SYSTEMS WITH RELIABILITY, LLP

BROADCAST ANTENNAS AND TRANSMISSION LINE

PATTERN CERTIFICATION

DIRECTIONAL FM ANTENNA
WRYV
October 7, 2009

Station	: WRYV
Location	: Milroy, PA
Frequency	: 88.7 MHz
Channel	: 204B1
Antenna Model	: FMEC/2 HWS-PLUS-DA
Maximum Antenna Gain	
Vertical	: 1.70 / 2.30 dB
Horizontal	: 1.70 / 2.30 dB

ANTENNA DESCRIPTION

A custom designed **FMEC/2 HWS-PLUS-DA** antenna was used to produce the required directional azimuth pattern. Each antenna bay consists of a circularly polarized dipole-radiating element enclosed in a radome with a horizontal and vertical parasitic system. The array is comprised of two bays, that are spaced a half wavelength apart, mounted to a pole atop a tower pointing **295°** true north.

DESCRIPTION OF TEST PROCEDURE

The test antenna consists of a third-scale model antenna and parasitic system. This antenna was mounted to an exact replicated third-scale 4-inch pole that will attach to an existing model tower with the use of mounting brackets supplied with the finalized antenna. The pole and antenna were placed 20 ft. on a platform. All feed cables were properly grounded during pattern testing. Horizontal and vertical parasitic elements were used to obtain the submitted directional azimuth 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 266.1 MHz. The antenna under test was rotated in a clockwise direction. A gain reference was taken using a dipole tuned to 266.1 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 ***96.4 %*** of the **RMS** value of the pattern authorized in the related construction permit **BMPED-20090609AAC**. The vertical component **RMS** value is **0.682**. The horizontal component **RMS** value is **0.596**. The circular polarized component **RMS** value is **0.700**.

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

Measured vertical polarized directivity:	**2.150 / 3.320 dB**
Measured horizontal polarized directivity:	**2.818 / 4.500 dB**
Measured circular polarized pattern directivity:	**2.040 / 3.100 dB**

Gain in each polarization was calculated using the following relation:

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

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

V-Pol. Gain = (2.150)(0.567)(1.39) **= 1.7 / 2.3 dB**
H-Pol. Gain = (2.818)(0.433)(1.39) **= 1.7 / 2.3 dB**

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **21** ***meters*** (68.9 ft.) above ground level. The antenna aperture is **5.54 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 **295°** 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**
1356IDA	ELEVATION
1356IDB	ANTENNA ORENTATION WITH PARASITICS
1356IDC	PARASITIC MOUNTING BRACKET (Bay 1)
1356IDD	PARASITIC MOUNTING BRACKET (Bay 2)
1356IDE	ANTENNA STABILIZATION BRACKET DETAIL
2105A10	TEST RANGE SCHEMATIC

The array shall be mounted according to **DWG. 1356IDA**. The parasitic assembly and mounting information is shown in **DWG. 1356IDB, DWG. 1356IDC, DWG. 1356IDD** and **DWG. 1356IDE**. The antenna elements shall be aligned at the same heading as in **DWG. 1356IDB**. This will ensure that the antenna is oriented properly at **295°** true north.

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

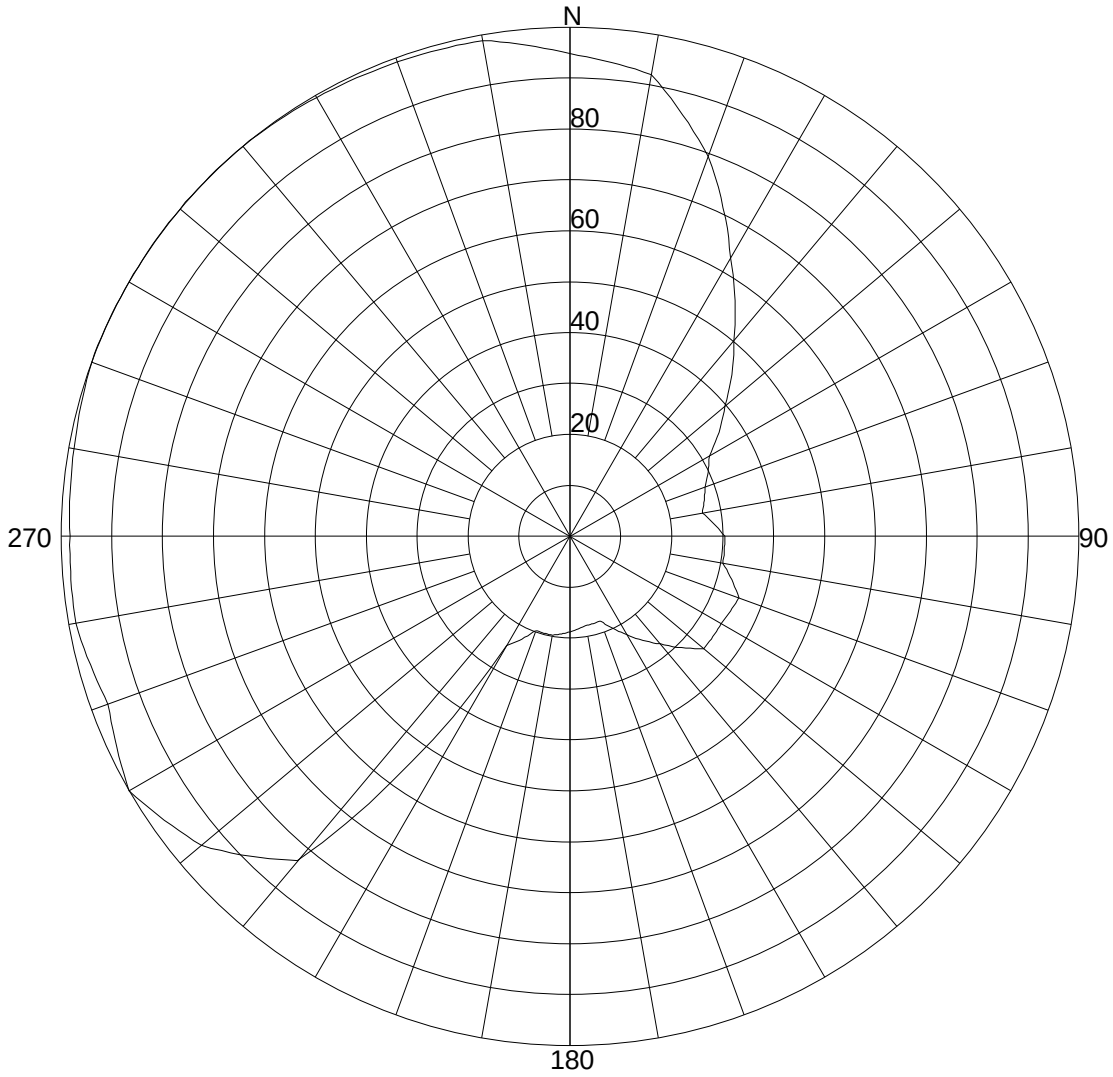
Network Analyzer	:	Hewlett Packard Model # 8753C Serial Number: 08753 – 69138 Calibrated 4/26/08, SWR, Inc.
Computer	:	Pentium 3, 450 MHz, Range Program
Printer	:	Hewlett-Packard Laser Jet 6L
Positioner	:	Orbit Positioner Calibrated 1/10/08, SWR, Inc.

Prepared by:

_____

Mark A. Gergely
Electrical Engineer
Systems With Reliability LLP

Exhibit 1: Circular Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WRYV / Jim Schomer*

Date: 10/7/2009

ANTENNA TYPE: FMEC/2 HWS-PLUS-DA

FREQUENCY: 88.7 MHz

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.03979 / 3.1dB

PATTERN RMS: *0.700*

Micro-Tek Eng. Ver 2.5

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relatve Field(dB)
0	.9480 (-0.45)	180	.1880 (-14.47)
5	.9345 (-0.58)	185	.1925 (-14.27)
10	.9210 (-0.71)	190	.1970 (-14.07)
15	.8575 (-1.33)	195	.1970 (-14.07)
20	.7940 (-1.99)	200	.1970 (-14.07)
25	.7125 (-2.93)	205	.2225 (-13.01)
30	.6310 (-3.99)	210	.2480 (-12.08)
35	.5660 (-4.93)	215	.5400 (-5.34)
40	.5010 (-5.99)	220	.8320 (-1.59)
45	.4495 (-6.93)	225	.8885 (-1.02)
50	.3980 (-7.98)	230	.9450 (-0.48)
55	.3570 (-8.92)	235	.9725 (-0.23)
60	.3160 (-9.98)	240	1.0000 (0.01)
65	.2990 (-10.46)	245	.9825 (-0.14)
70	.2820 (-10.96)	250	.9650 (-0.3)
75	.2730 (-11.25)	255	.9755 (-0.21)
80	.2640 (-11.54)	260	.9860 (-0.11)
85	.2840 (-10.9)	265	.9840 (-0.13)
90	.3040 (-10.31)	270	.9820 (-0.15)
95	.3045 (-10.3)	275	.9855 (-0.12)
100	.3050 (-10.29)	280	.9890 (-0.09)
105	.3290 (-9.63)	285	.9945 (-0.04)
110	.3530 (-9.02)	290	1.0000 (0.01)
115	.3480 (-9.14)	295	1.0000 (0.01)
120	.3430 (-9.27)	300	1.0000 (0.01)
125	.3430 (-9.27)	305	1.0000 (0.01)
130	.3430 (-9.27)	310	1.0000 (0.01)
135	.3095 (-10.16)	315	1.0000 (0.01)
140	.2760 (-11.15)	320	1.0000 (0.01)
145	.2495 (-12.02)	325	.9975 (-0.01)
150	.2230 (-13)	330	.9950 (-0.03)
155	.2000 (-13.94)	335	.9930 (-0.05)
160	.1770 (-14.99)	340	.9910 (-0.07)
165	.1775 (-14.97)	345	.9900 (-0.08)
170	.1780 (-14.94)	350	.9890 (-0.09)
175	.1830 (-14.7)	355	.9685 (-0.27)

