



SYSTEMS WITH RELIABILITY, LP

BROADCAST ANTENNAS AND TRANSMISSION SYSTEMS

PATTERN CERTIFICATION

DIRECTIONAL FM ANTENNA WRKC

September 6, 2011

Call Letters	: WRKC
Location	: WILKES-BARRE, PA
Frequency	: 88.5 MHz
Channel	: 203A
Antenna Model	: FMECD/3-DA 0.8 WS
Maximum Antenna Gain	
Vertical	: 2.739 / 4.376 dB
Horizontal	: 2.739 / 4.376 dB

ANTENNA DESCRIPTION

A custom designed **FMECD/3-DA 0.8 WS** 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 three bays, that are spaced **0.8 Wavelength** apart, mounted to a tower pointing **258 Degrees** true north.

DESCRIPTION OF TEST PROCEDURE

The test antenna consisted of a full scale antenna bay and parasitic system. This antenna was mounted to a pipe attached to a full scale model tower section with the use of the same 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 vertical polarization was obtained by varying the mounting distance and orientation.

The source antenna, a vertical/horizontal dipole Arrowhead Panel 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 Arrowhead antenna was operated in the transmit mode at a frequency of 88.5 MHz. The antenna under test was rotated in a clockwise direction. A gain reference was taken using a dipole tuned to 88.5 MHz. The received signal does not exceed a maximum to minimum ratio of 15 dB.

TEST RESULTS

The attached calculations verify that the **RMS** value of this antenna is **89.3 %** of the **RMS** value of the pattern authorized in the related construction permit **BPED-20110113ABD**. The circular polarized component **RMS** value is **0.782**.

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

Calculated composite azimuth pattern directivity: 1.633 / 2.131 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 = (1.978)(2.930)(0.4726) = 2.739 / 4.376 dB

H-Pol. Gain = (1.772)(2.930)(0.5274) = 2.739 / 4.376 dB

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **52.4 meters** (171.92 ft.) above ground level. The antenna total length is **23.78 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 system's orientation and the mounting details are described in the following drawings:

DRAWING NO.	TITLE
1570D00	ANTENNA ELEVATION
1570D01	ANTENNA ORIENTATION
1570D02	PARASITIC PLACEMENT
1570D03	ADJUSTABLE BRACKET ASSEMBLY
2105A10	TEST RANGE SCHEMATIC

The array shall be mounted according to **DWG. 1570D00**. The antenna elements shall be aligned at **258 Degrees** as in **DWG. 1570D01**. The parasitic are to be mounted according to **DWG. 1570D02**. The adjustable bracket assembly is shown in **DWG. 1570D03**.

DOCUMENT EXHIBITS

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

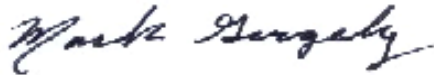
Exhibit 1	Circular Polarized Azimuth Pattern (Composite) Field Strength Tabulations
Exhibit 2	Measured Horizontal Polarized Azimuth Pattern Measured Field Strength Tabulations (Horizontal)
Exhibit 3	Measured Vertical Polarized Azimuth Pattern Measured Field Strength Tabulations (Vertical)
Exhibit 4	Elevation Pattern Elevation Pattern 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 Controller and Positioner

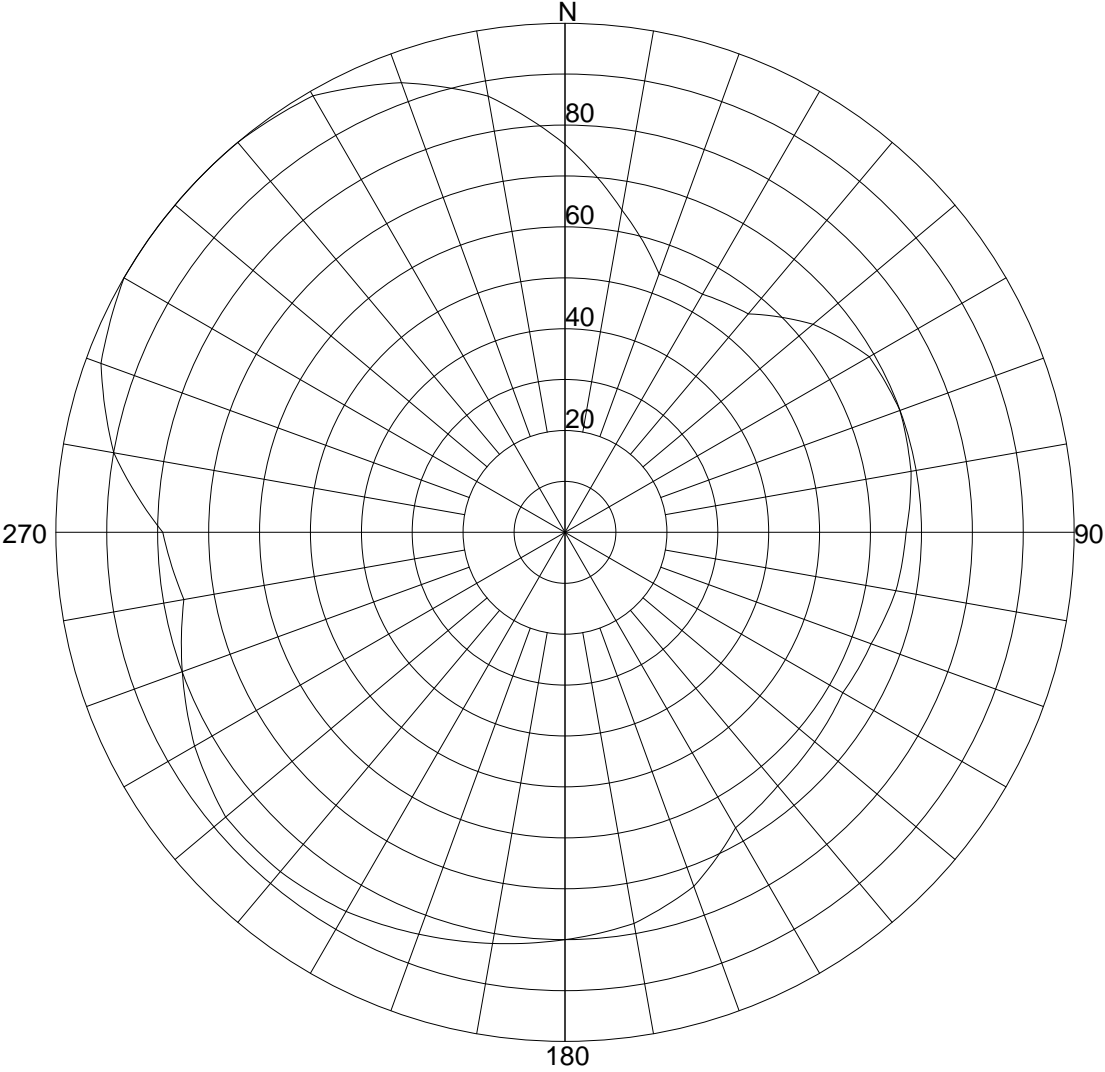
All equipment was calibrated to ANSI/NCSL Z540-1-1994 specs

