SYSTEMS WITH RELIABILITY, LLP

BROADCAST ANTENNAS AND TRANSMISSION LINE

PATTERN CERTIFICATION

DIRECTIONAL FM ANTENNA
WFBV
October 11, 2011

Call Sign	:	WFBV
Location	:	Selinsgrove, PA
Frequency	:	90.1 MHz
Channel	:	211A
Antenna Model	:	FMECR/2 DA
Maximum Antenna Gain		
Horizontal	:	**2.263 / 3.546 dB**
Vertical	**:**	**2.263 / 3.546 dB**

ANTENNA DESCRIPTION

A custom designed **FMECR/2 DA** antenna was used to produce the required directional azimuth pattern. Each antenna bay consists of a circularly polarized circular dipole-radiating element inside a radome with horizontal and vertical parasitics. The array is comprised of two bays, that are spaced a wavelength apart, mounted to a support pipe and mounted to the tower pointing 190 degrees true north.

DESCRIPTION OF TEST PROCEDURE

The test antenna consists of a single bay third-scale model antenna and parasitic system. This antenna was mounted to a pipe attached to a self-supporting third scale model tower with the use of mounting brackets supplied with the finalized antenna. The tower was placed on a 20 ft. high platform. All feed cables are properly grounded during pattern testing. Horizontal and vertical parasitic elements were used to obtain the desired directional pattern.

The source antenna, a vertical/horizontal dipole Cavity Back Resonator antenna configuration was mounted approximately 100 feet from the test antenna. The source's height was adjusted to provide a uniform field at the test antenna location. The CBR antenna was operated in the transmit mode at a frequency of 270.3 MHz. The antenna under test was rotated in a clockwise direction. A gain reference was taken using a dipole tuned to 270.3 MHz. Nowhere, does the received signal exceed a maximum to minimum ratio of 15 dB.

TEST RESULTS

The attached calculations verify that the **RMS** value of this antenna is ***97.1 %*** of the **RMS** value of the pattern authorized in the related construction permit **BNPED-20071017ABA**. The vertical component **RMS** value is **0.671**. The horizontal component **RMS** value is **0.631**. The circular polarized component **RMS** value is **0.688**.

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

Measured vertical polarized directivity:	**2.223 / 3.470 dB**
Measured horizontal polarized directivity:	**2.514 / 4.000 dB**
Measured circular polarized pattern directivity:	**2.110 / 3.240 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 = (2.223)(.530)(1.918) **= 2.263 / 3.546 dB**
H-Pol. Gain = (2.514)(.470)(1.918) **= 2.263 / 3.546 dB**

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **29 *meters (95.15 ft.)*** above ground level. The antenna aperture is **10 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 parasitic system is custom designed to shape and direct the antenna pattern as required. The systems orientation and the mounting details are described in the following drawings:

DRAWING NO.	**TITLE**
1600D00	ELEVATION
1600D01	ANTENNA ORENTATION WITH PARASITICS
1600D02	BAY 1 PARASITIC PLACEMENT AND ASSEMBLY
1600D03	BAY 2 PARASITIC PLACEMENT AND ASSEMBLY
1600D04	MOUNTING PIPE INSTALLATION
2105A10	TEST RANGE SCHEMATIC

The array shall be mounted according to **DWG. 1600D00**. The antenna elements shall be aligned at the same heading as in **DWG. 1600D01**. This will ensure that the antenna is oriented properly at 190 degrees true north. Each bay's parasitic assembly is shown in **DWG. 1600D02 THRU 1600D03**. The mounting pipe shall be installed according to **DWG. 1600D04** .

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, Range Program
Printer	:	Hewlett-Packard Laser Jet 6L
Positioner	:	Orbit Positioner
		All equipment is calibrated to ANSI/NCSL Z540-1-1994 specs

Prepared by:

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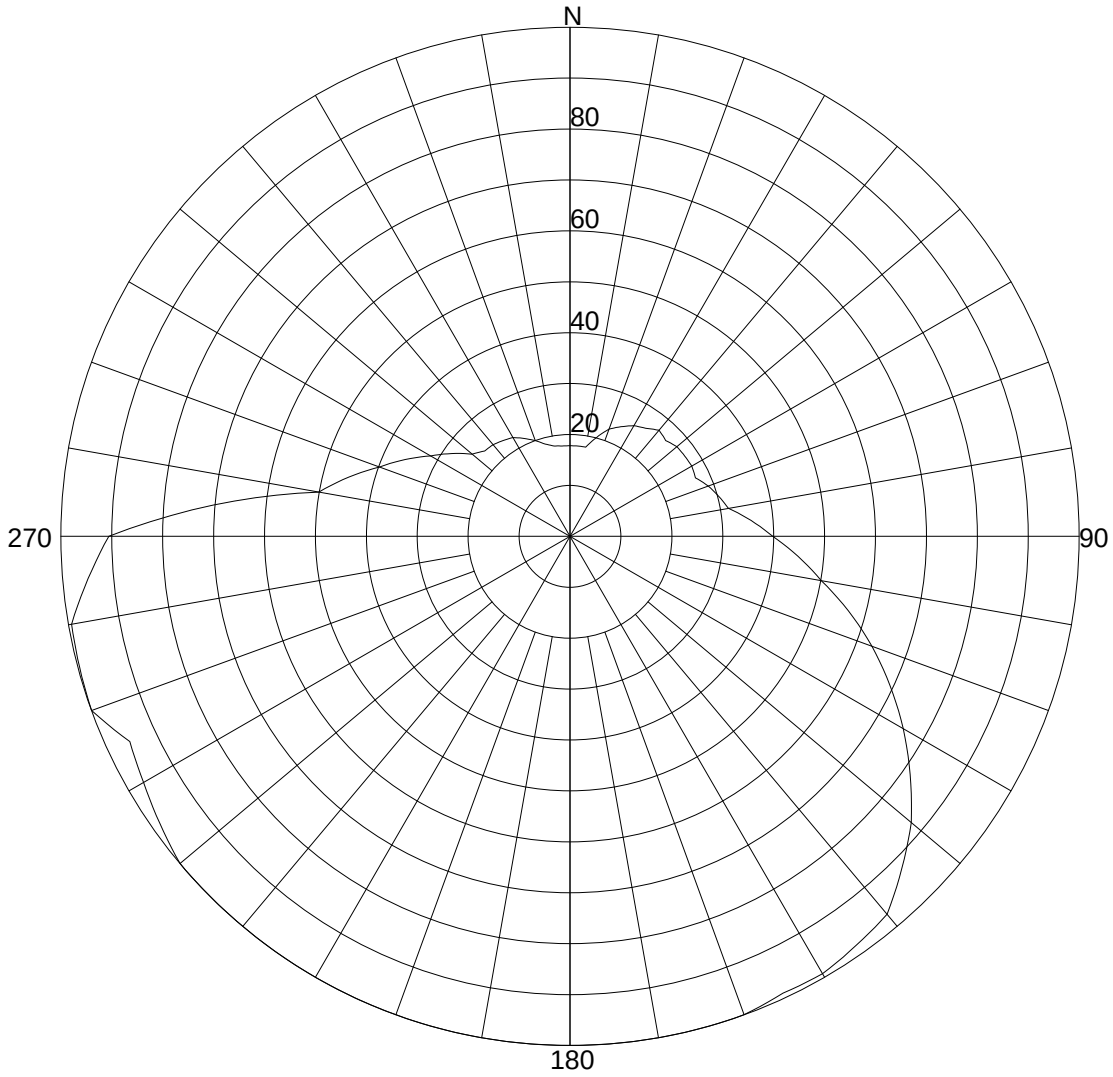
Mark A. Gergely
Electrical Engineer
Systems With Reliability LLP

Exhibit 1: Composite Circular Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*

Date: 10/11/2011

ANTENNA TYPE: FMECR/2 DA

FREQUENCY: 90.1 MHz

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.11028 / 3.24dB

PATTERN RMS: *0.688*

Micro-Tek Eng. ver 2.5

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

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relatve Field(dB)
0	.1780 (-14.94)	180	1.0000 (0.01)
5	.1780 (-14.94)	185	1.0000 (0.01)
10	.1780 (-14.94)	190	1.0000 (0.01)
15	.2010 (-13.89)	195	1.0000 (0.01)
20	.2240 (-12.96)	200	1.0000 (0.01)
25	.2375 (-12.45)	205	1.0000 (0.01)
30	.2510 (-11.97)	210	1.0000 (0.01)
35	.2590 (-11.7)	215	1.0000 (0.01)
40	.2720 (-11.28)	220	1.0000 (0.01)
45	.2660 (-11.47)	225	1.0000 (0.01)
50	.2740 (-11.21)	230	1.0000 (0.01)
55	.2750 (-11.18)	235	.9835 (-0.14)
60	.2760 (-11.15)	240	.9670 (-0.28)
65	.2720 (-11.28)	245	.9540 (-0.4)
70	.2890 (-10.75)	250	1.0000 (0.01)
75	.3025 (-10.36)	255	.9970 (-0.02)
80	.3160 (-9.98)	260	.9940 (-0.04)
85	.3570 (-8.92)	265	.9500 (-0.44)
90	.3980 (-7.98)	270	.9060 (-0.85)
95	.4495 (-6.93)	275	.7035 (-3.04)
100	.5010 (-5.99)	280	.5010 (-5.99)
105	.5660 (-4.93)	285	.4495 (-6.93)
110	.6310 (-3.99)	290	.3980 (-7.98)
115	.6935 (-3.17)	295	.3570 (-8.92)
120	.7560 (-2.42)	300	.3160 (-9.98)
125	.8155 (-1.76)	305	.2835 (-10.92)
130	.8750 (-1.15)	310	.2510 (-11.97)
135	.9220 (-0.7)	315	.2370 (-12.47)
140	.9690 (-0.26)	320	.2350 (-12.54)
145	.9805 (-0.16)	325	.2295 (-12.75)
150	.9920 (-0.06)	330	.2240 (-12.96)
155	.9900 (-0.08)	335	.2120 (-13.43)
160	1.0000 (0.01)	340	.2000 (-13.94)
165	1.0000 (0.01)	345	.1875 (-14.49)
170	1.0000 (0.01)	350	.1800 (-14.85)
175	1.0000 (0.01)	355	.1780 (-14.94)

