SYSTEMS WITH RELIABILITY, LLP

BROADCAST ANTENNAS AND TRANSMISSION LINE

PATTERN CERTIFICATION

DIRECTIONAL FM ANTENNA
WZXY
May 17, 2013

Call Sign	:	WZXY
Location	:	Spring Grove. PA
Frequency	:	90.7 MHz
Channel	:	214A
Antenna Model	:	FMEC/1-DA
Maximum Antenna Gain		
Horizontal	:	**0.942 / -0.258 dB**
Vertical	:	**0.942 / -0.258 dB**

ANTENNA DESCRIPTION

A custom designed FMEC1-DA antenna was fabricated to conform to the prescribed directional azimuth pattern. The antenna bay consists of a circularly polarized, cross-V dipole radiating element mounted to a 2" (inch) schedule 40 support pole. The support pole is mounted to an 14" (inch) face Rohn 35G tower. The antenna array points 130 degrees true north.

DESCRIPTION OF TEST PROCEDURE

The test antenna consisted of a single third-scale bay and parasitic system. 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 using horizontal parasitics, 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 transmit mode, at frequency 272.1 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 272.1 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 ***88.6%*** of the **RMS** value of the pattern authorized in the related construction permit **BMPED-20130207AAD.** The vertical component **RMS** value is **0.695**. The horizontal component **RMS** value is **0.673**. The circular polarized component **RMS** value is **0.777**.

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

Measured vertical polarized directivity:	**2.068 / 3.155 dB**
Measured horizontal polarized directivity:	**2.205 / 3.434 dB**
Measured circular polarized pattern directivity:	**1.656 / 2.191 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 = (2.068)(..515)(.883) **= 0.942 / -0.258 dB**
H-Pol. Gain = (2.199)(.485)(.883) **= 0.942 / -0.258 dB**

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **46** ***meters (118.12 ft.)*** above ground level. The antenna aperture is **5 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 ***130 degrees*** true North.

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

DRAWING NO.	**TITLE**
1782D00	ELEVATION
1782D01	ANTENNA ORENTATION
1782D02	ANTENNNA PARASITIC PLACEMENT
2105A10	TEST RANGE SCHEMATIC

The array shall be mounted according to **DWG. 1782D00**. The antenna elements shall be aligned at the same heading as in **DWG. 1782D01**. This will ensure that the antenna is oriented properly at 130 degrees true north. **DWG. 1782D02** shows the parasitic placement and mounting detail. The test range schematic **DWG. 2105A10** shows the mounting configuration of the antenna setup on our range.

DOCUMENT EXHIBITS

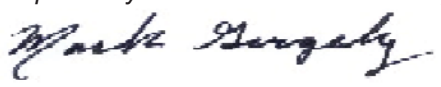
The following exhibits are included as part of this Certificate of Compliance:

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

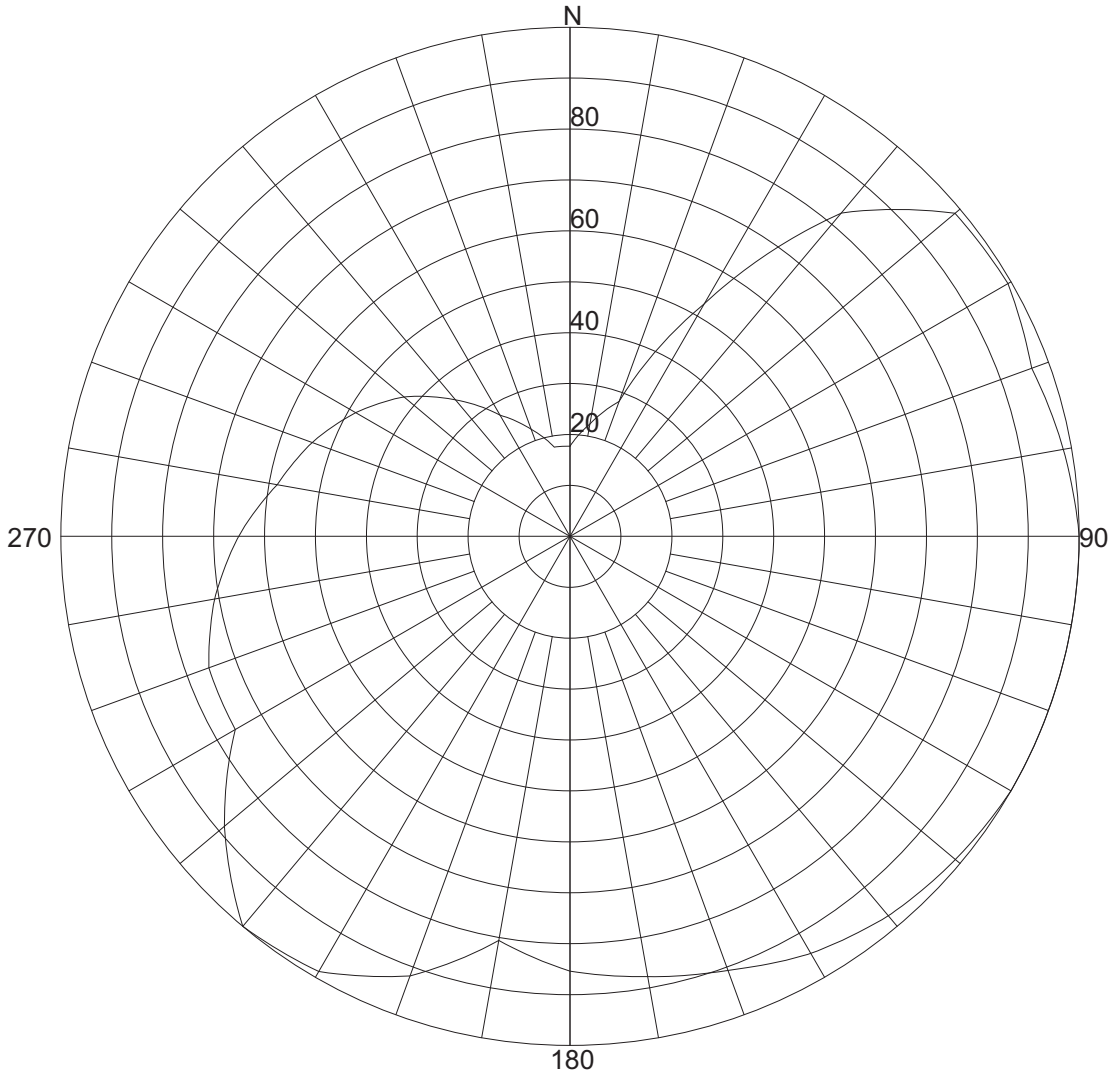
Network Analyzer	:	Hewlett Packard Model # 8753C Serial Number: 08753 – 69138
Computer	:	Pentium 3, 450 MHz, SAMS Range Program
Printer	:	Hewlett-Packard Laser Jet 6L
Positioner	:	Orbit Positioner
		All equipment is calibrated to ANSI/NCSL Z540-1-1994 specs

Prepared by:



Mark A. Gergely
Electrical Engineer
Systems With Reliability LLP

Exhibit 1: Circular Polarized Azimuth Pattern (Composite)



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WZXY*

Date: 5/17/2013

ANTENNA TYPE: FMEC/1-DA

FREQUENCY: 90.7 MHz

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.65617 / 2.19dB

PATTERN RMS: *0.777*

Micro-Tek Eng. ver 2.5

Exhibit 1 (cont'd): Circular Polarized Azimuth Pattern Tabulations (Composite)