Prepared by:



Mark A. Gergely
Electrical Engineer
Systems With Reliability LP

Exhibit 1: Circular Polarized Composite Azimuth Pattern



Azimuth Pattern

Systems With Reliability

Scale: Linear
Unit: Relative Field

CLIENT: <i>WRKC</i>	Date: 9/6/2011
ANTENNA TYPE: FMECD/3-DA 0.8 WS	
FREQUENCY: 88.5 MHz	
PATTERN POL.: Circular	CIRCULARITY(+/-dB): <i>N/A</i>
AZ. DIRECTIVITY: 1.63327 / 2.131dB	PATTERN RMS: 0.782

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.7620 (-2.361)	180	.8000 (-1.938)
5	.7025 (-3.067)	185	.8100 (-1.83)
10	.6430 (-3.836)	190	.8200 (-1.724)
15	.5915 (-4.561)	195	.8300 (-1.618)
20	.5400 (-5.352)	200	.8400 (-1.514)
25	.5400 (-5.352)	205	.8500 (-1.412)
30	.5400 (-5.352)	210	.8600 (-1.31)
35	.5500 (-5.193)	215	.8650 (-1.26)
40	.5600 (-5.036)	220	.8700 (-1.21)
45	.5980 (-4.466)	225	.8700 (-1.21)
50	.6360 (-3.931)	230	.8700 (-1.21)
55	.6630 (-3.57)	235	.8550 (-1.361)
60	.6900 (-3.223)	240	.8400 (-1.514)
65	.6950 (-3.16)	245	.8200 (-1.724)
70	.7000 (-3.098)	250	.8000 (-1.938)
75	.6950 (-3.16)	255	.7800 (-2.158)
80	.6900 (-3.223)	260	.7600 (-2.384)
85	.6800 (-3.35)	265	.7750 (-2.214)
90	.6700 (-3.479)	270	.7900 (-2.047)
95	.6650 (-3.544)	275	.8450 (-1.463)
100	.6600 (-3.609)	280	.9000 (-0.915)
105	.6500 (-3.742)	285	.9350 (-0.584)
110	.6400 (-3.876)	290	.9700 (-0.265)
115	.6350 (-3.945)	295	.9850 (-0.131)
120	.6300 (-4.013)	300	1.0000 (0)
125	.6350 (-3.945)	305	1.0000 (0)
130	.6400 (-3.876)	310	1.0000 (0)
135	.6450 (-3.809)	315	1.0000 (0)
140	.6500 (-3.742)	320	1.0000 (0)
145	.6600 (-3.609)	325	.9950 (-0.044)
150	.6700 (-3.479)	330	.9900 (-0.087)
155	.7050 (-3.036)	335	.9650 (-0.309)
160	.7400 (-2.615)	340	.9400 (-0.537)
165	.7600 (-2.384)	345	.9050 (-0.867)
170	.7800 (-2.158)	350	.8700 (-1.21)
175	.7900 (-2.047)	355	.8160 (-1.766)

