 MHz, SAMS Range Program
<b>Printer</b>	:	Hewlett-Packard Laser Jet 6L
<b>Positioner</b>	:	Orbit Positioner

All equipment is calibrated to ANSI/NCSS Z540-1-1994 specs

*Prepared by:*



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**Kevin W. Rager**  
Antenna Engineer  
Systems With Reliability, LP

## Surveyor's Declaration

I, \_\_\_\_\_, subject to the penalties of perjury, do declare the following:

- 1.) I am a licensed surveyor in the state(s) of \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.
- 2.) I have provided professional services to \_\_\_\_\_  
(permit tee name), permit tee of WYSZ-FM, Maumee (city of license), OH  
(state), during the installation of the WYSZ-FM directional antenna.
- 3.) I certify that the WYSZ-FM directional antenna has been oriented at the proper azimuth as authorized in the drawings section (Exhibit 7) of the Proof of Performance for WYSZ-FM. Namely Drawing #2085D01 shows the proper heading to be 180 degrees from true North.

Sign \_\_\_\_\_

Dated: \_\_\_\_\_mm/dd/yy

## Engineer's Declaration

I, \_\_\_\_\_, subject to the penalties of perjury, do declare the following:

1.) I am the holder of a valid General Radio Telephone Operators License, Number \_\_\_\_\_ (FCC License No.)

2.) I have been a member of the Society of Broadcast Engineer's since \_\_\_\_\_(year)

3.) That I have been employed as a technical consultant with the firm of:

\_\_\_\_\_ (firm name), of

\_\_\_\_\_ (city state)

4.) That \_\_\_\_\_ (Firm's Name) was retained by \_\_\_\_\_ (Permit tee's Name) for the purpose of preparing its application for the construction permit of WYSZ-FM Maumee (City), Ohio (State), from which the underlying Construction Permit (FCC File Number BMPED-20160613AAX) was granted by the Commission.

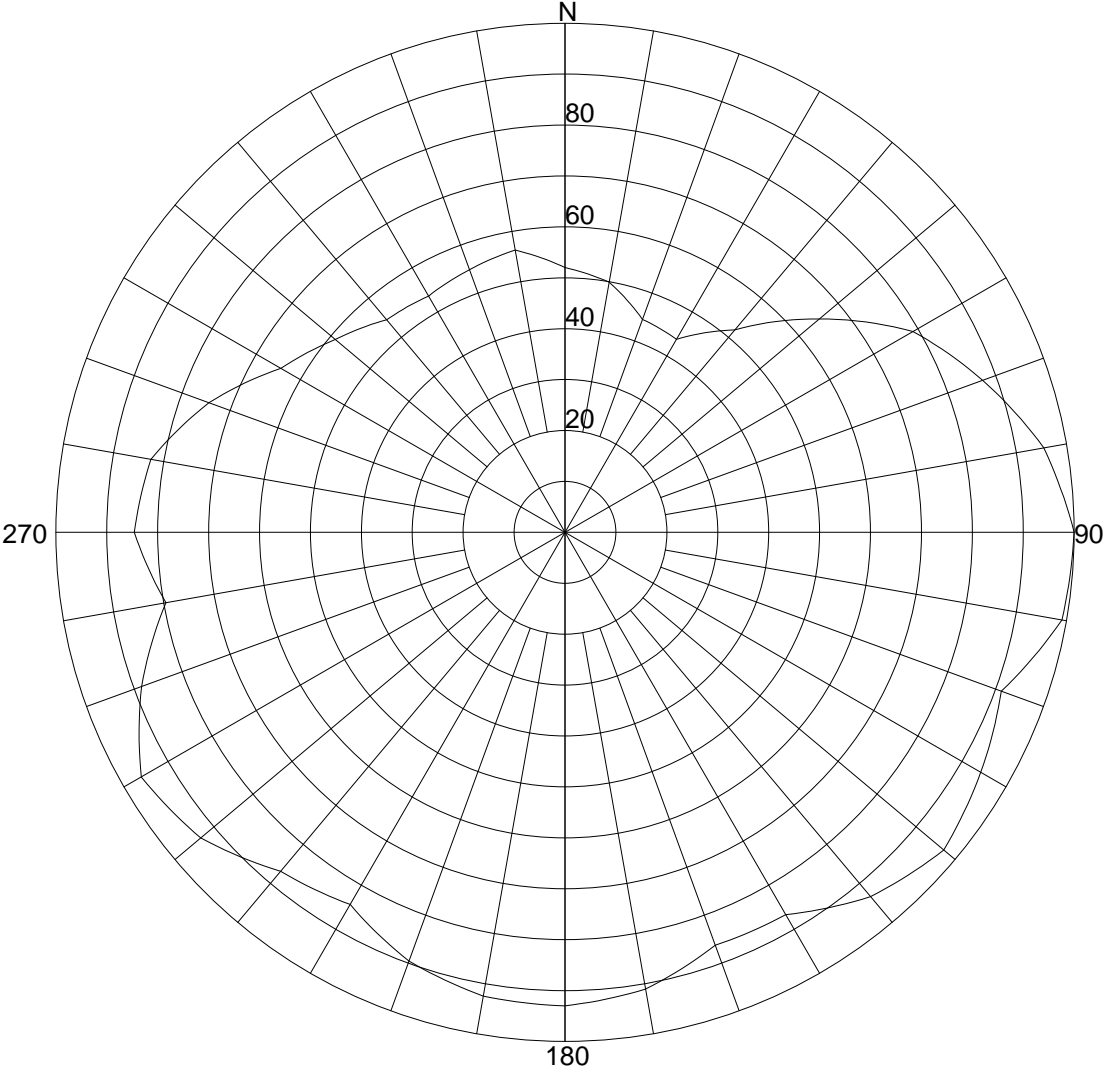
1.) That I am familiar with the terms and conditions of the WYSZ-FM Construction Permit.

2.) I hereby certify that I have overseen the installation of the WYSZ-FM directional antenna and that the installation was complete to the manufacturer's instructions outlined in the Proof of Performance Drawings section (Exhibit 7) for WYSZ-FM.

Sign \_\_\_\_\_

Dated: \_\_\_\_\_mm/dd/yy

Exhibit 1: Circular Polarized Azimuth Pattern



Azimuth Pattern

Systems With Reliability

Scale: Linear  
Unit: Relative Field

CLIENT: WYSZ	Date: 6/6/2017
ANTENNA TYPE: FMEC/3-PLUS-DA	
FREQUENCY: 89.3 MHz	
PATTERN POL.: Circular	CIRCULARITY(+/-dB):
AZ. DIRECTIVITY: 1.57596 / 1.98dB	PATTERN RMS: 0.797

## Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.5200 (-5.68 )	180	.9300 (-0.63 )
5	.5095 (-5.86 )	185	.9275 (-0.65 )
10	.4990 (-6.04 )	190	.9250 (-0.68 )
15	.4720 (-6.52 )	195	.9105 (-0.81 )
20	.4450 (-7.03 )	200	.8960 (-0.95 )
25	.4415 (-7.1 )	205	.8700 (-1.21 )
30	.4380 (-7.17 )	210	.8440 (-1.47 )
35	.4785 (-6.4 )	215	.8565 (-1.35 )
40	.5190 (-5.7 )	220	.8690 (-1.22 )
45	.5855 (-4.65 )	225	.9015 (-0.9 )
50	.6520 (-3.72 )	230	.9340 (-0.59 )
55	.7205 (-2.85 )	235	.9475 (-0.47 )
60	.7890 (-2.06 )	240	.9610 (-0.35 )
65	.8310 (-1.61 )	245	.9230 (-0.7 )
70	.8730 (-1.18 )	250	.8850 (-1.06 )
75	.9140 (-0.78 )	255	.8405 (-1.51 )
80	.9550 (-0.4 )	260	.7960 (-1.98 )
85	.9775 (-0.2 )	265	.8210 (-1.71 )
90	1.0000 ( 0 )	270	.8460 (-1.45 )
95	.9955 (-0.04 )	275	.8360 (-1.56 )
100	.9910 (-0.08 )	280	.8260 (-1.66 )
105	.9515 (-0.43 )	285	.7850 (-2.1 )
110	.9120 (-0.8 )	290	.7440 (-2.57 )
115	.9275 (-0.65 )	295	.6940 (-3.17 )
120	.9430 (-0.51 )	300	.6440 (-3.82 )
125	.9570 (-0.38 )	305	.6165 (-4.2 )
130	.9710 (-0.26 )	310	.5890 (-4.6 )
135	.9525 (-0.42 )	315	.5670 (-4.93 )
140	.9340 (-0.59 )	320	.5450 (-5.27 )
145	.9005 (-0.91 )	325	.5405 (-5.34 )
150	.8670 (-1.24 )	330	.5360 (-5.42 )
155	.8650 (-1.26 )	335	.5425 (-5.31 )
160	.8630 (-1.28 )	340	.5490 (-5.21 )
165	.8870 (-1.04 )	345	.5560 (-5.1 )
170	.9110 (-0.81 )	350	.5630 (-4.99 )
175	.9205 (-0.72 )	355	.5415 (-5.33 )