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.1770 (-15.04)	180	.8540 (-1.37)
5	.2005 (-13.96)	185	.8300 (-1.62)
10	.2240 (-13)	190	.8060 (-1.87)
15	.2530 (-11.94)	195	.8625 (-1.28)
20	.2820 (-11)	200	.9190 (-0.73)
25	.4045 (-7.86)	205	.9530 (-0.42)
30	.5270 (-5.56)	210	.9870 (-0.11)
35	.6780 (-3.38)	215	.9935 (-0.06)
40	.8290 (-1.63)	220	1.0000 (0)
45	.9080 (-0.84)	225	.9430 (-0.51)
50	.9870 (-0.11)	230	.8860 (-1.05)
55	.9900 (-0.09)	235	.8225 (-1.7)
60	.9930 (-0.06)	240	.7590 (-2.4)
65	.9790 (-0.18)	245	.7570 (-2.42)
70	.9650 (-0.31)	250	.7550 (-2.44)
75	.9745 (-0.22)	255	.7320 (-2.71)
80	.9840 (-0.14)	260	.7090 (-2.99)
85	.9920 (-0.07)	265	.6800 (-3.35)
90	1.0000 (0)	270	.6510 (-3.73)
95	1.0000 (0)	275	.6175 (-4.19)
100	1.0000 (0)	280	.5840 (-4.67)
105	1.0000 (0)	285	.5615 (-5.01)
110	1.0000 (0)	290	.5390 (-5.37)
115	1.0000 (0)	295	.5125 (-5.81)
120	1.0000 (0)	300	.4860 (-6.27)
125	.9940 (-0.05)	305	.4560 (-6.82)
130	.9880 (-0.1)	310	.4260 (-7.41)
135	.9805 (-0.17)	315	.3880 (-8.22)
140	.9730 (-0.24)	320	.3500 (-9.12)
145	.9595 (-0.36)	325	.3125 (-10.1)
150	.9460 (-0.48)	330	.2750 (-11.21)
155	.9265 (-0.66)	335	.2495 (-12.06)
160	.9070 (-0.85)	340	.2240 (-13)
165	.8925 (-0.99)	345	.2010 (-13.94)
170	.8780 (-1.13)	350	.1780 (-14.99)
175	.8660 (-1.25)	355	.1775 (-15.02)

Systems With Reliability

CLIENT: *WZXY* Date: 5/17/2013

ANTENNA TYPE: FMEC/1-DA

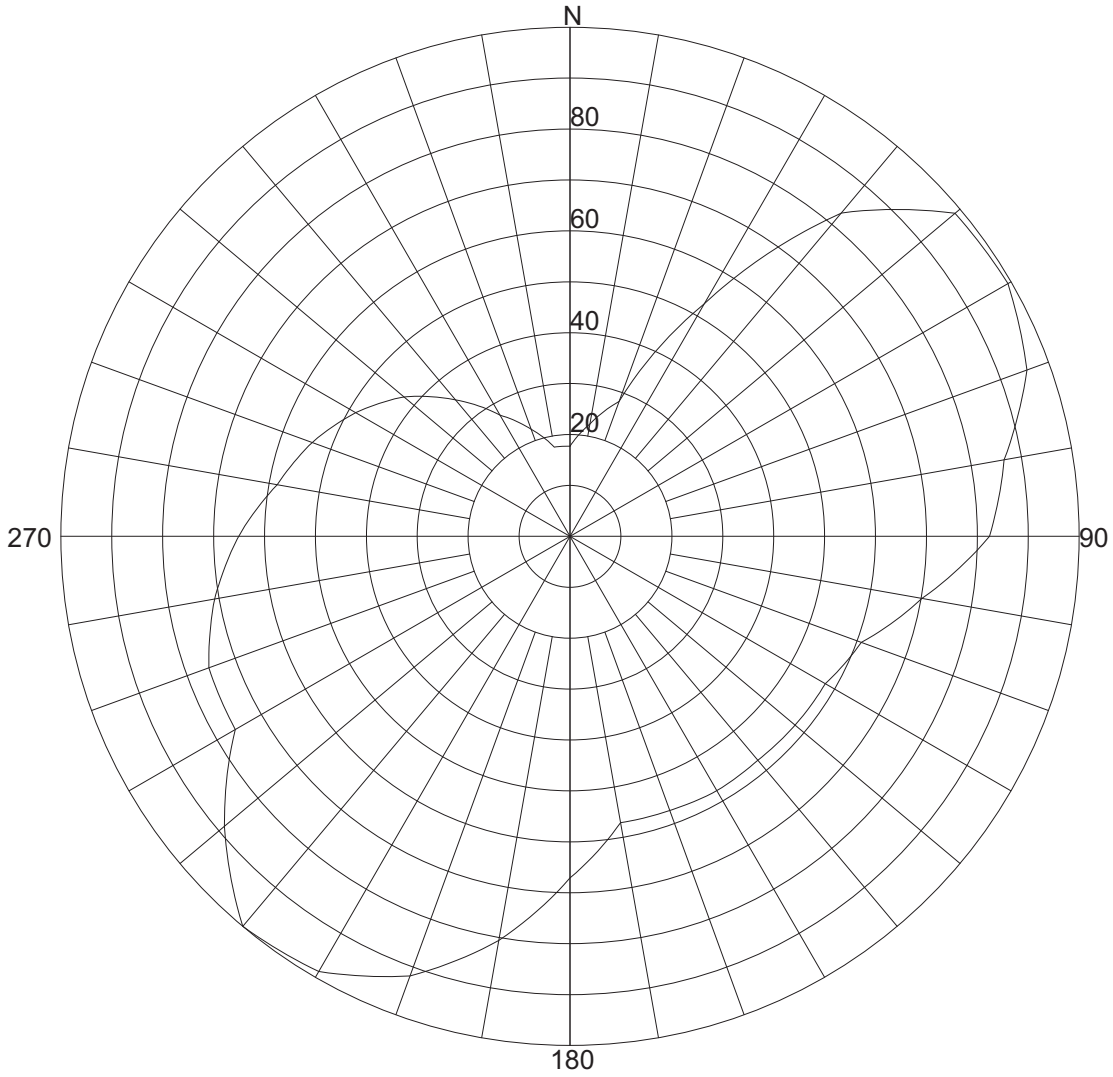
FREQUENCY: 90.7 MHz

PATTERN POL.: Circular CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.65617 / 2.19dB PATTERN RMS: *0.777*

Micro-Tek Eng. ver 2.5

Exhibit 2: Measured Horizontal Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WZXY*

Date: 5/17/2013

ANTENNA TYPE: FMEC/1-DA

FREQUENCY: 90.7 MHz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.2049 / 3.43dB

PATTERN RMS: *0.673*

Micro-Tek Eng. ver 2.5

Exhibit 2 (cont'd): Measured Horizontal Polarized Azimuth Pattern Tabulations

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.1770 (-15.04)	180	.6710 (-3.47)
5	.2005 (-13.96)	185	.7385 (-2.63)
10	.2240 (-13)	190	.8060 (-1.87)
15	.2530 (-11.94)	195	.8625 (-1.28)
20	.2820 (-11)	200	.9190 (-0.73)
25	.4045 (-7.86)	205	.9530 (-0.42)
30	.5270 (-5.56)	210	.9870 (-0.11)
35	.6780 (-3.38)	215	.9935 (-0.06)
40	.8290 (-1.63)	220	1.0000 (0)
45	.9080 (-0.84)	225	.9430 (-0.51)
50	.9870 (-0.11)	230	.8860 (-1.05)
55	.9900 (-0.09)	235	.8225 (-1.7)
60	.9930 (-0.06)	240	.7590 (-2.4)
65	.9740 (-0.23)	245	.7570 (-2.42)
70	.9550 (-0.4)	250	.7550 (-2.44)
75	.9105 (-0.81)	255	.7320 (-2.71)
80	.8660 (-1.25)	260	.7090 (-2.99)
85	.8450 (-1.46)	265	.6800 (-3.35)
90	.8240 (-1.68)	270	.6510 (-3.73)
95	.7630 (-2.35)	275	.6175 (-4.19)
100	.7020 (-3.07)	280	.5840 (-4.67)
105	.6555 (-3.67)	285	.5615 (-5.01)
110	.6090 (-4.31)	290	.5390 (-5.37)
115	.5940 (-4.52)	295	.5125 (-5.81)
120	.5790 (-4.75)	300	.4860 (-6.27)
125	.5780 (-4.76)	305	.4560 (-6.82)
130	.5770 (-4.78)	310	.4260 (-7.41)
135	.5755 (-4.8)	315	.3880 (-8.22)
140	.5740 (-4.82)	320	.3500 (-9.12)
145	.5755 (-4.8)	325	.3125 (-10.1)
150	.5770 (-4.78)	330	.2750 (-11.21)
155	.5750 (-4.81)	335	.2495 (-12.06)
160	.5730 (-4.84)	340	.2240 (-13)
165	.5720 (-4.85)	345	.2010 (-13.94)
170	.5710 (-4.87)	350	.1780 (-14.99)
175	.6210 (-4.14)	355	.1775 (-15.02)