Systems With Reliability

CLIENT: *WRKC*

Date: 9/6/2011

ANTENNA TYPE: FMECD/3-DA 0.8 WS

FREQUENCY: 88.5 MHz

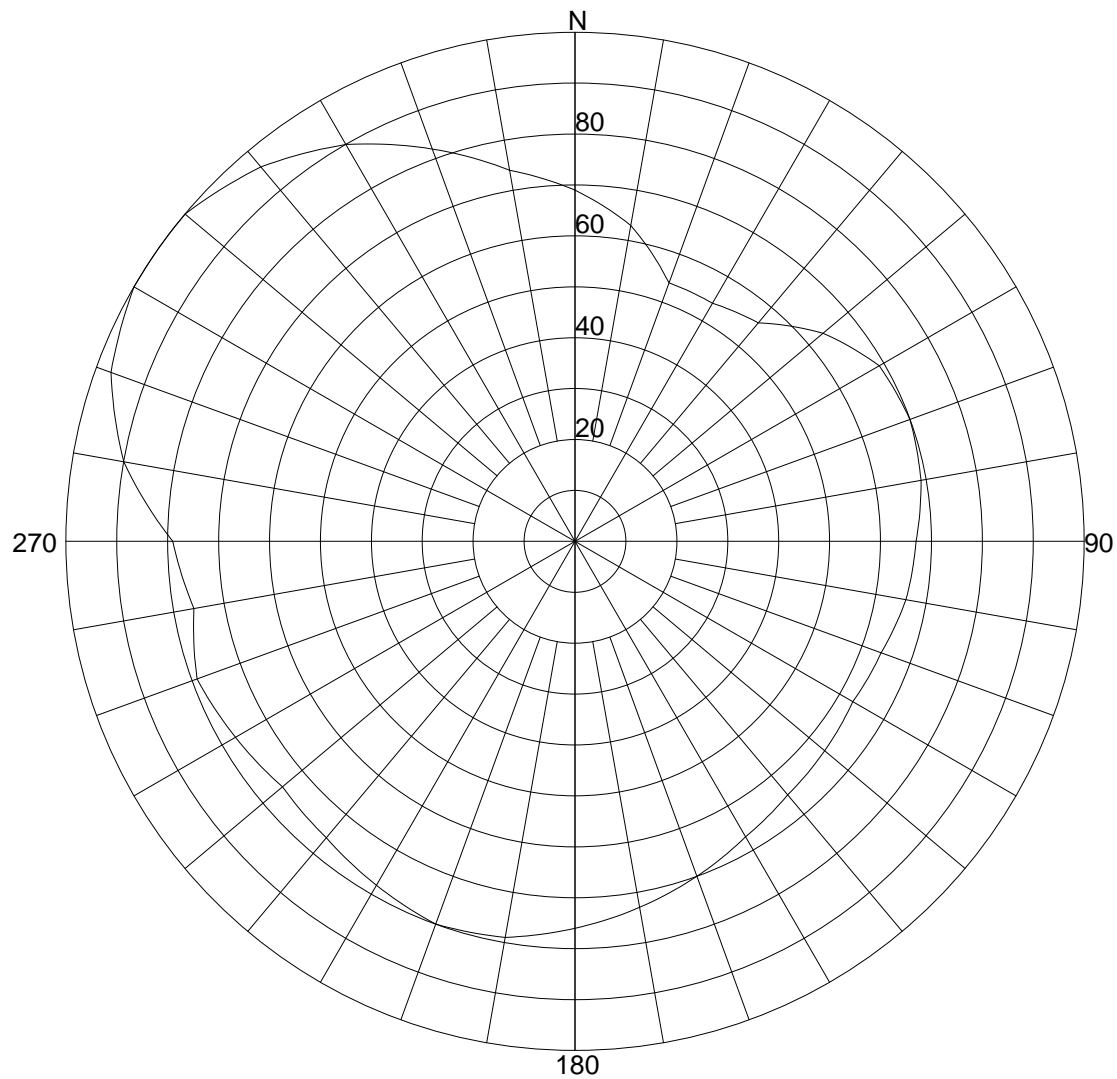
PATTERN POL.: Circular

CIRCULARITY(+/-dB): *N/A*

AZ. DIRECTIVITY: 1.63327 / 2.131dB

PATTERN RMS: *0.782*

Exhibit 2: Horizontal Polarized Azimuth Pattern



Azimuth Pattern

Systems With Reliability

Scale: Linear

Unit: Relative Field

CLIENT: *WRKC*

Date: 9/6/2011

ANTENNA TYPE: FMECD/3-DA 0.8 WS

FREQUENCY: 88.5 MHz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.77239 / 2.486dB

PATTERN RMS: 0.751

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.6900 (-3.223)	180	.7600 (-2.384)
5	.6600 (-3.609)	185	.7750 (-2.214)
10	.6300 (-4.013)	190	.7900 (-2.047)
15	.5850 (-4.657)	195	.7950 (-1.993)
20	.5400 (-5.352)	200	.8000 (-1.938)
25	.5400 (-5.352)	205	.7900 (-2.047)
30	.5400 (-5.352)	210	.7800 (-2.158)
35	.5500 (-5.193)	215	.7700 (-2.27)
40	.5600 (-5.036)	220	.7600 (-2.384)
45	.5980 (-4.466)	225	.7550 (-2.441)
50	.6360 (-3.931)	230	.7500 (-2.499)
55	.6630 (-3.57)	235	.7600 (-2.384)
60	.6900 (-3.223)	240	.7700 (-2.27)
65	.6950 (-3.16)	245	.7800 (-2.158)
70	.7000 (-3.098)	250	.7900 (-2.047)
75	.6950 (-3.16)	255	.7750 (-2.214)
80	.6900 (-3.223)	260	.7600 (-2.384)
85	.6800 (-3.35)	265	.7750 (-2.214)
90	.6700 (-3.479)	270	.7900 (-2.047)
95	.6650 (-3.544)	275	.8450 (-1.463)
100	.6600 (-3.609)	280	.9000 (-0.915)
105	.6500 (-3.742)	285	.9350 (-0.584)
110	.6400 (-3.876)	290	.9700 (-0.265)
115	.6350 (-3.945)	295	.9850 (-0.131)
120	.6300 (-4.013)	300	1.0000 (0)
125	.6350 (-3.945)	305	1.0000 (0)
130	.6400 (-3.876)	310	1.0000 (0)
135	.6450 (-3.809)	315	.9800 (-0.175)
140	.6500 (-3.742)	320	.9600 (-0.355)
145	.6600 (-3.609)	325	.9300 (-0.63)
150	.6700 (-3.479)	330	.9000 (-0.915)
155	.6850 (-3.286)	335	.8600 (-1.31)
160	.7000 (-3.098)	340	.8200 (-1.724)
165	.7150 (-2.914)	345	.7800 (-2.158)
170	.7300 (-2.734)	350	.7400 (-2.615)
175	.7450 (-2.557)	355	.7150 (-2.914)

