



SYSTEMS WITH RELIABILITY, LLP
BROADCAST ANTENNAS AND TRANSMISSION LINE

PATTERN CERTIFICATION

DIRECTIONAL FM ANTENNA

WYFY

December 23, 2011

Call Sign	:	WYFY
Location	:	Cambridge, OH
Frequency	:	88.1 MHz
Channel	:	201A
Antenna Model	:	FMECR/2-PLUS-DA
Maximum Antenna Gain	:	
Horizontal	:	1.827 / 2.617 dB
Vertical	:	1.827 / 2.617 dB

ANTENNA DESCRIPTION

A custom designed **FMECR/2 -PLUS-DA** antenna was used to produce the required directional azimuth pattern. Each antenna bay consists of a circularly polarized cross-V dipole-radiating element with a horizontal parasitic system. The array is comprised of two bays, that are spaced a full wavelength apart, mounted to a tower pointing 175 degrees true north.

DESCRIPTION OF TEST PROCEDURE

The test antenna consists of a third-scale model antenna and parasitic system. This antenna was mounted to a pipe attached to a 8-inch third scale model tower (24" Full scale) 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 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 264.3 MHz. The antenna under test was rotated in a clockwise direction. A gain reference was taken using a dipole tuned to 264.3 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 **92.9 %** of the **RMS** value of the pattern authorized in the related construction permit **BMPED-20110825AAM**. The vertical component **RMS** value is **0.733**. The horizontal component **RMS** value is **0.716**. The circular polarized component **RMS** value is **0.751**.

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

Measured vertical polarized directivity:	1.859 / 2.690 dB
Measured horizontal polarized directivity:	1.953 / 2.910 dB
Measured circular polarized pattern directivity:	1.774 / 2.490 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	= (1.859)(.512)(1.918)	= 1.827 / 2.617 dB
H-Pol. Gain	= (1.953)(.488)(1.918)	= 1.827 / 2.617 dB

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **61 meters (200.14 ft.)** above ground level. The antenna aperture is **11.16 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 **175 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
1626D00	ELEVATION
1626D01	ANTENNA ORIENTATION WITH PARASITICS
1626D02	BAY 1-2 PARASITIC PLACEMENT
2105A10	TEST RANGE SCHEMATIC

The array shall be mounted according to **DWG. 1626D00**. The antenna elements shall be aligned at the same heading as in **DWG. 1626D01**. This will ensure that the antenna is oriented properly at 175 degrees true north. Each bay's parasitic assembly is shown in **DWG. 1626D02**.

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 calibrated by SWR to ANSI/NCSL Z540-1-1994 Specifications.

Prepared by:



Mark A. Gergely
Electrical Engineer
Systems With Reliability LLP

Surveyor's Declaration

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

- 1.) I am a licensed surveyor in the state(s) of _____, _____ and _____.
- 2.) I have provided professional services to _____ (permit tee name), permit tee of WYFY-FM, Cambridge (city of license), OH (state), during the installation of the WYFY -FM directional antenna.
- 3.) I certify that the WYFY -FM directional antenna has been oriented at the proper azimuth as authorized in the construction permit (FCC File Number BMPED-20110825AAM

Sign _____

Dated: _____mm/dd/yy

Engineer's Declaration

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

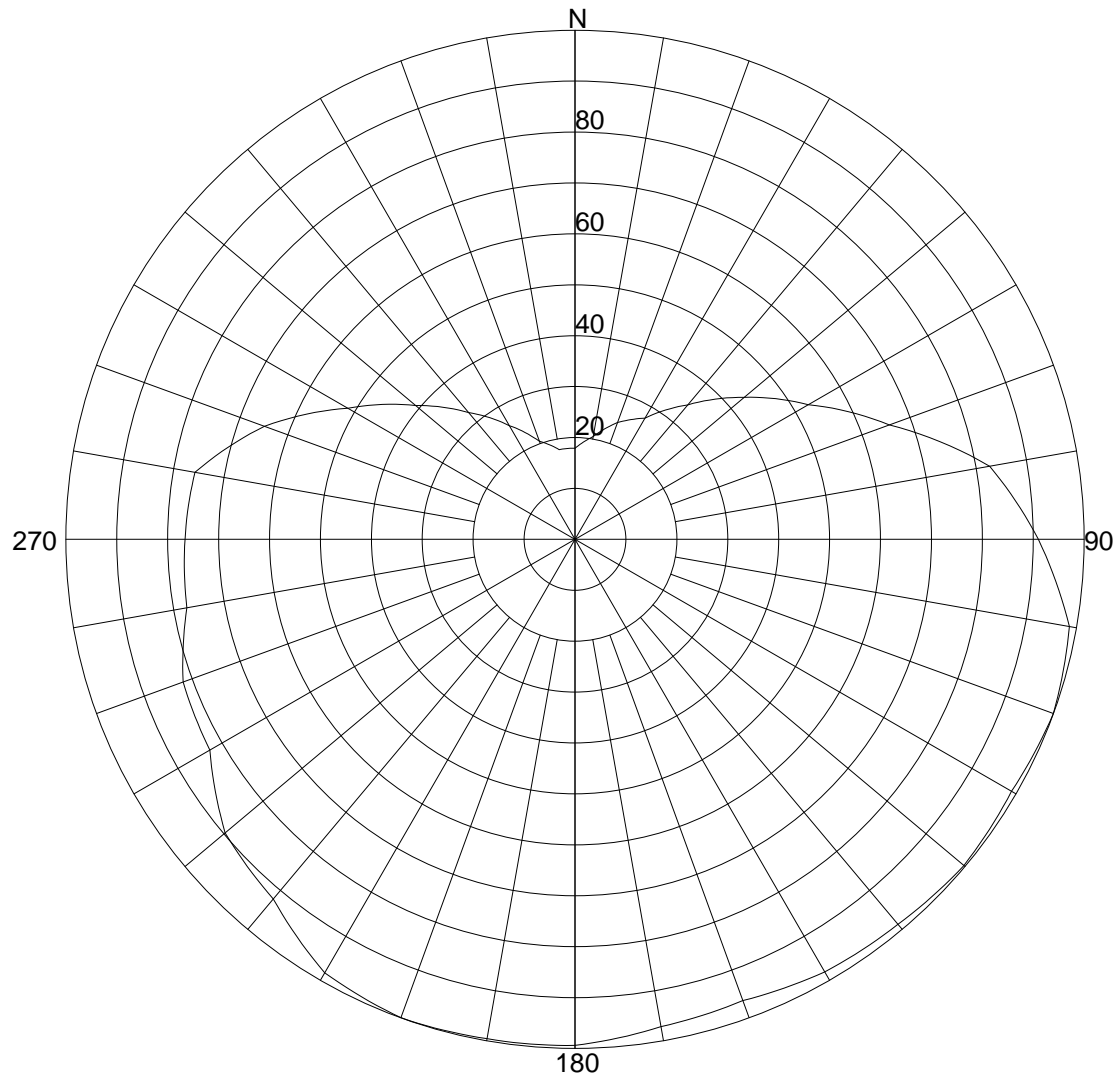
- 1.) I am the holder of a valid General Radio Telephone Operators License, Number _____ (FCC License No.)
- 2.) I have been a member of the Society of Broadcast Engineer's since _____ (year)
- 3.) That I have been employed as a technical consultant with the firm of:

_____ (firm name), of
_____ (city state)
- 4.) That _____ (Firm's Name) was retained
by _____ (Permit tee's Name) for the
purpose of preparing its application for the construction permit of WYFY -FM
Cambridge (City), Ohio (State), from which the underlying Construction Permit
(FCC File Number BMPED-20110825AAM) was granted by the Commission.
- 5.) That I am familiar with the terms and conditions of the WYFY -FM Construction
Permit.
- 6.) I hereby certify that I have overseen the installation of the WYFY -FM directional
antenna and that the installation was complete to the manufacturer's instructions.

Sign _____

Dated: _____ mm/dd/yy

Exhibit 1: Circular Polarized Azimuth Pattern



Azimuth Pattern

Systems With Reliability

Scale: Linear

Unit: Relative Field

CLIENT: *WYFY / BBN*

Date: 1/6/2012

ANTENNA TYPE: FMECR/2-PLUS-DA

FREQUENCY: 88.1 MHz

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.7743 / 2.49dB

PATTERN RMS: 0.751

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	.1790 (-14.89)	180	.9940 (-0.04)
5	.1920 (-14.29)	185	.9950 (-0.03)
10	.2050 (-13.72)	190	.9960 (-0.03)
15	.2245 (-12.94)	195	.9980 (-0.01)
20	.2440 (-12.22)	200	1.0000 (0.01)
25	.2595 (-11.68)	205	.9915 (-0.07)
30	.2750 (-11.18)	210	.9830 (-0.14)
35	.3100 (-10.14)	215	.9525 (-0.41)
40	.3450 (-9.22)	220	.9220 (-0.7)
45	.3895 (-8.17)	225	.9095 (-0.81)
50	.4340 (-7.23)	230	.8970 (-0.93)
55	.4815 (-6.33)	235	.8625 (-1.27)
60	.5290 (-5.51)	240	.8280 (-1.63)
65	.5930 (-4.52)	245	.8235 (-1.68)
70	.6570 (-3.64)	250	.8190 (-1.72)
75	.7420 (-2.58)	255	.7965 (-1.97)
80	.8270 (-1.64)	260	.7740 (-2.21)
85	.8685 (-1.21)	265	.7700 (-2.26)
90	.9100 (-0.81)	270	.7660 (-2.3)
95	.9480 (-0.45)	275	.7620 (-2.35)
100	.9860 (-0.11)	280	.7580 (-2.4)
105	.9930 (-0.05)	285	.7035 (-3.04)
110	1.0000 (0.01)	290	.6490 (-3.74)
115	.9950 (-0.03)	295	.5820 (-4.69)
120	.9900 (-0.08)	300	.5150 (-5.75)
125	.9935 (-0.05)	305	.4620 (-6.69)
130	.9970 (-0.02)	310	.4090 (-7.74)
135	.9920 (-0.06)	315	.3670 (-8.68)
140	.9870 (-0.1)	320	.3250 (-9.74)
145	.9840 (-0.13)	325	.2915 (-10.68)
150	.9810 (-0.16)	330	.2580 (-11.73)
155	.9725 (-0.23)	335	.2315 (-12.67)
160	.9640 (-0.31)	340	.2050 (-13.72)
165	.9680 (-0.27)	345	.1920 (-14.29)
170	.9720 (-0.24)	350	.1790 (-14.89)
175	.9830 (-0.14)	355	.1790 (-14.89)