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*

Date: 10/11/2011

ANTENNA TYPE: FMECR/2 DA

FREQUENCY: 90.1 MHz

PATTERN POL.: Circular

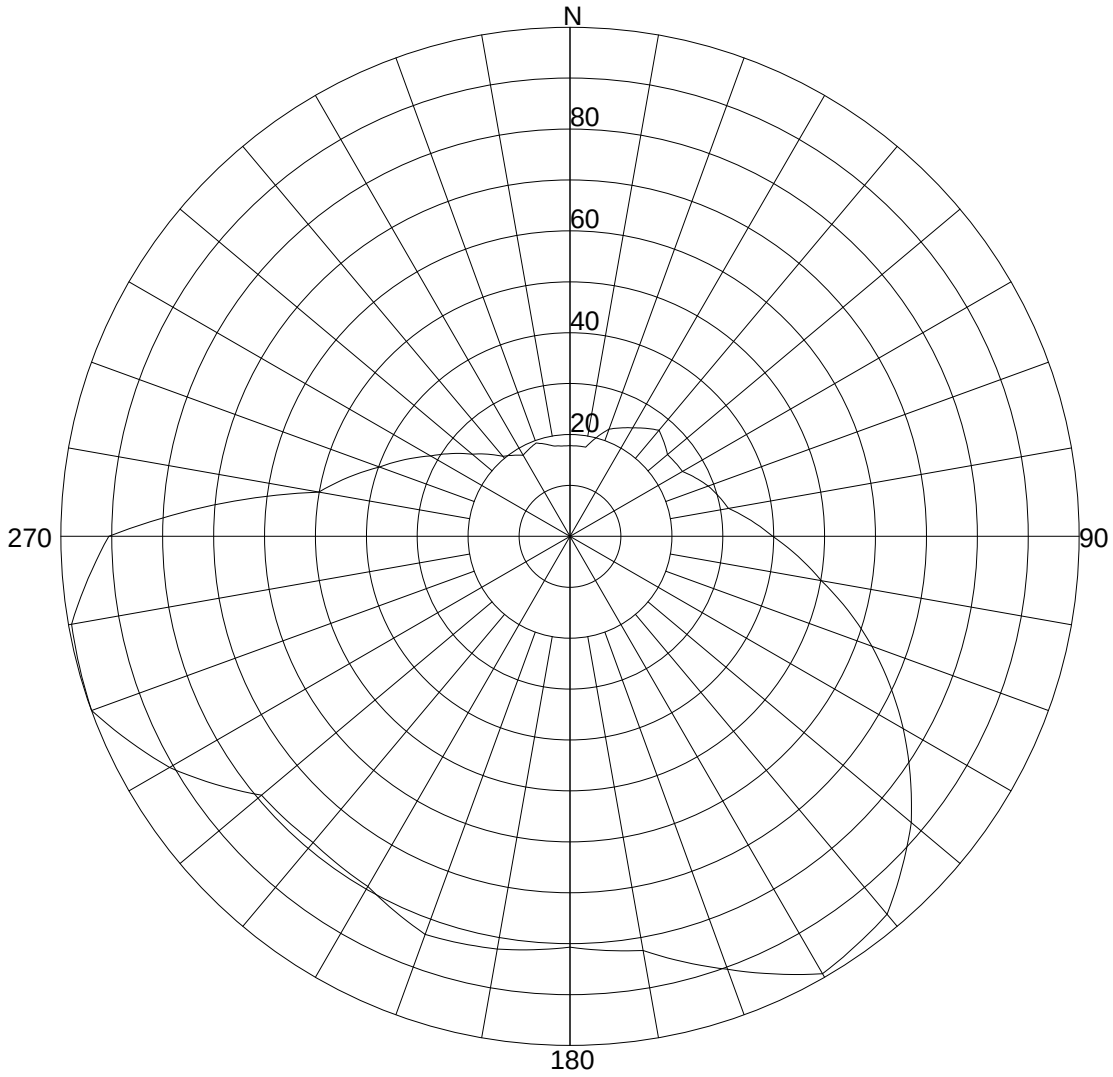
CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.11028 / 3.24dB

PATTERN RMS: *0.688*

Micro-Tek Eng. ver 2.5

Exhibit 2: Measured Horizontal Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*

Date: 10/11/2011

ANTENNA TYPE: FMECR/2 DA

FREQUENCY: 90.1 MHz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.51377 / 4.0dB

PATTERN RMS: *0.631*

Micro-Tek Eng. ver 2.5

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

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relatve Field(dB)
0	.1780 (-14.94)	180	.8070 (-1.85)
5	.1780 (-14.94)	185	.8150 (-1.77)
10	.1780 (-14.94)	190	.8230 (-1.68)
15	.2010 (-13.89)	195	.8275 (-1.63)
20	.2240 (-12.96)	200	.8320 (-1.59)
25	.2350 (-12.54)	205	.8130 (-1.79)
30	.2460 (-12.15)	210	.7940 (-1.99)
35	.2590 (-11.7)	215	.7895 (-2.04)
40	.2720 (-11.28)	220	.7850 (-2.09)
45	.2610 (-11.63)	225	.7880 (-2.06)
50	.2500 (-12.01)	230	.7910 (-2.03)
55	.2525 (-11.92)	235	.8495 (-1.41)
60	.2550 (-11.84)	240	.9080 (-0.83)
65	.2720 (-11.28)	245	.9540 (-0.4)
70	.2890 (-10.75)	250	1.0000 (0.01)
75	.3025 (-10.36)	255	.9970 (-0.02)
80	.3160 (-9.98)	260	.9940 (-0.04)
85	.3570 (-8.92)	265	.9500 (-0.44)
90	.3980 (-7.98)	270	.9060 (-0.85)
95	.4495 (-6.93)	275	.7035 (-3.04)
100	.5010 (-5.99)	280	.5010 (-5.99)
105	.5660 (-4.93)	285	.4495 (-6.93)
110	.6310 (-3.99)	290	.3980 (-7.98)
115	.6935 (-3.17)	295	.3570 (-8.92)
120	.7560 (-2.42)	300	.3160 (-9.98)
125	.8155 (-1.76)	305	.2835 (-10.92)
130	.8750 (-1.15)	310	.2510 (-11.97)
135	.9220 (-0.7)	315	.2280 (-12.8)
140	.9690 (-0.26)	320	.2050 (-13.72)
145	.9805 (-0.16)	325	.1945 (-14.18)
150	.9920 (-0.06)	330	.1840 (-14.66)
155	.9485 (-0.45)	335	.1895 (-14.4)
160	.9050 (-0.86)	340	.1950 (-14.15)
165	.8655 (-1.24)	345	.1875 (-14.49)
170	.8260 (-1.65)	350	.1800 (-14.85)
175	.8165 (-1.75)	355	.1780 (-14.94)

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*

Date: 10/11/2011

ANTENNA TYPE: FMECR/2 DA

FREQUENCY: 90.1 MHz

PATTERN POL.: Horizontal

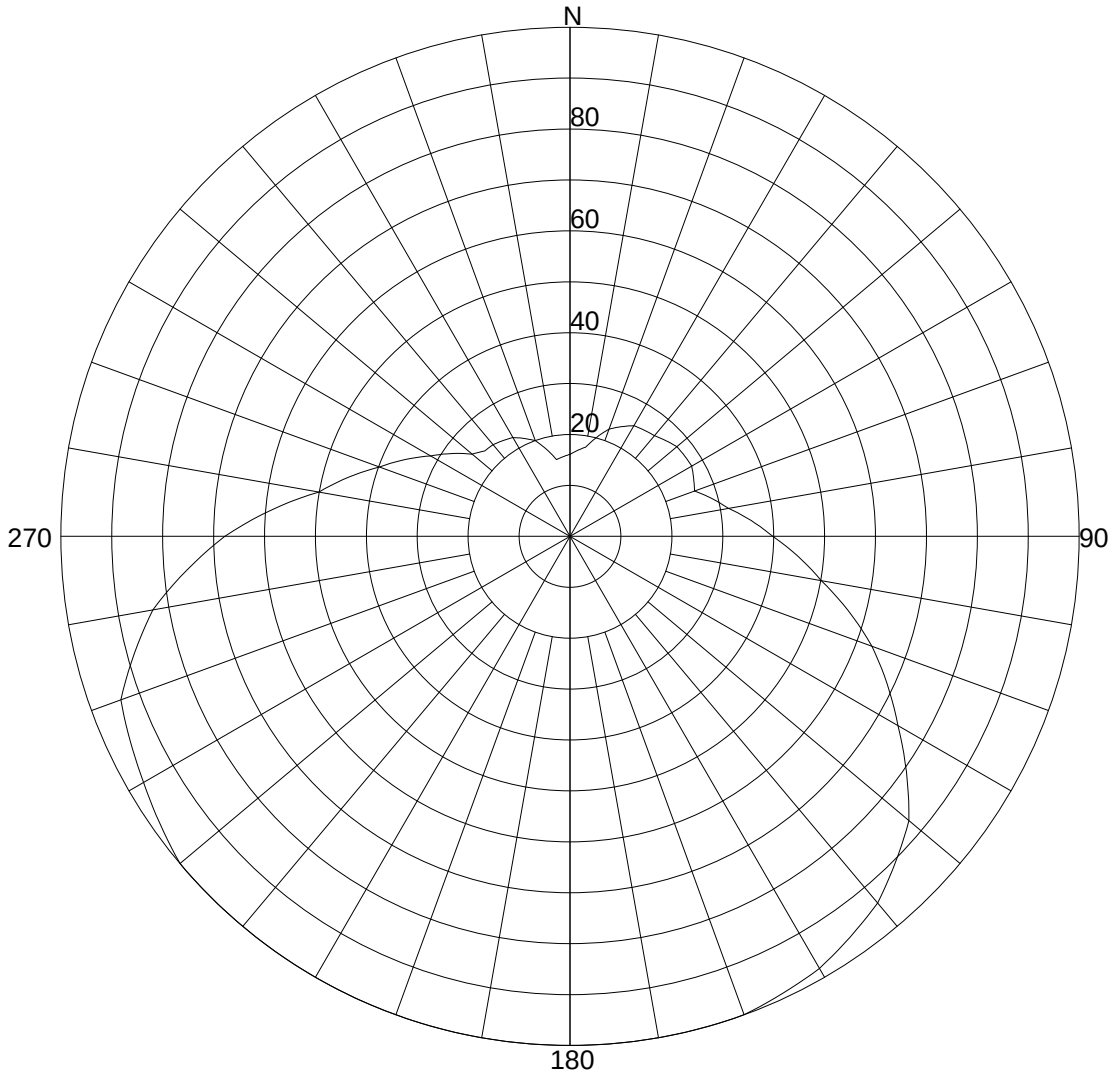
CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.51377 / 4.0dB