Systems With Reliability

CLIENT: *WRKC*

Date: 9/6/2011

ANTENNA TYPE: FMECD/3-DA 0.8 WS

FREQUENCY: 88.5 MHz

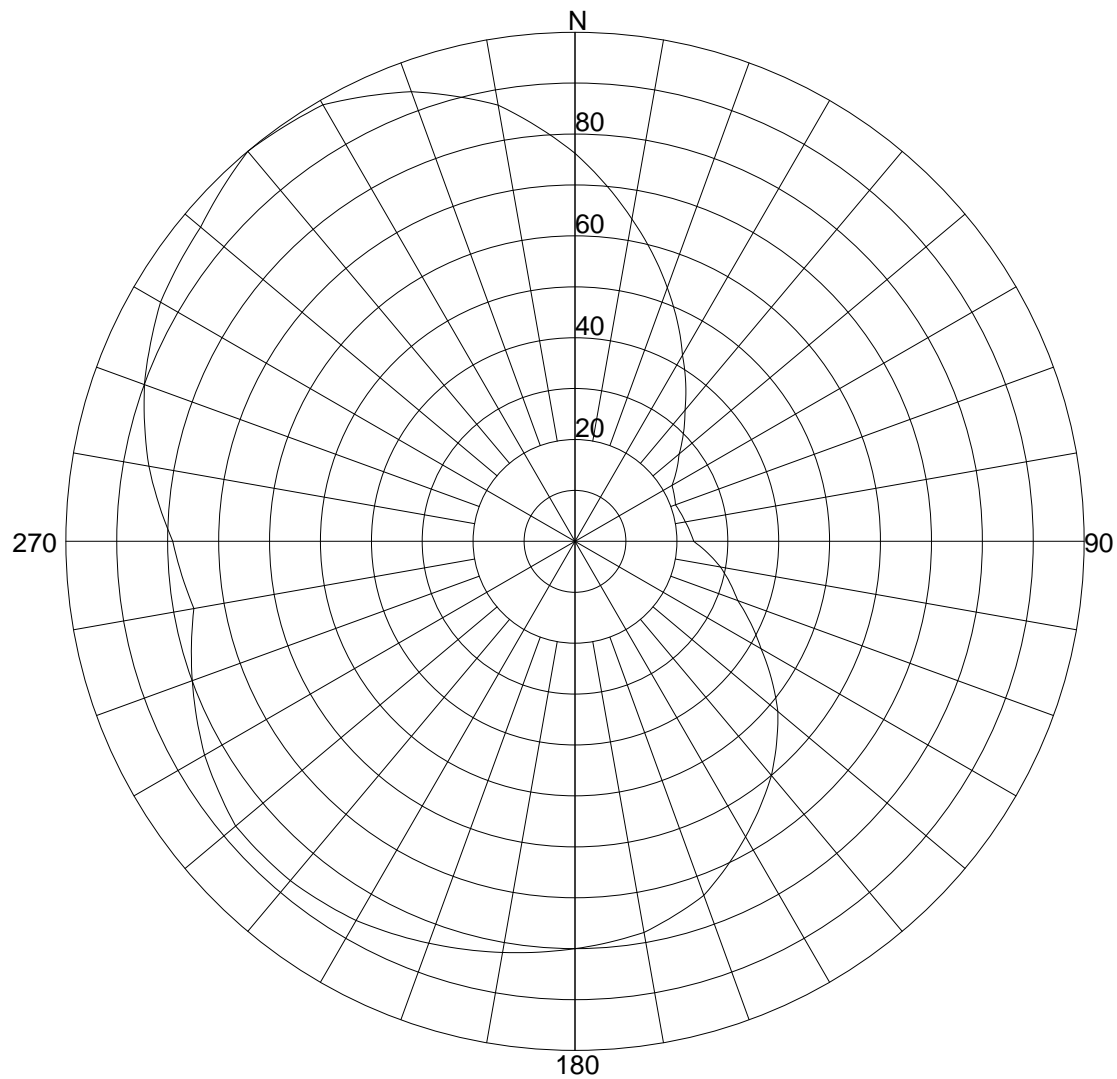
PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.77239 / 2.486dB

PATTERN RMS: 0.751

Exhibit 3: Vertical Polarized Azimuth Pattern



Azimuth Pattern

Systems With Reliability

Scale: Linear

Unit: Relative Field

CLIENT: *WRKC*

Date: 9/6/2011

ANTENNA TYPE: FMECD/3-DA 0.8 WS

FREQUENCY: 88.5 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.97788 / 2.962dB

PATTERN RMS: 0.711

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.7620 (-2.361)	180	.8000 (-1.938)
5	.7025 (-3.067)	185	.8100 (-1.83)
10	.6430 (-3.836)	190	.8200 (-1.724)
15	.5865 (-4.635)	195	.8300 (-1.618)
20	.5300 (-5.514)	200	.8400 (-1.514)
25	.4760 (-6.448)	205	.8500 (-1.412)
30	.4220 (-7.494)	210	.8600 (-1.31)
35	.3790 (-8.427)	215	.8650 (-1.26)
40	.3360 (-9.473)	220	.8700 (-1.21)
45	.3015 (-10.414)	225	.8700 (-1.21)
50	.2670 (-11.47)	230	.8700 (-1.21)
55	.2435 (-12.27)	235	.8550 (-1.361)
60	.2200 (-13.152)	240	.8400 (-1.514)
65	.2150 (-13.351)	245	.8200 (-1.724)
70	.2100 (-13.556)	250	.8000 (-1.938)
75	.2150 (-13.351)	255	.7800 (-2.158)
80	.2200 (-13.152)	260	.7600 (-2.384)
85	.2265 (-12.899)	265	.7750 (-2.214)
90	.2330 (-12.653)	270	.7900 (-2.047)
95	.2615 (-11.651)	275	.8200 (-1.724)
100	.2900 (-10.752)	280	.8500 (-1.412)
105	.3150 (-10.034)	285	.8750 (-1.16)
110	.3400 (-9.37)	290	.9000 (-0.915)
115	.3810 (-8.381)	295	.9200 (-0.724)
120	.4220 (-7.494)	300	.9400 (-0.537)
125	.4710 (-6.54)	305	.9500 (-0.446)
130	.5200 (-5.68)	310	.9600 (-0.355)
135	.5600 (-5.036)	315	.9800 (-0.175)
140	.6000 (-4.437)	320	1.0000 (0)
145	.6350 (-3.945)	325	.9950 (-0.044)
150	.6700 (-3.479)	330	.9900 (-0.087)
155	.7050 (-3.036)	335	.9650 (-0.309)
160	.7400 (-2.615)	340	.9400 (-0.537)
165	.7600 (-2.384)	345	.9050 (-0.867)
170	.7800 (-2.158)	350	.8700 (-1.21)
175	.7900 (-2.047)	355	.8160 (-1.766)