Systems With Reliability

CLIENT: *WRYV / Jim Schomer* Date: 10/7/2009

ANTENNA TYPE: FMEC/2 HWS-PLUS-DA

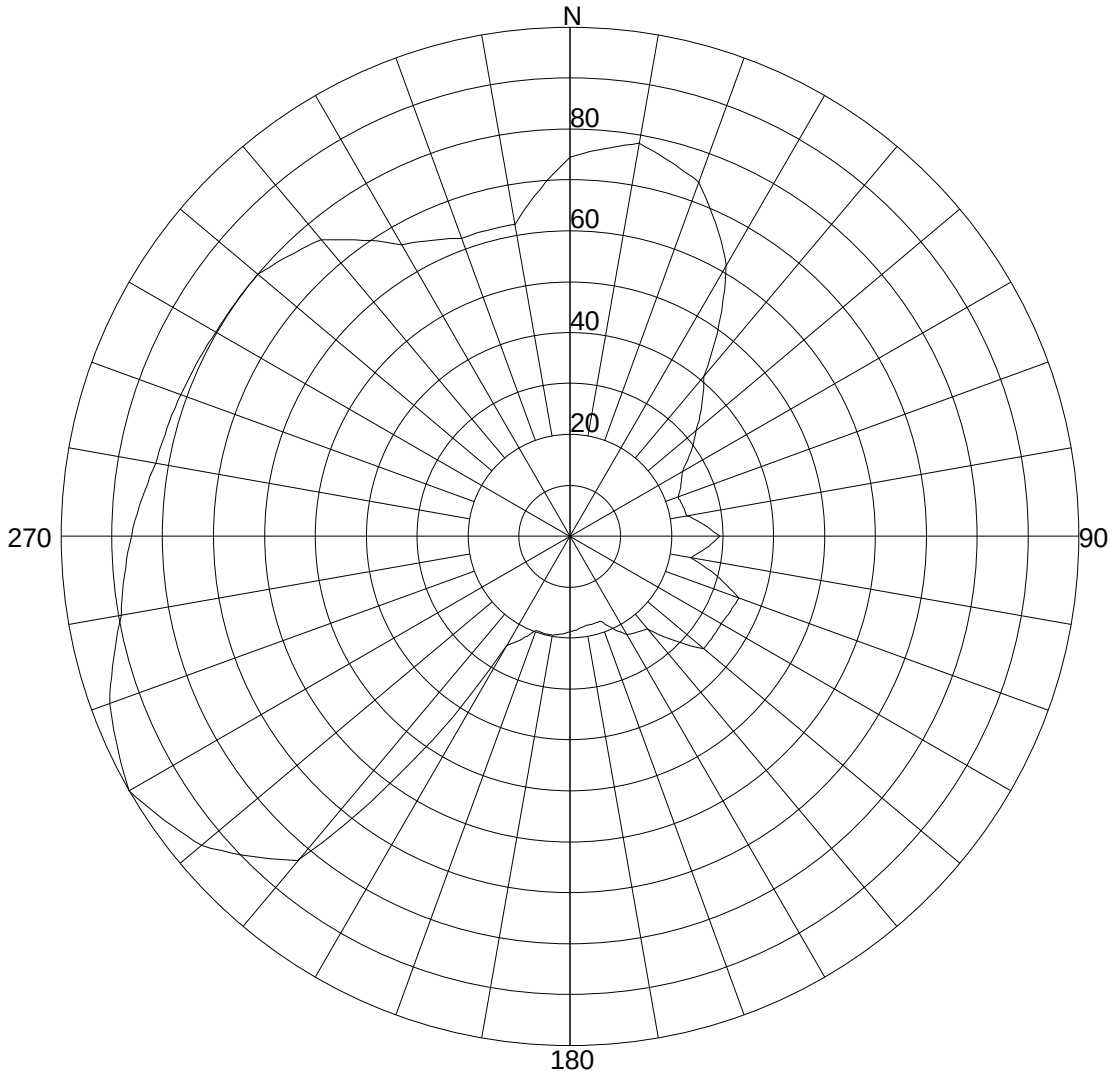
FREQUENCY: 88.7 MHz

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

AZ. DIRECTIVITY: 2.03979 / 3.1dB PATTERN RMS: *0.700*

Micro-Tek Eng. Ver 2.5

Exhibit 2: Measured Horizontal Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WRYV / Jim Schomer*

Date: 10/1/2009

ANTENNA TYPE: FMECR/2 HWS-PLUS-DA

FREQUENCY: 88.7 MHz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.81783 / 4.5dB

PATTERN RMS: *0.596*

Micro-Tek Eng. Ver 2.5

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relatve Field(dB)
0	.7450 (-2.55)	180	.1880 (-14.47)
5	.7645 (-2.32)	185	.1925 (-14.27)
10	.7840 (-2.1)	190	.1970 (-14.07)
15	.7620 (-2.35)	195	.1970 (-14.07)
20	.7400 (-2.6)	200	.1970 (-14.07)
25	.6775 (-3.37)	205	.2225 (-13.01)
30	.6150 (-4.21)	210	.2480 (-12.08)
35	.5120 (-5.8)	215	.5400 (-5.34)
40	.4090 (-7.74)	220	.8320 (-1.59)
45	.3665 (-8.69)	225	.8885 (-1.02)
50	.3240 (-9.76)	230	.9450 (-0.48)
55	.2895 (-10.74)	235	.9725 (-0.23)
60	.2550 (-11.84)	240	1.0000 (0.01)
65	.2405 (-12.34)	245	.9810 (-0.16)
70	.2260 (-12.88)	250	.9620 (-0.33)
75	.2295 (-12.75)	255	.9285 (-0.64)
80	.2330 (-12.62)	260	.8950 (-0.95)
85	.2640 (-11.54)	265	.8785 (-1.12)
90	.2950 (-10.57)	270	.8620 (-1.28)
95	.2680 (-11.4)	275	.8440 (-1.46)
100	.2410 (-12.32)	280	.8260 (-1.65)
105	.2970 (-10.52)	285	.8195 (-1.72)
110	.3530 (-9.02)	290	.8130 (-1.79)
115	.3480 (-9.14)	295	.8080 (-1.84)
120	.3430 (-9.27)	300	.8030 (-1.89)
125	.3430 (-9.27)	305	.8015 (-1.91)
130	.3430 (-9.27)	310	.8000 (-1.93)
135	.2900 (-10.72)	315	.7800 (-2.15)
140	.2370 (-12.47)	320	.7600 (-2.37)
145	.2300 (-12.73)	325	.7105 (-2.96)
150	.2230 (-13)	330	.6610 (-3.58)
155	.2000 (-13.94)	335	.6420 (-3.84)
160	.1770 (-14.99)	340	.6230 (-4.1)
165	.1775 (-14.97)	345	.6225 (-4.1)
170	.1780 (-14.94)	350	.6220 (-4.11)
175	.1830 (-14.7)	355	.6835 (-3.29)

