



SYSTEMS WITH RELIABILITY, LP
BROADCAST ANTENNAS AND TRANSMISSION LINE

PATTERN CERTIFICATION
DIRECTIONAL FM ANTENNA
WYFO
May 27, 2015

Call Sign	:	WYFO
Location	:	Lakeland, FL
Frequency	:	91.9 MHz
Channel	:	220C3
Antenna Model	:	FM3/5-DA
Maximum Antenna Gain	:	
Horizontal	:	5.447 / 7.36 dB
Vertical	:	5.447 / 7.36 dB

ANTENNA DESCRIPTION

A custom designed FM3/5-DA antenna was fabricated to conform to the prescribed directional azimuth pattern. The antenna consists of five (5) circularly polarized, cross-V dipole radiating elements full wave spaced mounted to a thirty-six (36)" (inch) face tower. The antenna array points 190 degrees 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 tower 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. Parasitic elements were used for performance enhancement.

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 275.7 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 275.7 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 **90.0%** of the **RMS** value of the pattern authorized in the related FCC file **BPED-20131217DSQ**. The vertical component **RMS** value is **0.639**. The horizontal component **RMS** value is **0.738**. The circular polarized component **RMS** value is **0.842**.

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

Measured vertical polarized directivity:	2.451 / 3.89 dB
Measured horizontal polarized directivity:	1.836 / 2.64 dB
Measured circular polarized pattern directivity:	1.409 / 1.49 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 = (2.45058)(.4283)(5.190)	= 5.447 / 7.36 dB
H-Pol. Gain = (1.83563)(.5717)(5.190)	= 5.447 / 7.36 dB

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **77 meters (252.64 ft.)** above ground level. The antenna aperture is **42.81 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 **190 degrees** true North.

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

DRAWING NO.	TITLE
1935D00	ELEVATION
1935D01	ANTENNA ORIENTATION
1935D02/1935D03	PARASITIC PLACEMENT
2105A10	TEST RANGE SCHEMATIC

The array shall be mounted according to all details outlined in **DWG. 1935D00**. The antenna elements shall be aligned at the same heading as in **DWG. 1935D01**. This will ensure that the antenna is oriented properly at 190 degrees true north. The parasitic placement is shown on **DWG. 1935D02** and **1935D03**. 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:

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

TEST EQUIPMENT

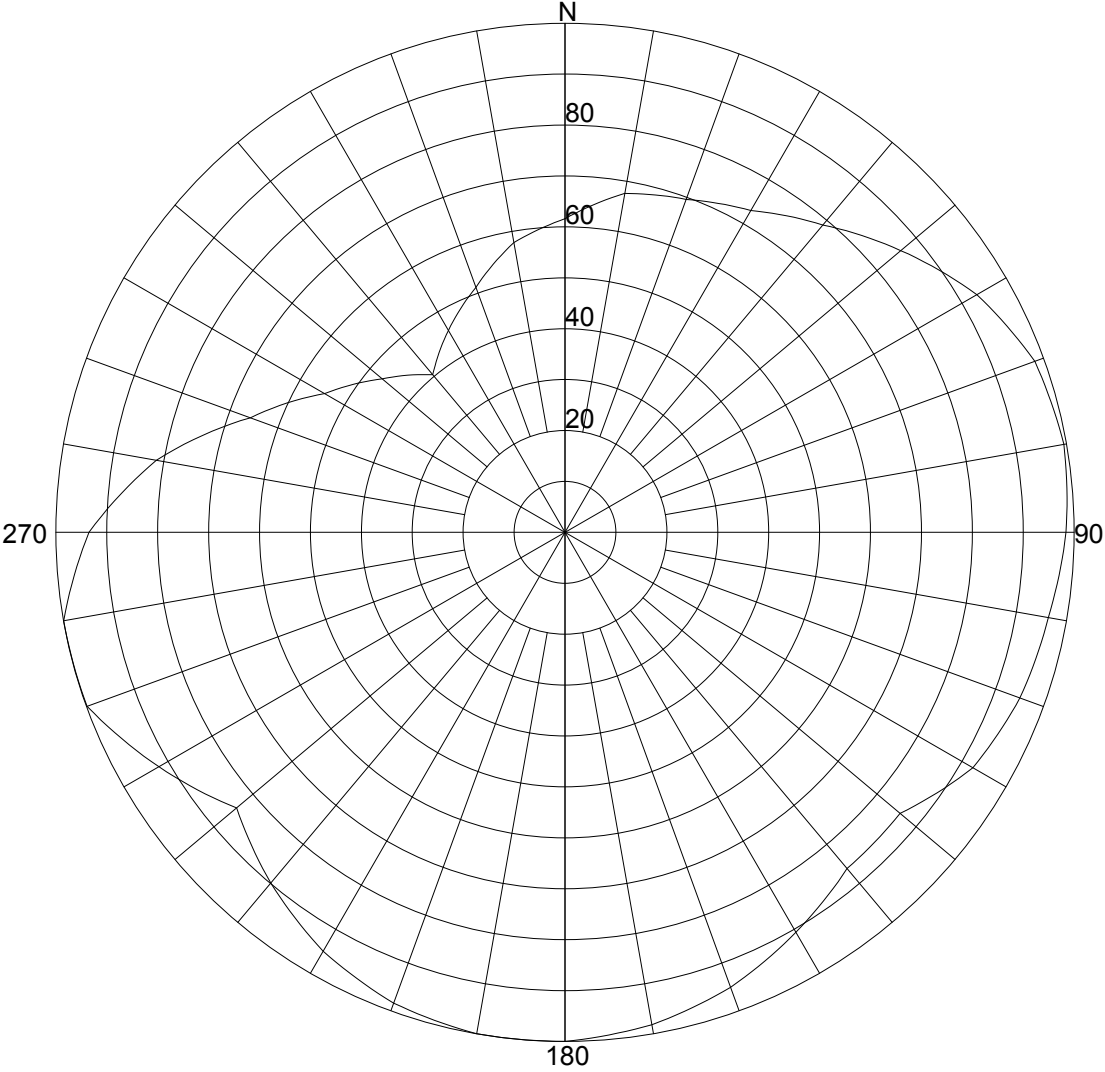
Network Analyzer	:	Hewlett Packard Model # 8753C Serial Number: 08753 – 69138
Computer	:	Pentium 3, 450 MHz, SAMS Range Program
Printer	:	Hewlett-Packard Laser Jet 6L
Positioner	:	Orbit Positioner
All equipment is calibrated to ANSI/NCSL Z540-1-1994 specs		

Prepared by:



Kevin W. Rager
Antenna Engineer
Systems With Reliability, LP

Exhibit 1: Circular Polarized Azimuth Pattern



Azimuth Pattern

Systems With Reliability LP

Scale: Linear
Unit: Relative Field

CLIENT: WYFO	Date: 5/5/2015
ANTENNA TYPE: FM3/5-DA	
FREQUENCY: 91.9 MHz	
PATTERN POL.: Circular	CIRCULARITY(+/-dB):
AZ. DIRECTIVITY: 1.40939 / 1.49dB	PATTERN RMS: 0.842

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.6160 (-4.21)	180	1.0000 (0)
5	.6460 (-3.8)	185	1.0000 (0)
10	.6760 (-3.4)	190	1.0000 (0)
15	.6860 (-3.27)	195	.9920 (-0.07)
20	.6960 (-3.15)	200	.9840 (-0.14)
25	.7130 (-2.94)	205	.9670 (-0.29)
30	.7300 (-2.73)	210	.9500 (-0.45)
35	.7590 (-2.4)	215	.9245 (-0.68)
40	.7880 (-2.07)	220	.8990 (-0.92)
45	.8245 (-1.68)	225	.8705 (-1.2)
50	.8610 (-1.3)	230	.8420 (-1.49)
55	.8975 (-0.94)	235	.8815 (-1.1)
60	.9340 (-0.59)	240	.9210 (-0.71)
65	.9580 (-0.37)	245	.9600 (-0.35)
70	.9820 (-0.16)	250	.9990 (-0.01)
75	.9885 (-0.1)	255	.9995 (0)
80	.9950 (-0.04)	260	1.0000 (0)
85	.9895 (-0.09)	265	.9675 (-0.29)
90	.9840 (-0.14)	270	.9350 (-0.58)
95	.9740 (-0.23)	275	.8750 (-1.16)
100	.9640 (-0.32)	280	.8150 (-1.78)
105	.9575 (-0.38)	285	.7365 (-2.66)
110	.9510 (-0.44)	290	.6580 (-3.64)
115	.9380 (-0.56)	295	.6015 (-4.42)
120	.9250 (-0.68)	300	.5450 (-5.27)
125	.8920 (-0.99)	305	.5070 (-5.9)
130	.8590 (-1.32)	310	.4690 (-6.58)
135	.8605 (-1.3)	315	.4365 (-7.2)
140	.8620 (-1.29)	320	.4040 (-7.87)
145	.8845 (-1.07)	325	.4310 (-7.31)
150	.9070 (-0.85)	330	.4580 (-6.78)
155	.9290 (-0.64)	335	.4850 (-6.29)
160	.9510 (-0.44)	340	.5120 (-5.81)
165	.9665 (-0.3)	345	.5450 (-5.27)
170	.9820 (-0.16)	350	.5780 (-4.76)
175	.9910 (-0.08)	355	.5970 (-4.48)

Systems With Reliability LP

CLIENT: WYFO

Date: 5/5/2015

ANTENNA TYPE: FM3/5-DA

FREQUENCY: 91.9 MHz

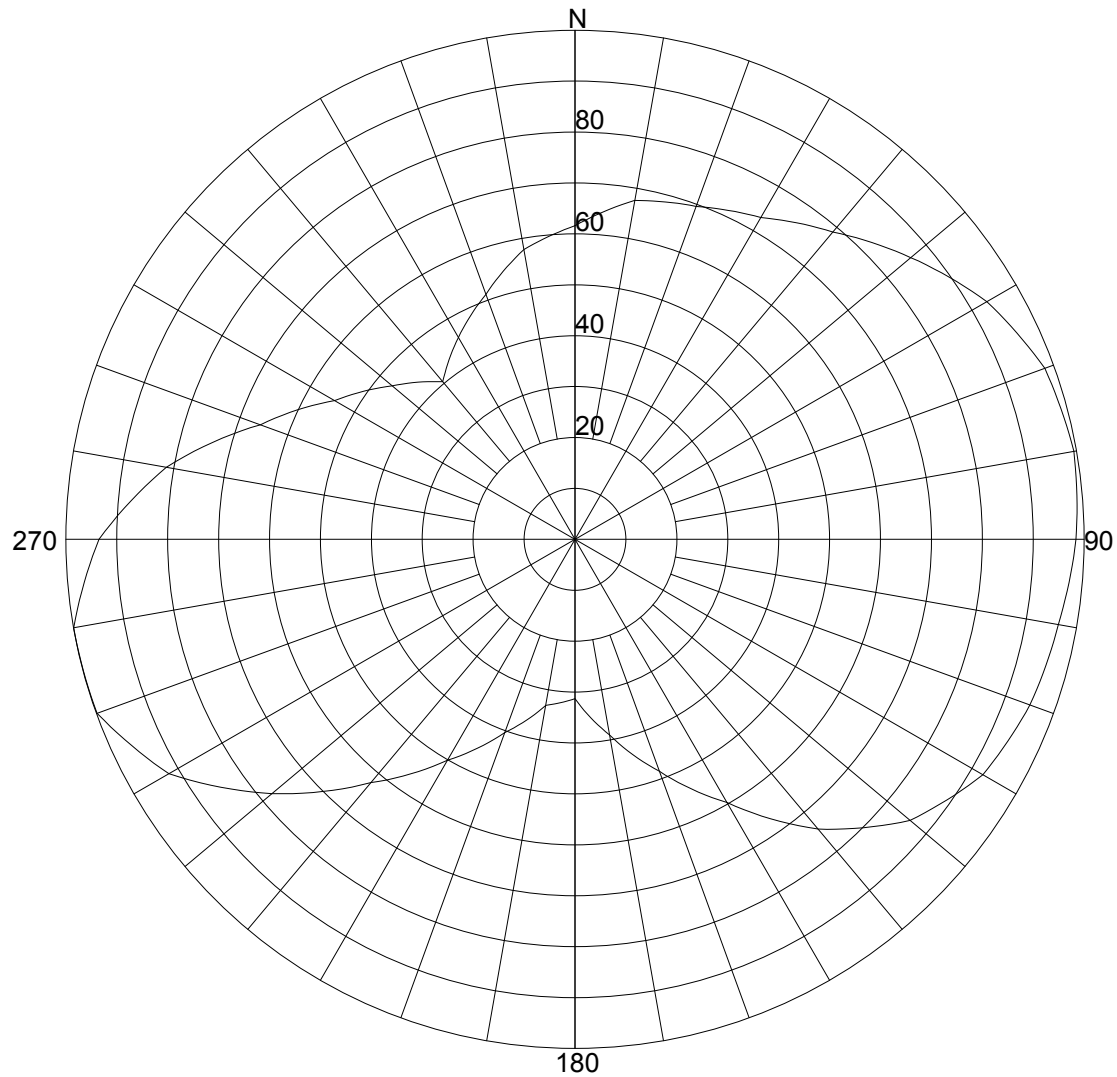
PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.40939 / 1.49dB

PATTERN RMS: 0.842

Exhibit 2: Measured Horizontal Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability LP