Systems With Reliability

CLIENT: WYFY / BBN

Date: 1/6/2012

ANTENNA TYPE: FMECR/2-PLUS-DA

FREQUENCY: 88.1 MHz

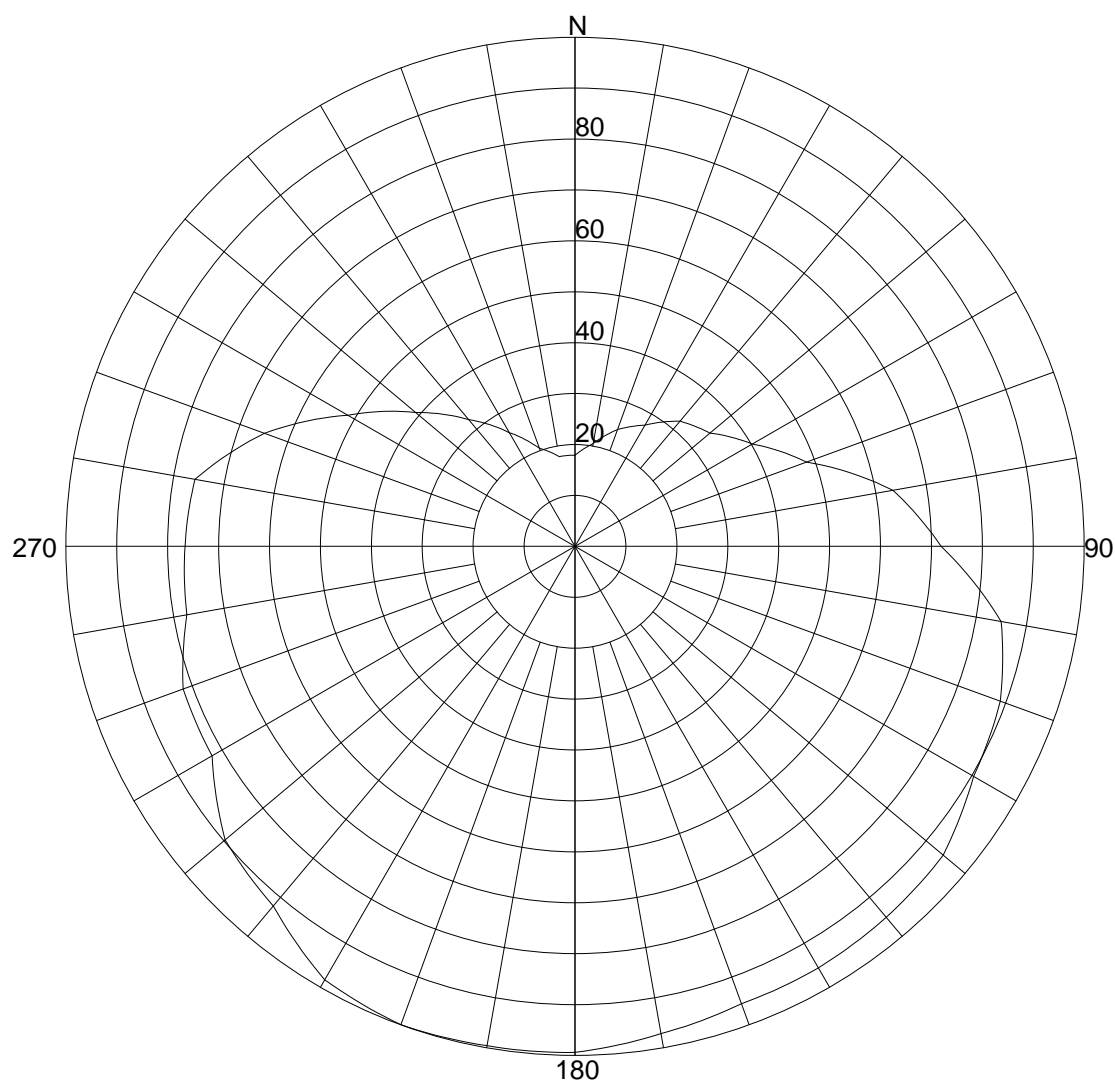
PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.7743 / 2.49dB

PATTERN RMS: 0.751

Exhibit 2: Measured Horizontal Polarized Azimuth Pattern



Azimuth Pattern

Systems With Reliability

Scale: Linear

Unit: Relative Field

CLIENT: *WYFY / BBN*

Date: 1/6/2012

ANTENNA TYPE: FMECR/2-PLUS-DA

FREQUENCY: 88.1 MHz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.95311 / 2.91dB

PATTERN RMS: 0.716

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	.1790 (-14.89)	180	.9940 (-0.04)
5	.1920 (-14.29)	185	.9950 (-0.03)
10	.2050 (-13.72)	190	.9960 (-0.03)
15	.2245 (-12.94)	195	.9980 (-0.01)
20	.2440 (-12.22)	200	1.0000 (0.01)
25	.2595 (-11.68)	205	.9915 (-0.07)
30	.2750 (-11.18)	210	.9830 (-0.14)
35	.2980 (-10.49)	215	.9525 (-0.41)
40	.3210 (-9.84)	220	.9220 (-0.7)
45	.3335 (-9.51)	225	.9095 (-0.81)
50	.3460 (-9.19)	230	.8970 (-0.93)
55	.3740 (-8.52)	235	.8600 (-1.3)
60	.4020 (-7.89)	240	.8230 (-1.68)
65	.4430 (-7.05)	245	.8210 (-1.7)
70	.4840 (-6.29)	250	.8190 (-1.72)
75	.5590 (-5.04)	255	.7965 (-1.97)
80	.6340 (-3.94)	260	.7740 (-2.21)
85	.6765 (-3.38)	265	.7700 (-2.26)
90	.7190 (-2.85)	270	.7660 (-2.3)
95	.7845 (-2.1)	275	.7620 (-2.35)
100	.8500 (-1.4)	280	.7580 (-2.4)
105	.8695 (-1.2)	285	.7035 (-3.04)
110	.8890 (-1.01)	290	.6490 (-3.74)
115	.8965 (-0.94)	295	.5820 (-4.69)
120	.9040 (-0.87)	300	.5150 (-5.75)
125	.9240 (-0.68)	305	.4620 (-6.69)
130	.9440 (-0.49)	310	.4090 (-7.74)
135	.9475 (-0.46)	315	.3670 (-8.68)
140	.9510 (-0.43)	320	.3250 (-9.74)
145	.9535 (-0.4)	325	.2915 (-10.68)
150	.9560 (-0.38)	330	.2580 (-11.73)
155	.9560 (-0.38)	335	.2315 (-12.67)
160	.9560 (-0.38)	340	.2050 (-13.72)
165	.9640 (-0.31)	345	.1920 (-14.29)
170	.9720 (-0.24)	350	.1790 (-14.89)
175	.9830 (-0.14)	355	.1790 (-14.89)