Systems With Reliability

CLIENT: *WRKC*

Date: 9/6/2011

ANTENNA TYPE: FMECD/3-DA 0.8 WS

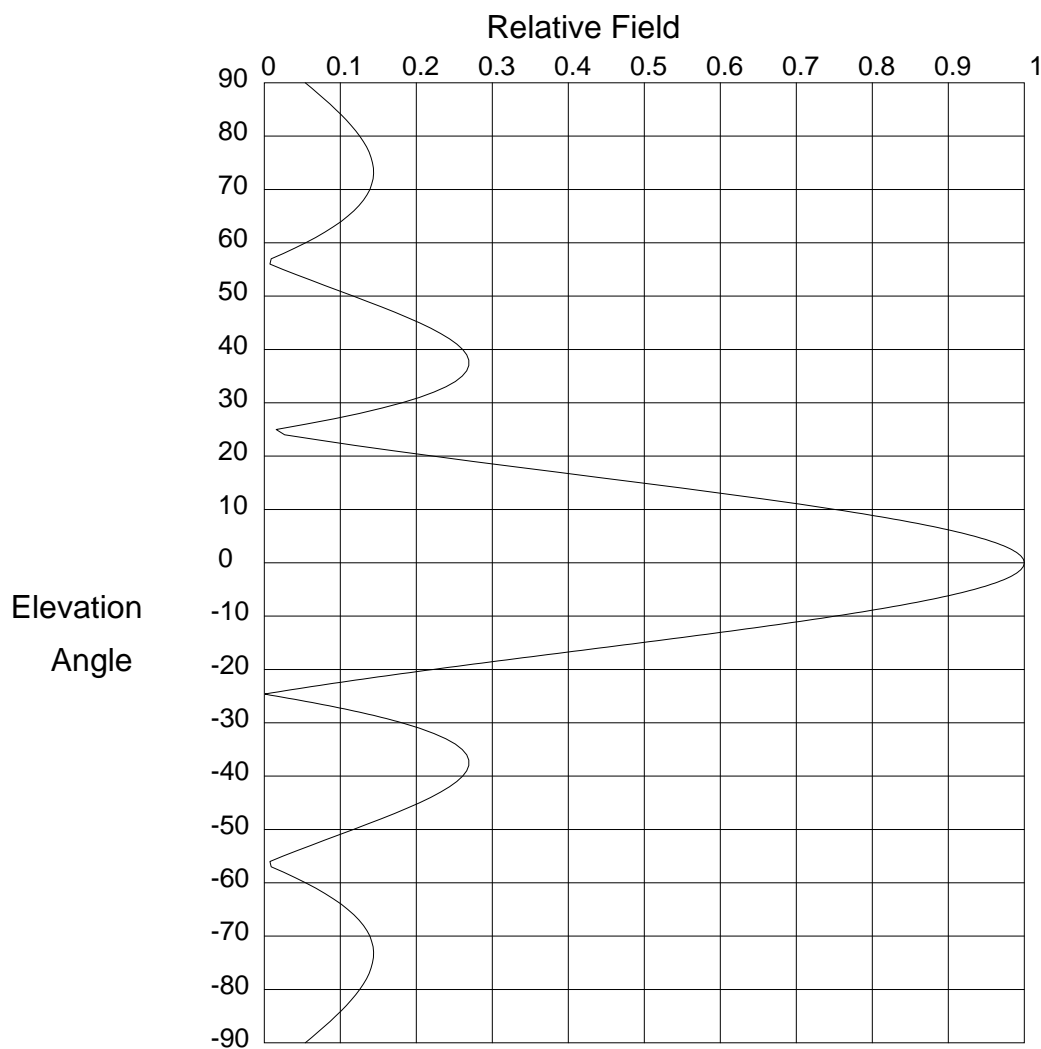
FREQUENCY: 88.5 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.97788 / 2.962dB

PATTERN RMS: 0.711



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: *WRKC*

Date: 8/30/2011

ANTENNA TYPE: FMEC/3-DA 0.8 WS

FREQUENCY: 88.5 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.930/4.669 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.930/4.669 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	.054 (-25.363)	52.0	.08 (-21.976)	14.0	.55 (-5.196)
89.0	.062 (-24.103)	51.0	.098 (-20.138)	13.0	.603 (-4.392)
88.0	.071 (-23.021)	50.0	.117 (-18.624)	12.0	.655 (-3.678)
87.0	.079 (-22.081)	49.0	.136 (-17.346)	11.0	.704 (-3.045)
86.0	.087 (-21.257)	48.0	.154 (-16.254)	10.0	.751 (-2.483)
85.0	.094 (-20.531)	47.0	.172 (-15.313)	9.8	.76 (-2.379)
84.0	.101 (-19.89)	46.0	.188 (-14.499)	9.6	.769 (-2.278)
83.0	.108 (-19.325)	45.0	.204 (-13.797)	9.4	.778 (-2.179)
82.0	.114 (-18.828)	44.0	.219 (-13.195)	9.2	.787 (-2.082)
81.0	.12 (-18.392)	43.0	.232 (-12.685)	9.0	.795 (-1.988)
80.0	.126 (-18.015)	42.0	.244 (-12.262)	8.8	.804 (-1.897)
79.0	.13 (-17.693)	41.0	.253 (-11.923)	8.6	.812 (-1.808)
78.0	.135 (-17.423)	40.0	.261 (-11.666)	8.4	.82 (-1.722)
77.0	.138 (-17.204)	39.0	.266 (-11.491)	8.2	.828 (-1.637)
76.0	.141 (-17.036)	38.0	.269 (-11.4)	8.0	.836 (-1.556)
75.0	.143 (-16.918)	37.0	.269 (-11.398)	7.8	.844 (-1.476)
74.0	.144 (-16.852)	36.0	.266 (-11.489)	7.6	.851 (-1.399)
73.0	.144 (-16.839)	35.0	.261 (-11.683)	7.4	.859 (-1.324)
72.0	.143 (-16.881)	34.0	.251 (-11.99)	7.2	.866 (-1.251)
71.0	.142 (-16.981)	33.0	.239 (-12.429)	7.0	.873 (-1.181)
70.0	.139 (-17.144)	32.0	.223 (-13.024)	6.8	.88 (-1.113)
69.0	.135 (-17.374)	31.0	.204 (-13.808)	6.6	.886 (-1.047)
68.0	.131 (-17.68)	30.0	.181 (-14.838)	6.4	.893 (-0.983)
67.0	.125 (-18.071)	29.0	.155 (-16.202)	6.2	.899 (-0.921)
66.0	.118 (-18.56)	28.0	.125 (-18.058)	6.0	.906 (-0.861)
65.0	.11 (-19.163)	27.0	.092 (-20.739)	5.8	.912 (-0.804)
64.0	.101 (-19.905)	26.0	.055 (-25.14)	5.6	.917 (-0.748)
63.0	.091 (-20.818)	25.0	.016 (-36.095)	5.4	.923 (-0.695)
62.0	.08 (-21.955)	24.0	.027 (-31.39)	5.2	.929 (-0.644)
61.0	.068 (-23.396)	23.0	.072 (-22.816)	5.0	.934 (-0.595)
60.0	.054 (-25.285)	22.0	.12 (-18.406)	4.8	.939 (-0.547)
59.0	.04 (-27.909)	21.0	.17 (-15.382)	4.6	.944 (-0.502)
58.0	.025 (-31.993)	20.0	.222 (-13.072)	4.4	.949 (-0.459)
57.0	.009 (-40.714)	19.0	.275 (-11.202)	4.2	.953 (-0.418)
56.0	.007 (-42.53)	18.0	.33 (-9.635)	4.0	.957 (-0.379)
55.0	.025 (-32.105)	17.0	.385 (-8.293)	3.8	.961 (-0.342)
54.0	.043 (-27.389)	16.0	.44 (-7.126)	3.6	.965 (-0.306)
53.0	.061 (-24.288)	15.0	.495 (-6.101)	3.4	.969 (-0.273)