CLIENT: WYFO

Date: 5/5/2015

ANTENNA TYPE: FM3/5-DA

FREQUENCY: 91.9 MHz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.83563 / 2.64dB

PATTERN RMS: 0.738

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.6160 (-4.21)	180	.3130 (-10.09)
5	.6460 (-3.8)	185	.3220 (-9.84)
10	.6760 (-3.4)	190	.3310 (-9.6)
15	.6860 (-3.27)	195	.3675 (-8.69)
20	.6960 (-3.15)	200	.4040 (-7.87)
25	.7130 (-2.94)	205	.4525 (-6.89)
30	.7300 (-2.73)	210	.5010 (-6)
35	.7590 (-2.4)	215	.5625 (-5)
40	.7880 (-2.07)	220	.6240 (-4.1)
45	.8245 (-1.68)	225	.7005 (-3.09)
50	.8610 (-1.3)	230	.7770 (-2.19)
55	.8975 (-0.94)	235	.8490 (-1.42)
60	.9340 (-0.59)	240	.9210 (-0.71)
65	.9580 (-0.37)	245	.9600 (-0.35)
70	.9820 (-0.16)	250	.9990 (-0.01)
75	.9885 (-0.1)	255	.9995 (0)
80	.9950 (-0.04)	260	1.0000 (0)
85	.9895 (-0.09)	265	.9675 (-0.29)
90	.9840 (-0.14)	270	.9350 (-0.58)
95	.9740 (-0.23)	275	.8750 (-1.16)
100	.9640 (-0.32)	280	.8150 (-1.78)
105	.9575 (-0.38)	285	.7365 (-2.66)
110	.9510 (-0.44)	290	.6580 (-3.64)
115	.9380 (-0.56)	295	.6015 (-4.42)
120	.9250 (-0.68)	300	.5450 (-5.27)
125	.8920 (-0.99)	305	.5070 (-5.9)
130	.8590 (-1.32)	310	.4690 (-6.58)
135	.8010 (-1.93)	315	.4365 (-7.2)
140	.7430 (-2.58)	320	.4040 (-7.87)
145	.6700 (-3.48)	325	.4310 (-7.31)
150	.5970 (-4.48)	330	.4580 (-6.78)
155	.5410 (-5.34)	335	.4850 (-6.29)
160	.4850 (-6.29)	340	.5120 (-5.81)
165	.4375 (-7.18)	345	.5450 (-5.27)
170	.3900 (-8.18)	350	.5780 (-4.76)
175	.3515 (-9.08)	355	.5970 (-4.48)

Systems With Reliability LP

CLIENT: WYFO

Date: 5/5/2015

ANTENNA TYPE: FM3/5-DA

FREQUENCY: 91.9 MHz

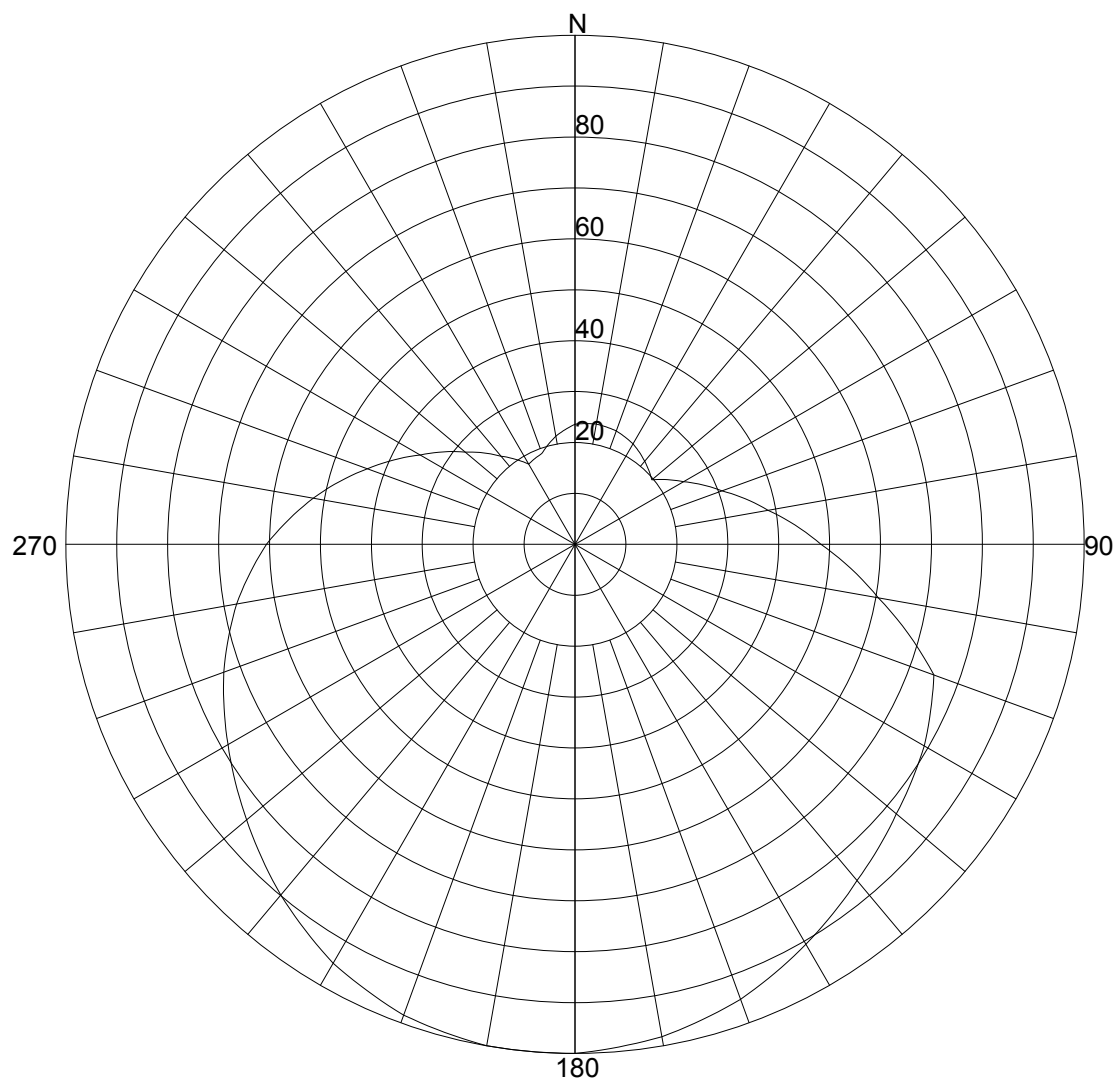
PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.83563 / 2.64dB