Systems With Reliability

CLIENT: *WRYV / Jim Schomer* Date: 10/1/2009

ANTENNA TYPE: FMECR/2 HWS-PLUS-DA

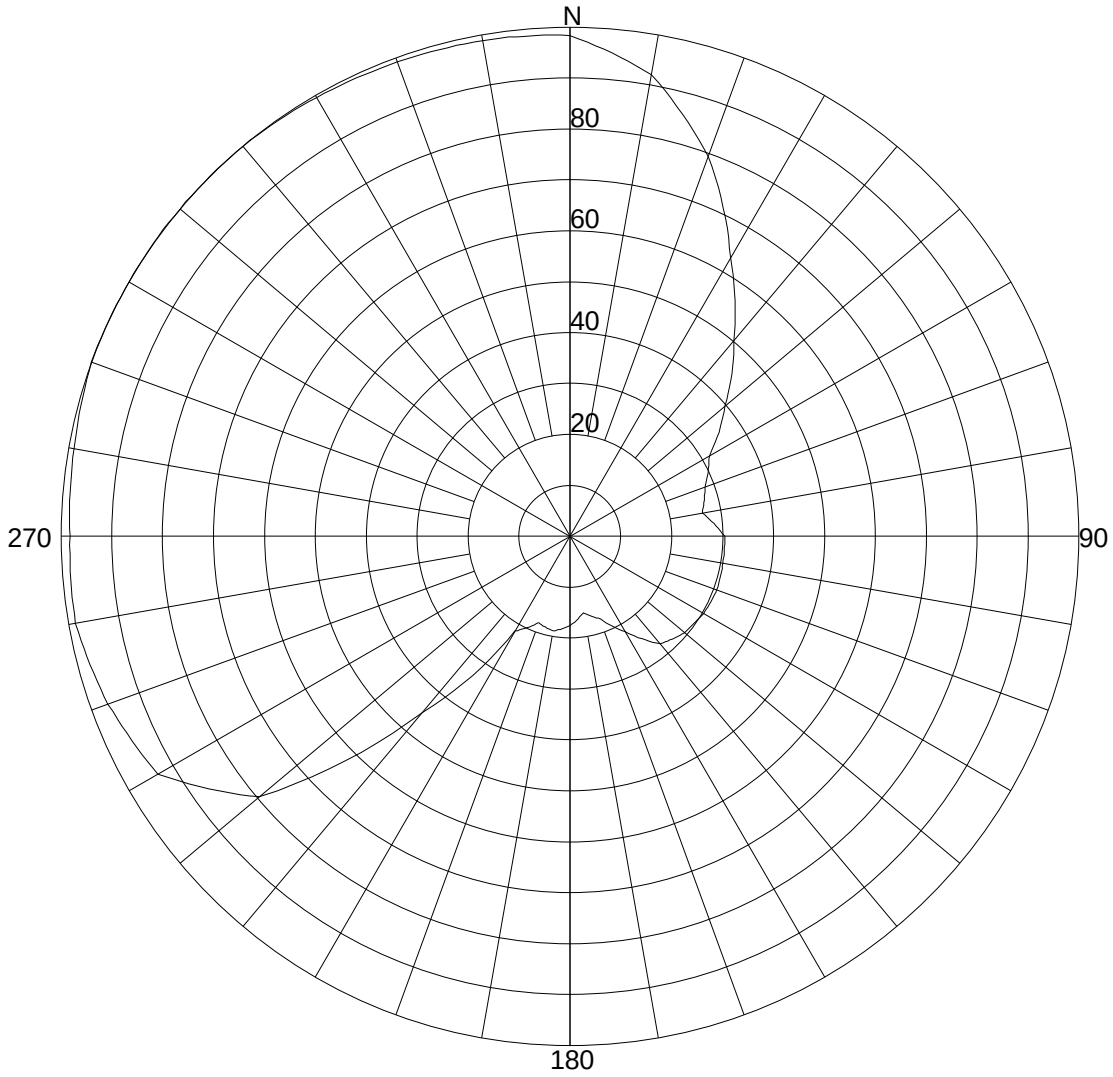
FREQUENCY: 88.7 MHz

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

AZ. DIRECTIVITY: 2.81783 / 4.5dB PATTERN RMS: *0.596*

Micro-Tek Eng. Ver 2.5

Exhibit 3: Measured Vertical Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WRYV / Jim Schomer*

Date: 10/7/2009

ANTENNA TYPE: FMEC/2 HWS-PLUS-DA

FREQUENCY: 88.7 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.15029 / 3.32dB

PATTERN RMS: *0.682*

Micro-Tek Eng. Ver 2.5

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relatve Field(dB)
0	.9840 (-0.13)	180	.1760 (-15.04)
5	.9525 (-0.41)	185	.1825 (-14.73)
10	.9210 (-0.71)	190	.1890 (-14.42)
15	.8575 (-1.33)	195	.1850 (-14.61)
20	.7940 (-1.99)	200	.1810 (-14.8)
25	.7125 (-2.93)	205	.1980 (-14.02)
30	.6310 (-3.99)	210	.2150 (-13.31)
35	.5660 (-4.93)	215	.3335 (-9.51)
40	.5010 (-5.99)	220	.4520 (-6.88)
45	.4495 (-6.93)	225	.6240 (-4.08)
50	.3980 (-7.98)	230	.7960 (-1.97)
55	.3570 (-8.92)	235	.8650 (-1.25)
60	.3160 (-9.98)	240	.9340 (-0.58)
65	.2990 (-10.46)	245	.9495 (-0.44)
70	.2820 (-10.96)	250	.9650 (-0.3)
75	.2730 (-11.25)	255	.9755 (-0.21)
80	.2640 (-11.54)	260	.9860 (-0.11)
85	.2840 (-10.9)	265	.9840 (-0.13)
90	.3040 (-10.31)	270	.9820 (-0.15)
95	.3045 (-10.3)	275	.9855 (-0.12)
100	.3050 (-10.29)	280	.9890 (-0.09)
105	.3060 (-10.26)	285	.9945 (-0.04)
110	.3070 (-10.23)	290	1.0000 (0.01)
115	.3050 (-10.29)	295	1.0000 (0.01)
120	.3030 (-10.34)	300	1.0000 (0.01)
125	.2985 (-10.47)	305	1.0000 (0.01)
130	.2940 (-10.6)	310	1.0000 (0.01)
135	.2850 (-10.87)	315	1.0000 (0.01)
140	.2760 (-11.15)	320	1.0000 (0.01)
145	.2460 (-12.15)	325	.9975 (-0.01)
150	.2160 (-13.27)	330	.9950 (-0.03)
155	.1940 (-14.2)	335	.9930 (-0.05)
160	.1720 (-15.24)	340	.9910 (-0.07)
165	.1625 (-15.73)	345	.9900 (-0.08)
170	.1530 (-16.25)	350	.9890 (-0.09)
175	.1645 (-15.62)	355	.9865 (-0.11)

Systems With Reliability

CLIENT: *WRYV / Jim Schomer*

Date: 10/7/2009

ANTENNA TYPE: FMEC/2 HWS-PLUS-DA

FREQUENCY: 88.7 MHz

PATTERN POL.: Vertical

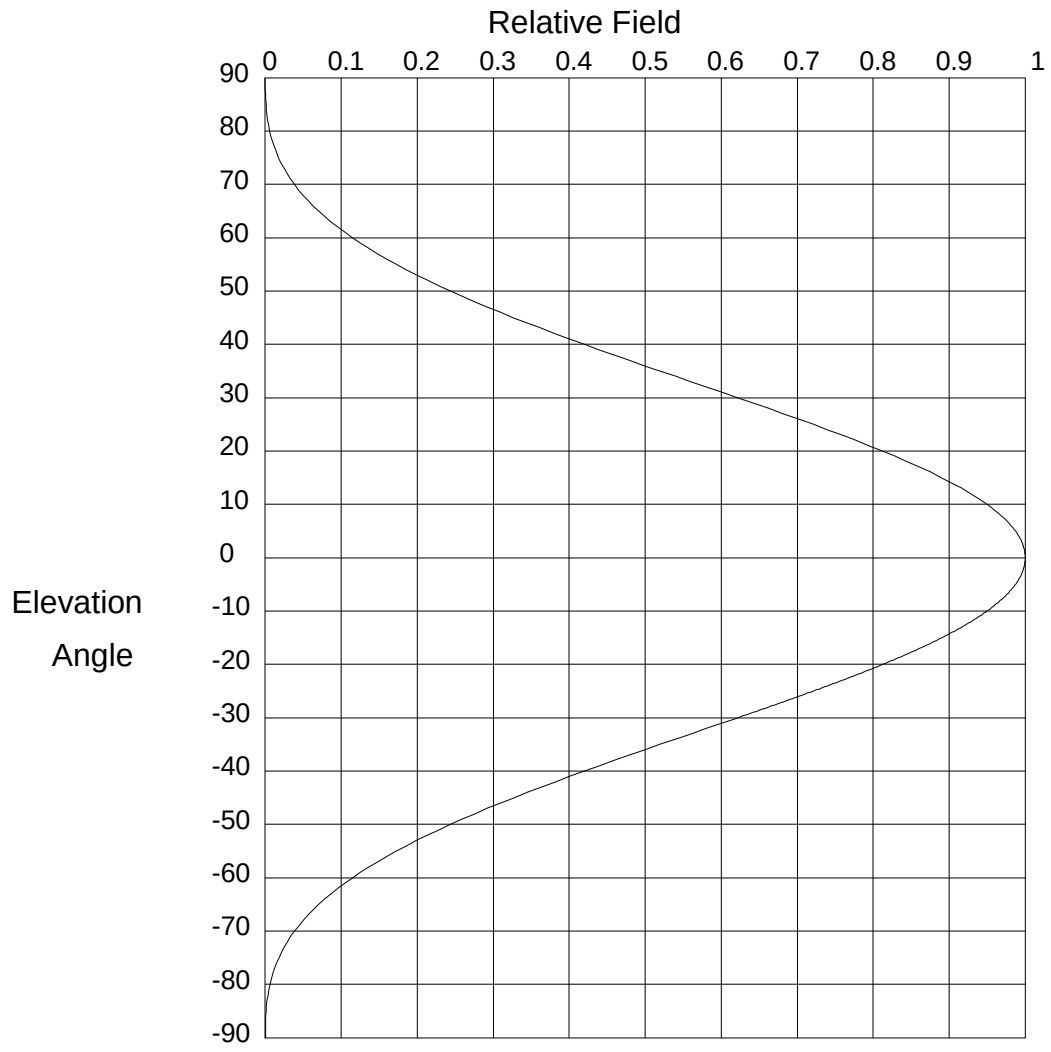
CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.15029 / 3.32dB