Systems With Reliability

Page 1 of 3

CLIENT: *WRKC*

Date: 8/30/2011

ANTENNA TYPE: FMEC/3-DA 0.8 WS

FREQUENCY: 88.5 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.930/4.669 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.930/4.669 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	.973 (-0.242)	-4.4	.949 (-0.459)	-12.0	.655 (-3.678)
3.0	.976 (-0.212)	-4.6	.944 (-0.502)	-12.2	.645 (-3.815)
2.8	.979 (-0.185)	-4.8	.939 (-0.547)	-12.4	.634 (-3.954)
2.6	.982 (-0.159)	-5.0	.934 (-0.595)	-12.6	.624 (-4.097)
2.4	.985 (-0.136)	-5.2	.929 (-0.644)	-12.8	.614 (-4.243)
2.2	.987 (-0.114)	-5.4	.923 (-0.695)	-13.0	.603 (-4.392)
2.0	.989 (-0.094)	-5.6	.917 (-0.748)	-13.2	.593 (-4.545)
1.8	.991 (-0.076)	-5.8	.912 (-0.804)	-13.4	.582 (-4.702)
1.6	.993 (-0.06)	-6.0	.906 (-0.861)	-13.6	.571 (-4.863)
1.4	.995 (-0.046)	-6.2	.899 (-0.921)	-13.8	.561 (-5.027)
1.2	.996 (-0.034)	-6.4	.893 (-0.983)	-14.0	.55 (-5.196)
1.0	.997 (-0.023)	-6.6	.886 (-1.047)	-14.2	.539 (-5.368)
.8	.998 (-0.015)	-6.8	.88 (-1.113)	-14.4	.528 (-5.545)
.6	.999 (-0.008)	-7.0	.873 (-1.181)	-14.6	.517 (-5.726)
.4	1.00 (-0.004)	-7.2	.866 (-1.251)	-14.8	.506 (-5.911)
.2	1.00 (-0.001)	-7.4	.859 (-1.324)	-15.0	.495 (-6.101)
.0	1.00 (0)	-7.6	.851 (-1.399)	-15.2	.484 (-6.296)
-.2	1.00 (-0.001)	-7.8	.844 (-1.476)	-15.4	.473 (-6.496)
-.4	1.00 (-0.004)	-8.0	.836 (-1.556)	-15.6	.462 (-6.701)
-.6	.999 (-0.008)	-8.2	.828 (-1.637)	-15.8	.451 (-6.911)
-.8	.998 (-0.015)	-8.4	.82 (-1.722)	-16.0	.44 (-7.126)
-1.0	.997 (-0.023)	-8.6	.812 (-1.808)	-16.2	.429 (-7.347)
-1.2	.996 (-0.034)	-8.8	.804 (-1.897)	-16.4	.418 (-7.574)
-1.4	.995 (-0.046)	-9.0	.795 (-1.988)	-16.6	.407 (-7.807)
-1.6	.993 (-0.06)	-9.2	.787 (-2.082)	-16.8	.396 (-8.047)
-1.8	.991 (-0.076)	-9.4	.778 (-2.179)	-17.0	.385 (-8.293)
-2.0	.989 (-0.094)	-9.6	.769 (-2.278)	-17.2	.374 (-8.546)
-2.2	.987 (-0.114)	-9.8	.76 (-2.379)	-17.4	.363 (-8.806)
-2.4	.985 (-0.136)	-10.0	.751 (-2.483)	-17.6	.352 (-9.074)
-2.6	.982 (-0.159)	-10.2	.742 (-2.59)	-17.8	.341 (-9.35)
-2.8	.979 (-0.185)	-10.4	.733 (-2.699)	-18.0	.33 (-9.635)
-3.0	.976 (-0.212)	-10.6	.723 (-2.812)	-18.2	.319 (-9.928)
-3.2	.973 (-0.242)	-10.8	.714 (-2.927)	-18.4	.308 (-10.231)
-3.4	.969 (-0.273)	-11.0	.704 (-3.045)	-18.6	.297 (-10.544)
-3.6	.965 (-0.306)	-11.2	.695 (-3.165)	-18.8	.286 (-10.867)
-3.8	.961 (-0.342)	-11.4	.685 (-3.289)	-19.0	.275 (-11.202)
-4.0	.957 (-0.379)	-11.6	.675 (-3.416)	-19.2	.265 (-11.548)
-4.2	.953 (-0.418)	-11.8	.665 (-3.546)	-19.4	.254 (-11.907)