PATTERN RMS: 0.738

Exhibit 3: Measured Vertical Polarized Azimuth Pattern



Azimuth Pattern

Systems With Reliability LP

Scale: Linear

Unit: Relative Field

CLIENT: WYFO

Date: 5/5/2015

ANTENNA TYPE: FM3/5-DA

FREQUENCY: 91.9 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.45058 / 3.89dB

PATTERN RMS: 0.639

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.2360 (-12.54)	180	1.0000 (0)
5	.2380 (-12.47)	185	1.0000 (0)
10	.2400 (-12.4)	190	1.0000 (0)
15	.2385 (-12.45)	195	.9920 (-0.07)
20	.2370 (-12.51)	200	.9840 (-0.14)
25	.2325 (-12.67)	205	.9670 (-0.29)
30	.2280 (-12.84)	210	.9500 (-0.45)
35	.2205 (-13.13)	215	.9245 (-0.68)
40	.2130 (-13.43)	220	.8990 (-0.92)
45	.2050 (-13.76)	225	.8705 (-1.2)
50	.1970 (-14.11)	230	.8420 (-1.49)
55	.2215 (-13.09)	235	.8145 (-1.78)
60	.2460 (-12.18)	240	.7870 (-2.08)
65	.2765 (-11.17)	245	.7605 (-2.38)
70	.3070 (-10.26)	250	.7340 (-2.69)
75	.3460 (-9.22)	255	.7045 (-3.04)
80	.3850 (-8.29)	260	.6750 (-3.41)
85	.4340 (-7.25)	265	.6405 (-3.87)
90	.4830 (-6.32)	270	.6060 (-4.35)
95	.5440 (-5.29)	275	.5640 (-4.97)
100	.6050 (-4.36)	280	.5220 (-5.65)
105	.6775 (-3.38)	285	.4780 (-6.41)
110	.7500 (-2.5)	290	.4340 (-7.25)
115	.7710 (-2.26)	295	.3925 (-8.12)
120	.7920 (-2.03)	300	.3510 (-9.09)
125	.8080 (-1.85)	305	.3165 (-9.99)
130	.8240 (-1.68)	310	.2820 (-11)
135	.8430 (-1.48)	315	.2540 (-11.9)
140	.8620 (-1.29)	320	.2260 (-12.92)
145	.8845 (-1.07)	325	.2040 (-13.81)
150	.9070 (-0.85)	330	.1820 (-14.8)
155	.9290 (-0.64)	335	.1860 (-14.61)
160	.9510 (-0.44)	340	.1900 (-14.42)
165	.9665 (-0.3)	345	.2030 (-13.85)
170	.9820 (-0.16)	350	.2160 (-13.31)
175	.9910 (-0.08)	355	.2260 (-12.92)

Systems With Reliability LP

CLIENT: WYFO

Date: 5/5/2015

ANTENNA TYPE: FM3/5-DA

FREQUENCY: 91.9 MHz

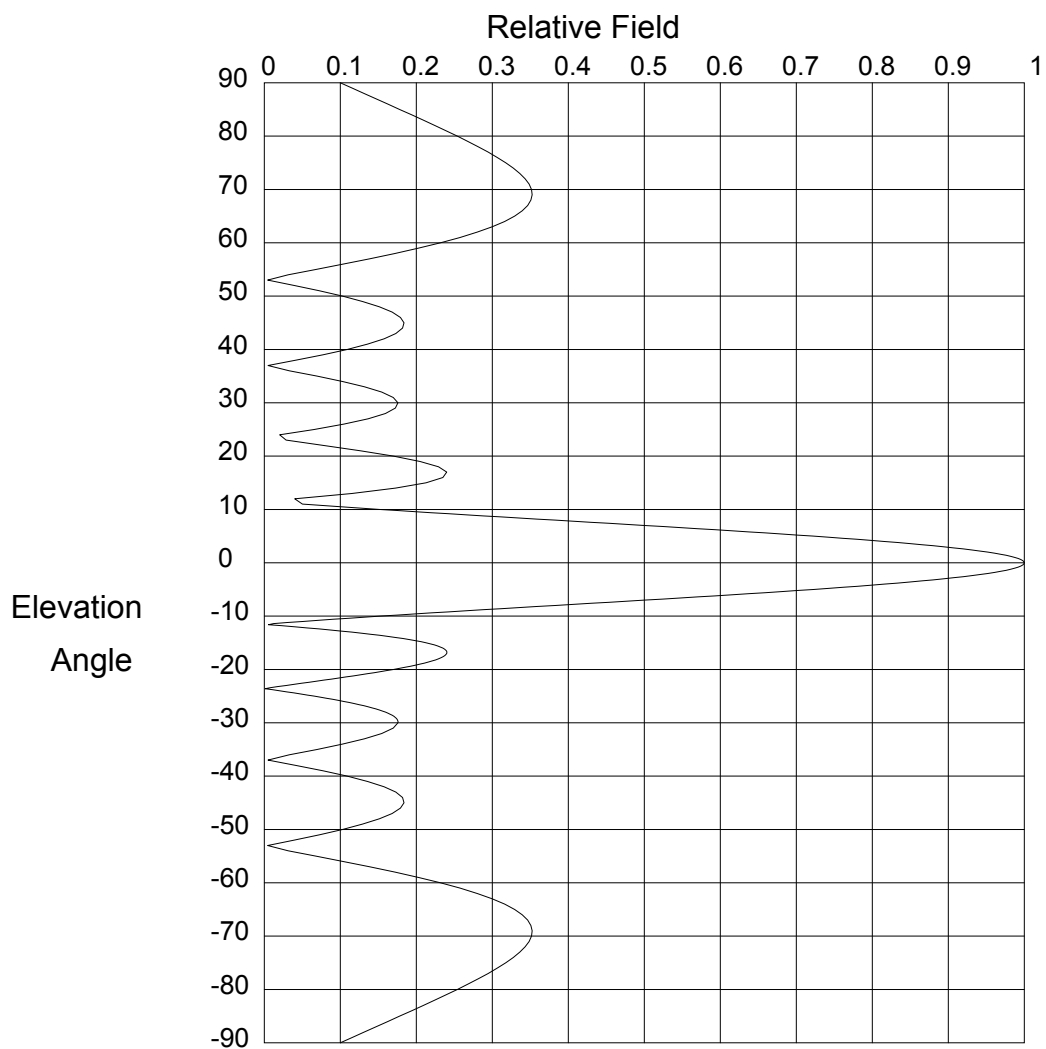
PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.45058 / 3.89dB