Systems With Reliability

CLIENT: *WZXY* Date: 5/17/2013

ANTENNA TYPE: FMEC/1-DA

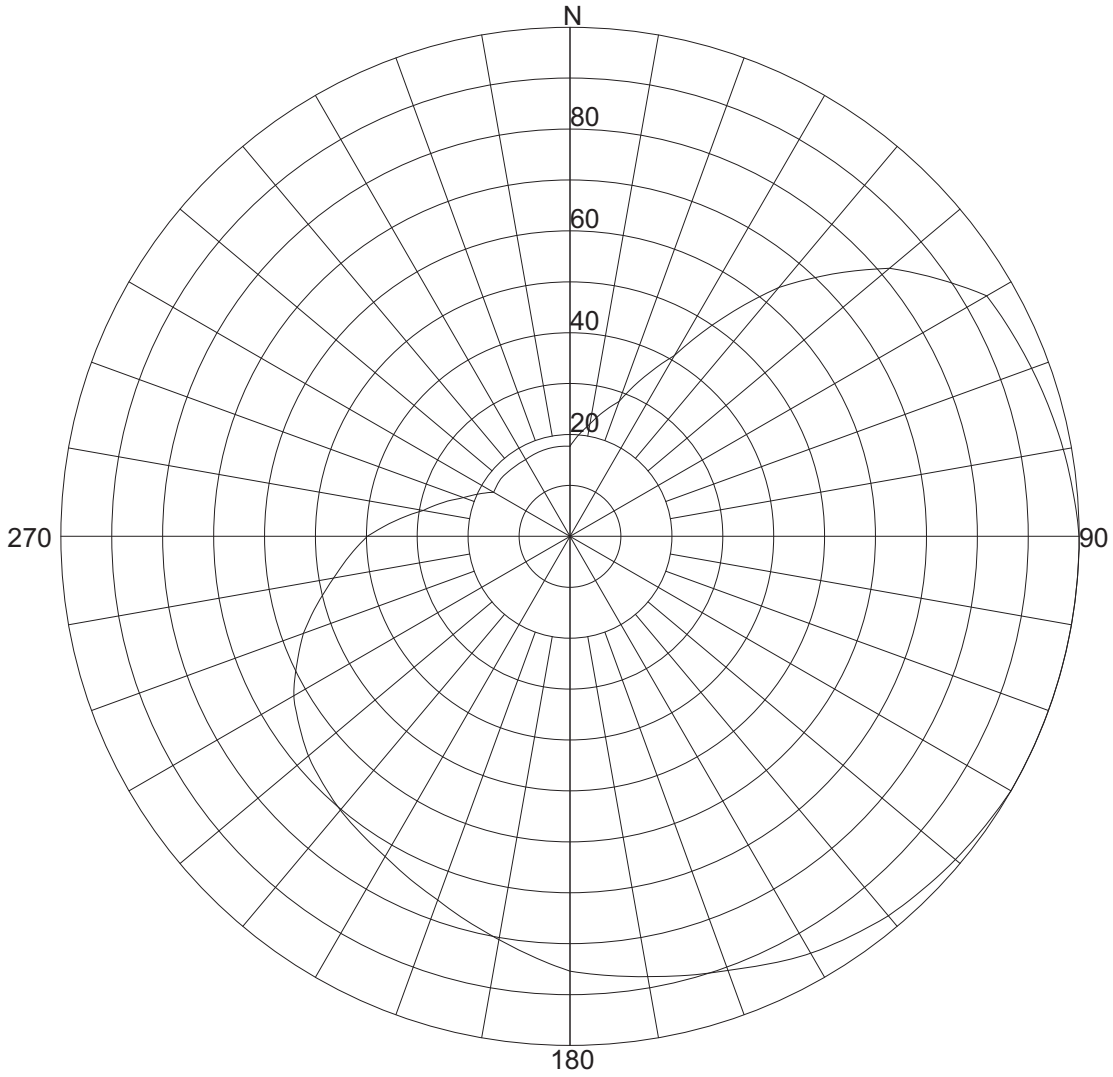
FREQUENCY: 90.7 MHz

PATTERN POL.: Horizontal CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.2049 / 3.43dB PATTERN RMS: *0.673*

Micro-Tek Eng. ver 2.5

Exhibit 3: Measured Vertical Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WZXY*

Date: 5/16/2013

ANTENNA TYPE: FMEC/1-DA

FREQUENCY: 90.7 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.06782 / 3.16dB

PATTERN RMS: *0.695*

Micro-Tek Eng. ver 2.5

Exhibit 3 (cont'd): Measured Vertical Polarized Azimuth Pattern Tabulations

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.1770 (-15.04)	180	.8540 (-1.37)
5	.2005 (-13.96)	185	.8290 (-1.63)
10	.2240 (-13)	190	.8040 (-1.89)
15	.2530 (-11.94)	195	.7820 (-2.14)
20	.2820 (-11)	200	.7600 (-2.38)
25	.3460 (-9.22)	205	.7430 (-2.58)
30	.4100 (-7.74)	210	.7260 (-2.78)
35	.5240 (-5.61)	215	.7140 (-2.93)
40	.6380 (-3.9)	220	.7020 (-3.07)
45	.7285 (-2.75)	225	.6865 (-3.27)
50	.8190 (-1.73)	230	.6710 (-3.47)
55	.8820 (-1.09)	235	.6490 (-3.76)
60	.9450 (-0.49)	240	.6270 (-4.05)
65	.9550 (-0.4)	245	.5920 (-4.55)
70	.9650 (-0.31)	250	.5570 (-5.08)
75	.9745 (-0.22)	255	.5140 (-5.78)
80	.9840 (-0.14)	260	.4710 (-6.54)
85	.9920 (-0.07)	265	.4345 (-7.24)
90	1.0000 (0)	270	.3980 (-8)
95	1.0000 (0)	275	.3455 (-9.23)
100	1.0000 (0)	280	.2930 (-10.66)
105	1.0000 (0)	285	.2575 (-11.78)
110	1.0000 (0)	290	.2220 (-13.07)
115	1.0000 (0)	295	.1975 (-14.09)
120	1.0000 (0)	300	.1730 (-15.24)
125	.9940 (-0.05)	305	.1750 (-15.14)
130	.9880 (-0.1)	310	.1770 (-15.04)
135	.9805 (-0.17)	315	.1760 (-15.09)
140	.9730 (-0.24)	320	.1750 (-15.14)
145	.9595 (-0.36)	325	.1745 (-15.16)
150	.9460 (-0.48)	330	.1740 (-15.19)
155	.9265 (-0.66)	335	.1755 (-15.11)
160	.9070 (-0.85)	340	.1770 (-15.04)
165	.8925 (-0.99)	345	.1775 (-15.02)
170	.8780 (-1.13)	350	.1780 (-14.99)
175	.8660 (-1.25)	355	.1775 (-15.02)