PATTERN RMS: *0.631*

Micro-Tek Eng. ver 2.5

Exhibit 3: Measured Vertical Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*

Date: 10/11/2011

ANTENNA TYPE: FMECR/2 DA

FREQUENCY: 90.1 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.22268 / 3.47dB

PATTERN RMS: *0.671*

Micro-Tek Eng. ver 2.5

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

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relatve Field(dB)
0	.1610 (-15.81)	180	1.0000 (0.01)
5	.1695 (-15.37)	185	1.0000 (0.01)
10	.1780 (-14.94)	190	1.0000 (0.01)
15	.2010 (-13.89)	195	1.0000 (0.01)
20	.2240 (-12.96)	200	1.0000 (0.01)
25	.2375 (-12.45)	205	1.0000 (0.01)
30	.2510 (-11.97)	210	1.0000 (0.01)
35	.2545 (-11.85)	215	1.0000 (0.01)
40	.2580 (-11.73)	220	1.0000 (0.01)
45	.2660 (-11.47)	225	1.0000 (0.01)
50	.2740 (-11.21)	230	1.0000 (0.01)
55	.2750 (-11.18)	235	.9835 (-0.14)
60	.2760 (-11.15)	240	.9670 (-0.28)
65	.2680 (-11.4)	245	.9530 (-0.41)
70	.2600 (-11.67)	250	.9390 (-0.54)
75	.2880 (-10.78)	255	.8855 (-1.05)
80	.3160 (-9.98)	260	.8320 (-1.59)
85	.3570 (-8.92)	265	.7550 (-2.43)
90	.3980 (-7.98)	270	.6780 (-3.36)
95	.4495 (-6.93)	275	.5895 (-4.58)
100	.5010 (-5.99)	280	.5010 (-5.99)
105	.5660 (-4.93)	285	.4495 (-6.93)
110	.6310 (-3.99)	290	.3980 (-7.98)
115	.6875 (-3.24)	295	.3570 (-8.92)
120	.7440 (-2.56)	300	.3160 (-9.98)
125	.8065 (-1.86)	305	.2835 (-10.92)
130	.8690 (-1.21)	310	.2510 (-11.97)
135	.9045 (-0.86)	315	.2370 (-12.47)
140	.9400 (-0.53)	320	.2350 (-12.54)
145	.9600 (-0.35)	325	.2295 (-12.75)
150	.9800 (-0.17)	330	.2240 (-12.96)
155	.9900 (-0.08)	335	.2120 (-13.43)
160	1.0000 (0.01)	340	.2000 (-13.94)
165	1.0000 (0.01)	345	.1765 (-15.02)
170	1.0000 (0.01)	350	.1530 (-16.25)
175	1.0000 (0.01)	355	.1570 (-16.03)

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*

Date: 10/11/2011

ANTENNA TYPE: FMECR/2 DA

FREQUENCY: 90.1 MHz

PATTERN POL.: Vertical

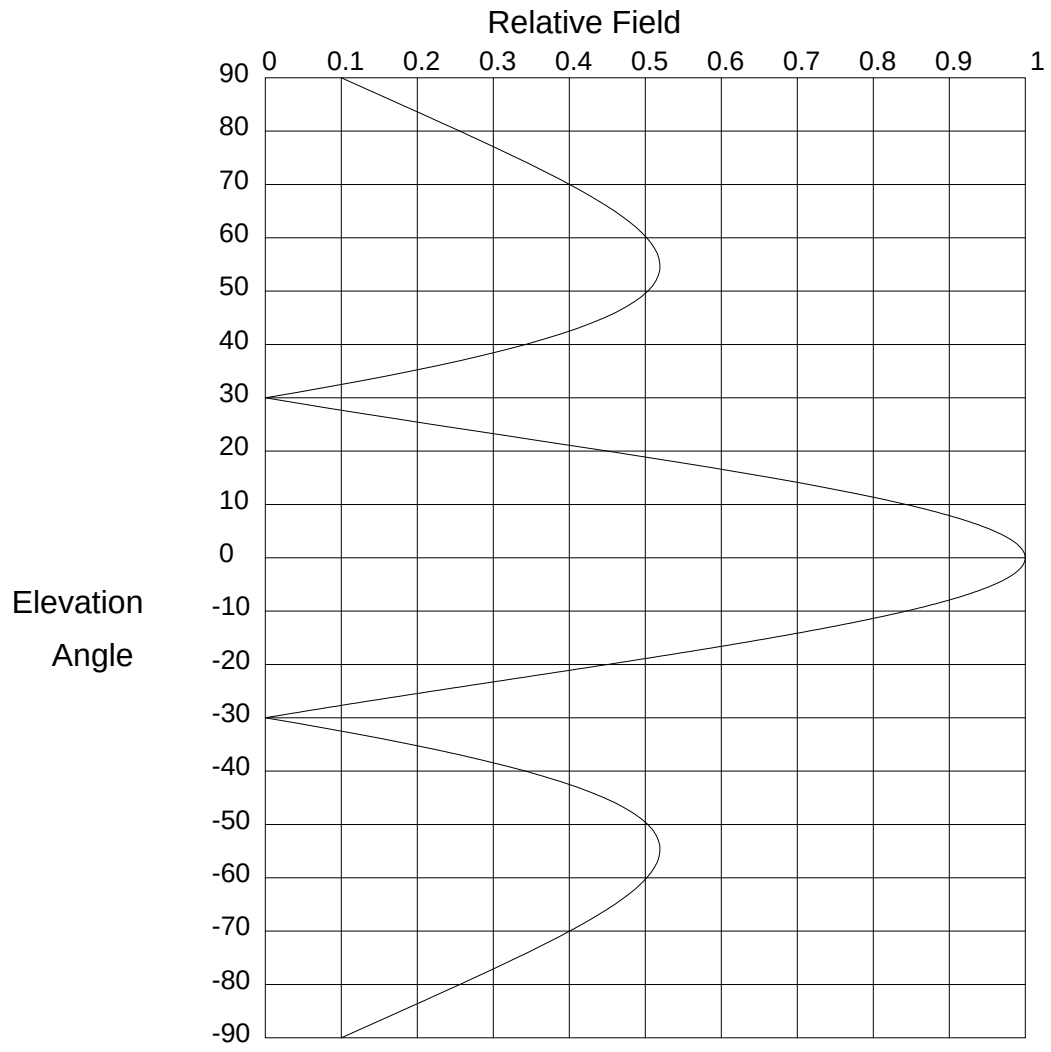
CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.22268 / 3.47dB