PATTERN RMS: 0.639

Exhibit 4: Elevation Pattern



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: WYFO

Date: 5/8/2015

ANTENNA TYPE: FM3/5-DA

FREQUENCY: 91.9 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 5.19/7.152 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 5.19/7.152 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	.04 (-28.037)	14.0	.173 (-15.244)
89.0	.116 (-18.733)	51.0	.073 (-22.772)	13.0	.115 (-18.791)
88.0	.131 (-17.628)	50.0	.103 (-19.753)	12.0	.04 (-27.96)
87.0	.147 (-16.648)	49.0	.129 (-17.759)	11.0	.05 (-25.993)
86.0	.163 (-15.77)	48.0	.151 (-16.392)	10.0	.153 (-16.311)
85.0	.178 (-14.975)	47.0	.168 (-15.477)	9.8	.175 (-15.154)
84.0	.194 (-14.251)	46.0	.179 (-14.928)	9.6	.197 (-14.119)
83.0	.209 (-13.588)	45.0	.184 (-14.706)	9.4	.219 (-13.181)
82.0	.224 (-12.979)	44.0	.182 (-14.802)	9.2	.242 (-12.325)
81.0	.239 (-12.419)	43.0	.173 (-15.231)	9.0	.265 (-11.537)
80.0	.254 (-11.905)	42.0	.158 (-16.038)	8.8	.288 (-10.808)
79.0	.268 (-11.433)	41.0	.136 (-17.315)	8.6	.311 (-10.131)
78.0	.282 (-11.003)	40.0	.109 (-19.243)	8.4	.335 (-9.499)
77.0	.295 (-10.613)	39.0	.077 (-22.23)	8.2	.359 (-8.907)
76.0	.307 (-10.264)	38.0	.042 (-27.5)	8.0	.382 (-8.351)
75.0	.318 (-9.955)	37.0	.005 (-46.165)	7.8	.406 (-7.828)
74.0	.328 (-9.688)	36.0	.033 (-29.676)	7.6	.43 (-7.335)
73.0	.336 (-9.464)	35.0	.069 (-23.177)	7.4	.454 (-6.868)
72.0	.343 (-9.286)	34.0	.103 (-19.746)	7.2	.477 (-6.427)
71.0	.348 (-9.157)	33.0	.132 (-17.594)	7.0	.501 (-6.008)
70.0	.352 (-9.079)	32.0	.155 (-16.215)	6.8	.524 (-5.612)
69.0	.352 (-9.057)	31.0	.17 (-15.409)	6.6	.547 (-5.235)
68.0	.351 (-9.096)	30.0	.176 (-15.095)	6.4	.57 (-4.878)
67.0	.347 (-9.201)	29.0	.173 (-15.259)	6.2	.593 (-4.538)
66.0	.34 (-9.38)	28.0	.159 (-15.946)	6.0	.616 (-4.215)
65.0	.33 (-9.642)	27.0	.137 (-17.284)	5.8	.638 (-3.909)
64.0	.316 (-9.997)	26.0	.105 (-19.575)	5.6	.659 (-3.617)
63.0	.30 (-10.46)	25.0	.066 (-23.657)	5.4	.681 (-3.34)
62.0	.28 (-11.047)	24.0	.02 (-33.83)	5.2	.702 (-3.077)
61.0	.258 (-11.782)	23.0	.029 (-30.87)	5.0	.722 (-2.827)
60.0	.232 (-12.698)	22.0	.079 (-22.091)	4.8	.742 (-2.59)
59.0	.203 (-13.842)	21.0	.127 (-17.942)	4.6	.762 (-2.366)
58.0	.172 (-15.287)	20.0	.17 (-15.395)	4.4	.78 (-2.153)
57.0	.139 (-17.153)	19.0	.205 (-13.761)	4.2	.799 (-1.953)
56.0	.104 (-19.67)	18.0	.229 (-12.791)	4.0	.816 (-1.763)
55.0	.068 (-23.366)	17.0	.24 (-12.394)	3.8	.833 (-1.584)
54.0	.031 (-30.047)	16.0	.235 (-12.576)	3.6	.85 (-1.416)
53.0	.005 (-46.648)	15.0	.213 (-13.434)	3.4	.865 (-1.258)

Systems With Reliability

Page 1 of 3

CLIENT: WYFO

Date: 5/8/2015

ANTENNA TYPE: FM3/5-DA

FREQUENCY: 91.9 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 5.19/7.152 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 5.19/7.152 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	.88 (-1.111)	-4.4	.78 (-2.153)	-12.0	.04 (-27.96)
3.0	.894 (-0.973)	-4.6	.762 (-2.366)	-12.2	.056 (-24.995)
2.8	.907 (-0.845)	-4.8	.742 (-2.59)	-12.4	.072 (-22.864)
2.6	.92 (-0.727)	-5.0	.722 (-2.827)	-12.6	.087 (-21.218)
2.4	.931 (-0.617)	-5.2	.702 (-3.077)	-12.8	.101 (-19.891)
2.2	.942 (-0.518)	-5.4	.681 (-3.34)	-13.0	.115 (-18.791)
2.0	.952 (-0.427)	-5.6	.659 (-3.617)	-13.2	.128 (-17.861)
1.8	.961 (-0.345)	-5.8	.638 (-3.909)	-13.4	.14 (-17.063)
1.6	.969 (-0.272)	-6.0	.616 (-4.215)	-13.6	.152 (-16.373)
1.4	.976 (-0.208)	-6.2	.593 (-4.538)	-13.8	.163 (-15.771)
1.2	.983 (-0.153)	-6.4	.57 (-4.878)	-14.0	.173 (-15.244)
1.0	.988 (-0.106)	-6.6	.547 (-5.235)	-14.2	.182 (-14.782)
.8	.992 (-0.068)	-6.8	.524 (-5.612)	-14.4	.191 (-14.375)
.6	.996 (-0.038)	-7.0	.501 (-6.008)	-14.6	.199 (-14.018)
.4	.998 (-0.017)	-7.2	.477 (-6.427)	-14.8	.206 (-13.706)
.2	1.00 (-0.004)	-7.4	.454 (-6.868)	-15.0	.213 (-13.434)
.0	1.00 (0)	-7.6	.43 (-7.335)	-15.2	.219 (-13.199)
-.2	1.00 (-0.004)	-7.8	.406 (-7.828)	-15.4	.224 (-12.997)
-.4	.998 (-0.017)	-8.0	.382 (-8.351)	-15.6	.228 (-12.828)
-.6	.996 (-0.038)	-8.2	.359 (-8.907)	-15.8	.232 (-12.688)
-.8	.992 (-0.068)	-8.4	.335 (-9.499)	-16.0	.235 (-12.576)
-1.0	.988 (-0.106)	-8.6	.311 (-10.131)	-16.2	.237 (-12.49)
-1.2	.983 (-0.153)	-8.8	.288 (-10.808)	-16.4	.239 (-12.43)
-1.4	.976 (-0.208)	-9.0	.265 (-11.537)	-16.6	.24 (-12.395)
-1.6	.969 (-0.272)	-9.2	.242 (-12.325)	-16.8	.24 (-12.383)
-1.8	.961 (-0.345)	-9.4	.219 (-13.181)	-17.0	.24 (-12.394)
-2.0	.952 (-0.427)	-9.6	.197 (-14.119)	-17.2	.239 (-12.429)
-2.2	.942 (-0.518)	-9.8	.175 (-15.154)	-17.4	.238 (-12.486)
-2.4	.931 (-0.617)	-10.0	.153 (-16.311)	-17.6	.235 (-12.565)
-2.6	.92 (-0.727)	-10.2	.132 (-17.621)	-17.8	.233 (-12.667)
-2.8	.907 (-0.845)	-10.4	.11 (-19.133)	-18.0	.229 (-12.791)
-3.0	.894 (-0.973)	-10.6	.09 (-20.923)	-18.2	.225 (-12.938)
-3.2	.88 (-1.111)	-10.8	.07 (-23.123)	-18.4	.221 (-13.107)
-3.4	.865 (-1.258)	-11.0	.05 (-25.993)	-18.6	.216 (-13.301)
-3.6	.85 (-1.416)	-11.2	.031 (-30.166)	-18.8	.211 (-13.518)
-3.8	.833 (-1.584)	-11.4	.012 (-38.116)	-19.0	.205 (-13.761)
-4.0	.816 (-1.763)	-11.6	.006 (-44.992)	-19.2	.199 (-14.03)
-4.2	.799 (-1.953)	-11.8	.023 (-32.725)	-19.4	.192 (-14.326)