PATTERN RMS: *0.682*

Micro-Tek Eng. Ver 2.5

Exhibit 4: Elevation Pattern



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: *WRYV / Jim Schomer*

Date: 10/5/2009

ANTENNA TYPE: FMECR/2 HWS-PLUS-DA

FREQUENCY: 88.7 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 1.39/1.43 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 1.39/1.43 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	.00 (-50)	52.0	.214 (-13.4)	14.0	.904 (-0.878)
89.0	.00 (-91.156)	51.0	.229 (-12.821)	13.0	.917 (-0.757)
88.0	.00 (-78.01)	50.0	.244 (-12.26)	12.0	.929 (-0.644)
87.0	.00 (-69.988)	49.0	.259 (-11.717)	11.0	.94 (-0.541)
86.0	.001 (-64.112)	48.0	.276 (-11.191)	10.0	.95 (-0.447)
85.0	.001 (-59.44)	47.0	.292 (-10.682)	9.8	.952 (-0.429)
84.0	.002 (-55.546)	46.0	.309 (-10.188)	9.6	.954 (-0.412)
83.0	.002 (-52.199)	45.0	.327 (-9.71)	9.4	.956 (-0.395)
82.0	.003 (-49.26)	44.0	.345 (-9.246)	9.2	.957 (-0.378)
81.0	.005 (-46.639)	43.0	.363 (-8.797)	9.0	.959 (-0.362)
80.0	.006 (-44.272)	42.0	.382 (-8.362)	8.8	.961 (-0.346)
79.0	.008 (-42.113)	41.0	.401 (-7.941)	8.6	.963 (-0.33)
78.0	.01 (-40.128)	40.0	.42 (-7.533)	8.4	.964 (-0.315)
77.0	.012 (-38.292)	39.0	.44 (-7.138)	8.2	.966 (-0.3)
76.0	.015 (-36.583)	38.0	.459 (-6.756)	8.0	.968 (-0.286)
75.0	.018 (-34.986)	37.0	.479 (-6.387)	7.8	.969 (-0.272)
74.0	.021 (-33.487)	36.0	.50 (-6.029)	7.6	.971 (-0.258)
73.0	.025 (-32.074)	35.0	.52 (-5.683)	7.4	.972 (-0.244)
72.0	.029 (-30.74)	34.0	.54 (-5.349)	7.2	.974 (-0.231)
71.0	.034 (-29.475)	33.0	.561 (-5.027)	7.0	.975 (-0.219)
70.0	.039 (-28.274)	32.0	.581 (-4.716)	6.8	.977 (-0.206)
69.0	.044 (-27.13)	31.0	.601 (-4.416)	6.6	.978 (-0.194)
68.0	.05 (-26.039)	30.0	.622 (-4.126)	6.4	.979 (-0.183)
67.0	.056 (-24.997)	29.0	.642 (-3.848)	6.2	.98 (-0.171)
66.0	.063 (-24)	28.0	.662 (-3.58)	6.0	.982 (-0.161)
65.0	.07 (-23.044)	27.0	.682 (-3.323)	5.8	.983 (-0.15)
64.0	.078 (-22.126)	26.0	.702 (-3.076)	5.6	.984 (-0.14)
63.0	.087 (-21.245)	25.0	.721 (-2.839)	5.4	.985 (-0.13)
62.0	.096 (-20.397)	24.0	.74 (-2.612)	5.2	.986 (-0.121)
61.0	.105 (-19.581)	23.0	.759 (-2.395)	5.0	.987 (-0.111)
60.0	.115 (-18.794)	22.0	.777 (-2.188)	4.8	.988 (-0.103)
59.0	.125 (-18.036)	21.0	.795 (-1.991)	4.6	.989 (-0.094)
58.0	.136 (-17.304)	20.0	.812 (-1.804)	4.4	.99 (-0.086)
57.0	.148 (-16.597)	19.0	.829 (-1.626)	4.2	.991 (-0.079)
56.0	.16 (-15.914)	18.0	.846 (-1.457)	4.0	.992 (-0.071)
55.0	.173 (-15.254)	17.0	.861 (-1.299)	3.8	.993 (-0.064)
54.0	.186 (-14.615)	16.0	.876 (-1.149)	3.6	.993 (-0.058)
53.0	.20 (-13.998)	15.0	.89 (-1.009)	3.4	.994 (-0.052)

Systems With Reliability

CLIENT: *WRYV / Jim Schomer*
Date: 10/5/2009
ANTENNA TYPE: FMECR/2 HWS-PLUS-DA
FREQUENCY: 88.7 MHz
PATTERN POL.: Circular
DIRECTIVITY(Peak): 1.39/1.43 dBd
Beam Tilt (Deg.) : *0*
DIRECTIVITY(Horiz): 1.39/1.43 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)
3.2	.995 (-0.046)	-4.4	.99 (-0.086)	-12.0	.929 (-0.644)
3.0	.995 (-0.04)	-4.6	.989 (-0.094)	-12.2	.926 (-0.666)
2.8	.996 (-0.035)	-4.8	.988 (-0.103)	-12.4	.924 (-0.688)
2.6	.997 (-0.03)	-5.0	.987 (-0.111)	-12.6	.921 (-0.711)
2.4	.997 (-0.026)	-5.2	.986 (-0.121)	-12.8	.919 (-0.733)
2.2	.998 (-0.022)	-5.4	.985 (-0.13)	-13.0	.917 (-0.757)
2.0	.998 (-0.018)	-5.6	.984 (-0.14)	-13.2	.914 (-0.78)
1.8	.998 (-0.014)	-5.8	.983 (-0.15)	-13.4	.912 (-0.804)
1.6	.999 (-0.011)	-6.0	.982 (-0.161)	-13.6	.909 (-0.828)
1.4	.999 (-0.009)	-6.2	.98 (-0.171)	-13.8	.906 (-0.853)
1.2	.999 (-0.006)	-6.4	.979 (-0.183)	-14.0	.904 (-0.878)
1.0	.999 (-0.004)	-6.6	.978 (-0.194)	-14.2	.901 (-0.904)
.8	1.00 (-0.003)	-6.8	.977 (-0.206)	-14.4	.899 (-0.929)
.6	1.00 (-0.002)	-7.0	.975 (-0.219)	-14.6	.896 (-0.956)
.4	1.00 (-0.001)	-7.2	.974 (-0.231)	-14.8	.893 (-0.982)
.2	1.00 (0)	-7.4	.972 (-0.244)	-15.0	.89 (-1.009)
.0	1.00 (0)	-7.6	.971 (-0.258)	-15.2	.888 (-1.036)
-.2	1.00 (0)	-7.8	.969 (-0.272)	-15.4	.885 (-1.064)
-.4	1.00 (-0.001)	-8.0	.968 (-0.286)	-15.6	.882 (-1.092)
-.6	1.00 (-0.002)	-8.2	.966 (-0.3)	-15.8	.879 (-1.12)
-.8	1.00 (-0.003)	-8.4	.964 (-0.315)	-16.0	.876 (-1.149)
-1.0	.999 (-0.004)	-8.6	.963 (-0.33)	-16.2	.873 (-1.178)
-1.2	.999 (-0.006)	-8.8	.961 (-0.346)	-16.4	.87 (-1.208)
-1.4	.999 (-0.009)	-9.0	.959 (-0.362)	-16.6	.867 (-1.238)
-1.6	.999 (-0.011)	-9.2	.957 (-0.378)	-16.8	.864 (-1.268)
-1.8	.998 (-0.014)	-9.4	.956 (-0.395)	-17.0	.861 (-1.299)
-2.0	.998 (-0.018)	-9.6	.954 (-0.412)	-17.2	.858 (-1.33)
-2.2	.998 (-0.022)	-9.8	.952 (-0.429)	-17.4	.855 (-1.361)
-2.4	.997 (-0.026)	-10.0	.95 (-0.447)	-17.6	.852 (-1.393)
-2.6	.997 (-0.03)	-10.2	.948 (-0.465)	-17.8	.849 (-1.425)
-2.8	.996 (-0.035)	-10.4	.946 (-0.483)	-18.0	.846 (-1.457)
-3.0	.995 (-0.04)	-10.6	.944 (-0.502)	-18.2	.842 (-1.49)
-3.2	.995 (-0.046)	-10.8	.942 (-0.521)	-18.4	.839 (-1.524)
-3.4	.994 (-0.052)	-11.0	.94 (-0.541)	-18.6	.836 (-1.557)
-3.6	.993 (-0.058)	-11.2	.937 (-0.561)	-18.8	.833 (-1.591)
-3.8	.993 (-0.064)	-11.4	.935 (-0.581)	-19.0	.829 (-1.626)
-4.0	.992 (-0.071)	-11.6	.933 (-0.602)	-19.2	.826 (-1.661)
-4.2	.991 (-0.079)	-11.8	.931 (-0.623)	-19.4	.823 (-1.696)

Systems With Reliability

CLIENT: *WRYV / Jim Schomer*

Date: 10/5/2009

ANTENNA TYPE: FMECR/2 HWS-PLUS-DA

FREQUENCY: 88.7 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 1.39/1.43 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 1.39/1.43 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)
-19.6	.819 (-1.731)	-27.2	.678 (-3.373)	-54.0	.186 (-14.615)
-19.8	.816 (-1.767)	-27.4	.674 (-3.424)	-55.0	.173 (-15.254)
-20.0	.812 (-1.804)	-27.6	.67 (-3.476)	-56.0	.16 (-15.914)
-20.2	.809 (-1.84)	-27.8	.666 (-3.528)	-57.0	.148 (-16.597)
-20.4	.806 (-1.877)	-28.0	.662 (-3.58)	-58.0	.136 (-17.304)
-20.6	.802 (-1.915)	-28.2	.658 (-3.633)	-59.0	.125 (-18.036)
-20.8	.799 (-1.953)	-28.4	.654 (-3.686)	-60.0	.115 (-18.794)
-21.0	.795 (-1.991)	-28.6	.65 (-3.739)	-61.0	.105 (-19.581)
-21.2	.792 (-2.03)	-28.8	.646 (-3.793)	-62.0	.096 (-20.397)
-21.4	.788 (-2.069)	-29.0	.642 (-3.848)	-63.0	.087 (-21.245)
-21.6	.784 (-2.108)	-29.2	.638 (-3.903)	-64.0	.078 (-22.126)
-21.8	.781 (-2.148)	-29.4	.634 (-3.958)	-65.0	.07 (-23.044)
-22.0	.777 (-2.188)	-29.6	.63 (-4.014)	-66.0	.063 (-24)
-22.2	.774 (-2.229)	-29.8	.626 (-4.07)	-67.0	.056 (-24.997)
-22.4	.77 (-2.27)	-30.0	.622 (-4.126)	-68.0	.05 (-26.039)
-22.6	.766 (-2.311)	-31.0	.601 (-4.416)	-69.0	.044 (-27.13)
-22.8	.763 (-2.353)	-32.0	.581 (-4.716)	-70.0	.039 (-28.274)
-23.0	.759 (-2.395)	-33.0	.561 (-5.027)	-71.0	.034 (-29.475)
-23.2	.755 (-2.438)	-34.0	.54 (-5.349)	-72.0	.029 (-30.74)
-23.4	.752 (-2.481)	-35.0	.52 (-5.683)	-73.0	.025 (-32.074)
-23.6	.748 (-2.524)	-36.0	.50 (-6.029)	-74.0	.021 (-33.487)
-23.8	.744 (-2.568)	-37.0	.479 (-6.387)	-75.0	.018 (-34.986)
-24.0	.74 (-2.612)	-38.0	.459 (-6.756)	-76.0	.015 (-36.583)
-24.2	.737 (-2.657)	-39.0	.44 (-7.138)	-77.0	.012 (-38.292)
-24.4	.733 (-2.701)	-40.0	.42 (-7.533)	-78.0	.01 (-40.128)
-24.6	.729 (-2.747)	-41.0	.401 (-7.941)	-79.0	.008 (-42.113)
-24.8	.725 (-2.793)	-42.0	.382 (-8.362)	-80.0	.006 (-44.272)
-25.0	.721 (-2.839)	-43.0	.363 (-8.797)	-81.0	.005 (-46.639)
-25.2	.717 (-2.885)	-44.0	.345 (-9.246)	-82.0	.003 (-49.26)
-25.4	.713 (-2.932)	-45.0	.327 (-9.71)	-83.0	.002 (-52.199)
-25.6	.71 (-2.98)	-46.0	.309 (-10.188)	-84.0	.002 (-55.546)
-25.8	.706 (-3.027)	-47.0	.292 (-10.682)	-85.0	.001 (-59.44)
-26.0	.702 (-3.076)	-48.0	.276 (-11.191)	-86.0	.001 (-64.112)
-26.2	.698 (-3.124)	-49.0	.259 (-11.717)	-87.0	.00 (-69.988)
-26.4	.694 (-3.173)	-50.0	.244 (-12.26)	-88.0	.00 (-78.01)
-26.6	.69 (-3.223)	-51.0	.229 (-12.821)	-89.0	.00 (-91.156)
-26.8	.686 (-3.272)	-52.0	.214 (-13.4)	-90.0	.00 (-50)
-27.0	.682 (-3.323)	-53.0	.20 (-13.998)	90.0	.00 (-50)