Systems With Reliability

CLIENT: WYFY / BBN

Date: 1/6/2012

ANTENNA TYPE: FMECR/2-PLUS-DA

FREQUENCY: 88.1 MHz

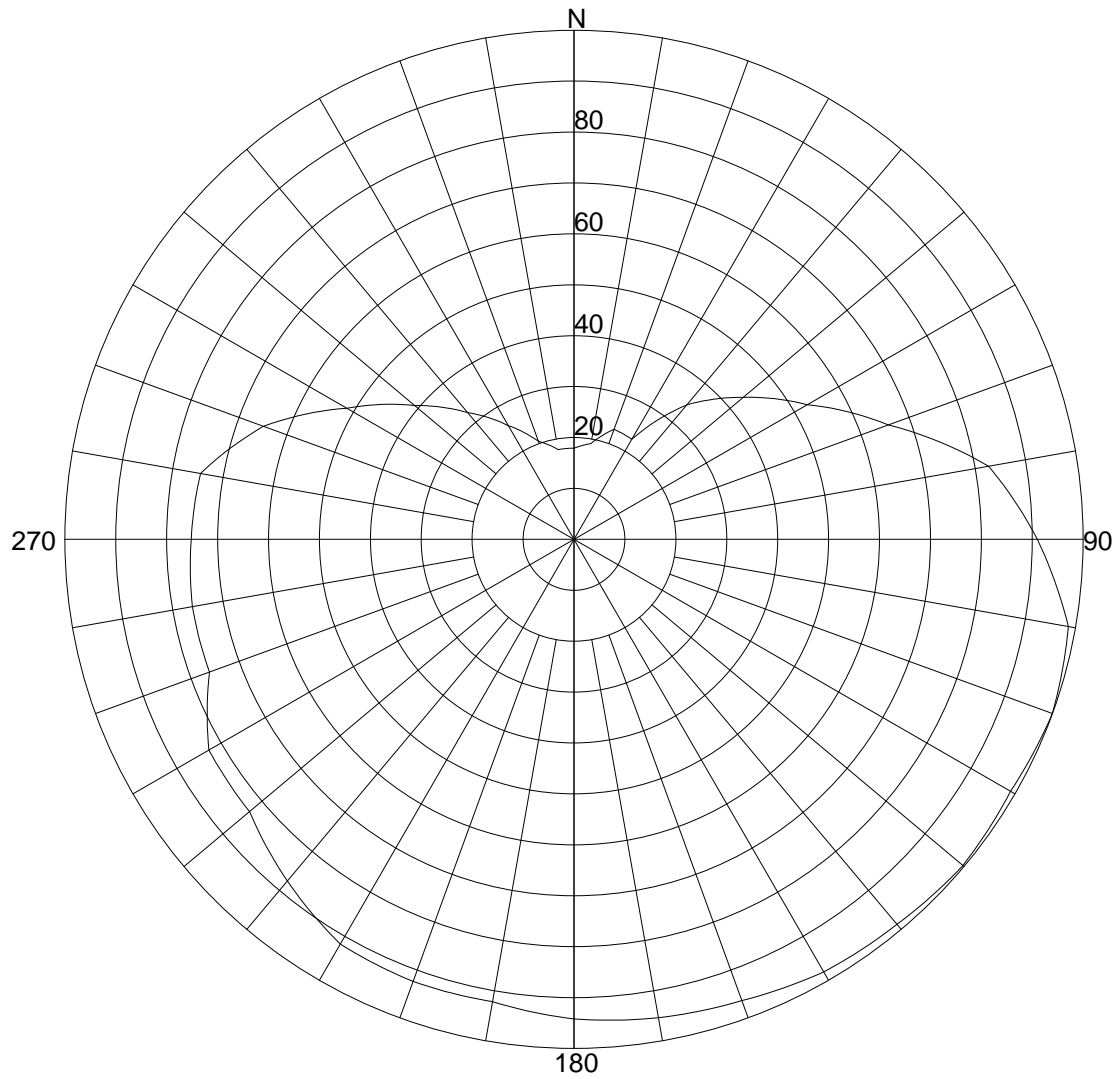
PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.95311 / 2.91dB

PATTERN RMS: 0.716

Exhibit 3: Measured Vertical Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WYFY / BBN*

Date: 1/6/2012

ANTENNA TYPE: FMECR/2-PLUS-DA

FREQUENCY: 88.1 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.85949 / 2.69dB

PATTERN RMS: 0.733

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

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	.1790 (-14.89)	180	.9420 (-0.51)
5	.1850 (-14.61)	185	.9320 (-0.6)
10	.1910 (-14.33)	190	.9220 (-0.7)
15	.2105 (-13.49)	195	.9230 (-0.69)
20	.2300 (-12.73)	200	.9240 (-0.68)
25	.2285 (-12.78)	205	.9210 (-0.71)
30	.2270 (-12.84)	210	.9180 (-0.73)
35	.2860 (-10.84)	215	.8970 (-0.93)
40	.3450 (-9.22)	220	.8760 (-1.14)
45	.3895 (-8.17)	225	.8540 (-1.36)
50	.4340 (-7.23)	230	.8320 (-1.59)
55	.4815 (-6.33)	235	.8300 (-1.61)
60	.5290 (-5.51)	240	.8280 (-1.63)
65	.5930 (-4.52)	245	.7950 (-1.98)
70	.6570 (-3.64)	250	.7620 (-2.35)
75	.7420 (-2.58)	255	.7615 (-2.36)
80	.8270 (-1.64)	260	.7610 (-2.36)
85	.8685 (-1.21)	265	.7565 (-2.41)
90	.9100 (-0.81)	270	.7520 (-2.46)
95	.9480 (-0.45)	275	.7485 (-2.5)
100	.9860 (-0.11)	280	.7450 (-2.55)
105	.9930 (-0.05)	285	.6970 (-3.12)
110	1.0000 (0.01)	290	.6490 (-3.74)
115	.9950 (-0.03)	295	.5820 (-4.69)
120	.9900 (-0.08)	300	.5150 (-5.75)
125	.9935 (-0.05)	305	.4620 (-6.69)
130	.9970 (-0.02)	310	.4090 (-7.74)
135	.9920 (-0.06)	315	.3670 (-8.68)
140	.9870 (-0.1)	320	.3250 (-9.74)
145	.9840 (-0.13)	325	.2915 (-10.68)
150	.9810 (-0.16)	330	.2580 (-11.73)
155	.9725 (-0.23)	335	.2315 (-12.67)
160	.9640 (-0.31)	340	.2050 (-13.72)
165	.9590 (-0.35)	345	.1920 (-14.29)
170	.9540 (-0.4)	350	.1790 (-14.89)
175	.9480 (-0.45)	355	.1790 (-14.89)