Systems With Reliability

Page 2 of 3

CLIENT: WYFO

Date: 5/8/2015

ANTENNA TYPE: FM3/5-DA

FREQUENCY: 91.9 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 5.19/7.152 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 5.19/7.152 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	.185 (-14.651)	-27.2	.142 (-16.953)	-54.0	.031 (-30.047)
-19.8	.178 (-15.007)	-27.4	.147 (-16.657)	-55.0	.068 (-23.366)
-20.0	.17 (-15.395)	-27.6	.152 (-16.392)	-56.0	.104 (-19.67)
-20.2	.162 (-15.819)	-27.8	.156 (-16.155)	-57.0	.139 (-17.153)
-20.4	.153 (-16.281)	-28.0	.159 (-15.946)	-58.0	.172 (-15.287)
-20.6	.145 (-16.786)	-28.2	.163 (-15.762)	-59.0	.203 (-13.842)
-20.8	.136 (-17.338)	-28.4	.166 (-15.603)	-60.0	.232 (-12.698)
-21.0	.127 (-17.942)	-28.6	.169 (-15.466)	-61.0	.258 (-11.782)
-21.2	.117 (-18.606)	-28.8	.171 (-15.352)	-62.0	.28 (-11.047)
-21.4	.108 (-19.339)	-29.0	.173 (-15.259)	-63.0	.30 (-10.46)
-21.6	.098 (-20.153)	-29.2	.174 (-15.187)	-64.0	.316 (-9.997)
-21.8	.088 (-21.063)	-29.4	.175 (-15.135)	-65.0	.33 (-9.642)
-22.0	.079 (-22.091)	-29.6	.176 (-15.102)	-66.0	.34 (-9.38)
-22.2	.069 (-23.266)	-29.8	.176 (-15.089)	-67.0	.347 (-9.201)
-22.4	.059 (-24.632)	-30.0	.176 (-15.095)	-68.0	.351 (-9.096)
-22.6	.049 (-26.26)	-31.0	.17 (-15.409)	-69.0	.352 (-9.057)
-22.8	.039 (-28.265)	-32.0	.155 (-16.215)	-70.0	.352 (-9.079)
-23.0	.029 (-30.87)	-33.0	.132 (-17.594)	-71.0	.348 (-9.157)
-23.2	.019 (-34.588)	-34.0	.103 (-19.746)	-72.0	.343 (-9.286)
-23.4	.009 (-41.163)	-35.0	.069 (-23.177)	-73.0	.336 (-9.464)
-23.6	.001 (-59.447)	-36.0	.033 (-29.676)	-74.0	.328 (-9.688)
-23.8	.011 (-39.355)	-37.0	.005 (-46.165)	-75.0	.318 (-9.955)
-24.0	.02 (-33.83)	-38.0	.042 (-27.5)	-76.0	.307 (-10.264)
-24.2	.03 (-30.522)	-39.0	.077 (-22.23)	-77.0	.295 (-10.613)
-24.4	.039 (-28.17)	-40.0	.109 (-19.243)	-78.0	.282 (-11.003)
-24.6	.048 (-26.355)	-41.0	.136 (-17.315)	-79.0	.268 (-11.433)
-24.8	.057 (-24.885)	-42.0	.158 (-16.038)	-80.0	.254 (-11.905)
-25.0	.066 (-23.657)	-43.0	.173 (-15.231)	-81.0	.239 (-12.419)
-25.2	.074 (-22.61)	-44.0	.182 (-14.802)	-82.0	.224 (-12.979)
-25.4	.082 (-21.702)	-45.0	.184 (-14.706)	-83.0	.209 (-13.588)
-25.6	.09 (-20.906)	-46.0	.179 (-14.928)	-84.0	.194 (-14.251)
-25.8	.098 (-20.202)	-47.0	.168 (-15.477)	-85.0	.178 (-14.975)
-26.0	.105 (-19.575)	-48.0	.151 (-16.392)	-86.0	.163 (-15.77)
-26.2	.112 (-19.014)	-49.0	.129 (-17.759)	-87.0	.147 (-16.648)
-26.4	.119 (-18.511)	-50.0	.103 (-19.753)	-88.0	.131 (-17.628)
-26.6	.125 (-18.058)	-51.0	.073 (-22.772)	-89.0	.116 (-18.733)
-26.8	.131 (-17.651)	-52.0	.04 (-28.037)	-90.0	.10 (-20)
-27.0	.137 (-17.284)	-53.0	.005 (-46.648)	90.0	.00 (-50)

Systems With Reliability

Page 3 of 3

CLIENT: WYFO

Date: 5/8/2015

ANTENNA TYPE: FM3/5-DA

FREQUENCY: 91.9 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 5.19/7.152 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 5.19/7.152 dBd

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

Exhibit 6: RMS Calculations



SYSTEMS WITH RELIABILITY, INC.
Broadcast Antennas and Transmission Systems

WYFO Antenna RMS Comparison

PROPOSED ANTENNA

Azimuth Heading	Relative Field
0	0.735
10	0.925
20	1
30	1
40	1
50	1
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	0.79
310	0.625
320	0.5
330	0.5
340	0.525
350	0.59

DESIGNED ANTENNA

Azimuth Heading	Relative Field
0	0.616
10	0.676
20	0.696
30	0.73
40	0.788
50	0.861
60	0.934
70	0.982
80	0.995
90	0.984
100	0.964
110	0.951
120	0.925
130	0.859
140	0.862
150	0.907
160	0.951
170	0.982
180	1
190	1
200	0.984
210	0.95
220	0.899
230	0.842
240	0.921
250	0.999
260	1
270	0.935
280	0.815
290	0.658
300	0.545
310	0.469
320	0.404
330	0.458
340	0.512
350	0.578