Systems With Reliability

CLIENT: *WRYV / Jim Schomer*
Date: 10/5/2009
ANTENNA TYPE: FMECR/2 HWS-PLUS-DA
FREQUENCY: 88.7 MHz
PATTERN POL.: Circular
DIRECTIVITY(Peak): 1.39/1.43 dBd
Beam Tilt (Deg.) : *0*
DIRECTIVITY(Horiz): 1.39/1.43 dBd
Null Fill(s)(%) : *0, 0, 0*

Micro-Tek Eng. Ver 2.5

SYSTEMS WITH RELIABILITY, LLP

BROADCAST ANTENNAS AND TRANSMISSION LINE

SYSTEM DATA SHEET

Customer	WRYV
Contact	Jim Schomer
Location	Milroy, PA
Antenna Model	FMECR/2 HWS-PLUS-DA
Channel / Frequency	204B1 / 88.7 MHz

ELECTRICAL SPECIFICATIONS

Antenna Specifications:

		H-POL	dB	V. Pol.	dB	
License ERP (KW)		2.2	3.424	2.2	3.424	**dB**
FCC Limit Pattern Directivity		1.899	2.784	1.899	2.784	**dB**
Elevation Directivity		1.39	1.430	1.390	1.430	**dB**
Azimuth Directivity		2.818	4.499	2.150	3.325	**dB**
Composite Pattern		2.040	3.096	2.040	3.096	**dB**
Polarization Ratio		0.433	-3.637	0.567	-2.463	**dB**
RMS Comp./RMS Limit	96.39 **%**					
Antenna Efficiency %		100	0	100	0	
Power Ratio (Pol. Ratio X Efficiency)		0.4328	0	0.5672	0	
Antenna Gain		1.695	2.292	1.695	2.292	**dB**

Antenna Input Power (KW) 1.298 **kW** 1.132 **(dBK)**

Feed Line Specifications:

Line Type	7/8" Foam	50 Ω	LDF5-50A
Attenuation Per 100 ft (dB)	0.342 **dB**		
Line Length (ft) AGL + 45'	210.00 **ft.**		
Total Line Attenuation (dB)	0.7182 **dB**		
Line Efficiency	84.76 **%**		
Power Input to the Line (KW)	1.531 **kW**	1.850 **(dBK)**	

MECHANICAL SPECIFICATIONS

No. Of Bays	2				
Antenna Aperture	5.54	**ft.**		1.69	**meter**
Center of Radiation AGL	68.90	**ft.**		21.01	**meter**
Antenna Weight with Radomes	400.00	**lbs.**		181.82	**kg**
Windload (50/33) with Radomes	1140.00	**lbs.**	**Windload CaAc**	32.50	**ft^2**

Prepared by: David K. Edmiston

David K. Edmiston Jr.
SWR, LLP

SYSTEMS WITH RELIABILITY, INC.
Broadcast Antennas and Transmission Systems

WRYV Antenna RMS Comparison

PROPOSED ANTENNA		DESIGNED ANTENNA	
Azimuth Heading	**Relative Field**	**Azimuth Heading**	**Relative Field**
0	1.000	0	0.948
10	1.000	10	0.921
20	0.794	20	0.794
30	0.631	30	0.631
40	0.501	40	0.501
50	0.398	50	0.398
60	0.316	60	0.316
70	0.282	70	0.282
80	0.355	80	0.264
90	0.442	90	0.304
100	0.473	100	0.305
110	0.473	110	0.353
120	0.446	120	0.343
130	0.355	130	0.343
140	0.282	140	0.276
150	0.224	150	0.223
160	0.178	160	0.177
170	0.178	170	0.178
180	0.188	180	0.188
190	0.197	190	0.197
200	0.197	200	0.197
210	0.248	210	0.248
220	1.000	220	0.832
230	1.000	230	0.945
240	1.000	240	1.000
250	1.000	250	0.965
260	1.000	260	0.986
270	1.000	270	0.982
280	1.000	280	0.989
290	1.000	290	1.000
300	1.000	300	1.000
310	1.000	310	1.000
320	1.000	320	1.000
330	1.000	330	0.995
340	1.000	340	0.991
350	1.000	350	0.989

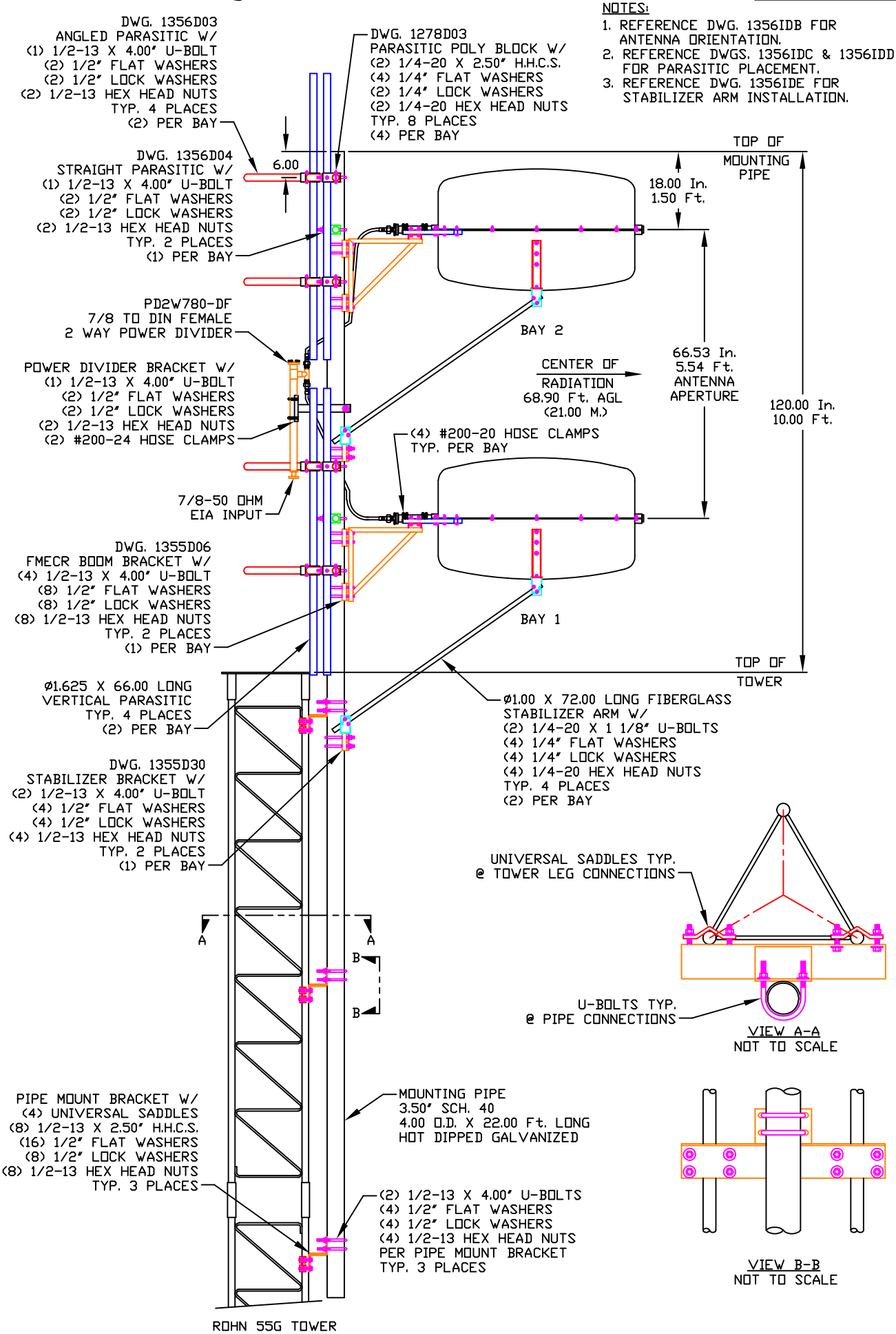
Sum of Relative Field Squared :	**19.079**	**Sum of Relative Field Squared :**	**17.724**
Sum Divided by 36 (Readings) :	**0.530**	**Sum Divided by 36 (Readings) :**	**0.492**
Square Root :	**0.728**	**Square Root :**	**0.702**

Percentage of Construction Permit Antenna Filled : **96.38%**

Exhibit 7: Drawings

DRAWING NUMBER: 1356IDA

NOTES:
1. REFERENCE DWG. 1356IDB FOR ANTENNA ORIENTATION.
2. REFERENCE DWGS. 1356IDC & 1356IDD FOR PARASITIC PLACEMENT.
3. REFERENCE DWG. 1356IDE FOR STABILIZER ARM INSTALLATION.