## Systems With Reliability

CLIENT: WYSZ

Date: 6/6/2017

ANTENNA TYPE: FMEC/3-PLUS-DA

FREQUENCY: 89.3 MHz

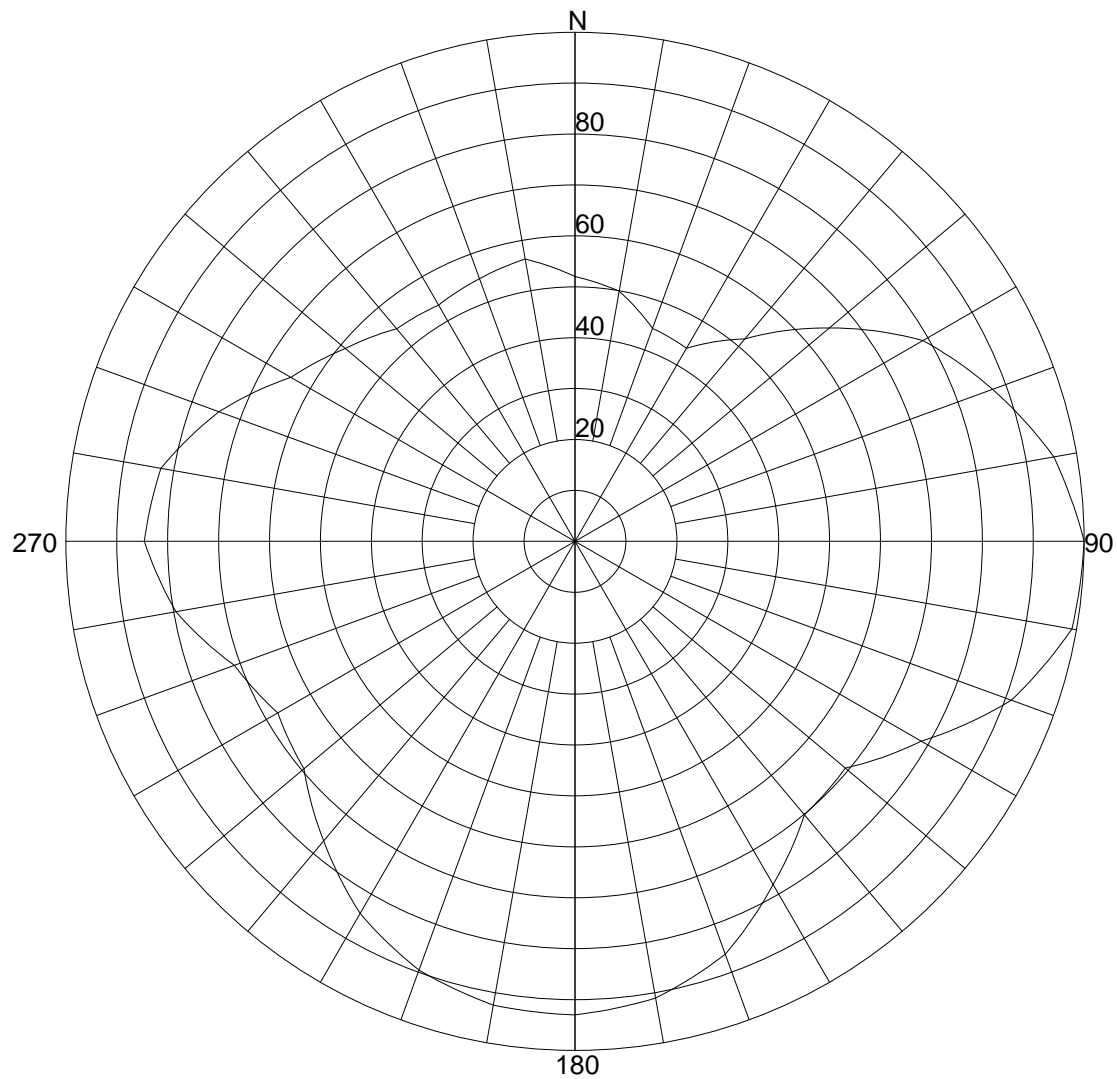
PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.57596 / 1.98dB

PATTERN RMS: 0.797

## Exhibit 2: Measured Horizontal Polarized Azimuth Pattern



### Azimuth Pattern

## Systems With Reliability

Scale: Linear

Unit: Relative Field

CLIENT: WYSZ

Date: 6/6/2017

ANTENNA TYPE: FMEC/3-PLUS-DA

FREQUENCY: 89.3 MHz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.77559 / 2.49dB

PATTERN RMS: 0.750



## Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.5200 (-5.68 )	180	.9300 (-0.63 )
5	.5095 (-5.86 )	185	.9275 (-0.65 )
10	.4990 (-6.04 )	190	.9250 (-0.68 )
15	.4720 (-6.52 )	195	.9105 (-0.81 )
20	.4450 (-7.03 )	200	.8960 (-0.95 )
25	.4415 (-7.1 )	205	.8700 (-1.21 )
30	.4380 (-7.17 )	210	.8440 (-1.47 )
35	.4785 (-6.4 )	215	.8060 (-1.87 )
40	.5190 (-5.7 )	220	.7680 (-2.29 )
45	.5855 (-4.65 )	225	.7315 (-2.72 )
50	.6520 (-3.72 )	230	.6950 (-3.16 )
55	.7205 (-2.85 )	235	.6845 (-3.29 )
60	.7890 (-2.06 )	240	.6740 (-3.43 )
65	.8310 (-1.61 )	245	.6930 (-3.19 )
70	.8730 (-1.18 )	250	.7120 (-2.95 )
75	.9140 (-0.78 )	255	.7540 (-2.45 )
80	.9550 (-0.4 )	260	.7960 (-1.98 )
85	.9775 (-0.2 )	265	.8210 (-1.71 )
90	1.0000 ( 0 )	270	.8460 (-1.45 )
95	.9955 (-0.04 )	275	.8360 (-1.56 )
100	.9910 (-0.08 )	280	.8260 (-1.66 )
105	.9515 (-0.43 )	285	.7850 (-2.1 )
110	.9120 (-0.8 )	290	.7440 (-2.57 )
115	.8485 (-1.43 )	295	.6940 (-3.17 )
120	.7850 (-2.1 )	300	.6440 (-3.82 )
125	.7390 (-2.63 )	305	.6165 (-4.2 )
130	.6930 (-3.19 )	310	.5890 (-4.6 )
135	.6970 (-3.14 )	315	.5670 (-4.93 )
140	.7010 (-3.09 )	320	.5450 (-5.27 )
145	.7395 (-2.62 )	325	.5405 (-5.34 )
150	.7780 (-2.18 )	330	.5360 (-5.42 )
155	.8205 (-1.72 )	335	.5425 (-5.31 )
160	.8630 (-1.28 )	340	.5490 (-5.21 )
165	.8870 (-1.04 )	345	.5560 (-5.1 )
170	.9110 (-0.81 )	350	.5630 (-4.99 )
175	.9205 (-0.72 )	355	.5415 (-5.33 )