Sum of Relative Field Squared : 31.534
Sum Divided by 36 (Readings) : 0.876
Square Root : 0.936

Sum of Relative Field Squared : 25.564
Sum Divided by 36 (Readings) : 0.710
Square Root : 0.843

Percentage of Construction Permit Antenna Filled :

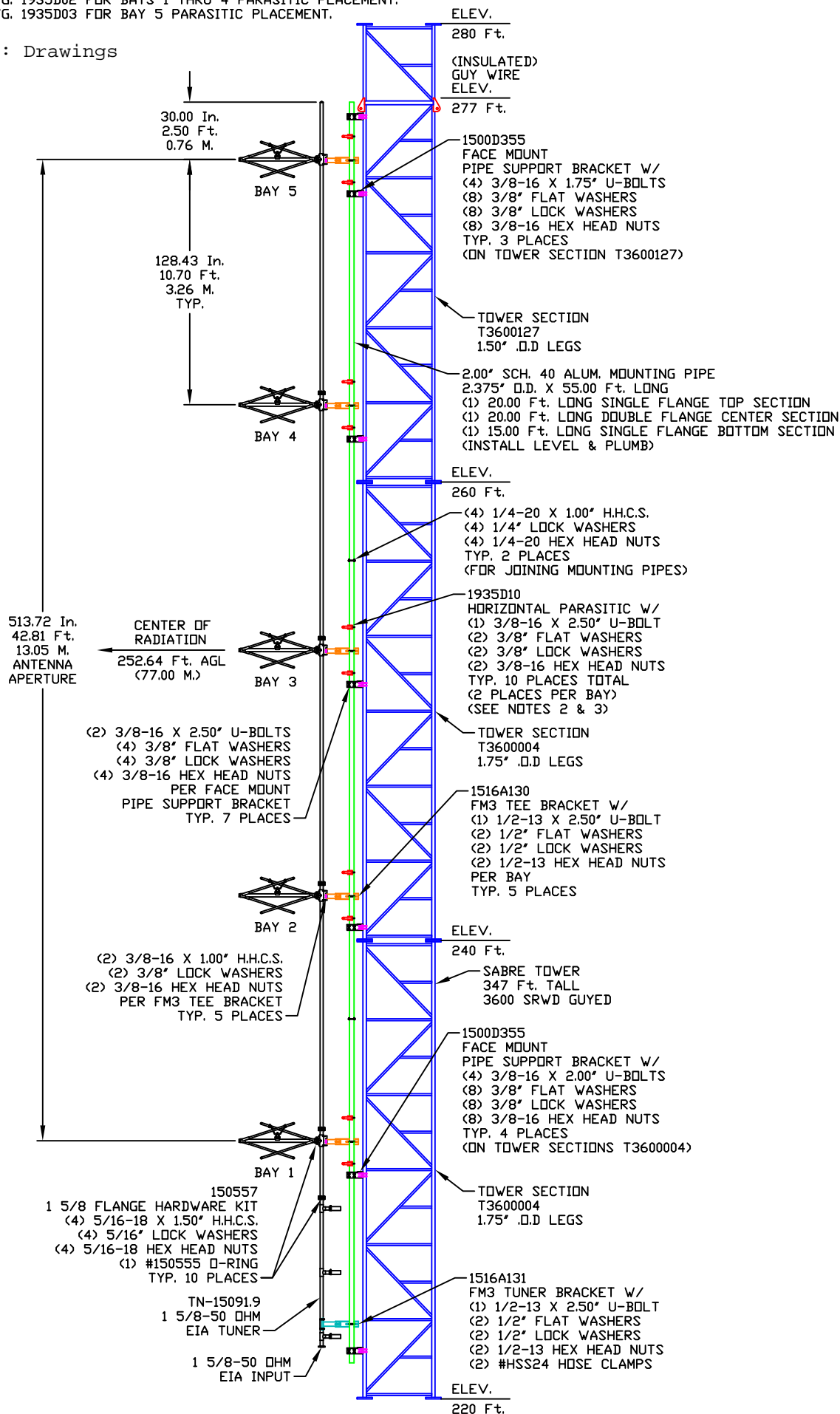
90.0%

NOTES:

1. REFERENCE DWG. 1935D01 FOR ANTENNA ORIENTATION.
2. REFERENCE DWG. 1935D02 FOR BAYS 1 THRU 4 PARASITIC PLACEMENT.
3. REFERENCE DWG. 1935D03 FOR BAY 5 PARASITIC PLACEMENT.

DRAWING NUMBER: 1935D00

Exhibit 7: Drawings



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

TITLE: FM3/5-DA, FREQ.
WYFO, LAKELAND, FL

MATERIAL:

SIZE: REV APPR. DATE
C 1
2
3

ENGINEER:

SCALE: NTS

NAME: RAC

DATE: 5/27/15

SHEET

1 OF 1

DRAWING NUMBER: 1935D00

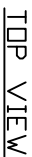
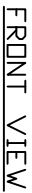


REVISION RECORD	
REV 	APPROVAL DATE

DRAWING
NUMBER:
1935D01

5/27/15 SHEET 1 OF 1

Exhibit 7 (cont'd): Drawings



REVISION RECORD		
REV	APPROVAL	DATE

FMS/5-DA, FREQ. 91.9
WYFO, LAKELAND, FL
PARASITIC PLACEMENT
BAYS 1 THRU 4

A

SCALE: NTS

NAME: D A C

DATE _____

5/27/

SHEP

1 OF 1



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

NOTE:

THIS ASSEMBLY IS FOR BAY 5.