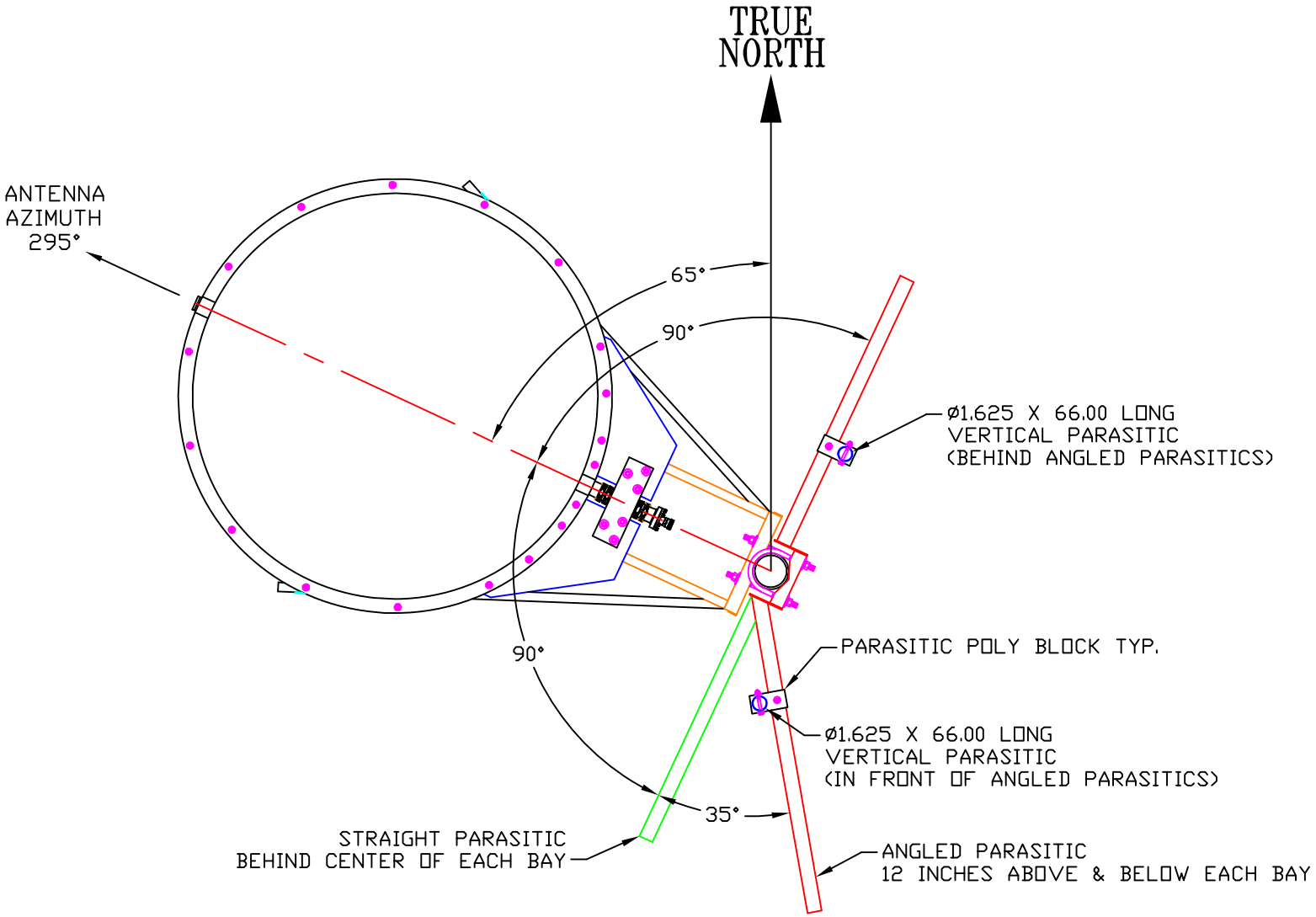


SYSTEMS WITH RELIABILITY, INC 619 INDUSTRIAL PARK ROAD EBENSBURG, PENNSYLVANIA 15931	TITLE: FMECR/2 PLUS-HWS-DA, FREQ. 88.7 WRYV, MILROY, PA MATERIAL:	SIZE C	REV 1 2 3	APPR.	DATE	ENGINEER:	DRAWING NUMBER: 1356IDA
						SCALE: NTS	NAME: RAC DATE: 10/6/09 SHEET 1 OF 1

NOTE:

Exhibit 7(cont'd): Drawings

DRAWING NUMBER: 1356IDB



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 PLUS-HWS-DA, FREQ. 88.7
WRYV, MILROY, PA

MATERIAL: ANTENNA ORIENTATION
FROM TRUE NORTH

SIZE A

PARTS MADE BY THIS DRAWING

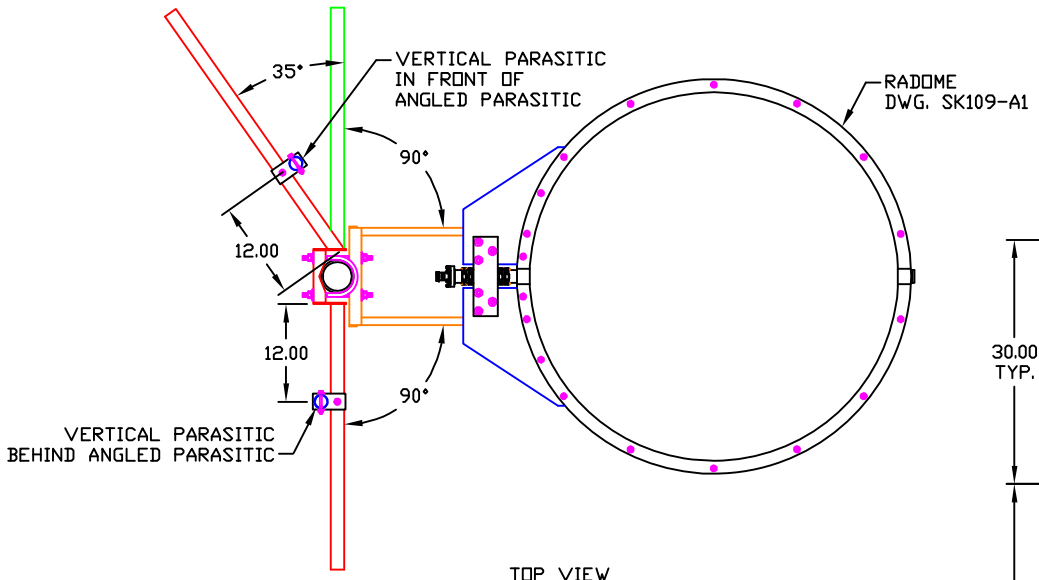
DRAWING NUMBER: 1356IDB

SCALE: NTS | NAME: RAC | DATE: 10/6/09 | SHEET 1 OF 1

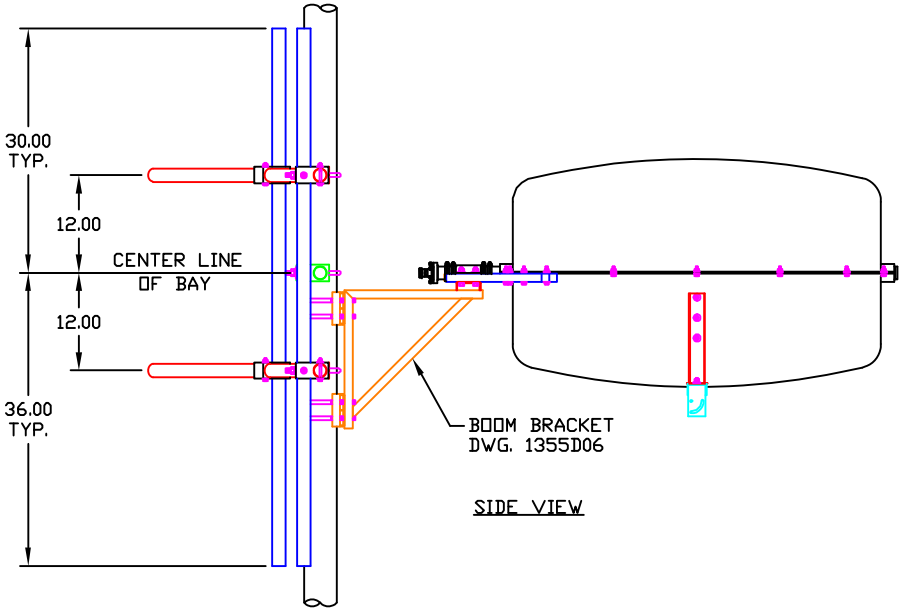
NOTE: Exhibit 7(cont'd): Drawings

DRAWING NUMBER: 1356IDC

THIS DRAWING FOR BAY #1.
SEE DWG. 1356IDD FOR BAY #2.