PATTERN RMS: *0.671*

Micro-Tek Eng. ver 2.5

Exhibit 4: Elevation Pattern



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*

Date: 10/11/2011

ANTENNA TYPE: FMEC/2 DA

FREQUENCY: 90.1 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 1.918/2.828 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 1.918/2.828 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	.514 (-5.775)	14.0	.705 (-3.031)
89.0	.116 (-18.733)	51.0	.51 (-5.855)	13.0	.743 (-2.581)
88.0	.131 (-17.627)	50.0	.503 (-5.963)	12.0	.779 (-2.174)
87.0	.147 (-16.648)	49.0	.495 (-6.101)	11.0	.812 (-1.809)
86.0	.163 (-15.768)	48.0	.486 (-6.272)	10.0	.843 (-1.482)
85.0	.178 (-14.971)	47.0	.474 (-6.479)	9.8	.849 (-1.421)
84.0	.194 (-14.242)	46.0	.461 (-6.724)	9.6	.855 (-1.361)
83.0	.21 (-13.571)	45.0	.446 (-7.013)	9.4	.861 (-1.303)
82.0	.225 (-12.951)	44.0	.429 (-7.349)	9.2	.866 (-1.246)
81.0	.241 (-12.374)	43.0	.41 (-7.738)	9.0	.872 (-1.191)
80.0	.256 (-11.836)	42.0	.39 (-8.189)	8.8	.877 (-1.137)
79.0	.271 (-11.332)	41.0	.367 (-8.709)	8.6	.883 (-1.084)
78.0	.286 (-10.859)	40.0	.342 (-9.31)	8.4	.888 (-1.033)
77.0	.301 (-10.415)	39.0	.316 (-10.008)	8.2	.893 (-0.983)
76.0	.316 (-9.997)	38.0	.288 (-10.824)	8.0	.898 (-0.935)
75.0	.331 (-9.603)	37.0	.257 (-11.786)	7.8	.903 (-0.887)
74.0	.345 (-9.231)	36.0	.225 (-12.937)	7.6	.908 (-0.841)
73.0	.36 (-8.881)	35.0	.192 (-14.343)	7.4	.912 (-0.797)
72.0	.374 (-8.551)	34.0	.156 (-16.113)	7.2	.917 (-0.753)
71.0	.387 (-8.24)	33.0	.119 (-18.454)	7.0	.921 (-0.711)
70.0	.401 (-7.948)	32.0	.081 (-21.828)	6.8	.926 (-0.67)
69.0	.413 (-7.673)	31.0	.041 (-27.712)	6.6	.93 (-0.631)
68.0	.426 (-7.417)	30.0	.00 (-50)	6.4	.934 (-0.593)
67.0	.438 (-7.178)	29.0	.042 (-27.469)	6.2	.938 (-0.556)
66.0	.449 (-6.956)	28.0	.086 (-21.343)	6.0	.942 (-0.52)
65.0	.46 (-6.751)	27.0	.13 (-17.727)	5.8	.946 (-0.485)
64.0	.47 (-6.563)	26.0	.175 (-15.145)	5.6	.949 (-0.452)
63.0	.479 (-6.392)	25.0	.22 (-13.135)	5.4	.953 (-0.42)
62.0	.488 (-6.239)	24.0	.266 (-11.491)	5.2	.956 (-0.389)
61.0	.495 (-6.103)	23.0	.312 (-10.103)	5.0	.959 (-0.36)
60.0	.502 (-5.986)	22.0	.359 (-8.906)	4.8	.963 (-0.331)
59.0	.508 (-5.887)	21.0	.405 (-7.858)	4.6	.966 (-0.304)
58.0	.512 (-5.807)	20.0	.45 (-6.929)	4.4	.969 (-0.278)
57.0	.516 (-5.747)	19.0	.495 (-6.1)	4.2	.971 (-0.253)
56.0	.518 (-5.708)	18.0	.54 (-5.356)	4.0	.974 (-0.229)
55.0	.519 (-5.69)	17.0	.583 (-4.685)	3.8	.976 (-0.207)
54.0	.519 (-5.694)	16.0	.625 (-4.078)	3.6	.979 (-0.186)
53.0	.517 (-5.722)	15.0	.666 (-3.528)	3.4	.981 (-0.165)

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*
Date: 10/11/2011
ANTENNA TYPE: FMEC/2 DA
FREQUENCY: 90.1 MHz
PATTERN POL.: Circular
DIRECTIVITY(Peak): 1.918/2.828 dBd
Beam Tilt (Deg.) : *0*
DIRECTIVITY(Horiz): 1.918/2.828 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	.983 (-0.146)	-4.4	.969 (-0.278)	-12.0	.779 (-2.174)
3.0	.985 (-0.129)	-4.6	.966 (-0.304)	-12.2	.772 (-2.252)
2.8	.987 (-0.112)	-4.8	.963 (-0.331)	-12.4	.765 (-2.332)
2.6	.989 (-0.097)	-5.0	.959 (-0.36)	-12.6	.757 (-2.413)
2.4	.991 (-0.082)	-5.2	.956 (-0.389)	-12.8	.75 (-2.496)
2.2	.992 (-0.069)	-5.4	.953 (-0.42)	-13.0	.743 (-2.581)
2.0	.993 (-0.057)	-5.6	.949 (-0.452)	-13.2	.736 (-2.667)
1.8	.995 (-0.046)	-5.8	.946 (-0.485)	-13.4	.728 (-2.755)
1.6	.996 (-0.037)	-6.0	.942 (-0.52)	-13.6	.721 (-2.845)
1.4	.997 (-0.028)	-6.2	.938 (-0.556)	-13.8	.713 (-2.937)
1.2	.998 (-0.021)	-6.4	.934 (-0.593)	-14.0	.705 (-3.031)
1.0	.998 (-0.014)	-6.6	.93 (-0.631)	-14.2	.698 (-3.126)
.8	.999 (-0.009)	-6.8	.926 (-0.67)	-14.4	.69 (-3.224)
.6	.999 (-0.005)	-7.0	.921 (-0.711)	-14.6	.682 (-3.323)
.4	1.00 (-0.002)	-7.2	.917 (-0.753)	-14.8	.674 (-3.425)
.2	1.00 (-0.001)	-7.4	.912 (-0.797)	-15.0	.666 (-3.528)
.0	1.00 (0)	-7.6	.908 (-0.841)	-15.2	.658 (-3.634)
-.2	1.00 (-0.001)	-7.8	.903 (-0.887)	-15.4	.65 (-3.742)
-.4	1.00 (-0.002)	-8.0	.898 (-0.935)	-15.6	.642 (-3.851)
-.6	.999 (-0.005)	-8.2	.893 (-0.983)	-15.8	.634 (-3.963)
-.8	.999 (-0.009)	-8.4	.888 (-1.033)	-16.0	.625 (-4.078)
-1.0	.998 (-0.014)	-8.6	.883 (-1.084)	-16.2	.617 (-4.194)
-1.2	.998 (-0.021)	-8.8	.877 (-1.137)	-16.4	.609 (-4.313)
-1.4	.997 (-0.028)	-9.0	.872 (-1.191)	-16.6	.60 (-4.435)
-1.6	.996 (-0.037)	-9.2	.866 (-1.246)	-16.8	.592 (-4.558)
-1.8	.995 (-0.046)	-9.4	.861 (-1.303)	-17.0	.583 (-4.685)
-2.0	.993 (-0.057)	-9.6	.855 (-1.361)	-17.2	.575 (-4.814)
-2.2	.992 (-0.069)	-9.8	.849 (-1.421)	-17.4	.566 (-4.945)
-2.4	.991 (-0.082)	-10.0	.843 (-1.482)	-17.6	.557 (-5.079)
-2.6	.989 (-0.097)	-10.2	.837 (-1.544)	-17.8	.549 (-5.216)
-2.8	.987 (-0.112)	-10.4	.831 (-1.608)	-18.0	.54 (-5.356)
-3.0	.985 (-0.129)	-10.6	.825 (-1.674)	-18.2	.531 (-5.499)
-3.2	.983 (-0.146)	-10.8	.818 (-1.74)	-18.4	.522 (-5.644)
-3.4	.981 (-0.165)	-11.0	.812 (-1.809)	-18.6	.513 (-5.793)
-3.6	.979 (-0.186)	-11.2	.805 (-1.879)	-18.8	.504 (-5.945)
-3.8	.976 (-0.207)	-11.4	.799 (-1.95)	-19.0	.495 (-6.1)
-4.0	.974 (-0.229)	-11.6	.792 (-2.023)	-19.2	.486 (-6.259)
-4.2	.971 (-0.253)	-11.8	.785 (-2.098)	-19.4	.477 (-6.421)

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*
Date: 10/11/2011
ANTENNA TYPE: FMEC/2 DA
FREQUENCY: 90.1 MHz
PATTERN POL.: Circular
DIRECTIVITY(Peak): 1.918/2.828 dBd
Beam Tilt (Deg.) : *0*
DIRECTIVITY(Horiz): 1.918/2.828 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	.468 (-6.587)	-27.2	.121 (-18.344)	-54.0	.519 (-5.694)
-19.8	.459 (-6.756)	-27.4	.112 (-19.006)	-55.0	.519 (-5.69)
-20.0	.45 (-6.929)	-27.6	.103 (-19.721)	-56.0	.518 (-5.708)
-20.2	.441 (-7.106)	-27.8	.094 (-20.496)	-57.0	.516 (-5.747)
-20.4	.432 (-7.288)	-28.0	.086 (-21.343)	-58.0	.512 (-5.807)
-20.6	.423 (-7.473)	-28.2	.077 (-22.278)	-59.0	.508 (-5.887)
-20.8	.414 (-7.663)	-28.4	.068 (-23.322)	-60.0	.502 (-5.986)
-21.0	.405 (-7.858)	-28.6	.06 (-24.503)	-61.0	.495 (-6.103)
-21.2	.396 (-8.057)	-28.8	.051 (-25.863)	-62.0	.488 (-6.239)
-21.4	.386 (-8.261)	-29.0	.042 (-27.469)	-63.0	.479 (-6.392)
-21.6	.377 (-8.471)	-29.2	.034 (-29.429)	-64.0	.47 (-6.563)
-21.8	.368 (-8.686)	-29.4	.025 (-31.951)	-65.0	.46 (-6.751)
-22.0	.359 (-8.906)	-29.6	.017 (-35.496)	-66.0	.449 (-6.956)
-22.2	.349 (-9.132)	-29.8	.008 (-41.54)	-67.0	.438 (-7.178)
-22.4	.34 (-9.365)	-30.0	.00 (-50)	-68.0	.426 (-7.417)
-22.6	.331 (-9.604)	-31.0	.041 (-27.712)	-69.0	.413 (-7.673)
-22.8	.322 (-9.85)	-32.0	.081 (-21.828)	-70.0	.401 (-7.948)
-23.0	.312 (-10.103)	-33.0	.119 (-18.454)	-71.0	.387 (-8.24)
-23.2	.303 (-10.364)	-34.0	.156 (-16.113)	-72.0	.374 (-8.551)
-23.4	.294 (-10.632)	-35.0	.192 (-14.343)	-73.0	.36 (-8.881)
-23.6	.285 (-10.909)	-36.0	.225 (-12.937)	-74.0	.345 (-9.231)
-23.8	.276 (-11.195)	-37.0	.257 (-11.786)	-75.0	.331 (-9.603)
-24.0	.266 (-11.491)	-38.0	.288 (-10.824)	-76.0	.316 (-9.997)
-24.2	.257 (-11.797)	-39.0	.316 (-10.008)	-77.0	.301 (-10.415)
-24.4	.248 (-12.113)	-40.0	.342 (-9.31)	-78.0	.286 (-10.859)
-24.6	.239 (-12.441)	-41.0	.367 (-8.709)	-79.0	.271 (-11.332)
-24.8	.23 (-12.781)	-42.0	.39 (-8.189)	-80.0	.256 (-11.836)
-25.0	.22 (-13.135)	-43.0	.41 (-7.738)	-81.0	.241 (-12.374)
-25.2	.211 (-13.503)	-44.0	.429 (-7.349)	-82.0	.225 (-12.951)
-25.4	.202 (-13.887)	-45.0	.446 (-7.013)	-83.0	.21 (-13.571)
-25.6	.193 (-14.287)	-46.0	.461 (-6.724)	-84.0	.194 (-14.242)
-25.8	.184 (-14.706)	-47.0	.474 (-6.479)	-85.0	.178 (-14.971)
-26.0	.175 (-15.145)	-48.0	.486 (-6.272)	-86.0	.163 (-15.768)
-26.2	.166 (-15.606)	-49.0	.495 (-6.101)	-87.0	.147 (-16.648)
-26.4	.157 (-16.092)	-50.0	.503 (-5.963)	-88.0	.131 (-17.627)
-26.6	.148 (-16.605)	-51.0	.51 (-5.855)	-89.0	.116 (-18.733)
-26.8	.139 (-17.149)	-52.0	.514 (-5.775)	-90.0	.10 (-20)
-27.0	.13 (-17.727)	-53.0	.517 (-5.722)	90.0	.00 (-50)