Systems With Reliability

CLIENT: WYFY / BBN

Date: 1/6/2012

ANTENNA TYPE: FMECR/2-PLUS-DA

FREQUENCY: 88.1 MHz

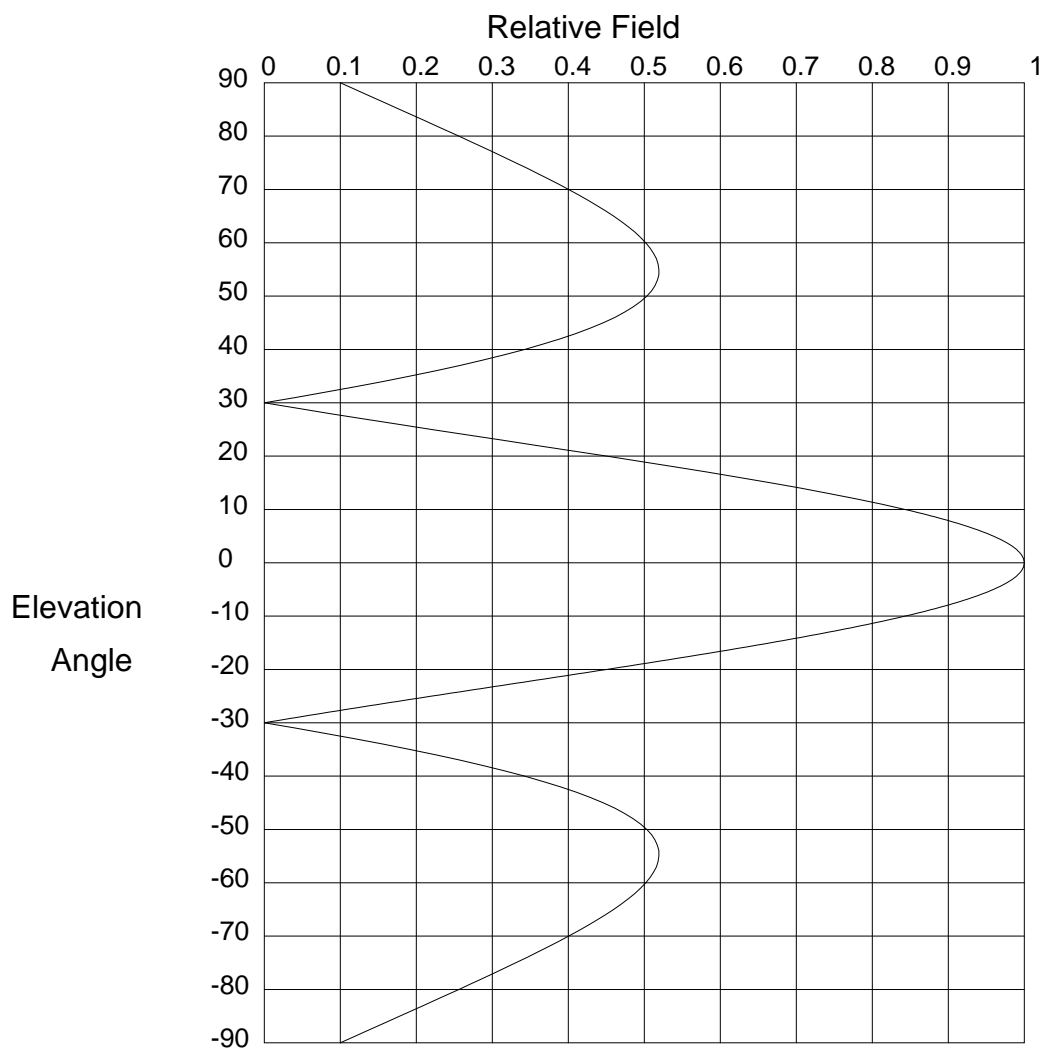
PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.85949 / 2.69dB

PATTERN RMS: 0.733

Exhibit 4: Elevation Pattern



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: WYFY/BBN

Date: 1/6/2012

ANTENNA TYPE: FMECR/2-PLUS-DA

FREQUENCY: 88.1 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)
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

Page 1 of 3

CLIENT: WYFY/BBN

Date: 1/6/2012

ANTENNA TYPE: FMECR/2-PLUS-DA

FREQUENCY: 88.1 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

Page 2 of 3

CLIENT: WYFY/BBN

Date: 1/6/2012

ANTENNA TYPE: FMECR/2-PLUS-DA

FREQUENCY: 88.1 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

Page 3 of 3

CLIENT: WYFY/BBN

Date: 1/6/2012

ANTENNA TYPE: FMCR/2-PLUS-DA

FREQUENCY: 88.1 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	WYFY
Contact	Michael Raley
Location	Cambridge, OH
Antenna Model	FMECR/2 PLUS-DA
Channel / Frequency	201A / 88.1 MHz

ELECTRICAL SPECIFICATIONS

Antenna Specifications:

	H-POL	dB		V. Pol.	dB
License ERP (KW)	1.500	1.761 dB		1.500	1.761 dB
FCC Limit Pattern Directivity	1.532	1.853 dB		1.532	1.853 dB
Elevation Directivity	1.918	2.828 dB		1.918	2.828 dB
Azimuth Directivity	1.953	2.907 dB		1.859	2.694 dB
Composite Pattern	1.774	2.490 dB		1.774	2.490 dB
Polarization Ratio	0.488	-3.118 dB		0.512	-2.905 dB
RMS Comp./RMS Limit	92.9 %				
Antenna Efficiency %	100	0		100	0
Power Ratio (Pol. Ratio X Efficiency)	0.4877	0		0.5123	0
Antenna Gain	1.827	2.617 dB		1.827	2.617 dB

Antenna Input Power (KW)	0.821 kW	-0.857 (dBK)
---------------------------------	----------	--------------

Feed Line Specifications:

Line Type- ANDREW	7/8" Virtual Air	50 Ω	AVA5-50
Attenuation Per 100 ft (dB)	0.317	dB	
Total Line Length (ft) AGL + 15'	215.14	ft.	
Total Line Attenuation (dB)	0.682	dB	
Line Efficiency	85.47	%	
Power Input to the Line (KW)	0.961 kW	-0.175 (dBK)	

MECHANICAL SPECIFICATIONS

No. Of Bays	2		
Antenna Aperture	11.16	ft.	3.40 meter
Center of Radiation AGL	200.14	ft.	61.00 meter
Antenna Weight with Pole	237.00	lbs.	107.73 kg
Windload (50/33)	580.00	lbs.	Windload CaAc 16.80 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

WYFY Antenna RMS Comparison

PROPOSED ANTENNA

Azimuth Heading	Relative Field
0	0.179
10	0.205
20	0.258
30	0.325
40	0.409
50	0.515
60	0.649
70	0.816
80	1.000
90	1.000
100	1.000
110	1.000
120	1.000
130	1.000
140	1.000
150	1.000
160	1.000
170	1.000
180	1.000
190	1.000
200	1.000
210	1.000
220	1.000
230	1.000
240	1.000
250	1.000
260	1.000
270	1.000
280	0.816
290	0.649
300	0.515
310	0.409
320	0.325
330	0.258
340	0.205
350	0.179