Systems With Reliability

CLIENT: *WZXY* Date: 5/16/2013

ANTENNA TYPE: FMEC/1-DA

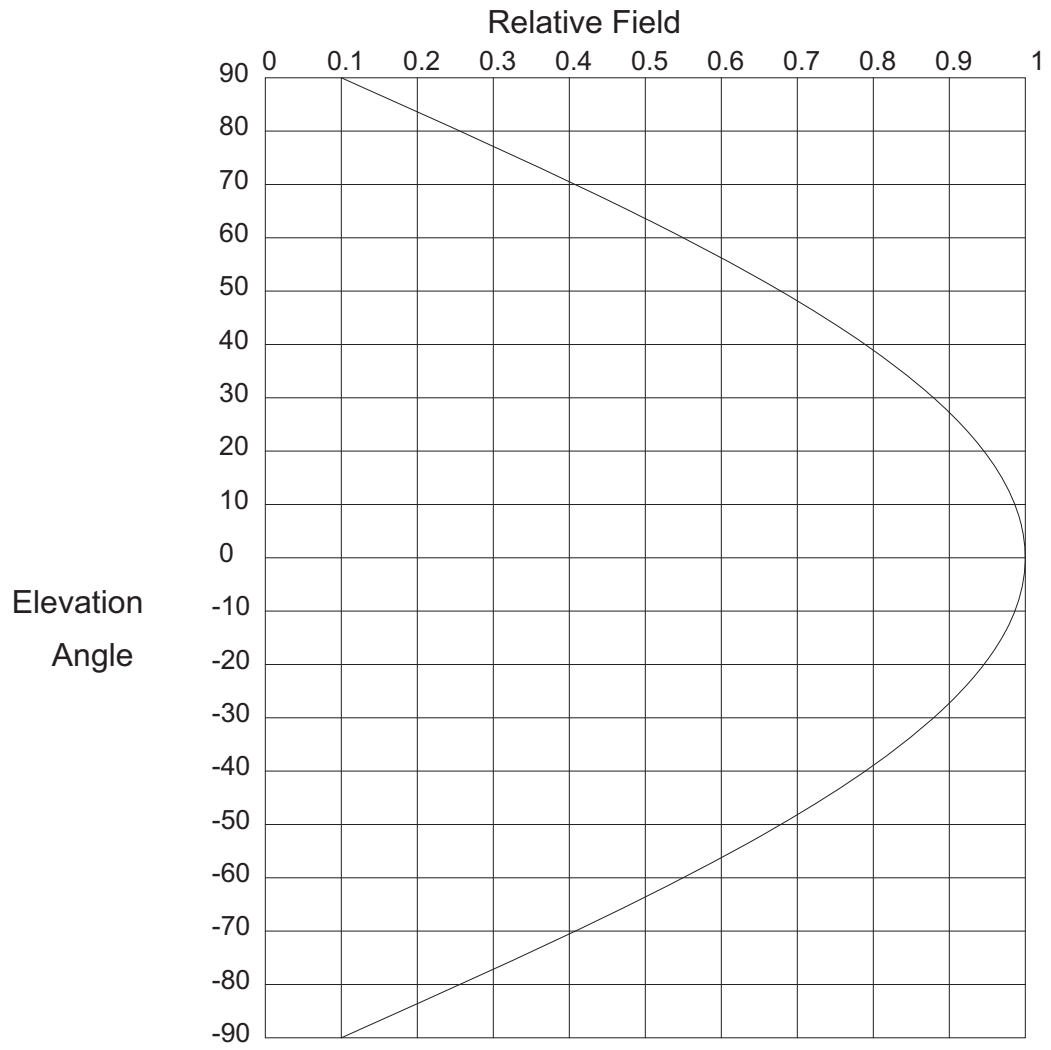
FREQUENCY: 90.7 MHz

PATTERN POL.: Vertical CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.06782 / 3.16dB PATTERN RMS: *0.695*

Micro-Tek Eng. ver 2.5

Exhibit 4: Elevation Pattern



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: *WZXY*

Date: 5/16/2013

ANTENNA TYPE: FMEC/1-DA

FREQUENCY: 90.7 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 0.883/-0.539 dBd

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

Micro-Tek Eng. ver 2.5

Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
90.0	.10 (-20)	52.0	.654 (-3.687)	14.0	.973 (-0.235)
89.0	.116 (-18.733)	51.0	.666 (-3.525)	13.0	.977 (-0.203)
88.0	.131 (-17.627)	50.0	.679 (-3.369)	12.0	.98 (-0.173)
87.0	.147 (-16.648)	49.0	.69 (-3.217)	11.0	.983 (-0.145)
86.0	.163 (-15.768)	48.0	.702 (-3.071)	10.0	.986 (-0.12)
85.0	.178 (-14.97)	47.0	.714 (-2.928)	9.8	.987 (-0.115)
84.0	.194 (-14.241)	46.0	.725 (-2.791)	9.6	.987 (-0.11)
83.0	.21 (-13.569)	45.0	.736 (-2.658)	9.4	.988 (-0.106)
82.0	.225 (-12.946)	44.0	.747 (-2.529)	9.2	.988 (-0.101)
81.0	.241 (-12.367)	43.0	.758 (-2.404)	9.0	.989 (-0.097)
80.0	.256 (-11.826)	42.0	.769 (-2.283)	8.8	.989 (-0.093)
79.0	.272 (-11.317)	41.0	.779 (-2.167)	8.6	.99 (-0.088)
78.0	.287 (-10.839)	40.0	.789 (-2.054)	8.4	.99 (-0.084)
77.0	.302 (-10.387)	39.0	.799 (-1.944)	8.2	.991 (-0.08)
76.0	.318 (-9.959)	38.0	.809 (-1.839)	8.0	.991 (-0.076)
75.0	.333 (-9.553)	37.0	.819 (-1.737)	7.8	.992 (-0.073)
74.0	.348 (-9.167)	36.0	.828 (-1.638)	7.6	.992 (-0.069)
73.0	.363 (-8.799)	35.0	.837 (-1.543)	7.4	.993 (-0.065)
72.0	.378 (-8.448)	34.0	.846 (-1.451)	7.2	.993 (-0.062)
71.0	.393 (-8.112)	33.0	.855 (-1.363)	7.0	.993 (-0.058)
70.0	.408 (-7.791)	32.0	.863 (-1.277)	6.8	.994 (-0.055)
69.0	.423 (-7.483)	31.0	.871 (-1.195)	6.6	.994 (-0.052)
68.0	.437 (-7.187)	30.0	.879 (-1.116)	6.4	.994 (-0.049)
67.0	.452 (-6.904)	29.0	.887 (-1.04)	6.2	.995 (-0.046)
66.0	.466 (-6.631)	28.0	.895 (-0.967)	6.0	.995 (-0.043)
65.0	.48 (-6.369)	27.0	.902 (-0.897)	5.8	.995 (-0.04)
64.0	.495 (-6.116)	26.0	.909 (-0.83)	5.6	.996 (-0.037)
63.0	.509 (-5.873)	25.0	.916 (-0.765)	5.4	.996 (-0.035)
62.0	.523 (-5.638)	24.0	.922 (-0.704)	5.2	.996 (-0.032)
61.0	.536 (-5.411)	23.0	.928 (-0.645)	5.0	.997 (-0.03)
60.0	.55 (-5.193)	22.0	.934 (-0.589)	4.8	.997 (-0.027)
59.0	.564 (-4.982)	21.0	.94 (-0.535)	4.6	.997 (-0.025)
58.0	.577 (-4.778)	20.0	.946 (-0.485)	4.4	.997 (-0.023)
57.0	.59 (-4.58)	19.0	.951 (-0.437)	4.2	.998 (-0.021)
56.0	.603 (-4.39)	18.0	.956 (-0.391)	4.0	.998 (-0.019)
55.0	.616 (-4.205)	17.0	.961 (-0.348)	3.8	.998 (-0.017)
54.0	.629 (-4.027)	16.0	.965 (-0.308)	3.6	.998 (-0.015)
53.0	.642 (-3.854)	15.0	.969 (-0.271)	3.4	.998 (-0.014)