Systems With Reliability

CLIENT: *WFBV / Clint Heiser*
Date: 10/11/2011
ANTENNA TYPE: FMEC/2 DA
FREQUENCY: 90.1 MHz
PATTERN POL.: Circular
DIRECTIVITY(Peak): 1.918/2.828 dBd
Beam Tilt (Deg.) : *0*
DIRECTIVITY(Horiz): 1.918/2.828 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	WFBV
Contact	Clint Heiser
Location	Selinsgrove, PA
Antenna Model	FMECR/2 DA
Channel / Frequency	211A / 90.1 MHz

ELECTRICAL SPECIFICATIONS

Antenna Specifications:

		H-POL	dB		V. Pol.	dB	
License ERP (KW)		1.450	1.614	**dB**	1.450	1.614	**dB**
FCC Limit Pattern Directivity		1.989	2.986	**dB**	1.989	2.986	**dB**
Elevation Directivity		1.918	2.828	**dB**	1.918	2.828	**dB**
Azimuth Directivity		2.514	4.003	**dB**	2.223	3.469	**dB**
Composite Pattern		2.110	3.243	**dB**	2.110	3.243	**dB**
Polarization Ratio		0.469	-3.286	**dB**	0.531	-2.751	**dB**
RMS Comp./RMS Limit	97.1 **%**						
Antenna Efficiency %		100	0		100	0	
Power Ratio (Pol. Ratio X Efficiency)		0.4693	0		0.5307	0	
Antenna Gain		2.263	3.546	**dB**	2.263	3.546	**dB**

Antenna Input Power (KW)	0.641 **kW**	-1.932 **(dBK)**	

Feed Line Specifications:

Line Type- ANDREW	1 1/4" Foam **50 Ω**	**VXL6-50**	
Attenuation Per 100 ft (dB)	0.259 **dB**		
Total Line Length (ft) AGL + 15'	110.15 **ft.**		
Total Line Attenuation (dB)	0.2853 **dB**		
Line Efficiency	93.64 **%**		
Power Input to the Line (KW)	0.684 **kW**	-1.647 **(dBK)**	

MECHANICAL SPECIFICATIONS

No. Of Bays	2				
Antenna Aperture	10.92 **ft.**			3.33	**meter**
Center of Radiation AGL	95.15 **ft.**			29.00	**meter**
Antenna Weight with Pole	350.00 **lbs.**			320.45	**kg**
Windload (50/33)	630.00 **lbs.**	**Windload CaAc**		18.20	**ft^2**

Prepared by:

David K. Edmiston Jr.
SWR, LLP

Exhibit 6: RMS Calculations

SYSTEMS WITH RELIABILITY, INC.
Broadcast Antennas and Transmission Systems

WFBV Antenna RMS Comparison

PROPOSED ANTENNA		DESIGNED ANTENNA	
Azimuth Heading	Relative Field	Azimuth Heading	Relative Field
0	0.178	0	0.178
10	0.178	10	0.178
20	0.224	20	0.224
30	0.282	30	0.251
40	0.355	40	0.272
50	0.447	50	0.274
60	0.398	60	0.276
70	0.398	70	0.289
80	0.316	80	0.316
90	0.398	90	0.398
100	0.501	100	0.501
110	0.631	110	0.631
120	0.794	120	0.756
130	1.000	130	0.875
140	1.000	140	0.969
150	1.000	150	0.992
160	1.000	160	1.000
170	1.000	170	1.000
180	1.000	180	1.000
190	1.000	190	1.000
200	1.000	200	1.000
210	1.000	210	1.000
220	1.000	220	1.000
230	1.000	230	1.000
240	1.000	240	0.967
250	1.000	250	1.000
260	1.000	260	0.994
270	1.000	270	0.906
280	0.501	280	0.501
290	0.398	290	0.398
300	0.316	300	0.316
310	0.251	310	0.251
320	0.251	320	0.235
330	0.251	330	0.224
340	0.251	340	0.200
350	0.200	350	0.180

Sum of Relative Field Squared :	**18.175**	**Sum of Relative Field Squared :**	**17.147**
Sum Divided by 36 (Readings) :	**0.505**	**Sum Divided by 36 (Readings) :**	**0.476**
Square Root :	**0.711**	**Square Root :**	**0.690**

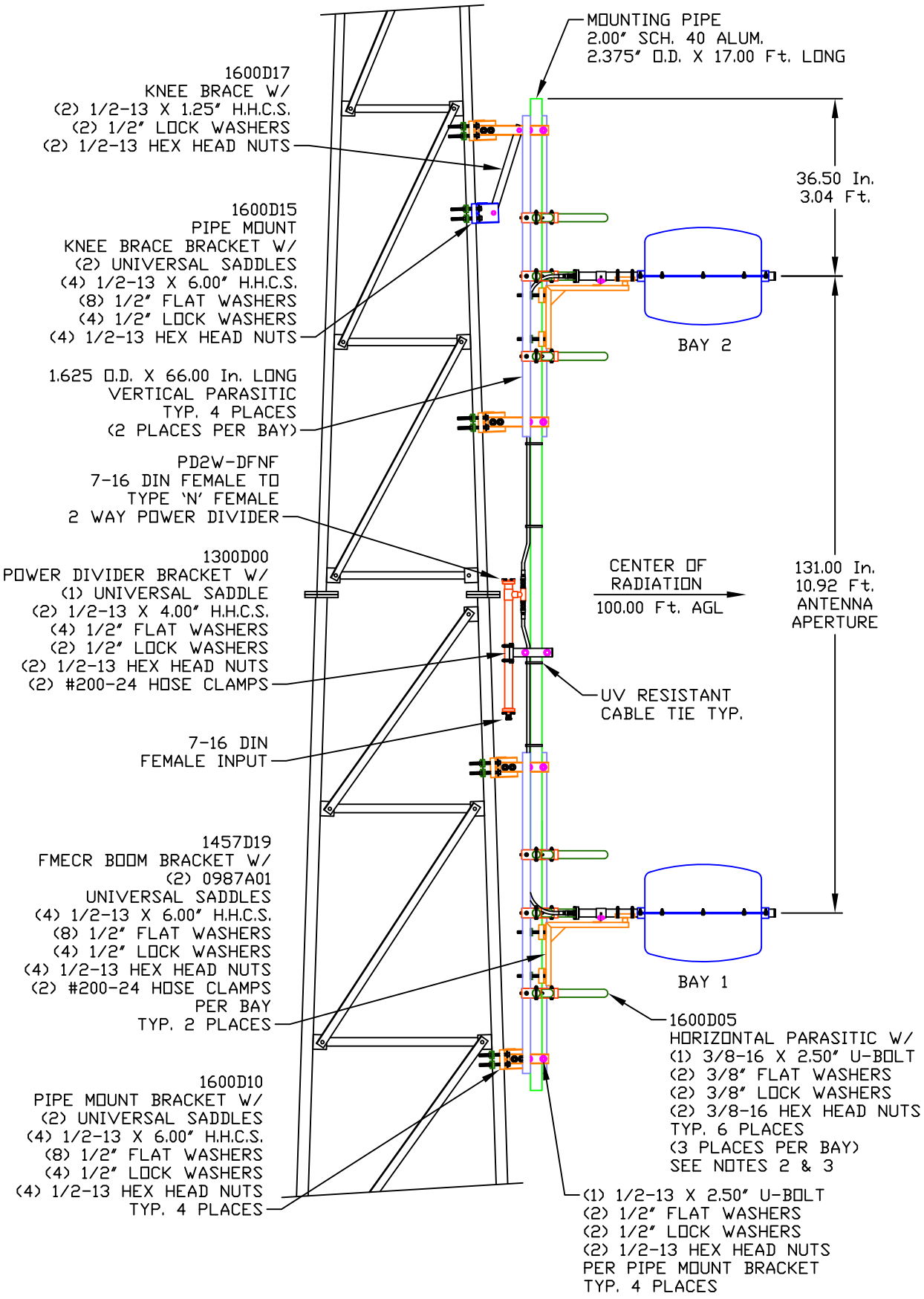
Percentage of Construction Permit Antenna Filled : **97.1%**

DRAWING NUMBER: 1600D00

NOTES:

1. REFERENCE DWG. 1600D01 FOR ANTENNA ORIENTATION.
2. REFERENCE DWG. 1600D02 FOR BAY 1 PARASITIC PLACEMENT.
3. REFERENCE DWG. 1600D03 FOR BAY 2 PARASITIC PLACEMENT.
4. REFERENCE DWG. 1600D04 FOR MOUNTNG PIPE INSTALLATION.