DESIGNED ANTENNA

Azimuth Heading	Relative Field
0	0.179
10	0.205
20	0.244
30	0.275
40	0.345
50	0.434
60	0.529
70	0.657
80	0.827
90	0.910
100	0.986
110	1.000
120	0.990
130	0.997
140	0.987
150	0.981
160	0.964
170	0.972
180	0.994
190	0.996
200	1.000
210	0.983
220	0.922
230	0.897
240	0.828
250	0.819
260	0.774
270	0.766
280	0.758
290	0.649
300	0.515
310	0.409
320	0.325
330	0.258
340	0.205
350	0.179

Sum of Relative Field Squared : 23.532
Sum Divided by 36 (Readings) : 0.654
Square Root : 0.808

Sum of Relative Field Squared : 20.315
Sum Divided by 36 (Readings) : 0.564
Square Root : 0.751

Percentage of Construction Permit Antenna Filled :

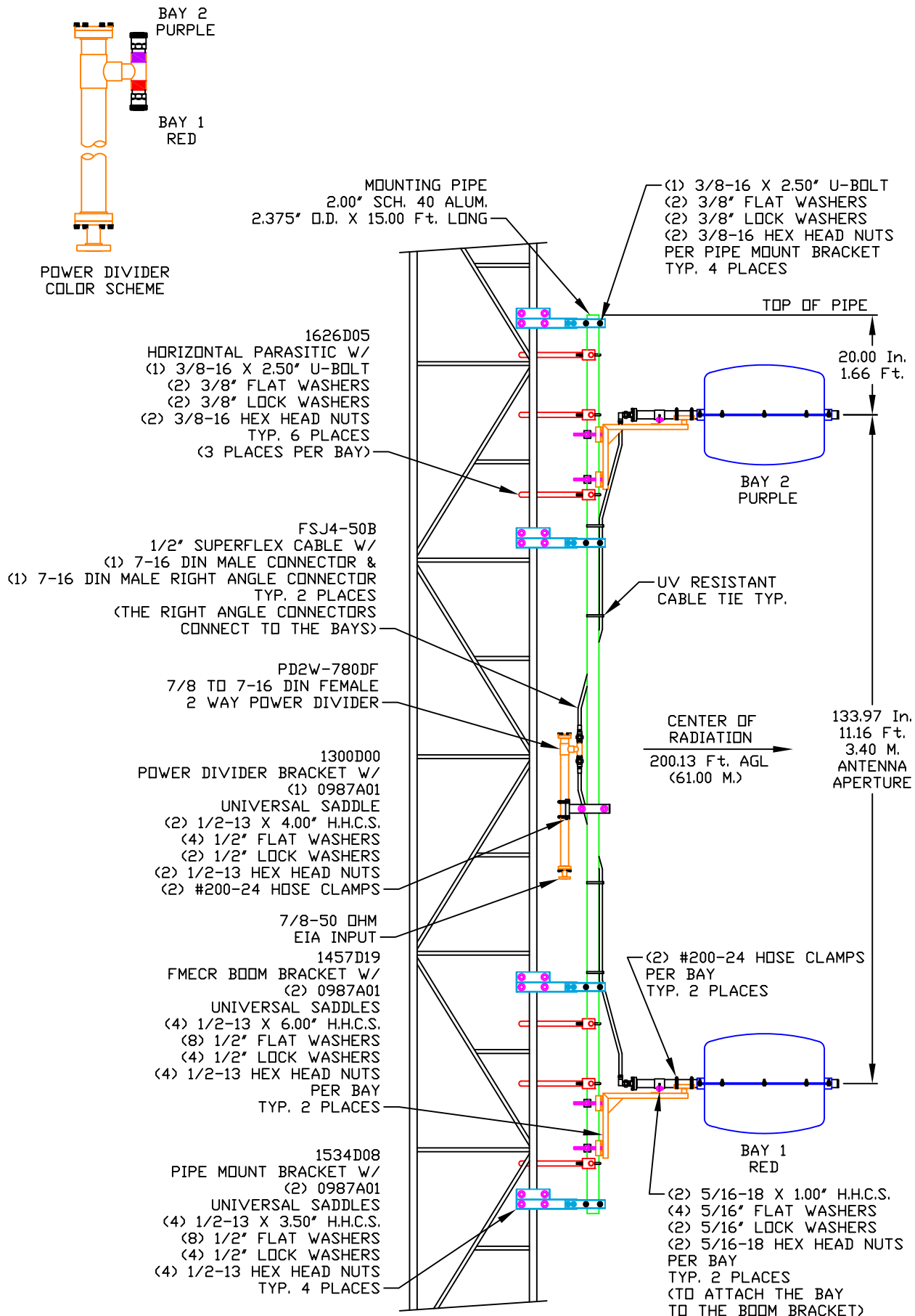
92.9%

NOTES:

1. REFERENCE DWG. 1626D01 FOR ANTENNA ORIENTATION.
2. REFERENCE DWG. 1626D02 FOR PARASITIC PLACEMENT.

Exhibit 7: Drawings

DRAWING NUMBER: 1626D00



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

TITLE: FMECR/2-PLUS-DA, FREQ. 88.1
WYFY, CAMBRIDGE, OH

MATERIAL:

SIZE REV APPR. DATE
C 1
2
3

ENGINEER:

SCALE: NTS

NAME: RAC

DATE: 1/6/12

SHEET

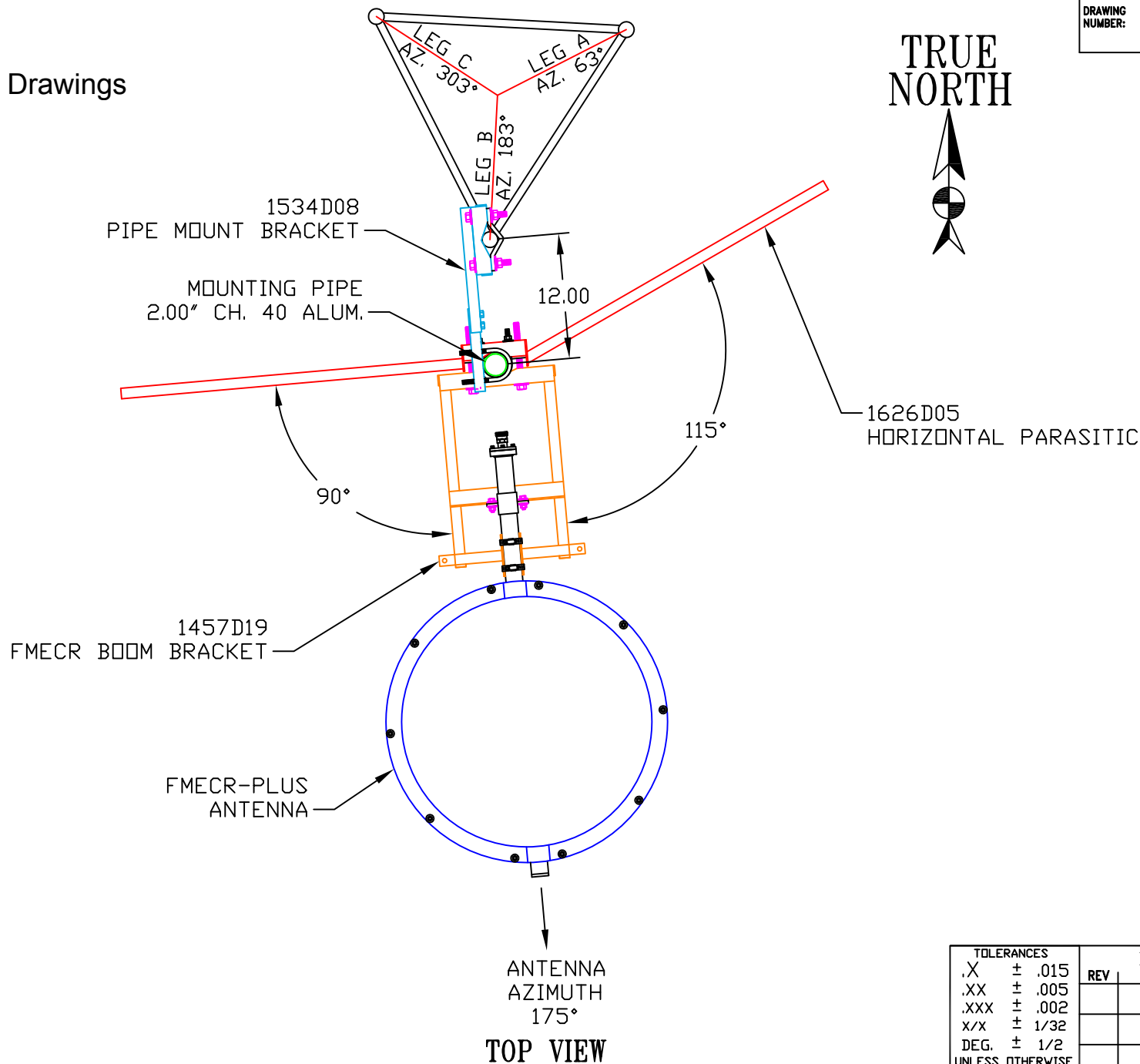
1 OF 1

DRAWING NUMBER: 1626D00

NOTE:

Exhibit 7 (cont'd): Drawings

DRAWING
NUMBER: 1626D01



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

REVISION RECORD		
REV	APPROVAL	DATE
DRAWING NUMBER: 1626D01		
SCALE: NTS	NAME: RAC	DATE: 1/6/12
SHEET 1 OF 1		



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

TITLE: FMECR/2-PLUS-DA, FREQ. 88.1
WYFY, CAMBRIDGE, OH

MATERIAL: ANTENNA ORIENTATION
FROM TRUE NORTH

SIZE
A

PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: RAC

DATE: 1/6/12

SHEET 1 OF 1

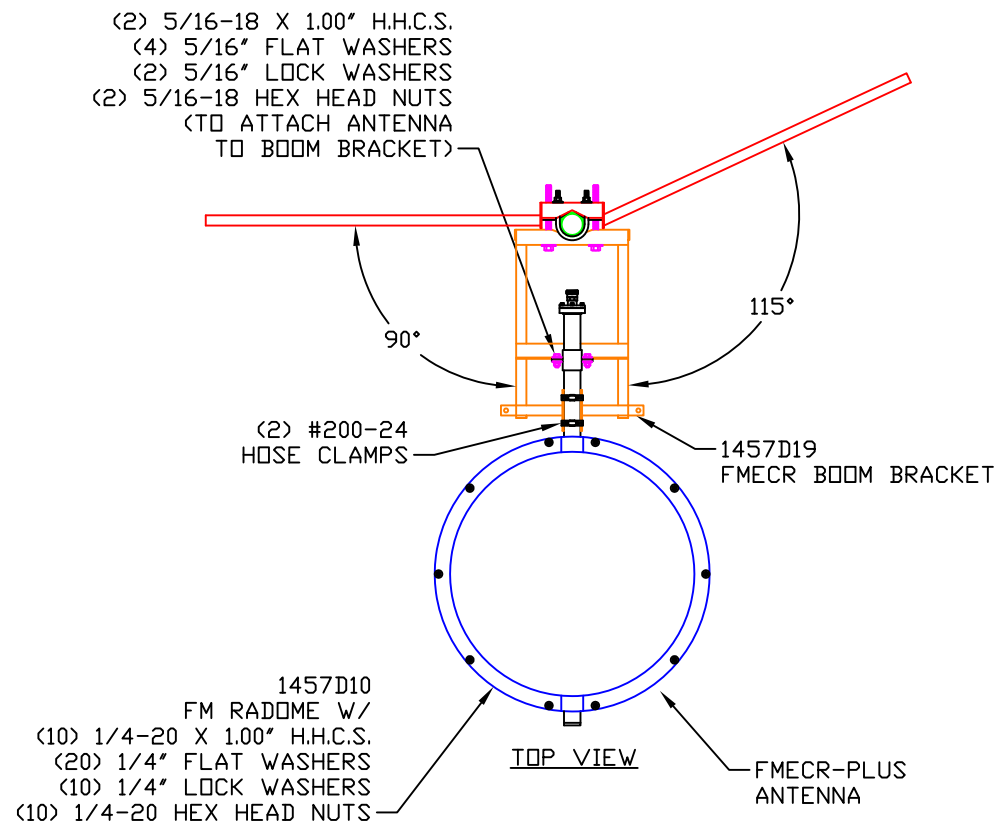
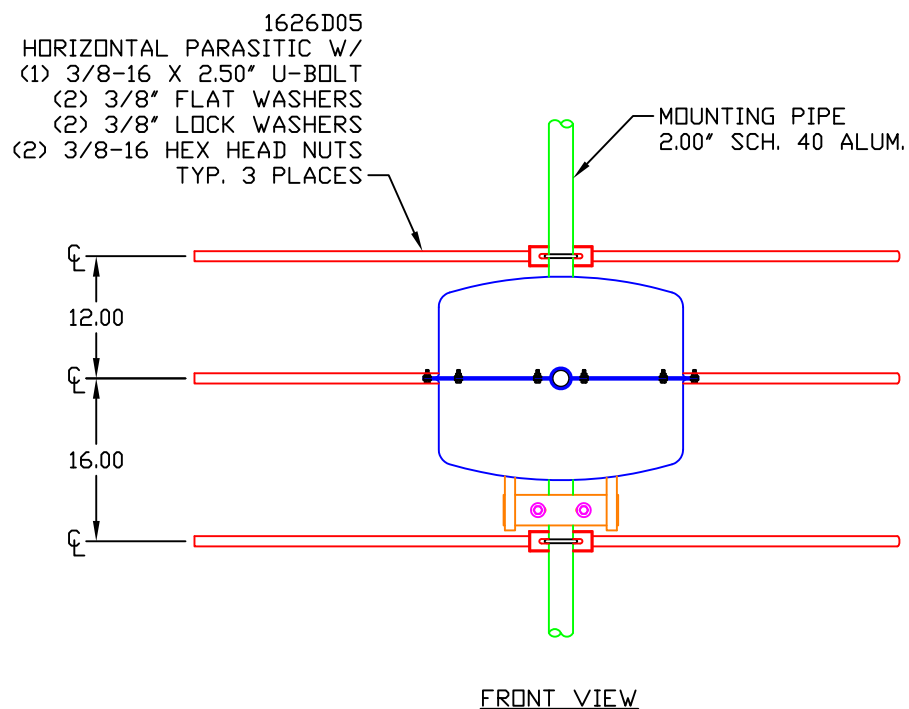
NOTE:

THIS ASSEMBLY IS TYPICAL FOR BOTH BAYS.

Exhibit 7 (cont'd): Drawings

DRAWING
NUMBER:

1626D02



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

TITLE: FMECR/2-PLUS-DA, FREQ. 88.1
WYFY, CAMBRIDGE, OH

MATERIAL: PARASITIC
PLACEMENT

SIZE
A

PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: RAC

DATE: 1/6/12

SHEET 1 OF 1

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

REVISION RECORD		
REV	APPROVAL	DATE

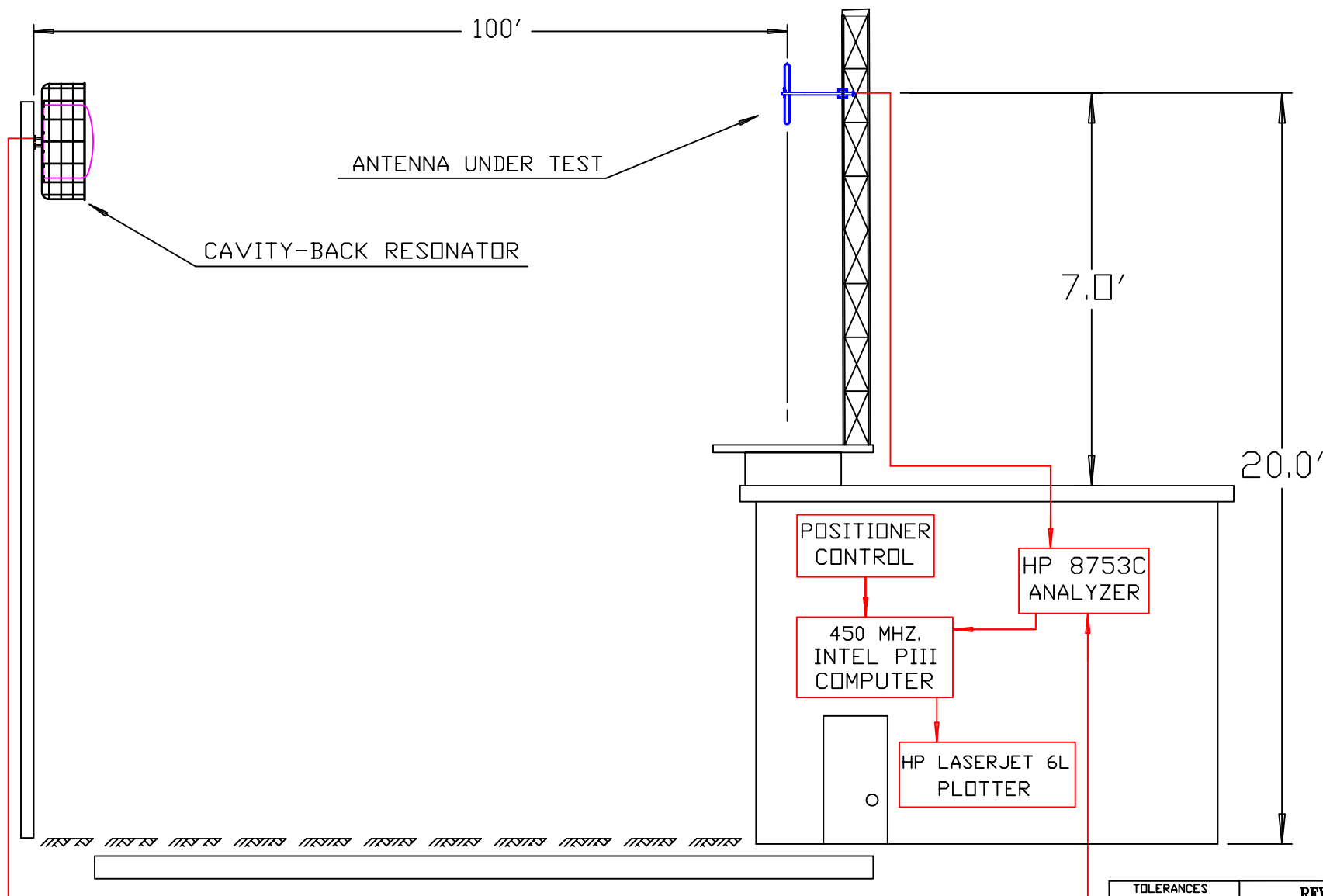
DRAWING
NUMBER:

1626D02

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



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

DRAWING
NUMBER:

2105A10