Systems With Reliability

CLIENT: *WZXY*
Date: 5/16/2013
ANTENNA TYPE: FMEC/1-DA
FREQUENCY: 90.7 MHz
PATTERN POL.: Circular
DIRECTIVITY(Peak): 0.883/-0.539 dBd
Beam Tilt (Deg.) : *0*
DIRECTIVITY(Horiz): 0.883/-0.539 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	.999 (-0.012)	-4.4	.997 (-0.023)	-12.0	.98 (-0.173)
3.0	.999 (-0.011)	-4.6	.997 (-0.025)	-12.2	.98 (-0.178)
2.8	.999 (-0.009)	-4.8	.997 (-0.027)	-12.4	.979 (-0.184)
2.6	.999 (-0.008)	-5.0	.997 (-0.03)	-12.6	.978 (-0.19)
2.4	.999 (-0.007)	-5.2	.996 (-0.032)	-12.8	.978 (-0.196)
2.2	.999 (-0.006)	-5.4	.996 (-0.035)	-13.0	.977 (-0.203)
2.0	.999 (-0.005)	-5.6	.996 (-0.037)	-13.2	.976 (-0.209)
1.8	1.00 (-0.004)	-5.8	.995 (-0.04)	-13.4	.975 (-0.215)
1.6	1.00 (-0.003)	-6.0	.995 (-0.043)	-13.6	.975 (-0.222)
1.4	1.00 (-0.002)	-6.2	.995 (-0.046)	-13.8	.974 (-0.229)
1.2	1.00 (-0.002)	-6.4	.994 (-0.049)	-14.0	.973 (-0.235)
1.0	1.00 (-0.001)	-6.6	.994 (-0.052)	-14.2	.973 (-0.242)
.8	1.00 (-0.001)	-6.8	.994 (-0.055)	-14.4	.972 (-0.249)
.6	1.00 (0)	-7.0	.993 (-0.058)	-14.6	.971 (-0.256)
.4	1.00 (0)	-7.2	.993 (-0.062)	-14.8	.97 (-0.263)
.2	1.00 (0)	-7.4	.993 (-0.065)	-15.0	.969 (-0.271)
.0	1.00 (0)	-7.6	.992 (-0.069)	-15.2	.969 (-0.278)
-.2	1.00 (0)	-7.8	.992 (-0.073)	-15.4	.968 (-0.285)
-.4	1.00 (0)	-8.0	.991 (-0.076)	-15.6	.967 (-0.293)
-.6	1.00 (0)	-8.2	.991 (-0.08)	-15.8	.966 (-0.3)
-.8	1.00 (-0.001)	-8.4	.99 (-0.084)	-16.0	.965 (-0.308)
-1.0	1.00 (-0.001)	-8.6	.99 (-0.088)	-16.2	.964 (-0.316)
-1.2	1.00 (-0.002)	-8.8	.989 (-0.093)	-16.4	.963 (-0.324)
-1.4	1.00 (-0.002)	-9.0	.989 (-0.097)	-16.6	.962 (-0.332)
-1.6	1.00 (-0.003)	-9.2	.988 (-0.101)	-16.8	.962 (-0.34)
-1.8	1.00 (-0.004)	-9.4	.988 (-0.106)	-17.0	.961 (-0.348)
-2.0	.999 (-0.005)	-9.6	.987 (-0.11)	-17.2	.96 (-0.357)
-2.2	.999 (-0.006)	-9.8	.987 (-0.115)	-17.4	.959 (-0.365)
-2.4	.999 (-0.007)	-10.0	.986 (-0.12)	-17.6	.958 (-0.374)
-2.6	.999 (-0.008)	-10.2	.986 (-0.124)	-17.8	.957 (-0.383)
-2.8	.999 (-0.009)	-10.4	.985 (-0.129)	-18.0	.956 (-0.391)
-3.0	.999 (-0.011)	-10.6	.985 (-0.134)	-18.2	.955 (-0.4)
-3.2	.999 (-0.012)	-10.8	.984 (-0.14)	-18.4	.954 (-0.409)
-3.4	.998 (-0.014)	-11.0	.983 (-0.145)	-18.6	.953 (-0.418)
-3.6	.998 (-0.015)	-11.2	.983 (-0.15)	-18.8	.952 (-0.427)
-3.8	.998 (-0.017)	-11.4	.982 (-0.156)	-19.0	.951 (-0.437)
-4.0	.998 (-0.019)	-11.6	.982 (-0.161)	-19.2	.95 (-0.446)
-4.2	.998 (-0.021)	-11.8	.981 (-0.167)	-19.4	.949 (-0.456)

Systems With Reliability

CLIENT: *WZXY*

Date: 5/16/2013

ANTENNA TYPE: FMEC/1-DA

FREQUENCY: 90.7 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 0.883/-0.539 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	.948 (-0.465)	-27.2	.90 (-0.911)	-54.0	.629 (-4.027)
-19.8	.947 (-0.475)	-27.4	.899 (-0.924)	-55.0	.616 (-4.205)
-20.0	.946 (-0.485)	-27.6	.898 (-0.939)	-56.0	.603 (-4.39)
-20.2	.945 (-0.495)	-27.8	.896 (-0.953)	-57.0	.59 (-4.58)
-20.4	.944 (-0.505)	-28.0	.895 (-0.967)	-58.0	.577 (-4.778)
-20.6	.942 (-0.515)	-28.2	.893 (-0.981)	-59.0	.564 (-4.982)
-20.8	.941 (-0.525)	-28.4	.892 (-0.996)	-60.0	.55 (-5.193)
-21.0	.94 (-0.535)	-28.6	.89 (-1.01)	-61.0	.536 (-5.411)
-21.2	.939 (-0.546)	-28.8	.889 (-1.025)	-62.0	.523 (-5.638)
-21.4	.938 (-0.556)	-29.0	.887 (-1.04)	-63.0	.509 (-5.873)
-21.6	.937 (-0.567)	-29.2	.886 (-1.055)	-64.0	.495 (-6.116)
-21.8	.936 (-0.578)	-29.4	.884 (-1.07)	-65.0	.48 (-6.369)
-22.0	.934 (-0.589)	-29.6	.883 (-1.085)	-66.0	.466 (-6.631)
-22.2	.933 (-0.6)	-29.8	.881 (-1.101)	-67.0	.452 (-6.904)
-22.4	.932 (-0.611)	-30.0	.879 (-1.116)	-68.0	.437 (-7.187)
-22.6	.931 (-0.622)	-31.0	.871 (-1.195)	-69.0	.423 (-7.483)
-22.8	.93 (-0.633)	-32.0	.863 (-1.277)	-70.0	.408 (-7.791)
-23.0	.928 (-0.645)	-33.0	.855 (-1.363)	-71.0	.393 (-8.112)
-23.2	.927 (-0.656)	-34.0	.846 (-1.451)	-72.0	.378 (-8.448)
-23.4	.926 (-0.668)	-35.0	.837 (-1.543)	-73.0	.363 (-8.799)
-23.6	.925 (-0.68)	-36.0	.828 (-1.638)	-74.0	.348 (-9.167)
-23.8	.923 (-0.692)	-37.0	.819 (-1.737)	-75.0	.333 (-9.553)
-24.0	.922 (-0.704)	-38.0	.809 (-1.839)	-76.0	.318 (-9.959)
-24.2	.921 (-0.716)	-39.0	.799 (-1.944)	-77.0	.302 (-10.387)
-24.4	.92 (-0.728)	-40.0	.789 (-2.054)	-78.0	.287 (-10.839)
-24.6	.918 (-0.74)	-41.0	.779 (-2.167)	-79.0	.272 (-11.317)
-24.8	.917 (-0.753)	-42.0	.769 (-2.283)	-80.0	.256 (-11.826)
-25.0	.916 (-0.765)	-43.0	.758 (-2.404)	-81.0	.241 (-12.367)
-25.2	.914 (-0.778)	-44.0	.747 (-2.529)	-82.0	.225 (-12.946)
-25.4	.913 (-0.791)	-45.0	.736 (-2.658)	-83.0	.21 (-13.569)
-25.6	.912 (-0.803)	-46.0	.725 (-2.791)	-84.0	.194 (-14.241)
-25.8	.91 (-0.816)	-47.0	.714 (-2.928)	-85.0	.178 (-14.97)
-26.0	.909 (-0.83)	-48.0	.702 (-3.071)	-86.0	.163 (-15.768)
-26.2	.908 (-0.843)	-49.0	.69 (-3.217)	-87.0	.147 (-16.648)
-26.4	.906 (-0.856)	-50.0	.679 (-3.369)	-88.0	.131 (-17.627)
-26.6	.905 (-0.87)	-51.0	.666 (-3.525)	-89.0	.116 (-18.733)
-26.8	.903 (-0.883)	-52.0	.654 (-3.687)	-90.0	.10 (-20)
-27.0	.902 (-0.897)	-53.0	.642 (-3.854)	90.0	.00 (-50)

Systems With Reliability

CLIENT: *WZXY*

Date: 5/16/2013

ANTENNA TYPE: FMEC/1-DA

FREQUENCY: 90.7 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 0.883/-0.539 dBd

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

Exhibit 5: Antenna Data Sheet

SYSTEMS WITH RELIABILITY, LLP

BROADCAST ANTENNAS AND TRANSMISSION LINE

SYSTEM DATA SHEET

Customer	WZXY
Contact	Charles Loughery
Location	Spring Grove, PA
Antenna Model	FMEC/1-DA
Channel / Frequency	214A / 90.7 MHz