## Systems With Reliability

CLIENT: WYSZ

Date: 6/6/2017

ANTENNA TYPE: FMEC/3-PLUS-DA

FREQUENCY: 89.3 MHz

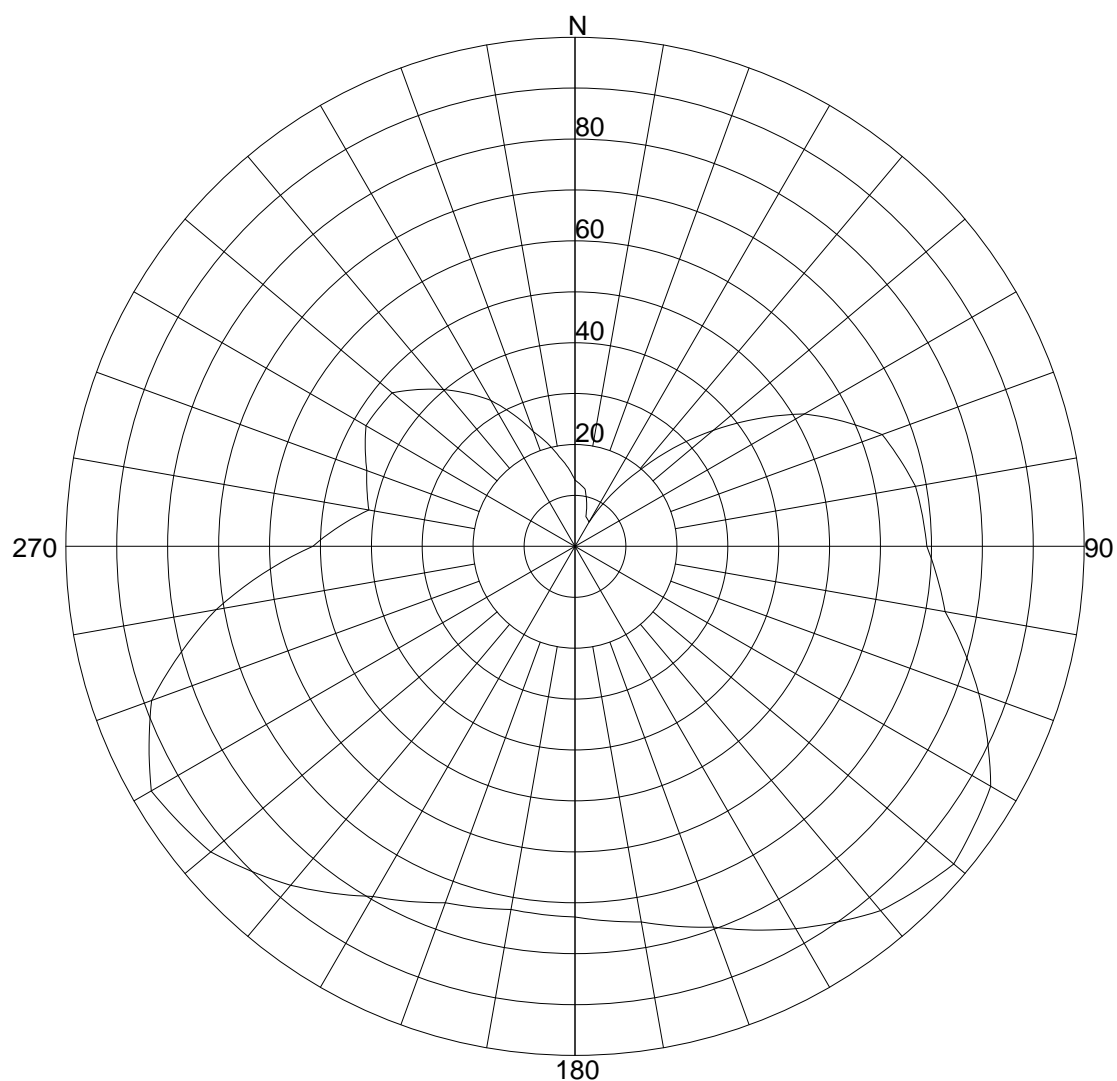
PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.77559 / 2.49dB

PATTERN RMS: 0.750

### Exhibit 3: Measured Vertical Polarized Azimuth Pattern



## Azimuth Pattern

Scale: Linear

Unit: Relative Field

## Systems With Reliability

CLIENT: WYSZ

Date: 6/6/2017

ANTENNA TYPE: FMEC/3-PLUS-DA

FREQUENCY: 89.3 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.36831 / 3.74dB

PATTERN RMS: 0.650

## Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.1300 (-17.72 )	180	.7280 (-2.76 )
5	.1220 (-18.27 )	185	.7260 (-2.78 )
10	.1140 (-18.86 )	190	.7240 (-2.81 )
15	.0880 (-21.11 )	195	.7345 (-2.68 )
20	.0620 (-24.15 )	200	.7450 (-2.56 )
25	.0585 (-24.66 )	205	.7695 (-2.28 )
30	.0550 (-25.19 )	210	.7940 (-2 )
35	.1230 (-18.2 )	215	.8315 (-1.6 )
40	.1910 (-14.38 )	220	.8690 (-1.22 )
45	.2725 (-11.29 )	225	.9015 (-0.9 )
50	.3540 (-9.02 )	230	.9340 (-0.59 )
55	.4370 (-7.19 )	235	.9475 (-0.47 )
60	.5200 (-5.68 )	240	.9610 (-0.35 )
65	.5810 (-4.72 )	245	.9230 (-0.7 )
70	.6420 (-3.85 )	250	.8850 (-1.06 )
75	.6605 (-3.6 )	255	.8005 (-1.93 )
80	.6790 (-3.36 )	260	.7160 (-2.9 )
85	.6850 (-3.29 )	265	.6155 (-4.22 )
90	.6910 (-3.21 )	270	.5150 (-5.76 )
95	.7145 (-2.92 )	275	.4630 (-6.69 )
100	.7380 (-2.64 )	280	.4110 (-7.72 )
105	.7910 (-2.04 )	285	.4230 (-7.47 )
110	.8440 (-1.47 )	290	.4350 (-7.23 )
115	.8935 (-0.98 )	295	.4545 (-6.85 )
120	.9430 (-0.51 )	300	.4740 (-6.48 )
125	.9570 (-0.38 )	305	.4715 (-6.53 )
130	.9710 (-0.26 )	310	.4690 (-6.58 )
135	.9525 (-0.42 )	315	.4355 (-7.22 )
140	.9340 (-0.59 )	320	.4020 (-7.92 )
145	.9005 (-0.91 )	325	.3665 (-8.72 )
150	.8670 (-1.24 )	330	.3310 (-9.6 )
155	.8315 (-1.6 )	335	.2855 (-10.89 )
160	.7960 (-1.98 )	340	.2400 (-12.4 )
165	.7725 (-2.24 )	345	.2095 (-13.58 )
170	.7490 (-2.51 )	350	.1790 (-14.94 )
175	.7385 (-2.63 )	355	.1545 (-16.22 )

## Systems With Reliability

CLIENT: WYSZ

Date: 6/6/2017

ANTENNA TYPE: FMEC/3-PLUS-DA

FREQUENCY: 89.3 MHz

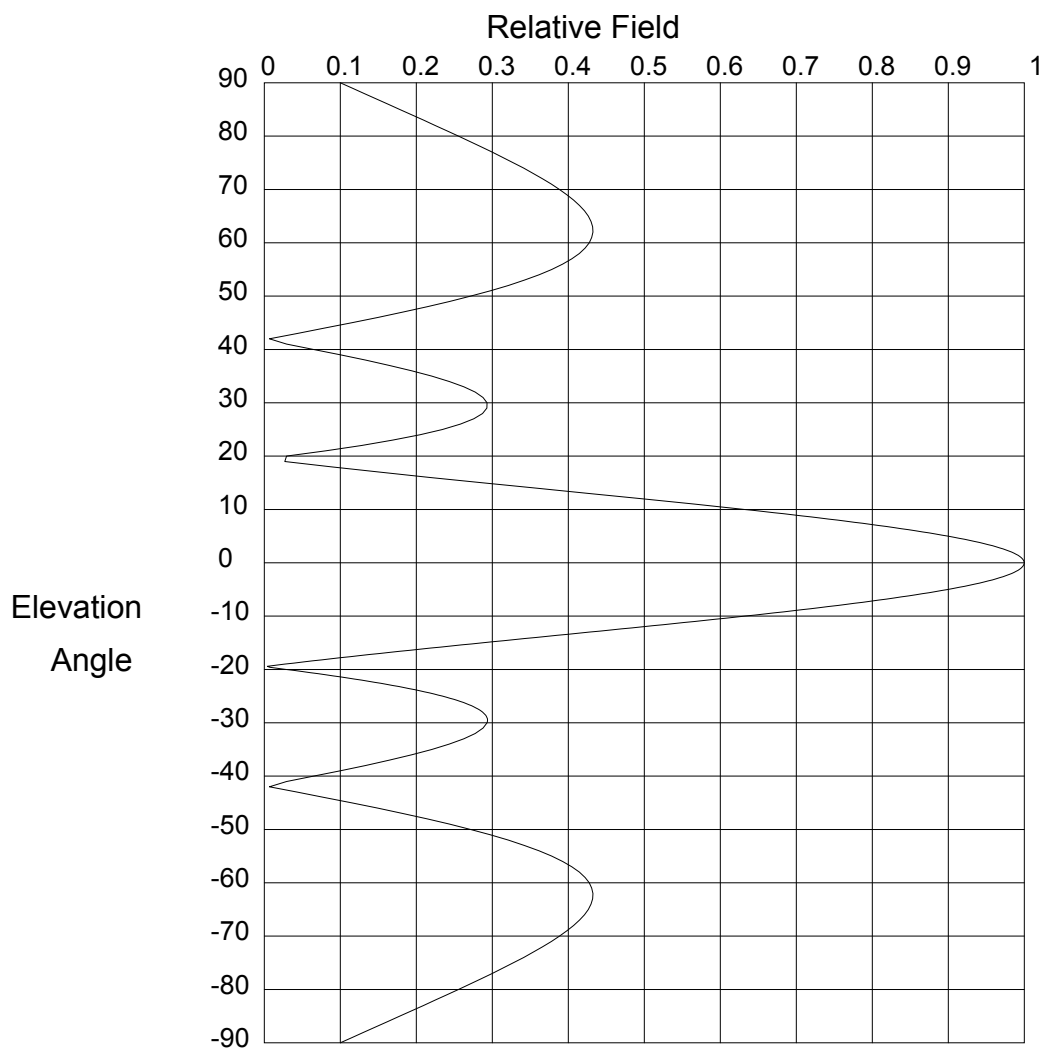
PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.36831 / 3.74dB