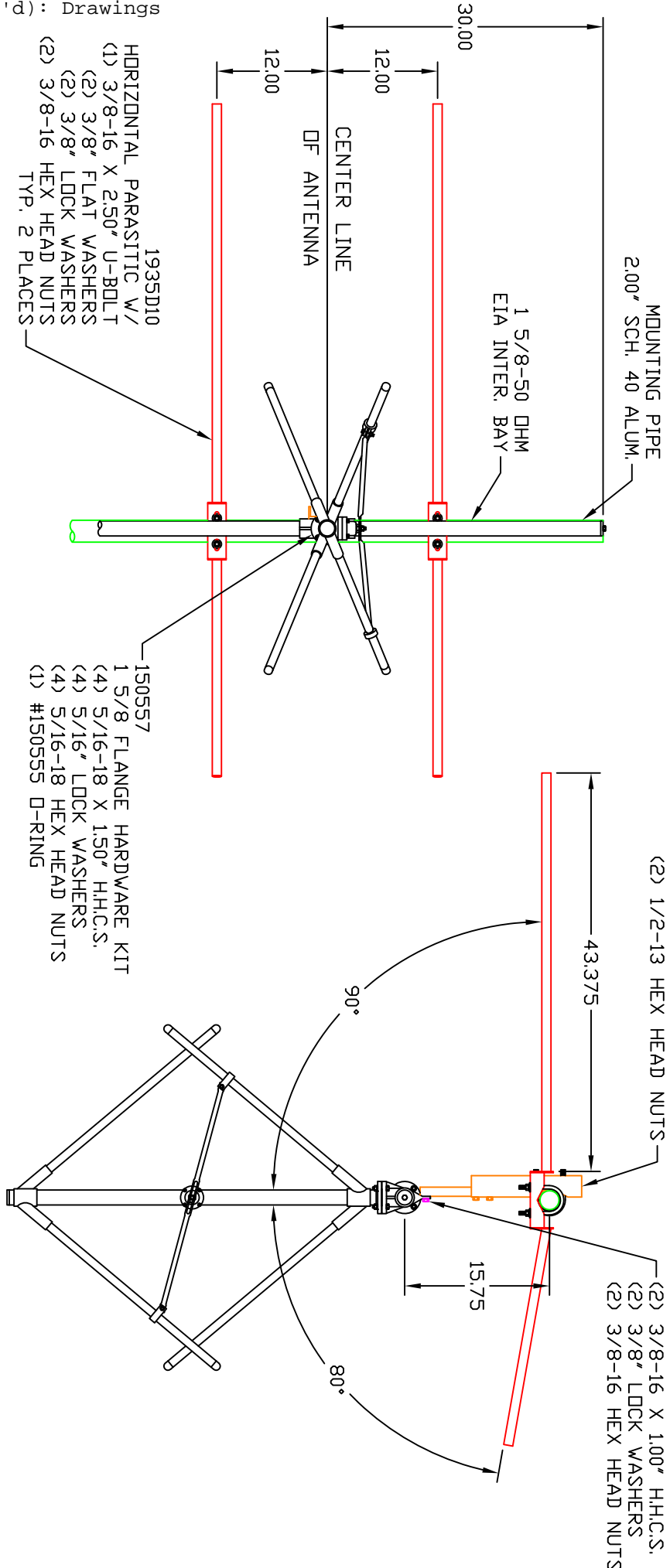
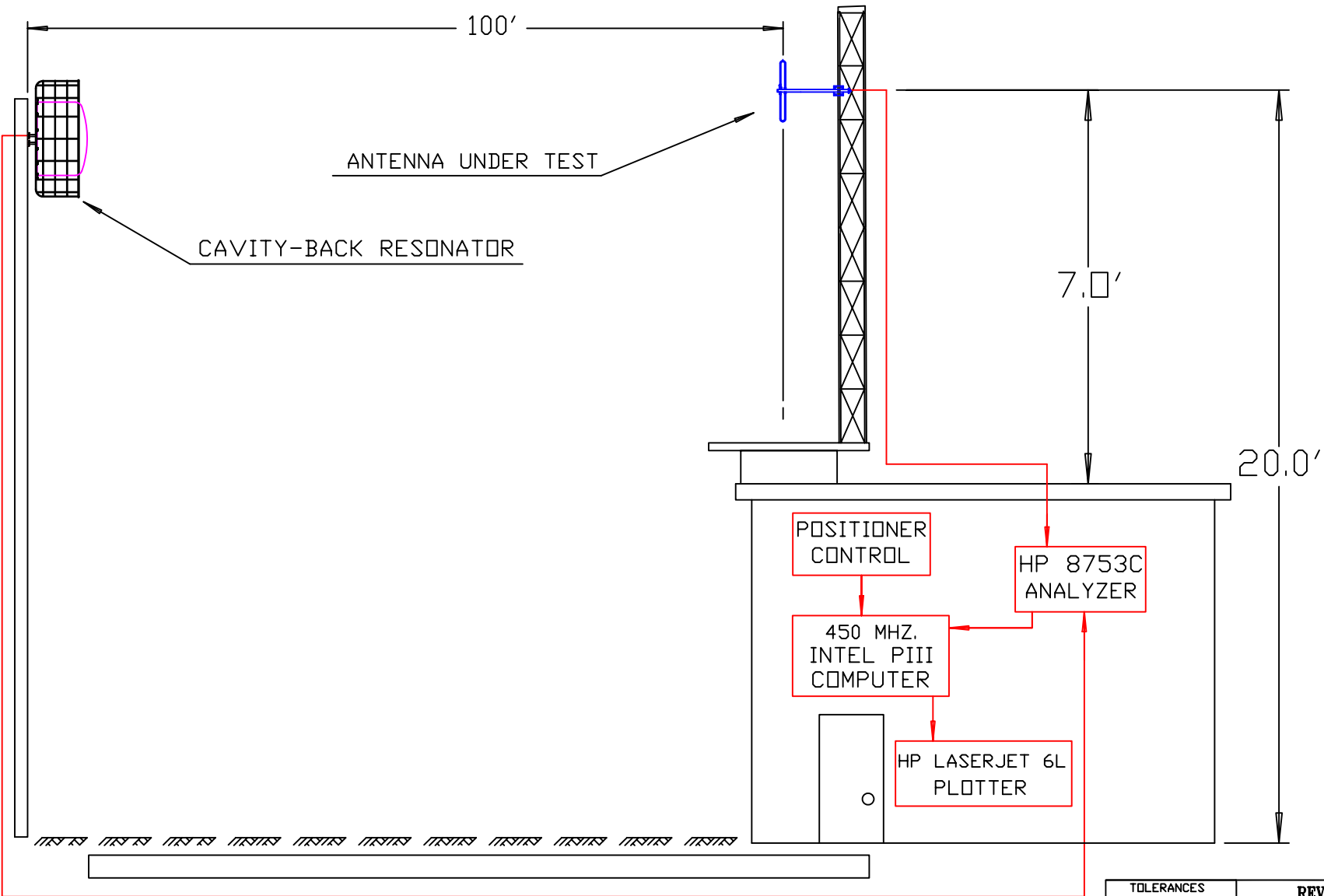


Exhibit 7 (cont'd): Drawings

		TITLE: FM3/5-DA, FREQ. 91.9 WYFO, LAKE LAND, FL PARASITIC PLACEMENT BAY 5		SIZE: A		SCALE: NTS		NAME: RAC		DATE: 5/27/15		SHEET 1 OF 1	
SYSTEMS WITH RELIABILITY, LP 619 INDUSTRIAL PARK ROAD EBENSBURG, PENNSYLVANIA 15931		MATERIAL:		PARTS MADE BY THIS DRAWING		DRAWING NUMBER: 1935D03		REVISION RECORD		APPROVAL		DATE	



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		