ELECTRICAL SPECIFICATIONS

Antenna Specifications:

		H-POL	dB		V. Pol.	dB	
License ERP (KW)		0.160	-7.959	**dB**	0.160	-7.959	**dB**
FCC Limit Pattern Directivity		1.300	1.139	**dB**	1.300	1.139	**dB**
Elevation Directivity		0.883	-0.540	**dB**	0.883	-0.540	**dB**
Azimuth Directivity		2.205	3.434	**dB**	2.068	3.155	**dB**
Composite Pattern		1.656	2.191	**dB**	1.656	2.191	**dB**
Polarization Ratio		0.484	-3.152	**dB**	0.516	-2.873	**dB**
RMS Comp./RMS Limit	88.6 **%**						
Antenna Efficiency %		100	0		100	0	
Power Ratio (Pol. Ratio X Efficiency)		0.4840	0		0.5160	0	
Antenna Gain		0.942	-0.258	**dB**	0.942	-0.258	**dB**

Antenna Input Power (KW)	0.170 **kW**	-7.700	**(dBK)**

Feed Line Specifications:

Line Type: Andrew	1/2" Foam	**50 Ω**	**LDF4-50A**
Attenuation Per 100 ft (dB)	0.629	**dB**	
Line Length (ft) AGL + Horizontal Run	200.00	**ft.**	
Total Line Attenuation (dB)	1.2580	**dB**	
Line Efficiency	74.85	**%**	
Power Input to the Line (KW)	0.227 **kW**	-6.442	**(dBK)**

MECHANICAL SPECIFICATIONS

No. Of Bays	1					
Antenna Aperture	5.00	**ft.**			1.52	**meter**
Center of Radiation AGL	150.93	**ft.**			46.00	**meter**
Antenna Weight	65.00	**lbs.**			29.55	**kg**
Windload (50/33)	120.00	**lbs.**	**Windload CaAc**		3.5	**ft^2**

Prepared by: David K Edmiston Jr.

David K. Edmiston Jr.
SWR, LLP

Exhibit 6: RMS Calculations

SYSTEMS WITH RELIABILITY, INC.
Broadcast Antennas and Transmission Systems

WZXY Antenna RMS Comparison

PROPOSED ANTENNA		DESIGNED ANTENNA	
Azimuth Heading	Relative Field	Azimuth Heading	Relative Field
0	0.178	0	0.177
10	0.224	10	0.224
20	0.282	20	0.282
30	0.861	30	0.527
40	0.989	40	0.829
50	1.000	50	0.987
60	1.000	60	0.993
70	1.000	70	0.965
80	1.000	80	0.984
90	1.000	90	1.000
100	1.000	100	1.000
110	1.000	110	1.000
120	1.000	120	1.000
130	1.000	130	0.988
140	1.000	140	0.973
150	1.000	150	0.946
160	1.000	160	0.907
170	1.000	170	0.878
180	1.000	180	0.854
190	1.000	190	0.806
200	1.000	200	0.919
210	1.000	210	0.987
220	1.000	220	1.000
230	0.886	230	0.886
240	0.785	240	0.759
250	0.759	250	0.755
260	0.804	260	0.709
270	0.846	270	0.651
280	0.907	280	0.584
290	0.990	290	0.539
300	0.990	300	0.486
310	0.990	310	0.426
320	0.841	320	0.350
330	0.275	330	0.275
340	0.224	340	0.224
350	0.178	350	0.178

Sum of Relative Field Squared :	**27.848**	**Sum of Relative Field Squared :**	**21.782**
Sum Divided by 36 (Readings) :	**0.774**	**Sum Divided by 36 (Readings) :**	**0.605**
Square Root :	**0.877**	**Square Root :**	**0.777**

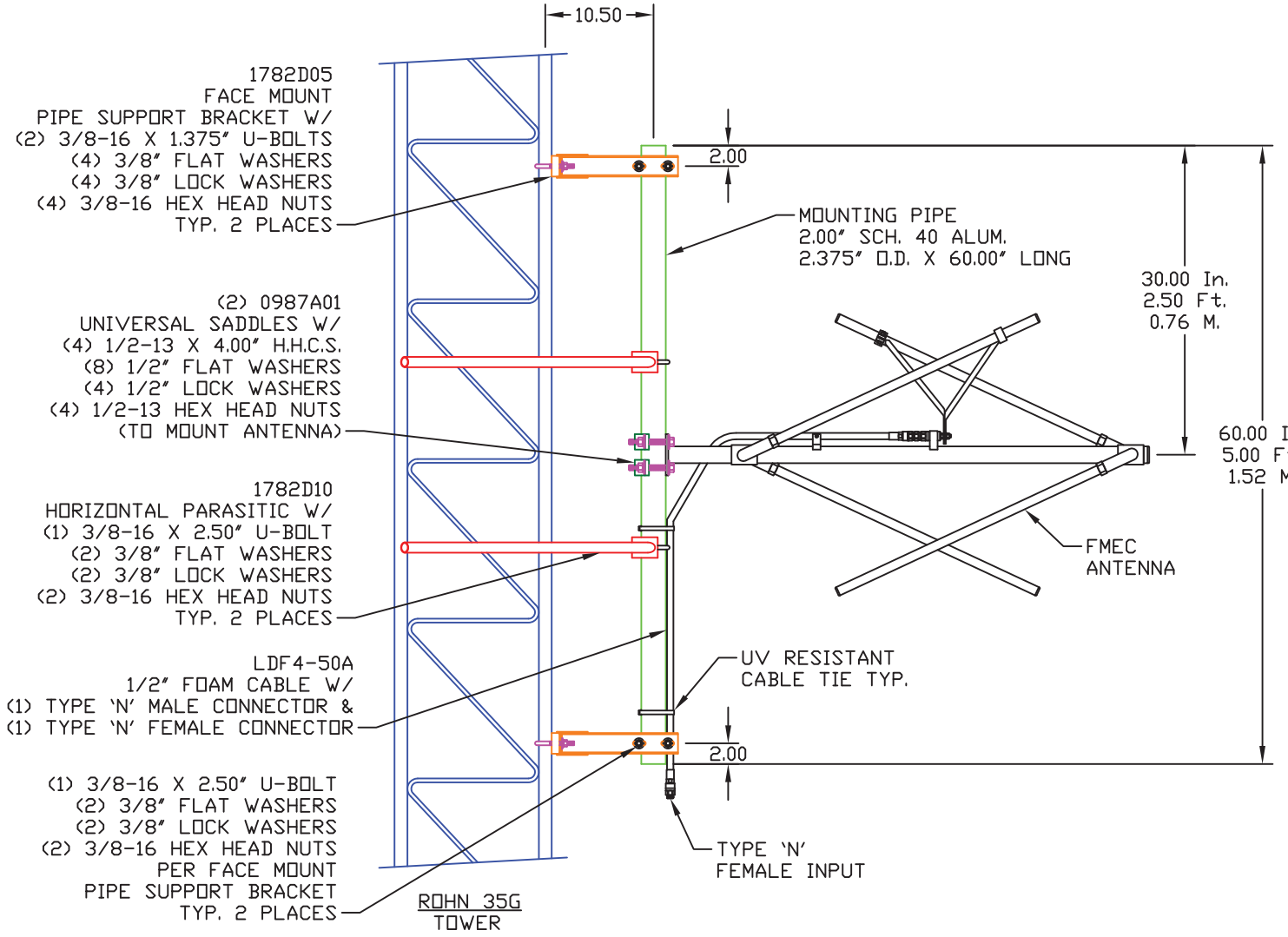
Percentage of Construction Permit Antenna Filled : **88.6%**

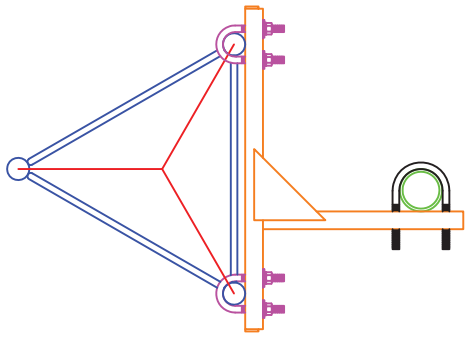
NOTE:

1. REFERENCE DWG. 1782D01 FOR ANTENNA ORIENTATION.
2. REFERENCE DWG. 1782D02 FOR PARASITIC PLACEMENT.

DRAWING NUMBER: 1782D00

Exhibit 7: Drawings





TOP VIEW
FACE MOUNT
PIPE SUPPORT BRACKET
NOT TO SCALE

TOLERANCES	
.X	± .015
.XX	± .005
.XXX	± .002
X/X	± 1/32
DEG.	± 1/2

UNLESS OTHERWISE SPECIFIED

REVISION RECORD

REV	APPROVAL	DATE

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

TITLE: FMEC/1-DA, FREQ. 90.7
WZXY, SPRING GROVE, PA

MATERIAL:

SIZE A

PARTS MADE BY THIS DRAWING

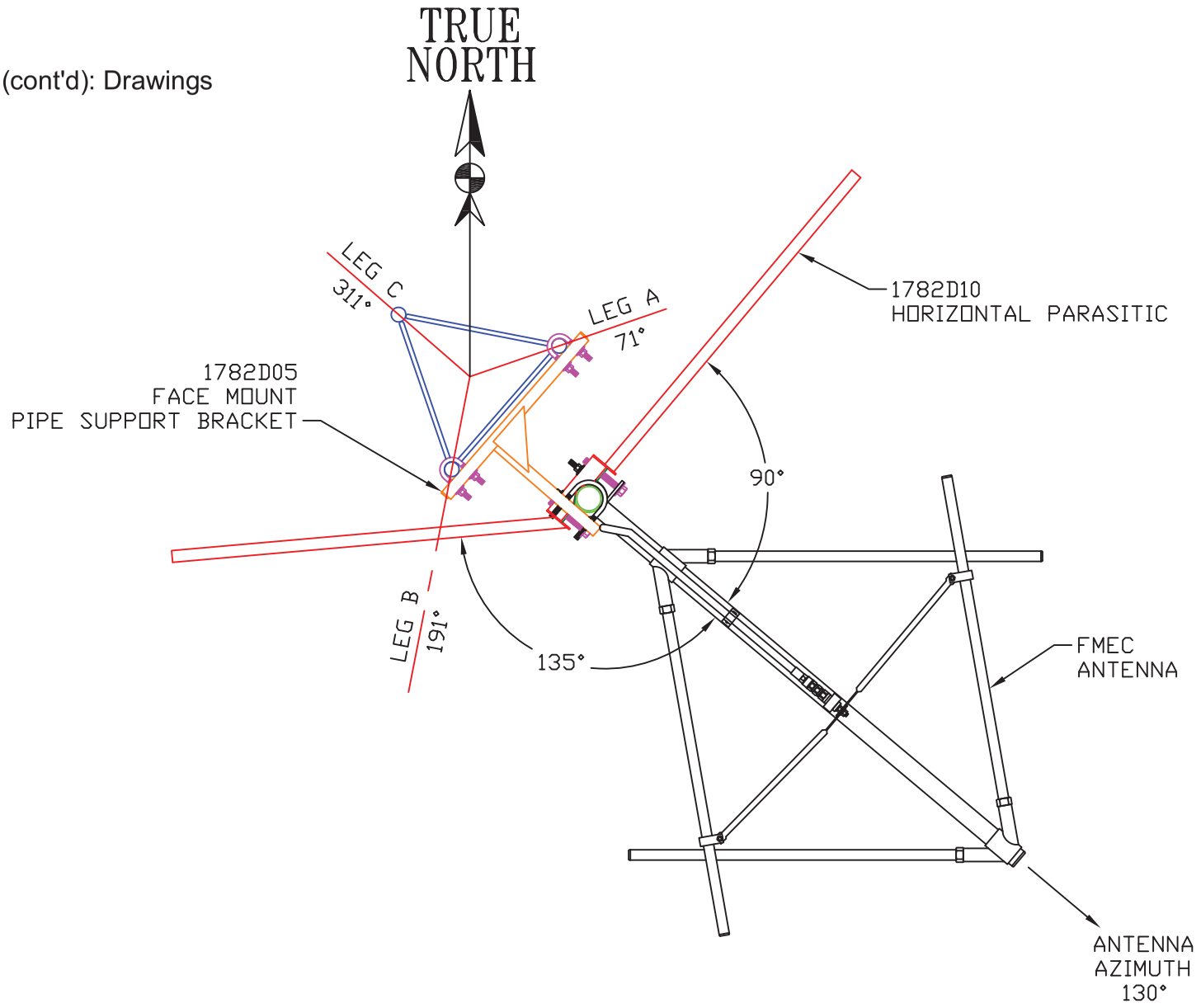
DRAWING NUMBER: 1782D00

SCALE: NTS | NAME: RAC | DATE: 5/16/13 | SHEET 1 OF 1

NOTE:

Exhibit 7 (cont'd): Drawings

DRAWING NUMBER: 1782D01



TOP VIEW

REVISION RECORD

REV	APPROVAL	DATE

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

TITLE: FMEC/1-DA, FREQ. 90.7
WZXY, SPRING GROVE, PA

MATERIAL: ANTENNA ORIENTATION
FROM TRUE NORTH

SIZE A

PARTS MADE BY THIS DRAWING

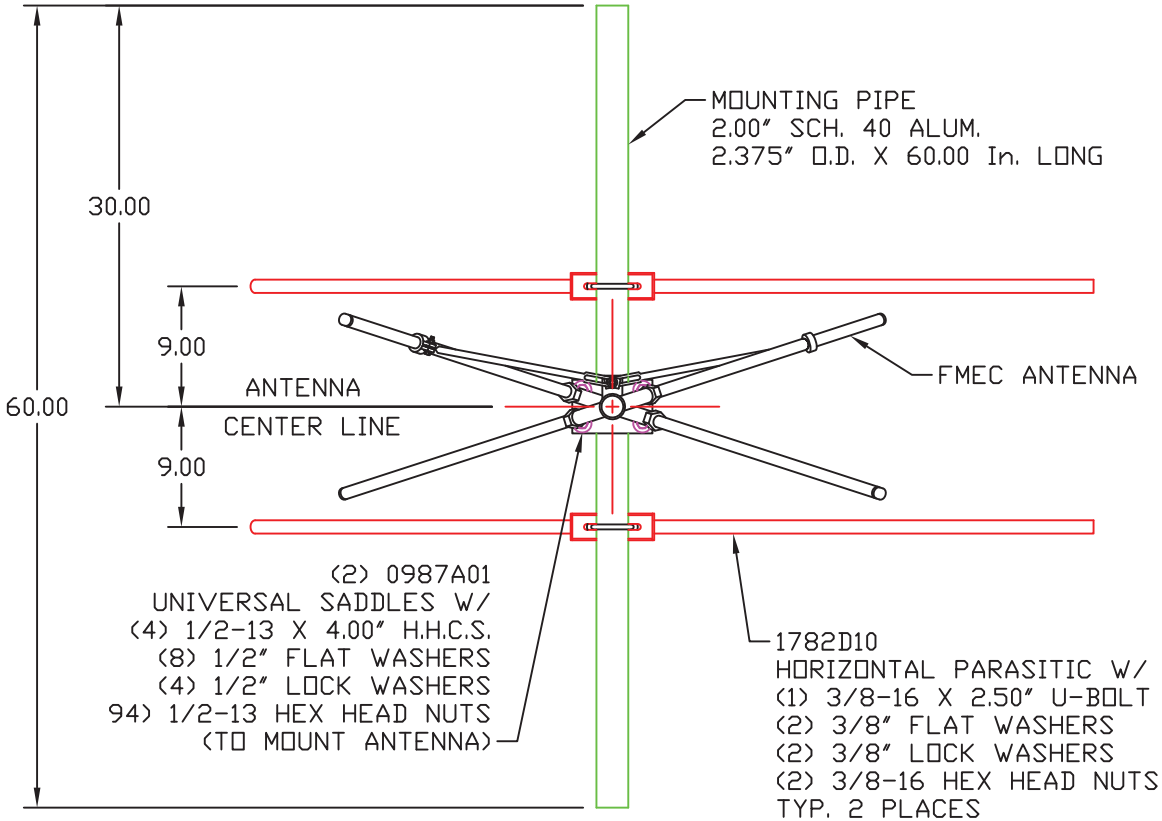
DRAWING NUMBER: 1782D01

SCALE: NTS | NAME: RAC | DATE: 5/16/13 | SHEET 1 OF 1

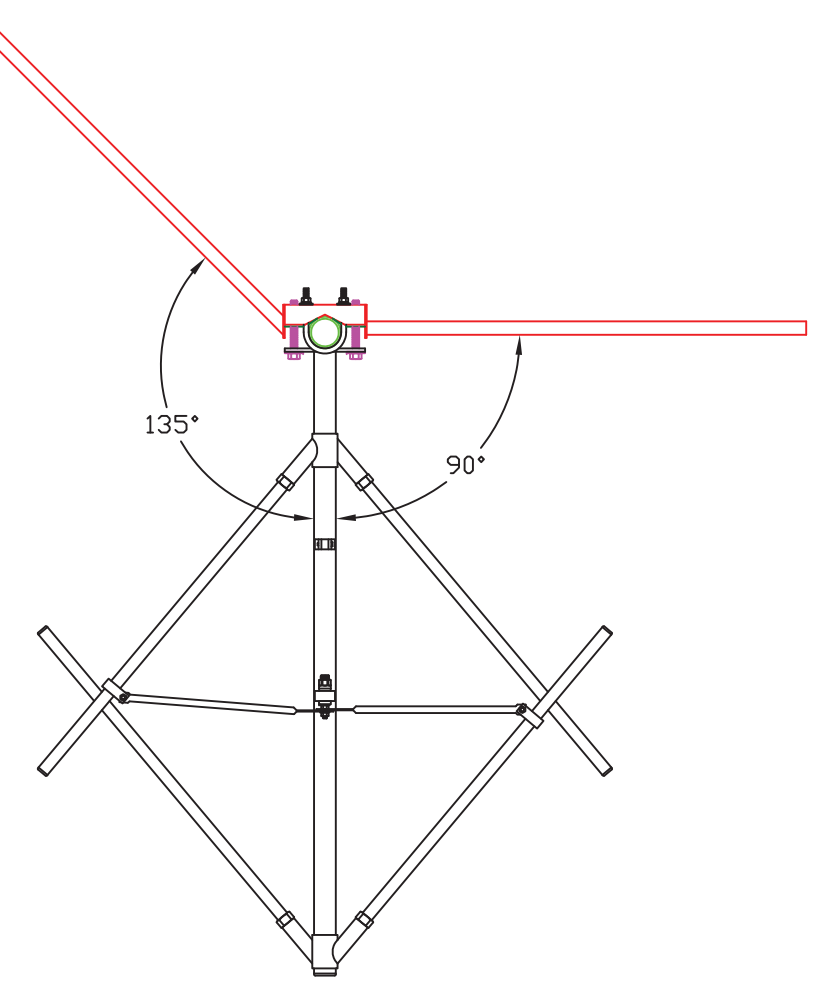
NOTE:

DRAWING NUMBER: 1782D02

Exhibit 7 (cont'd): Drawings



FRONT VIEW



TOP VIEW

TOLERANCES		
.X	±	.015
.XX	±	.005
.XXX	±	.002
X/X	±	1/32
DEG.	±	1/2

UNLESS OTHERWISE SPECIFIED

REVISION RECORD

REV	APPROVAL	DATE

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

TITLE: FMEC/1-DA, FREQ. 90.7
WZXY, SPRING GROVE, PA

MATERIAL: PARASITIC
PLACEMENT

SIZE A

PARTS MADE BY THIS DRAWING

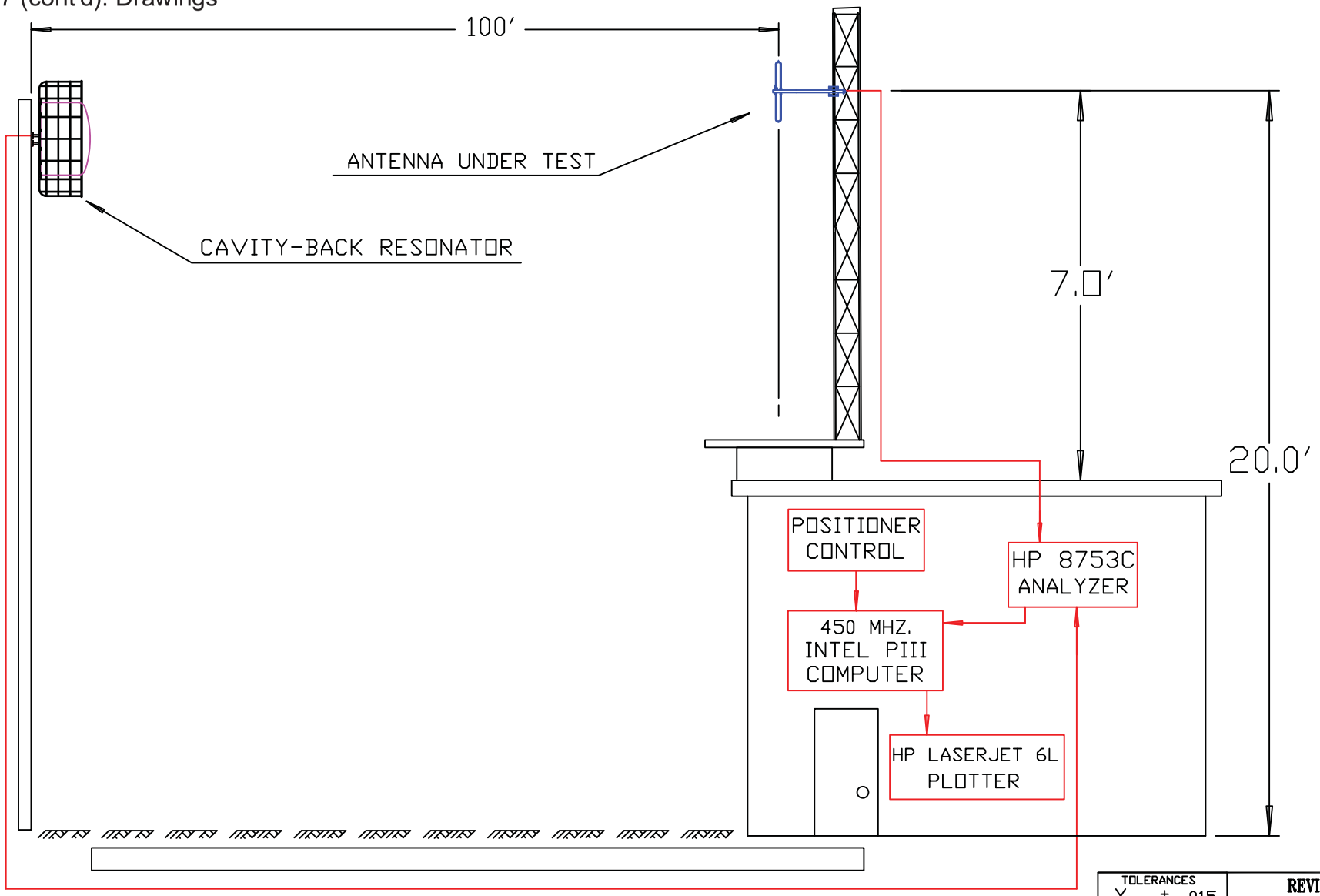
DRAWING NUMBER: 1782D02

SCALE: NTS | NAME: RAC | DATE: 5/16/13 | SHEET 1 OF 1

NOTE:

Exhibit 7 (cont'd): Drawings

DRAWING NUMBER: 2105A10



TOLERANCES	
.X	± .015
.XX	± .005
.XXX	± .002
X/X	± 1/32
DEG.	± 1/2

UNLESS OTHERWISE SPECIFIED

REVISION RECORD

REV	APPROVAL	DATE
2		10/7/05
1		4/30/02

DRAWING NUMBER: 2105A10

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

TITLE: TEST RANGE SCHEMATIC

MATERIAL:

SIZE: A

PARTS MADE BY THIS DRAWING

SCALE: NTS | NAME: JRM | DATE: 11/1/98 | SHEET 1 OF 1