PATTERN RMS: 0.650

#### Exhibit 4: Elevation Pattern



### Elevation Pattern

Scale: Linear

Units: Field, Relative

## Systems With Reliability

CLIENT: WYSZ

Date: 6/6/2017

ANTENNA TYPE: FMEC/3-PLUS-DA

FREQUENCY: 89.3 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.991/4.758 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.991/4.758 dBd

Null Fill(s)(%) : 0, 0, 0

## Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
90.0	.10 (-20)	52.0	.321 (-9.865)	14.0	.357 (-8.938 )
89.0	.116 (-18.733)	51.0	.298 (-10.529)	13.0	.428 (-7.377 )
88.0	.131 (-17.628)	50.0	.272 (-11.318)	12.0	.498 (-6.062 )
87.0	.147 (-16.648)	49.0	.244 (-12.26)	11.0	.566 (-4.942 )
86.0	.163 (-15.769)	48.0	.214 (-13.395)	10.0	.632 (-3.982 )
85.0	.178 (-14.972)	47.0	.182 (-14.784)	9.8	.645 (-3.807 )
84.0	.194 (-14.244)	46.0	.149 (-16.526)	9.6	.658 (-3.637 )
83.0	.21 (-13.575)	45.0	.115 (-18.805)	9.4	.671 (-3.472 )
82.0	.225 (-12.957)	44.0	.079 (-22.009)	9.2	.683 (-3.312 )
81.0	.24 (-12.385)	43.0	.043 (-27.275)	9.0	.695 (-3.157 )
80.0	.256 (-11.852)	42.0	.007 (-43.22)	8.8	.707 (-3.006 )
79.0	.271 (-11.356)	41.0	.029 (-30.637)	8.6	.719 (-2.86 )
78.0	.285 (-10.893)	40.0	.065 (-23.719)	8.4	.731 (-2.719 )
77.0	.30 (-10.462)	39.0	.10 (-19.999)	8.2	.743 (-2.582 )
76.0	.314 (-10.06)	38.0	.133 (-17.494)	8.0	.754 (-2.449 )
75.0	.328 (-9.686)	37.0	.165 (-15.651)	7.8	.766 (-2.321 )
74.0	.341 (-9.339)	36.0	.194 (-14.237)	7.6	.777 (-2.196 )
73.0	.354 (-9.018)	35.0	.22 (-13.132)	7.4	.787 (-2.076 )
72.0	.366 (-8.724)	34.0	.243 (-12.271)	7.2	.798 (-1.959 )
71.0	.378 (-8.455)	33.0	.263 (-11.612)	7.0	.808 (-1.847 )
70.0	.389 (-8.211)	32.0	.278 (-11.131)	6.8	.819 (-1.738 )
69.0	.398 (-7.995)	31.0	.288 (-10.815)	6.6	.829 (-1.633 )
68.0	.407 (-7.804)	30.0	.293 (-10.658)	6.4	.838 (-1.532 )
67.0	.415 (-7.642)	29.0	.293 (-10.662)	6.2	.848 (-1.434 )
66.0	.421 (-7.507)	28.0	.287 (-10.834)	6.0	.857 (-1.34 )
65.0	.426 (-7.403)	27.0	.276 (-11.192)	5.8	.866 (-1.249 )
64.0	.43 (-7.329)	26.0	.258 (-11.764)	5.6	.875 (-1.162 )
63.0	.432 (-7.287)	25.0	.234 (-12.598)	5.4	.883 (-1.078 )
62.0	.432 (-7.281)	24.0	.205 (-13.772)	5.2	.891 (-0.998 )
61.0	.431 (-7.31)	23.0	.169 (-15.43)	5.0	.899 (-0.921 )
60.0	.428 (-7.38)	22.0	.128 (-17.86)	4.8	.907 (-0.847 )
59.0	.422 (-7.491)	21.0	.081 (-21.813)	4.6	.914 (-0.777 )
58.0	.415 (-7.648)	20.0	.029 (-30.657)	4.4	.922 (-0.709 )
57.0	.405 (-7.856)	19.0	.027 (-31.323)	4.2	.928 (-0.645 )
56.0	.393 (-8.119)	18.0	.088 (-21.139)	4.0	.935 (-0.584 )
55.0	.378 (-8.442)	17.0	.152 (-16.379)	3.8	.941 (-0.527 )
54.0	.362 (-8.835)	16.0	.219 (-13.21)	3.6	.947 (-0.472 )
53.0	.343 (-9.305)	15.0	.287 (-10.833)	3.4	.953 (-0.421 )

## Systems With Reliability

Page 1 of 3

CLIENT: WYSZ

Date: 6/6/2017

ANTENNA TYPE: FMEC/3-PLUS-DA

FREQUENCY: 89.3 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.991/4.758 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.991/4.758 dBd

Null Fill(s)(%) : 0, 0, 0

## Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
3.2	.958 (-0.372)	-4.4	.922 (-0.709)	-12.0	.498 (-6.062)
3.0	.963 (-0.327)	-4.6	.914 (-0.777)	-12.2	.484 (-6.308)
2.8	.968 (-0.284)	-4.8	.907 (-0.847)	-12.4	.47 (-6.562)
2.6	.972 (-0.245)	-5.0	.899 (-0.921)	-12.6	.456 (-6.825)
2.4	.976 (-0.208)	-5.2	.891 (-0.998)	-12.8	.442 (-7.096)
2.2	.98 (-0.175)	-5.4	.883 (-1.078)	-13.0	.428 (-7.377)
2.0	.983 (-0.145)	-5.6	.875 (-1.162)	-13.2	.414 (-7.667)
1.8	.987 (-0.117)	-5.8	.866 (-1.249)	-13.4	.40 (-7.968)
1.6	.989 (-0.092)	-6.0	.857 (-1.34)	-13.6	.385 (-8.28)
1.4	.992 (-0.071)	-6.2	.848 (-1.434)	-13.8	.371 (-8.603)
1.2	.994 (-0.052)	-6.4	.838 (-1.532)	-14.0	.357 (-8.938)
1.0	.996 (-0.036)	-6.6	.829 (-1.633)	-14.2	.343 (-9.287)
.8	.997 (-0.023)	-6.8	.819 (-1.738)	-14.4	.329 (-9.65)
.6	.999 (-0.013)	-7.0	.808 (-1.847)	-14.6	.315 (-10.027)
.4	.999 (-0.006)	-7.2	.798 (-1.959)	-14.8	.301 (-10.421)
.2	1.00 (-0.001)	-7.4	.787 (-2.076)	-15.0	.287 (-10.833)
.0	1.00 (0)	-7.6	.777 (-2.196)	-15.2	.273 (-11.263)
-.2	1.00 (-0.001)	-7.8	.766 (-2.321)	-15.4	.26 (-11.714)
-.4	.999 (-0.006)	-8.0	.754 (-2.449)	-15.6	.246 (-12.187)
-.6	.999 (-0.013)	-8.2	.743 (-2.582)	-15.8	.232 (-12.685)
-.8	.997 (-0.023)	-8.4	.731 (-2.719)	-16.0	.219 (-13.21)
-1.0	.996 (-0.036)	-8.6	.719 (-2.86)	-16.2	.205 (-13.766)
-1.2	.994 (-0.052)	-8.8	.707 (-3.006)	-16.4	.192 (-14.356)
-1.4	.992 (-0.071)	-9.0	.695 (-3.157)	-16.6	.178 (-14.984)
-1.6	.989 (-0.092)	-9.2	.683 (-3.312)	-16.8	.165 (-15.656)
-1.8	.987 (-0.117)	-9.4	.671 (-3.472)	-17.0	.152 (-16.379)
-2.0	.983 (-0.145)	-9.6	.658 (-3.637)	-17.2	.139 (-17.16)
-2.2	.98 (-0.175)	-9.8	.645 (-3.807)	-17.4	.126 (-18.01)
-2.4	.976 (-0.208)	-10.0	.632 (-3.982)	-17.6	.113 (-18.943)
-2.6	.972 (-0.245)	-10.2	.619 (-4.163)	-17.8	.10 (-19.978)
-2.8	.968 (-0.284)	-10.4	.606 (-4.349)	-18.0	.088 (-21.139)
-3.0	.963 (-0.327)	-10.6	.593 (-4.541)	-18.2	.075 (-22.464)
-3.2	.958 (-0.372)	-10.8	.58 (-4.739)	-18.4	.063 (-24.008)
-3.4	.953 (-0.421)	-11.0	.566 (-4.942)	-18.6	.051 (-25.862)
-3.6	.947 (-0.472)	-11.2	.553 (-5.153)	-18.8	.039 (-28.188)
-3.8	.941 (-0.527)	-11.4	.539 (-5.37)	-19.0	.027 (-31.323)
-4.0	.935 (-0.584)	-11.6	.525 (-5.593)	-19.2	.016 (-36.185)
-4.2	.928 (-0.645)	-11.8	.511 (-5.824)	-19.4	.004 (-47.865)