Exhibit 7: Drawings

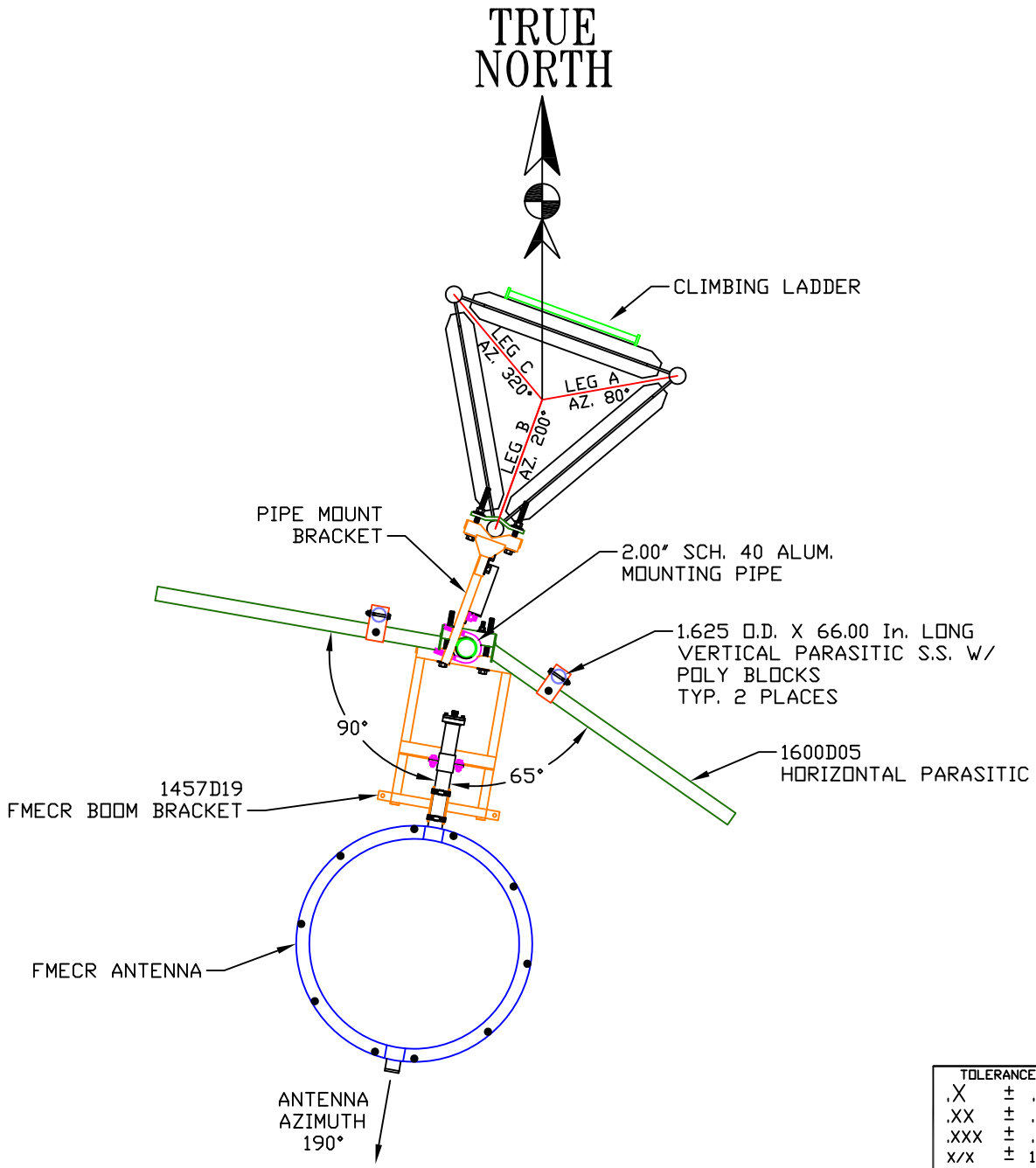


SYSTEMS WITH RELIABILITY, INC 619 INDUSTRIAL PARK ROAD EBENSBURG, PENNSYLVANIA 15931	TITLE: FMECR/2-DA, FREQ. 90.1 WFBV, SELINSGROVE, PA MATERIAL:	SIZE C	REV 1 2 3	APPR.	DATE	ENGINEER:	DRAWING NUMBER: 1600D00
						SCALE: NTS NAME: RAC DATE: 10/10/11	SHEET 1 OF 1

NOTE:

Exhibit 7 (cont'd): Drawings

DRAWING NUMBER: 1600D01



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, INC
619 INDUSTRIAL PARK ROAD
EBENSBURG, PENNSYLVANIA 15931

TITLE: FMECR/2-DA, FREQ. 90.1 WFBV, SELINSGROVE, PA

MATERIAL: ANTENNA ORIENTATION FROM TRUE NORTH

SIZE: A

PARTS MADE BY THIS DRAWING

DRAWING NUMBER: 1600D01

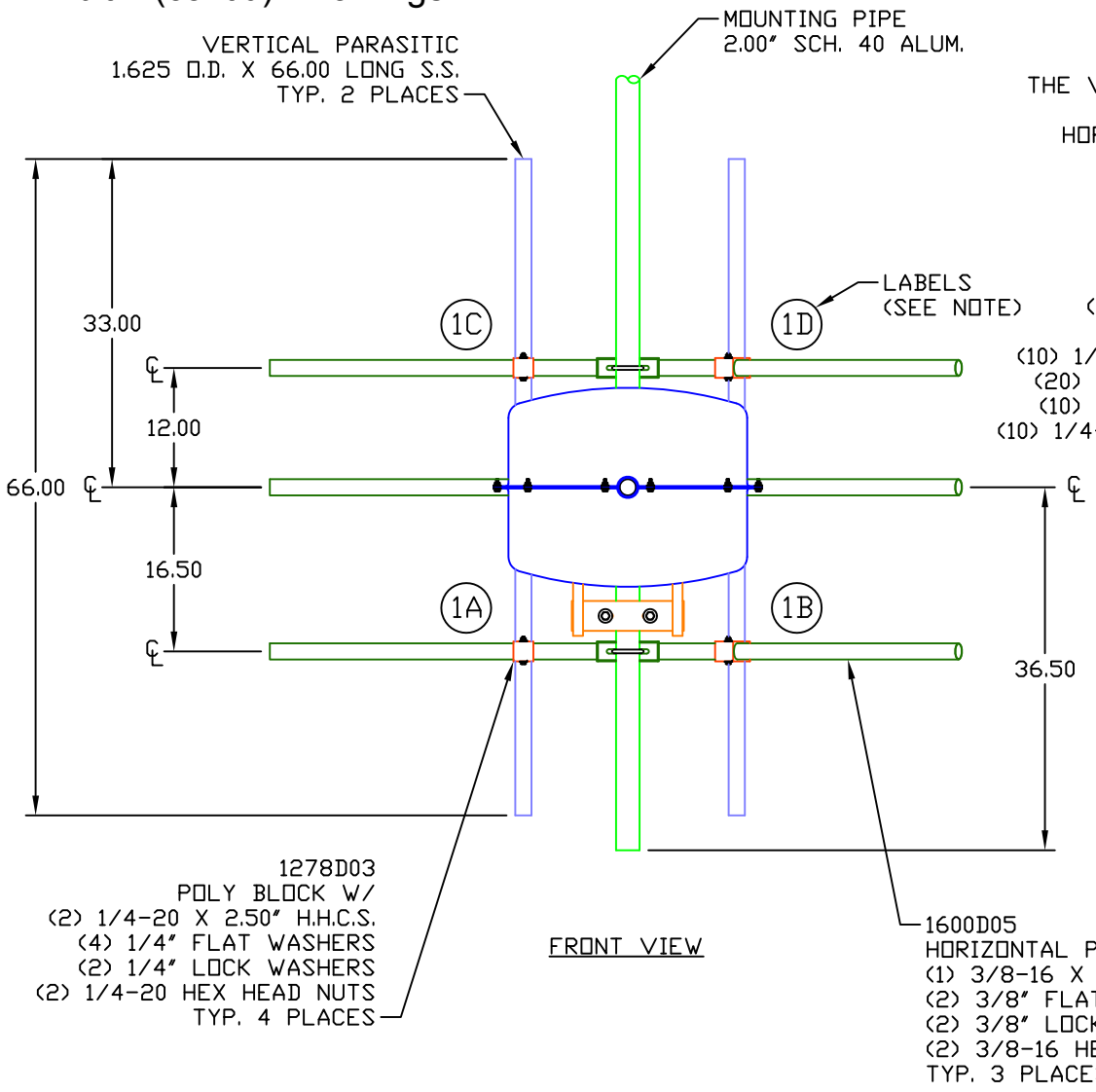
SCALE: NTS | NAME: RAC | DATE: 10/10/11 | SHEET 1 OF 1

NOTE:

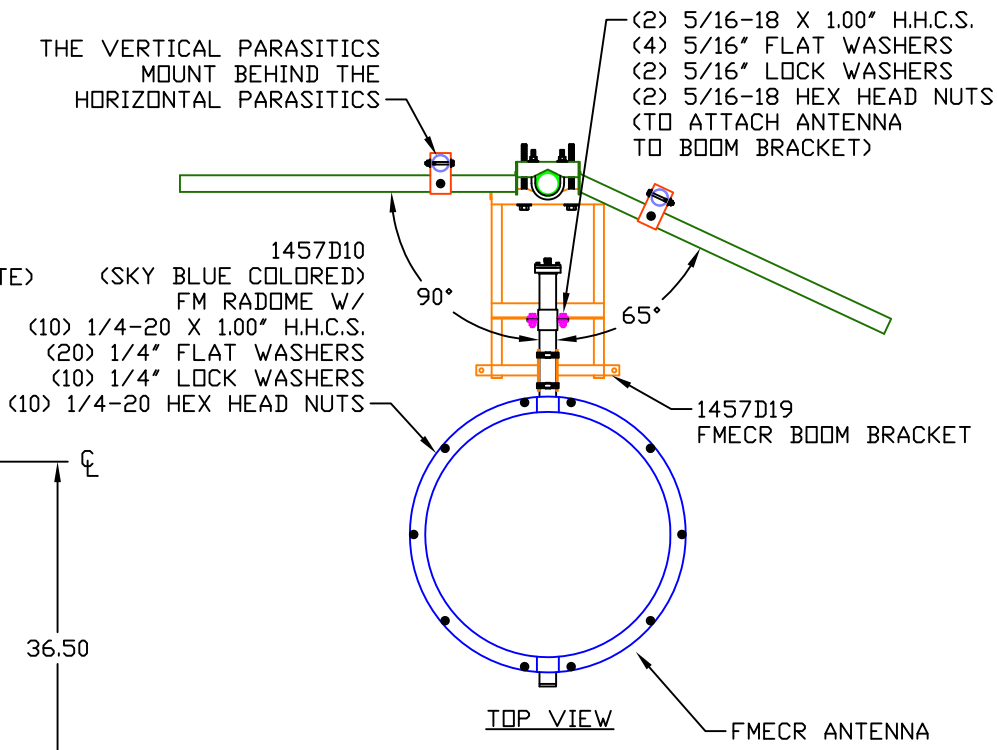
1. THE HORIZONTAL PARASITICS, VERTICAL PARASITICS & POLY BLOCKS ARE ALL FACTORY DRILLED & LABELED AS SHOWN IN THE FRONT VIEW. MATCH ALL CORRESPONDING LABELS DURING ASSEMBLY FOR CORRECT INSTALLATION.

DRAWING NUMBER: 1600D02

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, INC
619 INDUSTRIAL PARK ROAD
EBENSBURG, PENNSYLVANIA 15931

TITLE: FMECR/2-DA, FREQ. 90.1
WFBV, SELINSGROVE, PA

MATERIAL: BAY 1
PARASITIC PLACEMENT

SIZE: A

PARTS MADE BY THIS DRAWING

DRAWING NUMBER: 1600D02

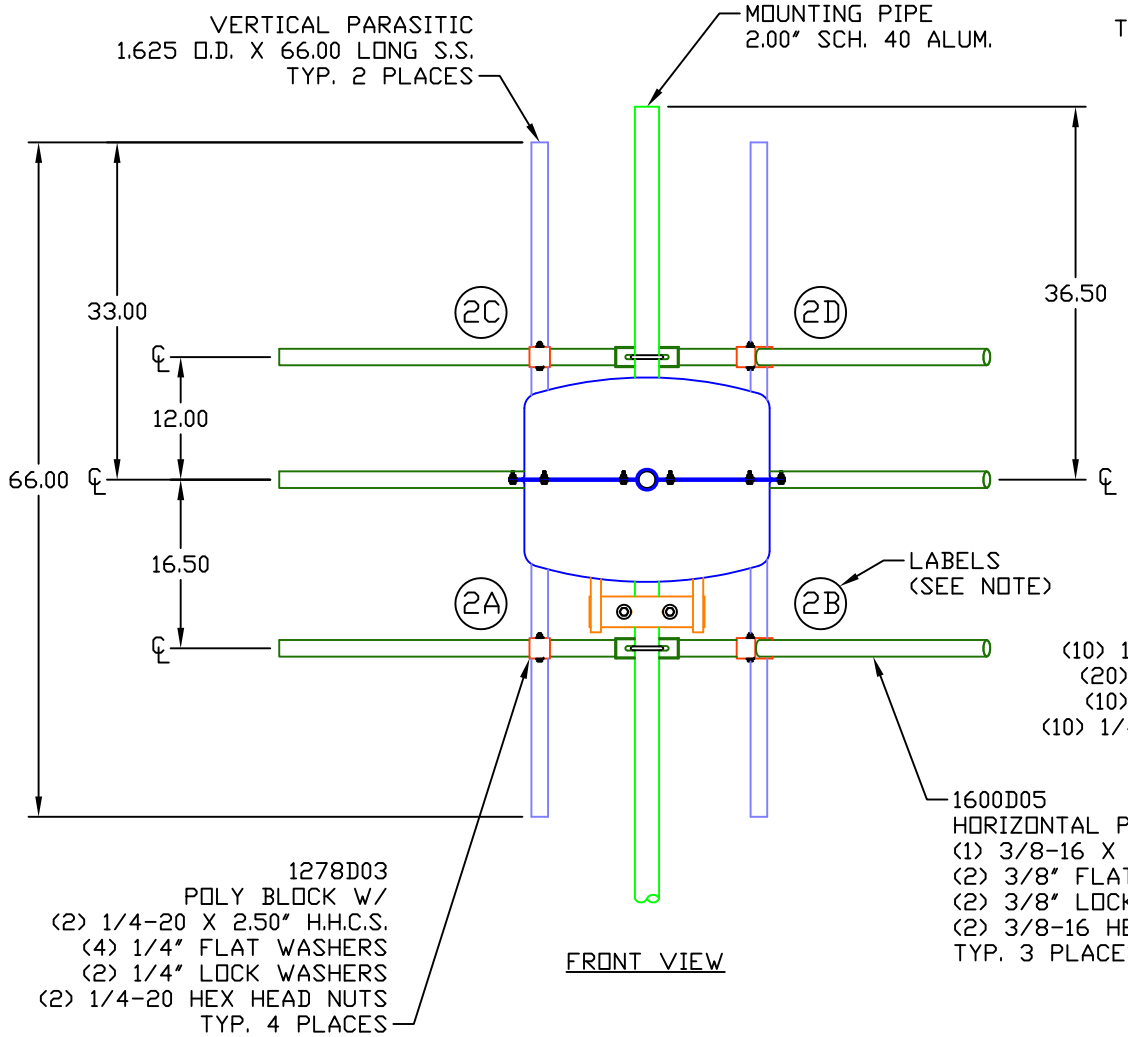
SCALE: NTS | NAME: RAC | DATE: 10/10/11 | SHEET 1 OF 1

NOTE:

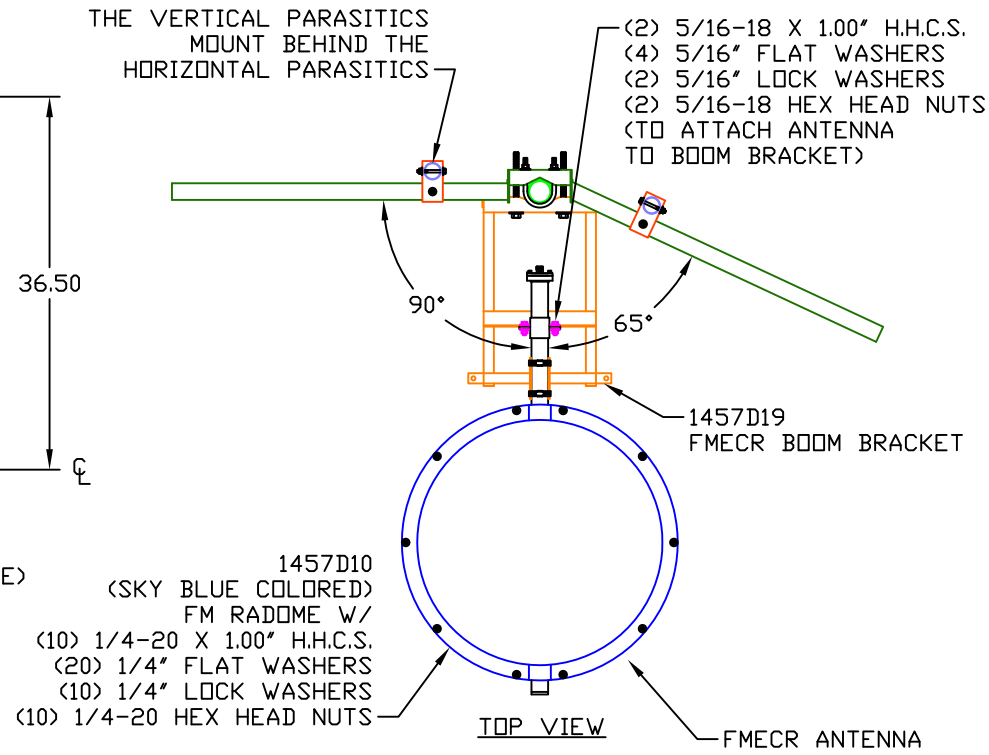
1. THE HORIZONTAL PARASITICS, VERTICAL PARASITICS & POLY BLOCKS ARE ALL FACTORY DRILLED & LABELED AS SHOWN IN THE FRONT VIEW. MATCH ALL CORRESPONDING LABELS DURING ASSEMBLY FOR CORRECT INSTALLATION.