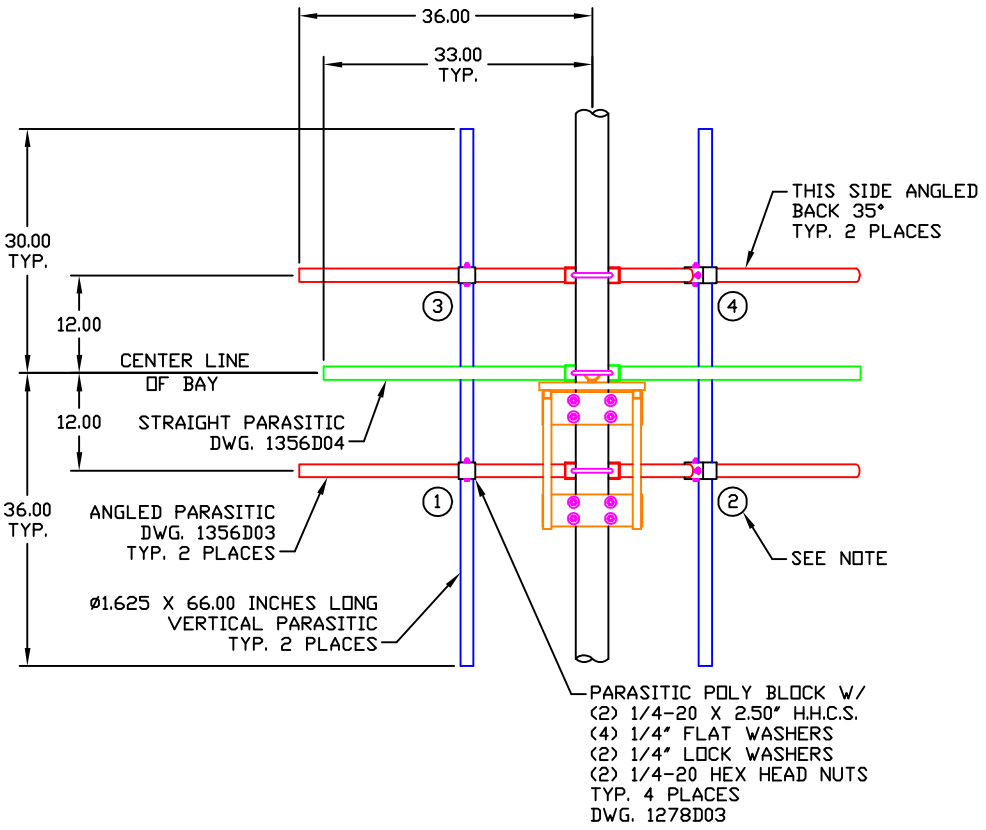


TOP VIEW



SIDE VIEW

NOTE:
THE ANGLED PARASITICS, VERTICAL PARASITICS & POLY BLOCKS ARE ALL FACTORY DRILLED & LABELED WITH NUMBERS CORRESPONDING TO THE NUMBER LOCATIONS IN THE FRONT VIEW. MATCH ALL NUMBERS DURING ASSEMBLY FOR PROPER INSTALLATION.



FRONT VIEW
(BOOM BRACKET & PARASITICS ONLY)
ANTENNA & RADOME REMOVED FOR CLARITY.

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 PLUS-HWS-DA, FREQ. 88.7
WRYV, MILROY, PA

MATERIAL: PARASITIC PLACEMENT
BAY #1

SIZE: A

PARTS MADE BY THIS DRAWING

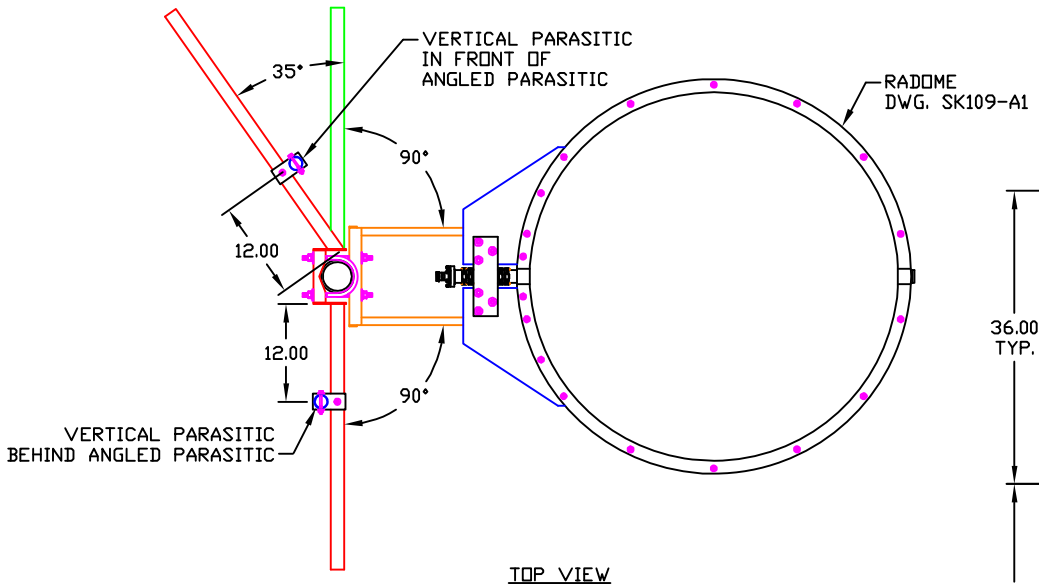
DRAWING NUMBER: 1356IDC

SCALE: NTS | NAME: RAC | DATE: 10/6/09 | SHEET 1 OF 1

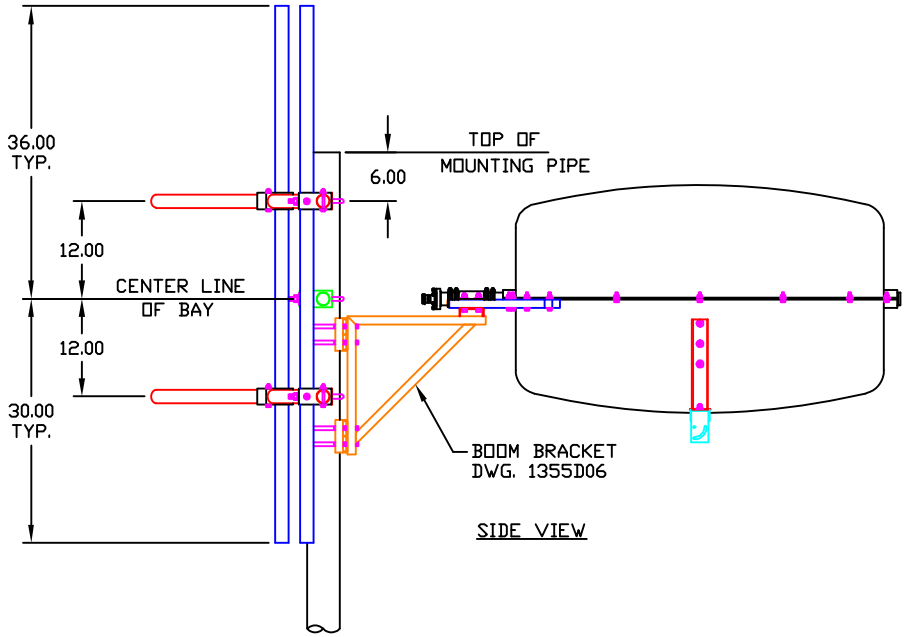
NOTE: Exhibit 7(cont'd): Drawings

DRAWING NUMBER: 1356IDD

THIS DRAWING FOR BAY #2.
SEE DWG. 1356IDC FOR BAY #1.

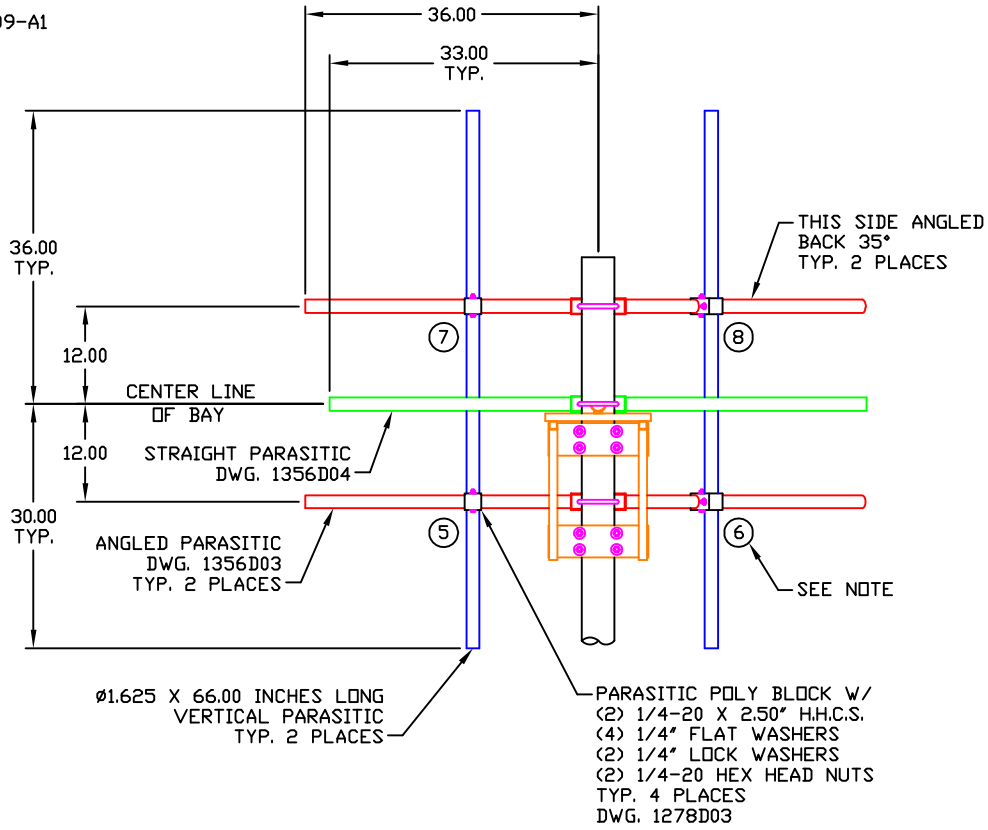


TOP VIEW



SIDE VIEW

NOTE:
THE ANGLED PARASITICS, VERTICAL PARASITICS & POLY BLOCKS ARE ALL FACTORY DRILLED & LABELED WITH NUMBERS CORRESPONDING TO THE NUMBER LOCATIONS IN THE FRONT VIEW. MATCH ALL NUMBERS DURING ASSEMBLY FOR PROPER INSTALLATION.