## Systems With Reliability

Page 2 of 3

CLIENT: WYSZ

Date: 6/6/2017

ANTENNA TYPE: FMEC/3-PLUS-DA

FREQUENCY: 89.3 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.991/4.758 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.991/4.758 dBd

Null Fill(s)(%) : 0, 0, 0

## Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
-19.6	.007 (-42.787)	-27.2	.278 (-11.104)	-54.0	.362 (-8.835 )
-19.8	.018 (-34.715)	-27.4	.281 (-11.025)	-55.0	.378 (-8.442 )
-20.0	.029 (-30.657)	-27.6	.283 (-10.953)	-56.0	.393 (-8.119 )
-20.2	.04 (-27.943)	-27.8	.285 (-10.89)	-57.0	.405 (-7.856 )
-20.4	.051 (-25.91)	-28.0	.287 (-10.834)	-58.0	.415 (-7.648 )
-20.6	.061 (-24.292)	-28.2	.289 (-10.785)	-59.0	.422 (-7.491 )
-20.8	.071 (-22.952)	-28.4	.29 (-10.744)	-60.0	.428 (-7.38 )
-21.0	.081 (-21.813)	-28.6	.291 (-10.71)	-61.0	.431 (-7.31 )
-21.2	.091 (-20.825)	-28.8	.292 (-10.682)	-62.0	.432 (-7.281 )
-21.4	.101 (-19.956)	-29.0	.293 (-10.662)	-63.0	.432 (-7.287 )
-21.6	.11 (-19.183)	-29.2	.293 (-10.648)	-64.0	.43 (-7.329 )
-21.8	.119 (-18.489)	-29.4	.294 (-10.641)	-65.0	.426 (-7.403 )
-22.0	.128 (-17.86)	-29.6	.294 (-10.64)	-66.0	.421 (-7.507 )
-22.2	.137 (-17.288)	-29.8	.294 (-10.646)	-67.0	.415 (-7.642 )
-22.4	.145 (-16.765)	-30.0	.293 (-10.658)	-68.0	.407 (-7.804 )
-22.6	.153 (-16.284)	-31.0	.288 (-10.815)	-69.0	.398 (-7.995 )
-22.8	.161 (-15.84)	-32.0	.278 (-11.131)	-70.0	.389 (-8.211 )
-23.0	.169 (-15.43)	-33.0	.263 (-11.612)	-71.0	.378 (-8.455 )
-23.2	.177 (-15.049)	-34.0	.243 (-12.271)	-72.0	.366 (-8.724 )
-23.4	.184 (-14.695)	-35.0	.22 (-13.132)	-73.0	.354 (-9.018 )
-23.6	.191 (-14.366)	-36.0	.194 (-14.237)	-74.0	.341 (-9.339 )
-23.8	.198 (-14.059)	-37.0	.165 (-15.651)	-75.0	.328 (-9.686 )
-24.0	.205 (-13.772)	-38.0	.133 (-17.494)	-76.0	.314 (-10.06 )
-24.2	.211 (-13.505)	-39.0	.10 (-19.999)	-77.0	.30 (-10.462 )
-24.4	.217 (-13.254)	-40.0	.065 (-23.719)	-78.0	.285 (-10.893 )
-24.6	.223 (-13.021)	-41.0	.029 (-30.637)	-79.0	.271 (-11.356 )
-24.8	.229 (-12.802)	-42.0	.007 (-43.22)	-80.0	.256 (-11.852 )
-25.0	.234 (-12.598)	-43.0	.043 (-27.275)	-81.0	.24 (-12.385 )
-25.2	.24 (-12.407)	-44.0	.079 (-22.009)	-82.0	.225 (-12.957 )
-25.4	.245 (-12.229)	-45.0	.115 (-18.805)	-83.0	.21 (-13.575 )
-25.6	.249 (-12.063)	-46.0	.149 (-16.526)	-84.0	.194 (-14.244 )
-25.8	.254 (-11.908)	-47.0	.182 (-14.784)	-85.0	.178 (-14.972 )
-26.0	.258 (-11.764)	-48.0	.214 (-13.395)	-86.0	.163 (-15.769 )
-26.2	.262 (-11.63)	-49.0	.244 (-12.26)	-87.0	.147 (-16.648 )
-26.4	.266 (-11.507)	-50.0	.272 (-11.318)	-88.0	.131 (-17.628 )
-26.6	.269 (-11.393)	-51.0	.298 (-10.529)	-89.0	.116 (-18.733 )
-26.8	.273 (-11.288)	-52.0	.321 (-9.865)	-90.0	.10 (-20 )
-27.0	.276 (-11.192)	-53.0	.343 (-9.305)	90.0	.00 (-50 )

## Systems With Reliability

Page 3 of 3

CLIENT: WYSZ

Date: 6/6/2017

ANTENNA TYPE: FMEC/3-PLUS-DA

FREQUENCY: 89.3 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.991/4.758 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.991/4.758 dBd

Null Fill(s)(%) : 0, 0, 0

# Exhibit 5: Antenna Data Sheet



**SYSTEMS WITH RELIABILITY, LP**

**BROADCAST ANTENNAS AND TRANSMISSION LINE**

## SYSTEM DATA SHEET

<b>Customer</b>	WYSZ
<b>Contact</b>	Alan Colwell
<b>Location</b>	Maumee, OH
<b>Antenna Model</b>	FMEC/3-PLUS-DA
<b>Channel / Frequency</b>	207A /89.3 MHz

### ELECTRICAL SPECIFICATIONS

#### Antenna Specifications:

	H-POL			V. Pol.	
License ERP ( KW)	2.700			2.700	
FCC Limit Pattern Directivity	1.153	0.618	dB	1.153	0.618 dB
Elevation Directivity	2.991	4.758	dB	2.991	4.758 dB
Azimuth Directivity	1.776	2.493	dB	2.368	3.744 dB
Composite Pattern	1.576	1.975	dB	1.576	1.975 dB
Polarization Ratio	0.572			0.428	
<b>RMS Comp./RMS Limit</b>	85.5 %				
Antenna Efficiency %	100			100	
Power Ratio ( Pol. Ratio X Efficiency)	0.5715			0.4285	
Antenna Gain	3.035	4.822	dB	3.035	4.822 dB

<b>Antenna Input Power (KW)</b>	0.890 kW	-0.508 (dBK)
---------------------------------	----------	--------------

#### Feed Line Specifications:

Line Type: Andrew	1 5/8" Foam 50 $\Omega$ LDF7-50
Attenuation Per 100 ft (dB)	0.193 dB
Line Length (ft) AGL + Horizontal Run	246.99 ft.
Total Line Attenuation (dB)	0.4767 dB
Line Efficiency	89.60 %
<b>Power Input to the Line (KW)</b>	0.993 kW -0.032 (dBK)

### MECHANICAL SPECIFICATIONS

<b>No. Of Bays</b>	3		
<b>Antenna Aperture</b>	22.03 ft.	6.71	meter
<b>Center of Radiation AGL</b>	221.99 ft.	67.66	meter
<b>Antenna Weight (Everything)</b>	275.00 lbs.	125.00	kg
<b>Windload (50/33)</b>	440.00 lbs.	<b>Windload CaAc</b>	11.80 ft^2