DRAWING NUMBER: 1600D03

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, INC
619 INDUSTRIAL PARK ROAD
EBENSBURG, PENNSYLVANIA 15931

TITLE: FMECR/2-DA, FREQ. 90.1
WFBV, SELINSGROVE, PA

MATERIAL: BAY 2
PARASITIC PLACEMENT

SIZE: A

PARTS MADE BY THIS DRAWING

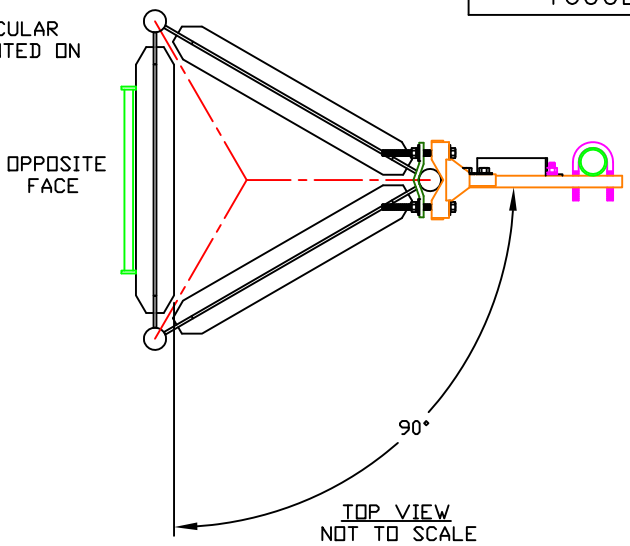
DRAWING NUMBER: 1600D03

SCALE: NTS | NAME: RAC | DATE: 10/10/11 | SHEET 1 OF 1

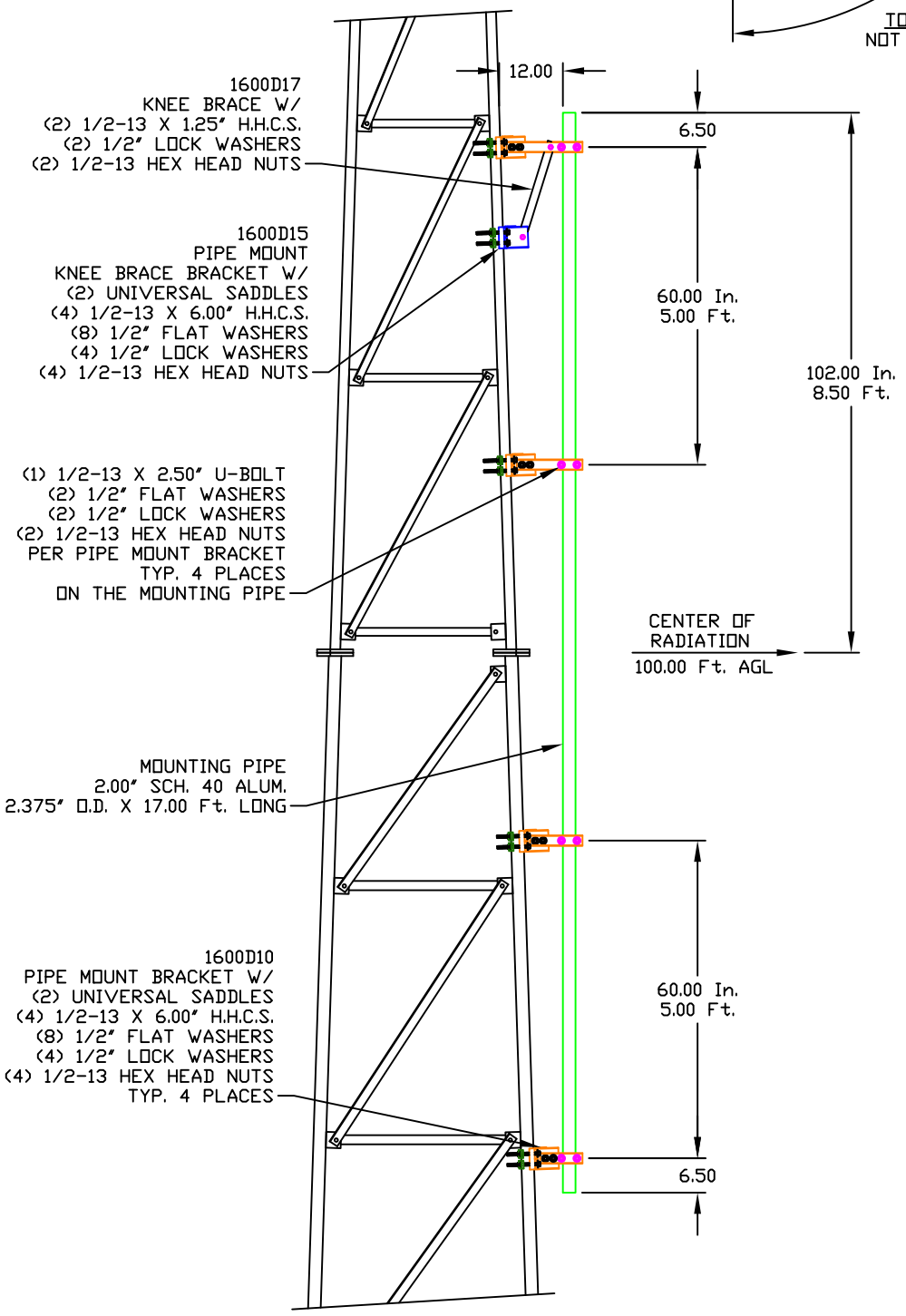
DRAWING NUMBER: 1600D04

NOTE:
THE PIPE MOUNT BRACKETS MUST BE MOUNTED PERPENDICULAR TO THE OPPOSITE FACE OF THE TOWER LEG TO BE MOUNTED ON TO KEEP THE PIPE LEVEL & PLUMB.

Exhibit 7 (cont'd): Drawings



TOP VIEW
NOT TO SCALE

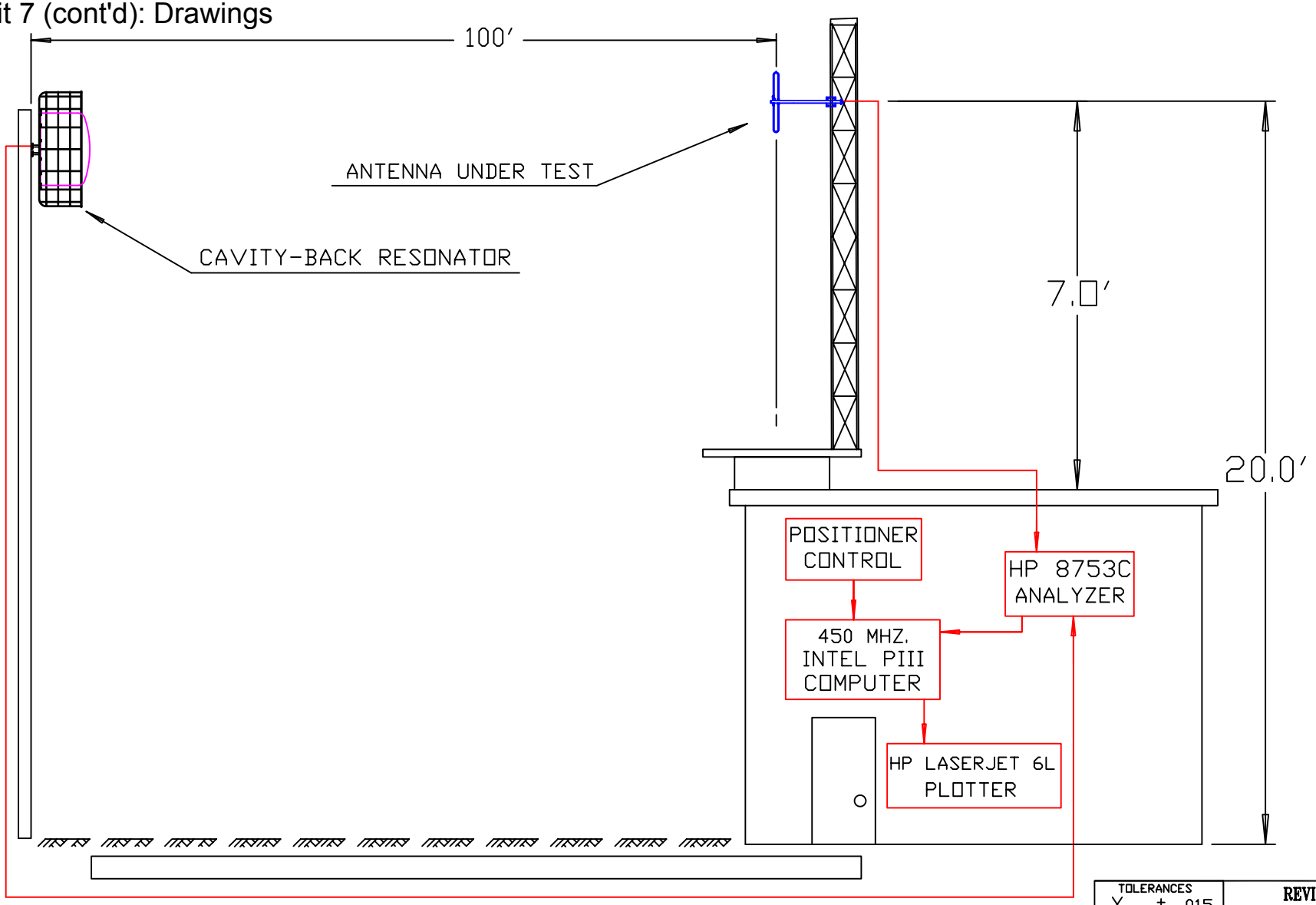


SYSTEMS WITH RELIABILITY, INC 619 INDUSTRIAL PARK ROAD EBENSBURG, PENNSYLVANIA 15931	TITLE: FMECR/2-DA, FREQ. 90.1 WFBV, SELINSGROVE, PA MATERIAL: MOUNTING PIPE INSTALLATION	SIZE C	REV 1 2 3	APPR.	DATE	ENGINEER:	DRAWING NUMBER: 1600D04 SCALE: NTS NAME: RAC DATE: 10/10/11 SHEET 1 OF 1

NOTE:

DRAWING NUMBER: 2105A10

Exhibit 7 (cont'd): Drawings



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