FRONT VIEW
(BOOM BRACKET & PARASITICS ONLY)
ANTENNA & RADOME REMOVED FOR CLARITY.

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 PLUS-HWS-DA, FREQ. 88.7
WRYV, MILROY, PA

MATERIAL: PARASITIC PLACEMENT
BAY #2

SIZE: A

PARTS MADE BY THIS DRAWING

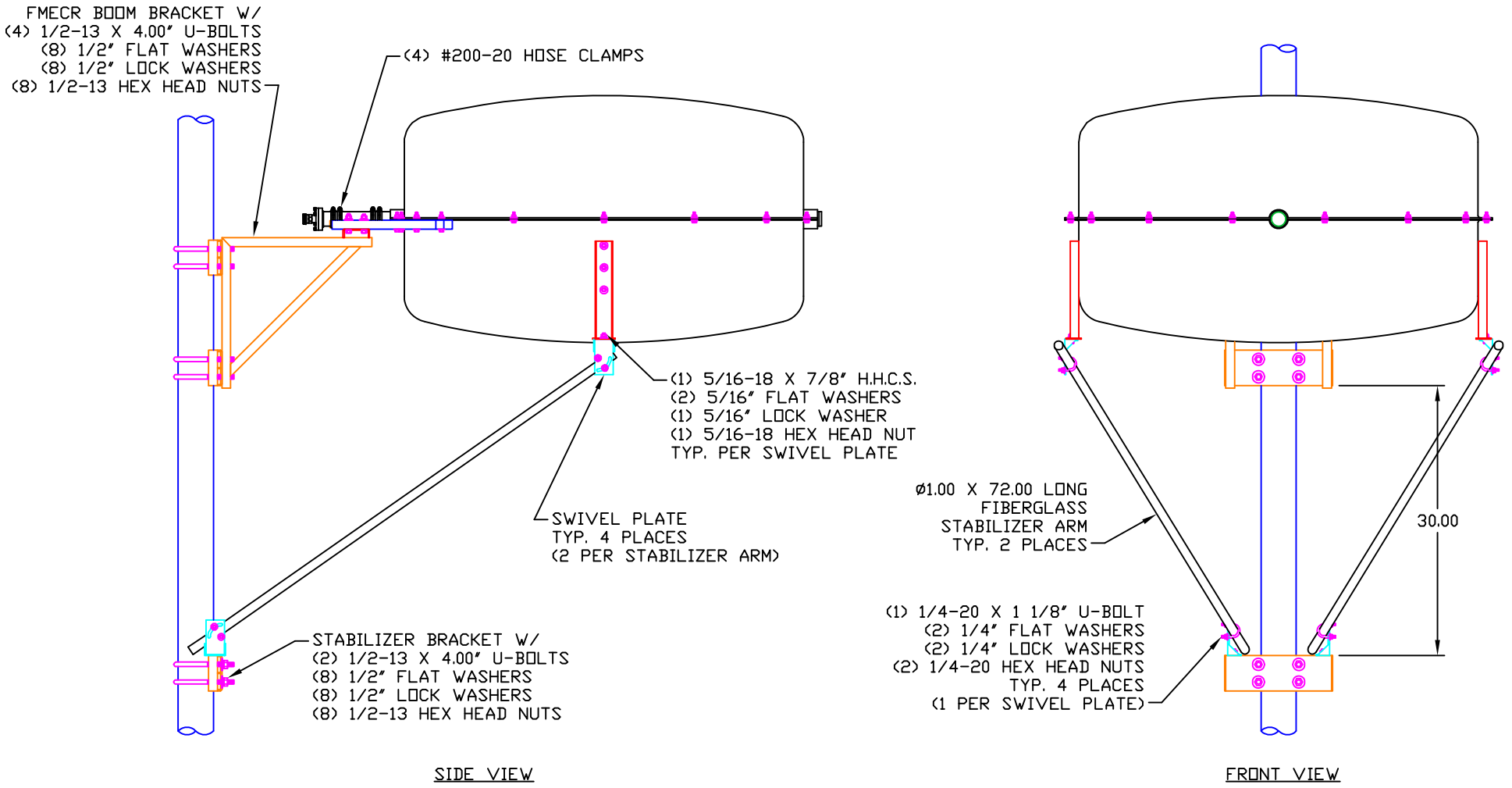
DRAWING NUMBER: 1356IDD

SCALE: NTS | NAME: RAC | DATE: 10/6/09 | SHEET 1 OF 1

NOTE:

Exhibit 7(cont'd): Drawings

DRAWING NUMBER: 1356IDE



SIDE VIEW

FRONT 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 PLUS-HWS-DA, FREQ. 88.7 WRYV, MILROY, PA

MATERIAL:

SIZE: A

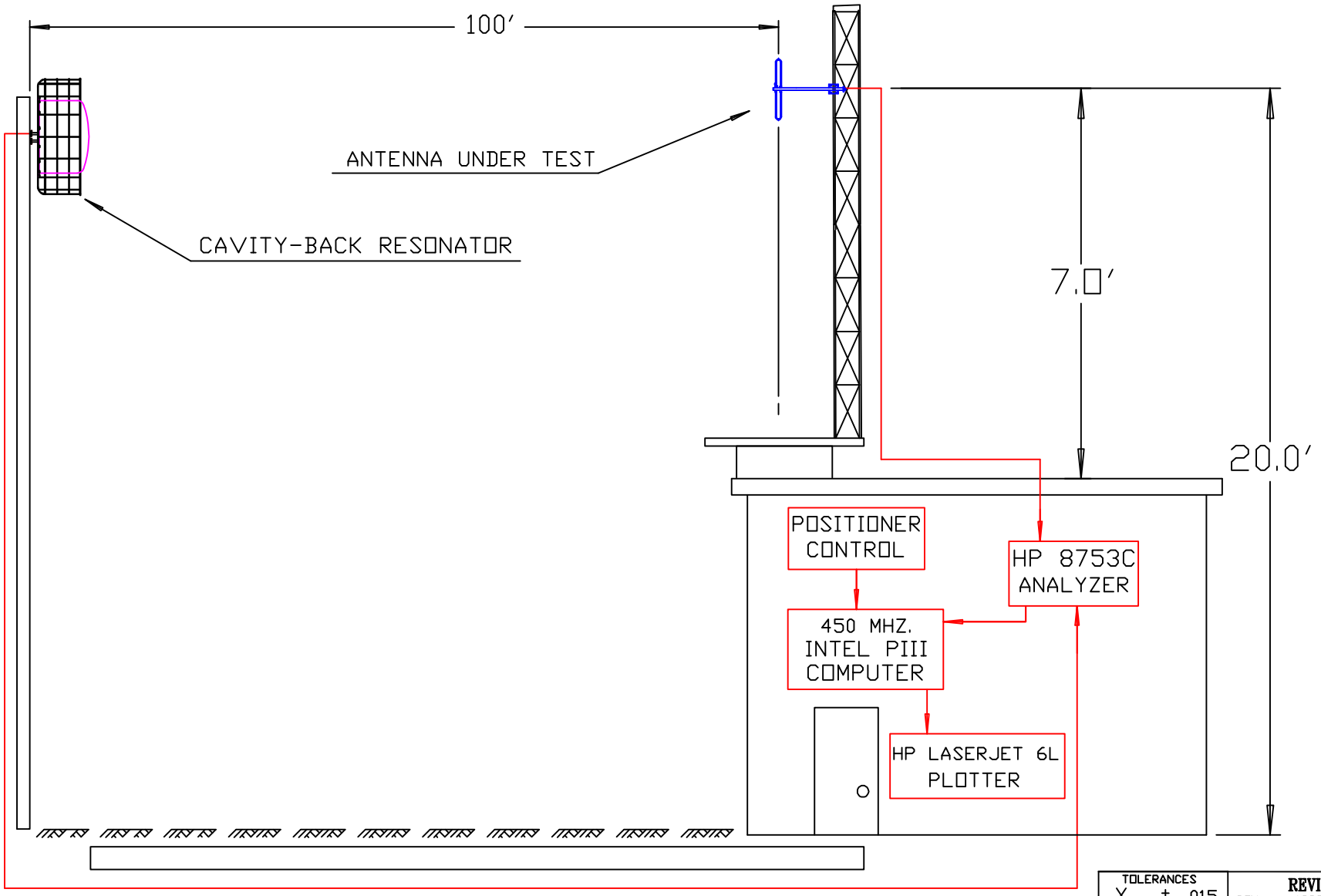
PARTS MADE BY THIS DRAWING

DRAWING NUMBER: 1356IDE

SCALE: NTS | NAME: RAC | DATE: 10/6/09 | 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