Prepared by:

Kevin W. Rager  
SWR, LP ENGINEERING



## Exhibit 6: RMS Calculations



**SYSTEMS WITH RELIABILITY, LP**  
Broadcast Antennas and Transmission Systems

### WYSZ Antenna RMS Comparison

#### PROPOSED ANTENNA

Azimuth Heading	Relative Field
0	0.523
10	0.515
20	0.509
30	0.587
40	0.731
50	0.916
60	1
70	1
80	1
90	1
100	1
110	1
120	1
130	1
140	1
150	1
160	1
170	1
180	1
190	1
200	1
210	1
220	1
230	1
240	1
250	1
260	1
270	1
280	1
290	1
300	1
310	1
320	1
330	0.915
340	0.73
350	0.598

#### DESIGNED ANTENNA

Azimuth Heading	Relative Field
0	0.52
10	0.499
20	0.445
30	0.438
40	0.519
50	0.652
60	0.789
70	0.873
80	0.955
90	1
100	0.991
110	0.912
120	0.943
130	0.971
140	0.934
150	0.867
160	0.863
170	0.911
180	0.93
190	0.925
200	0.896
210	0.844
220	0.869
230	0.934
240	0.961
250	0.885
260	0.796
270	0.846
280	0.826
290	0.744
300	0.644
310	0.589
320	0.545
330	0.536
340	0.549
350	0.563

Sum of Relative Field Squared : 31.244  
Sum Divided by 36 (Readings) : 0.868  
Square Root : 0.932

Sum of Relative Field Squared : 22.864  
Sum Divided by 36 (Readings) : 0.635  
Square Root : 0.797

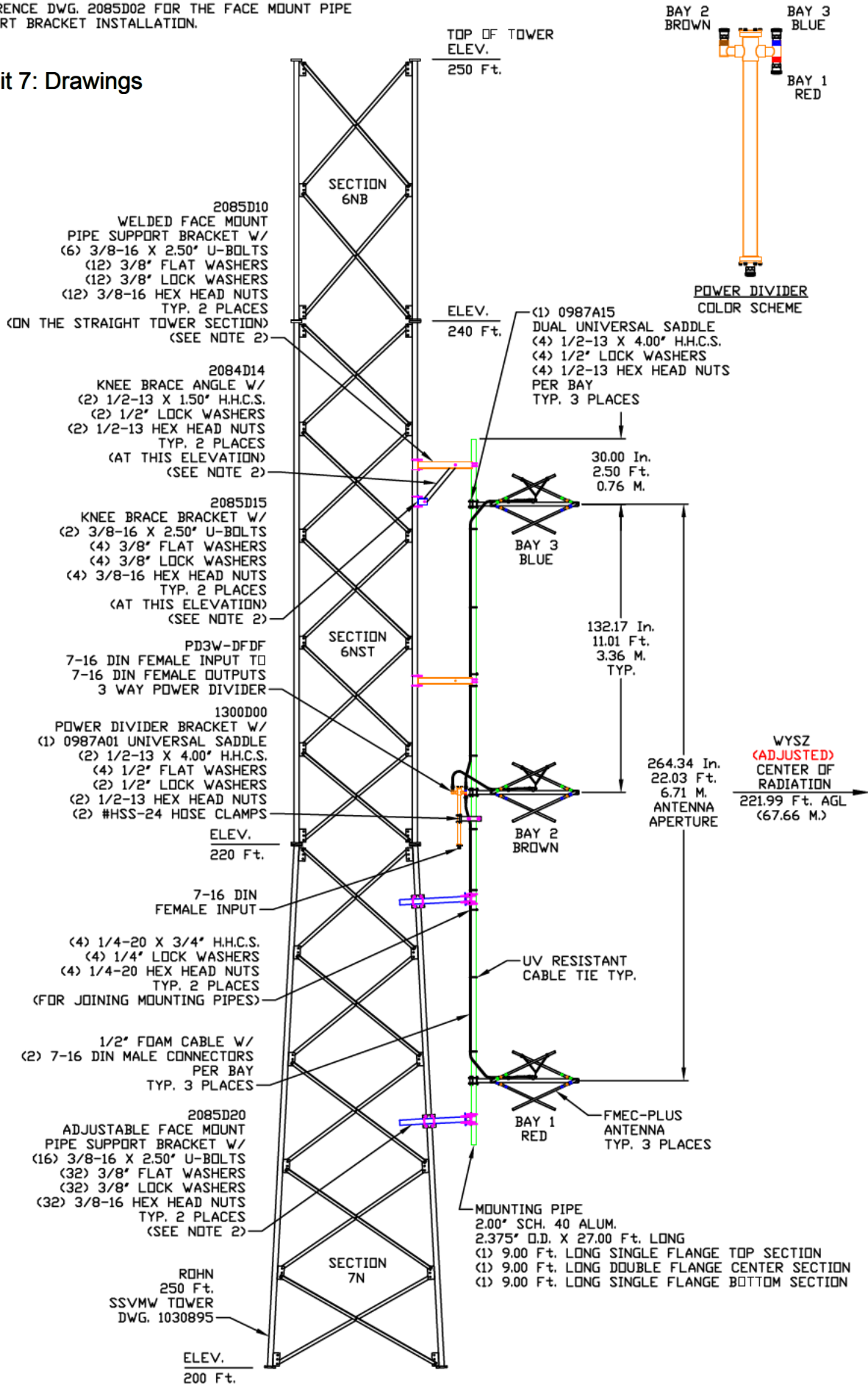
Percentage of Construction Permit Antenna Filled :

**85.5%**

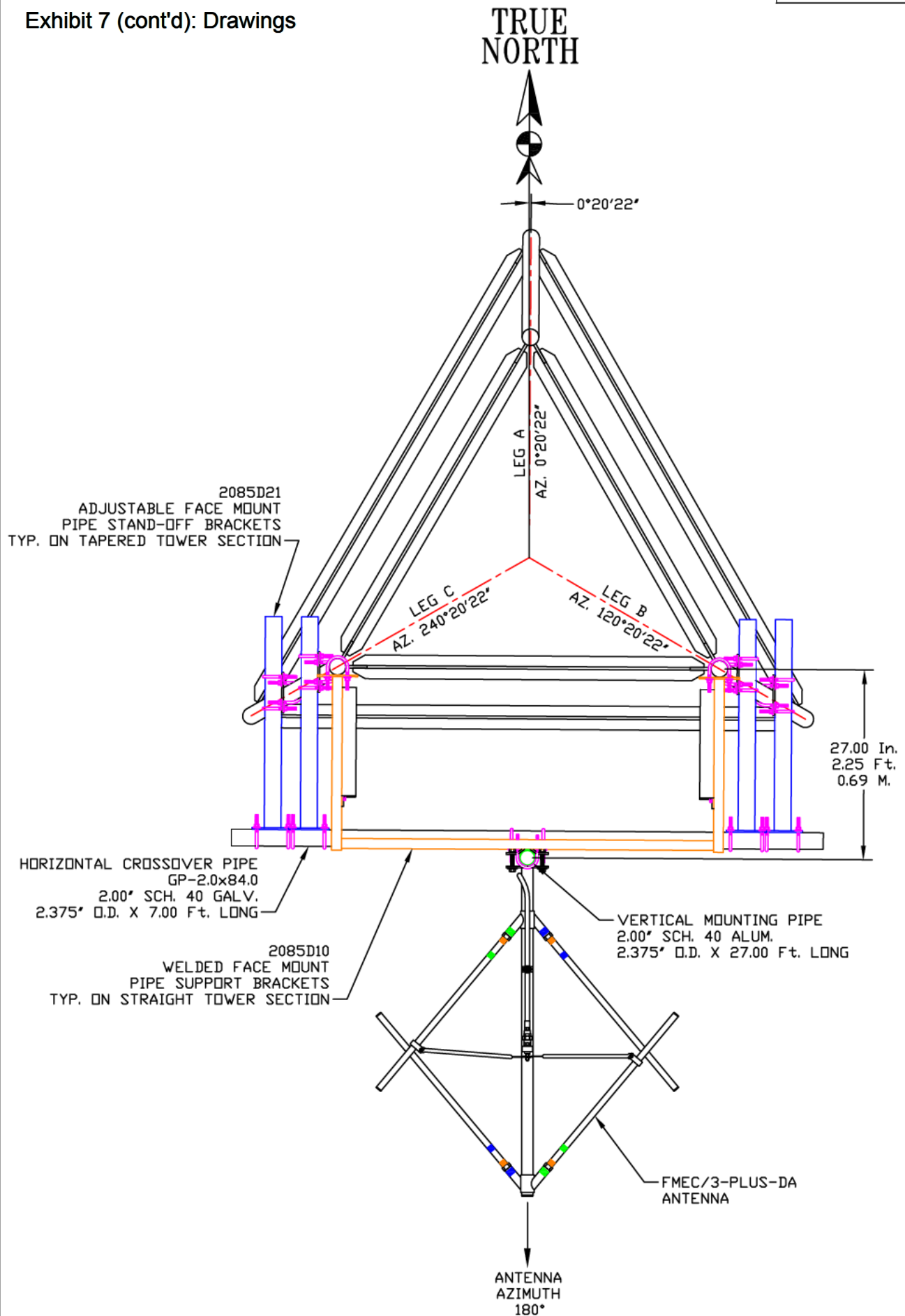
## NOTES:

1. REFERENCE DWG. 2085D01 FOR ANTENNA ORIENTATION.
2. REFERENCE DWG. 2085D02 FOR THE FACE MOUNT PIPE SUPPORT BRACKET INSTALLATION.

## Exhibit 7: Drawings



## Exhibit 7 (cont'd): Drawings



SYSTEMS WITH RELIABILITY, LP  
619 INDUSTRIAL PARK ROAD  
EBENSBURG, PENNSYLVANIA 15931

TITLE: FM/3-PLUS-DA  
WYSZ, MAUMEE, OH  
MATERIAL: ANTENNA ORIENTATION  
FROM TRUE NORTH

SIZE REV APPR. DATE  
C 1  
2  
3

ENGINEER:

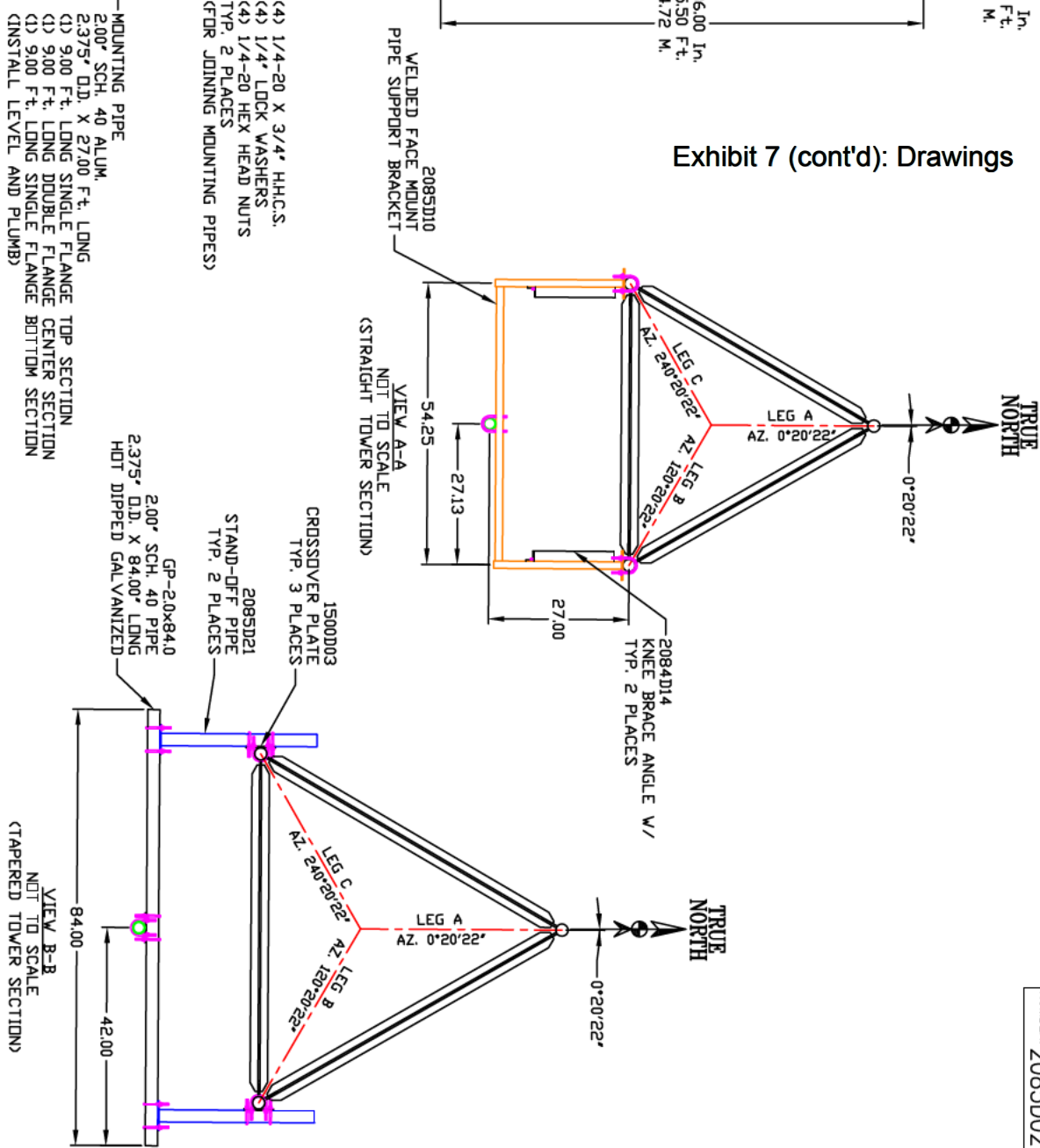
SCALE: NTS

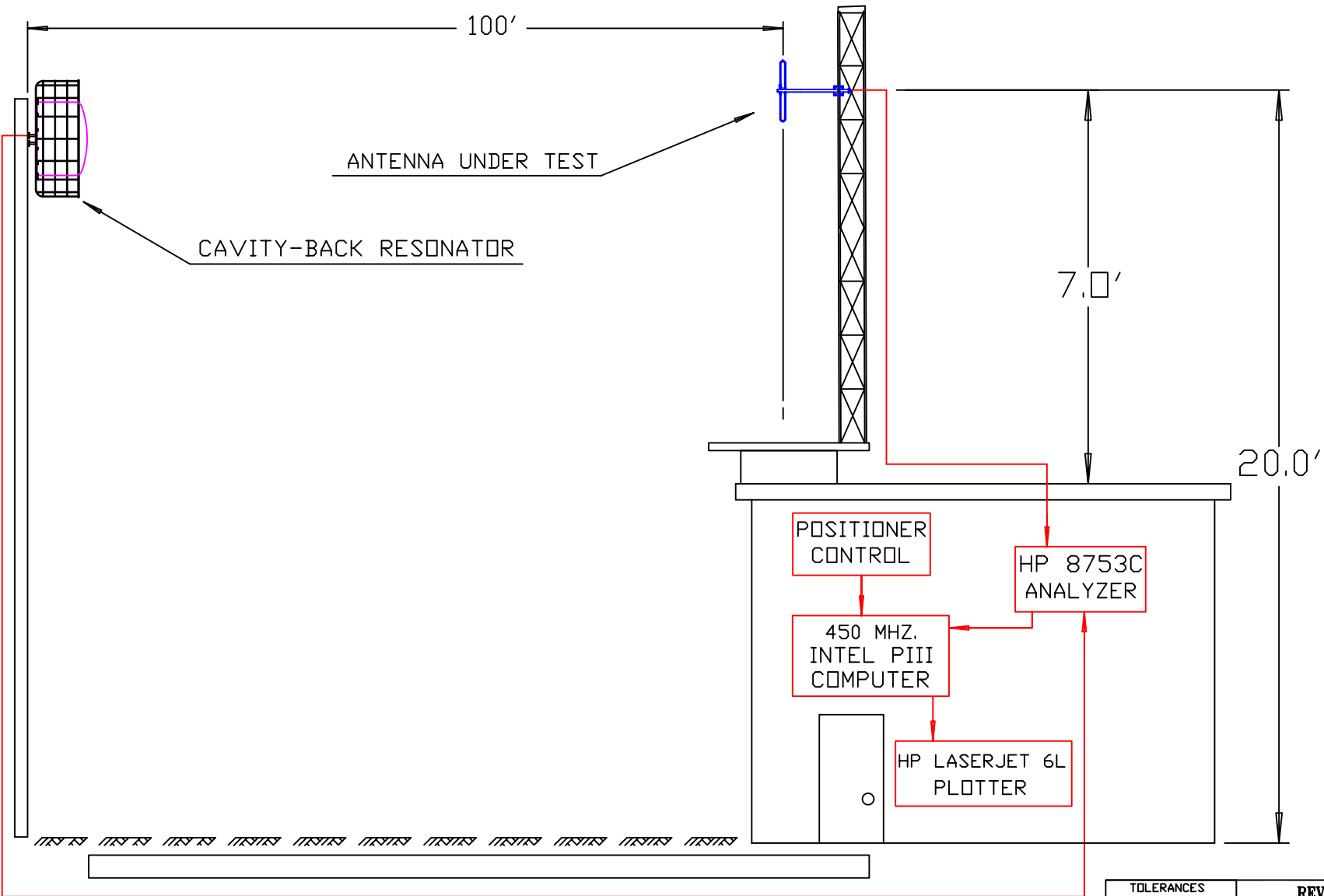
NAME: RAC

DATE: 6/30/17

SHEET 1 OF 1

DRAWING NUMBER: 2085D01

[illegible]



TOLERANCES			REVISION RECORD		
.X	± .015		REV	APPROVAL	DATE
.XX	± .005				
.XXX	± .002				
X/X	± 1/32				
DEG.	± 1/2				
UNLESS OTHERWISE SPECIFIED					
			2		10/7/05
			1		4/30/02
PARTS MADE BY THIS DRAWING			DRAWING NUMBER: 2105A10		
SCALE: NTS	NAME: JRM	DATE: 11/1/98	SHEET 1 OF 1		

## Engineer's Declaration

I, Alan Colwell, subject to the penalties of perjury, do declare the following:

1. ) I am the holder of a valid General Radio Telephone Operators License, Number  
PG-19-8978 (FCC License No.)
2. ) I have been a member of the Society of Broadcast Engineer's since 1983 (year)
3. ) That I have been employed as a technical consultant with the firm of:

Studios By Design (firm name), of

Toledo, Ohio (city state)

That Studios By Design (Firm's Name) was retained

by Side By Side, Inc (Permit tee's Name) for the

purpose of preparing its application for the construction permit of WYSZ-FM

Maumee (City), Ohio (State), from which the underlying Construction Permit

(FCC File Number BMPED-20160613AAX) was granted by the Commission.

1. ) That I am familiar with the terms and conditions of the WYSZ-FM Construction Permit.
2. ) I hereby certify that I have overseen the installation of the WYSZ-FM directional antenna and that the installation was complete to the manufacturer's instructions outlined in the Proof of Performance Drawings section (Exhibit 7) for WYSZ-FM.

Signed Alan Colwell Dated: 09/12/17 (mm/dd/yy)

619 Industrial Park Road, Ebensburg, PA 15931 Tel. 800 762 7743 / 814 472 5436 ♦ Fax 814 472 5552



## J. C. ANDRUS & ASSOCIATES, INC.

### - SURVEYORS -

5241 - A SECOR ROAD TOLEDO, OHIO 43623  
(419) 248-3737 • (734) 243-5877  
FAX (419) 248-1099 • 1-800-669-5315  
WEB: www.jcandrus.com

### Surveyor's Declaration

I, David A. Andrus, subject to the penalties of perjury, do declare the following:

I am a licensed surveyor in the state(s) of

Ohio #7322 and Michigan #40155.

1. ) I have provided professional services to Side by Side, Inc.  
(permit tee name), permit tee of WYSZ-FM, Maumee (city of license), OH (state),  
during the installation of the WYSZ-FM directional antenna.
2. ) I certify that the WYSZ-FM directional antenna has been oriented at the  
proper azimuth as authorized in the drawings section (Exhibit 7) of the Proof of  
Performance for WYSZ-FM. Namely Drawing #2085D01 shows the proper heading to  
be 180 degrees from true North. The azimuth was determined: Using the method of  
GPS observations to set the azimuth mark 180 degrees from true north and verifying the  
direction after installation with a total station and the accuracy of the measurement is:  
accuracy is approximately within a half degree.

Signed

Dated: 9/25/17 mm/dd/yy

619 Industrial Park Road, Ebensburg, PA 15931 Tel. 800 762 7743 / 814 472 5436 • Fax 814 472 5552

7/18/2017

WYSZ PATTERN CERTIFICATION

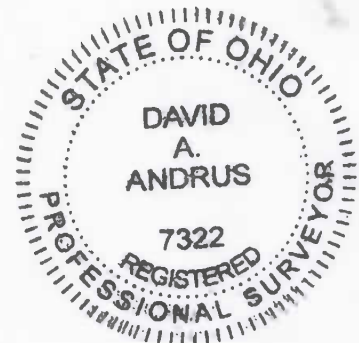
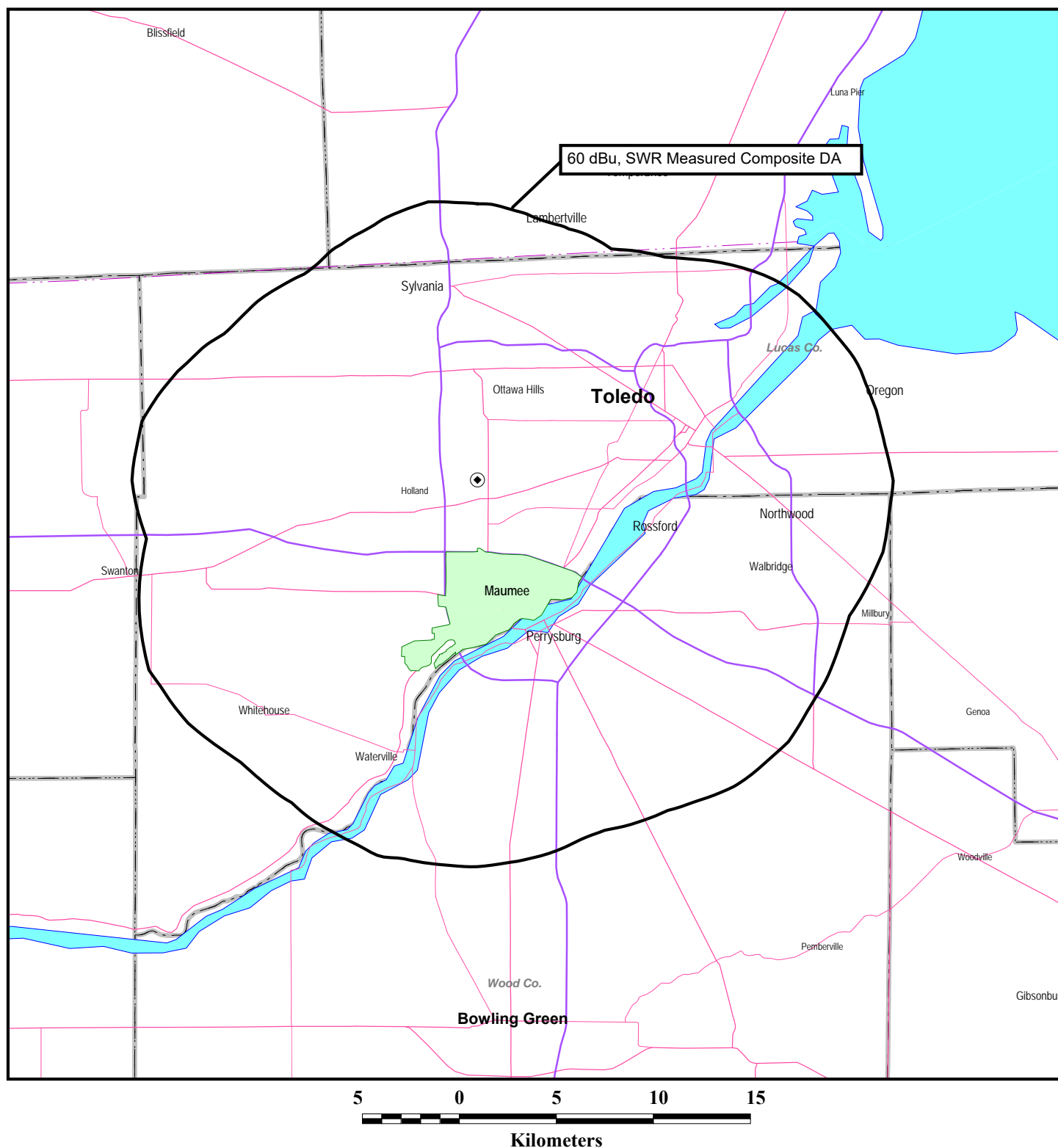




Figure 1



## COMPLIANCE WITH SECTION 73.515

STATION WYSZ  
MAUMEE, OHIO  
CH 207A (89.3 MHZ) 2.7 KW (DA) 74 M

du Treil, Lundin & Rackley, Inc. Sarasota, Florida