Systems With Reliability

Page 2 of 3

CLIENT: *WRKC*

Date: 8/30/2011

ANTENNA TYPE: FMEC/3-DA 0.8 WS

FREQUENCY: 88.5 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.930/4.669 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.930/4.669 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	.243 (-12.28)	-27.2	.099 (-20.109)	-54.0	.043 (-27.389)
-19.8	.233 (-12.668)	-27.4	.106 (-19.532)	-55.0	.025 (-32.105)
-20.0	.222 (-13.072)	-27.6	.112 (-19.002)	-56.0	.007 (-42.53)
-20.2	.212 (-13.493)	-27.8	.119 (-18.512)	-57.0	.009 (-40.714)
-20.4	.201 (-13.932)	-28.0	.125 (-18.058)	-58.0	.025 (-31.993)
-20.6	.191 (-14.392)	-28.2	.131 (-17.635)	-59.0	.04 (-27.909)
-20.8	.18 (-14.875)	-28.4	.137 (-17.241)	-60.0	.054 (-25.285)
-21.0	.17 (-15.382)	-28.6	.143 (-16.872)	-61.0	.068 (-23.396)
-21.2	.16 (-15.917)	-28.8	.149 (-16.526)	-62.0	.08 (-21.955)
-21.4	.15 (-16.483)	-29.0	.155 (-16.202)	-63.0	.091 (-20.818)
-21.6	.14 (-17.083)	-29.2	.16 (-15.896)	-64.0	.101 (-19.905)
-21.8	.13 (-17.722)	-29.4	.166 (-15.608)	-65.0	.11 (-19.163)
-22.0	.12 (-18.406)	-29.6	.171 (-15.337)	-66.0	.118 (-18.56)
-22.2	.11 (-19.141)	-29.8	.176 (-15.08)	-67.0	.125 (-18.071)
-22.4	.101 (-19.936)	-30.0	.181 (-14.838)	-68.0	.131 (-17.68)
-22.6	.091 (-20.803)	-31.0	.204 (-13.808)	-69.0	.135 (-17.374)
-22.8	.082 (-21.757)	-32.0	.223 (-13.024)	-70.0	.139 (-17.144)
-23.0	.072 (-22.816)	-33.0	.239 (-12.429)	-71.0	.142 (-16.981)
-23.2	.063 (-24.009)	-34.0	.251 (-11.99)	-72.0	.143 (-16.881)
-23.4	.054 (-25.376)	-35.0	.261 (-11.683)	-73.0	.144 (-16.839)
-23.6	.045 (-26.979)	-36.0	.266 (-11.489)	-74.0	.144 (-16.852)
-23.8	.036 (-28.92)	-37.0	.269 (-11.398)	-75.0	.143 (-16.918)
-24.0	.027 (-31.39)	-38.0	.269 (-11.4)	-76.0	.141 (-17.036)
-24.2	.018 (-34.801)	-39.0	.266 (-11.491)	-77.0	.138 (-17.204)
-24.4	.01 (-40.395)	-40.0	.261 (-11.666)	-78.0	.135 (-17.423)
-24.6	.001 (-59.752)	-41.0	.253 (-11.923)	-79.0	.13 (-17.693)
-24.8	.007 (-42.636)	-42.0	.244 (-12.262)	-80.0	.126 (-18.015)
-25.0	.016 (-36.095)	-43.0	.232 (-12.685)	-81.0	.12 (-18.392)
-25.2	.024 (-32.449)	-44.0	.219 (-13.195)	-82.0	.114 (-18.828)
-25.4	.032 (-29.922)	-45.0	.204 (-13.797)	-83.0	.108 (-19.325)
-25.6	.04 (-27.993)	-46.0	.188 (-14.499)	-84.0	.101 (-19.89)
-25.8	.048 (-26.439)	-47.0	.172 (-15.313)	-85.0	.094 (-20.531)
-26.0	.055 (-25.14)	-48.0	.154 (-16.254)	-86.0	.087 (-21.257)
-26.2	.063 (-24.028)	-49.0	.136 (-17.346)	-87.0	.079 (-22.081)
-26.4	.07 (-23.058)	-50.0	.117 (-18.624)	-88.0	.071 (-23.021)
-26.6	.078 (-22.199)	-51.0	.098 (-20.138)	-89.0	.062 (-24.103)
-26.8	.085 (-21.432)	-52.0	.08 (-21.976)	-90.0	.054 (-25.363)
-27.0	.092 (-20.739)	-53.0	.061 (-24.288)	90.0	.00 (-50)

Systems With Reliability

Page 3 of 3

CLIENT: *WRKC*

Date: 8/30/2011

ANTENNA TYPE: FMEC/3-DA 0.8 WS

FREQUENCY: 88.5 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.930/4.669 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.930/4.669 dBd

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

Exhibit 5: Antenna Data Sheet



SYSTEMS WITH RELIABILITY, LP

BROADCAST ANTENNAS AND TRANSMISSION SYSTEMS

SYSTEM DATA SHEET

Customer	WRKC
Contact	Mark Humphrey
Location	Wilkes-Barre, PA
Antenna Model	FMECD/3-DA 0.8 WS
Channel / Frequency	203A / 88.5 MHz

ELECTRICAL SPECIFICATIONS

Antenna Specifications:

	H-POL			V. Pol.		
License ERP (KW)	1.500	1.761	dBk	1.500	1.761	dBk
FCC Limit Pattern Directivity	1.304	1.153	dB	1.304	1.153	dB
Elevation Directivity	2.930	4.669	dB	2.930	4.669	dB
Azimuth Directivity	1.772	2.486	dB	1.978	2.962	dB
Composite Pattern	1.633	2.131	dB	1.633	2.131	dB
Polarization Ratio	0.527	-2.779	dB	0.473	-3.255	dB
RMS Comp./RMS Limit	89.3	%				
Antenna Efficiency	100	%	0.000	100.0	0	
Power Ratio (Pol. Ratio X Efficiency)	0.5274	0		0.4726	0	
Antenna Gain	2.739	4.376	dB	2.739	4.376	dB
Antenna Input Power (KW)	0.548 kW		-2.615 dBk			

Feed Line Specifications:

Line Type	LDF4-50A	1/2" Foam	50 Ω	
Attenuation Per 100 ft (dB)	0.621	dB		
Line Length (ft) Given	85.00	ft.		
Total Line Attenuation (dB)	0.5279	dB		
Line Efficiency	88.56	%		
Power Input to the Line (KW)	0.618	kW	-2.087 dBk	

MECHANICAL SPECIFICATIONS

No. Of Bays	3		
Antenna Total Length	23.78	ft.	5.42 m
Center of Radiation AGL	171.92	ft.	52.40 m
Antenna Weight with Brackets	111.50	lbs.	50.68 kg
Windload (50/33 psf) / CaAc	260.00	lbs.	7.50 ft ²

Prepared by:

Mark A. Gergely

Mark A. Gergely
SWR, LP, Engineering

9/6/2011



SYSTEMS WITH RELIABILITY, LP

Broadcast Antennas & Transmission Systems

WRKC Composite Antenna RMS Comparison

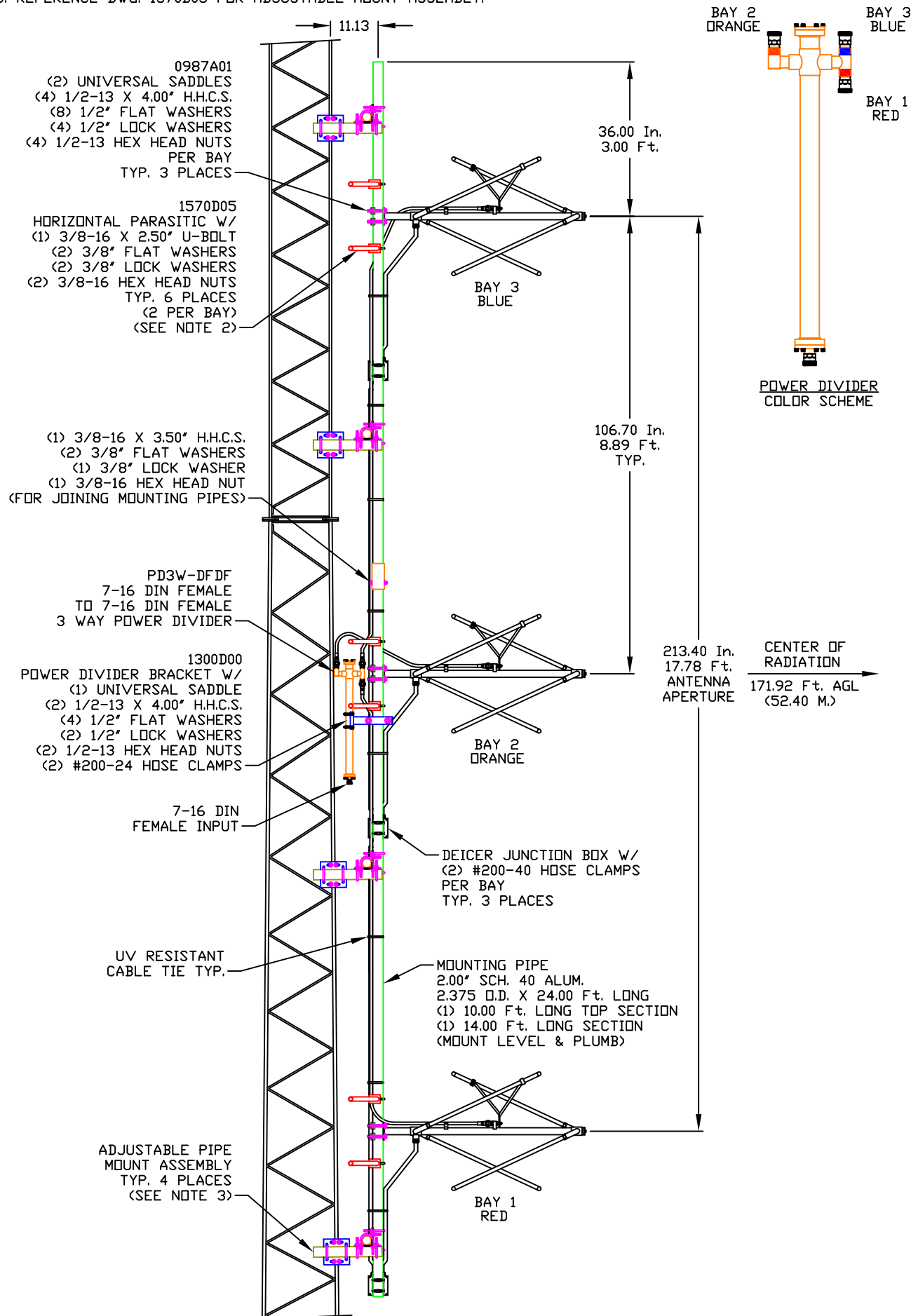
PROPOSED ANTENNA		DESIGNED ANTENNA	
Azimuth Heading	Relative Field	Azimuth Heading	Relative Field
0	0.762	0	0.762
10	0.643	10	0.643
20	0.580	20	0.540
30	0.570	30	0.540
40	0.560	40	0.560
50	0.636	50	0.636
60	0.793	60	0.690
70	0.950	70	0.700
80	0.950	80	0.690
90	0.818	90	0.670
100	0.657	100	0.660
110	0.650	110	0.640
120	0.710	120	0.630
130	0.770	130	0.640
140	0.950	140	0.650
150	1.000	150	0.670
160	1.000	160	0.740
170	1.000	170	0.780
180	1.000	180	0.800
190	1.000	190	0.820
200	1.000	200	0.840
210	1.000	210	0.860
220	1.000	220	0.870
230	0.900	230	0.870
240	0.840	240	0.840
250	0.830	250	0.800
260	0.760	260	0.760
270	0.790	270	0.790
280	0.995	280	0.900
290	1.000	290	0.970
300	1.000	300	1.000
310	1.000	310	1.000
320	1.000	320	1.000
330	1.000	330	0.990
340	1.000	340	0.940
350	0.959	350	0.870
Sum of Relative Field Squared :	27.646	Sum of Relative Field Squared :	22.056
Sum Divided by 36 (Readings) :	0.768	Sum Divided by 36 (Readings) :	0.613
Square Root :	0.876	Square Root :	0.783
Percentage of Construction Permit Antenna Filled :		89.3%	

NOTES:

1. REFERENCE DWG. 1570D01 FOR ANTENNA ORIENTATION.
2. REFERENCE DWG. 1570D02 FOR PARASITIC PLACEMENT.
3. REFERENCE DWG. 1570D03 FOR ADJUSTABLE MOUNT ASSEMBLY.

Exhibit 7: Drawings

DRAWING NUMBER: 1570D00



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

TITLE: FMECD/3-DA-0.8WS, FREQ. 88.5
WRKC, WILKES BARRE, PA

MATERIAL:

SIZE
C

REV	APPR.	DATE
1		
2		
3		

ENGINEER:

SCALE: NTS

NAME: RAC

DATE: 8/25/11

SHEET 1 OF 1

DRAWING NUMBER: 1570D00

DRAWING
NUMBER:

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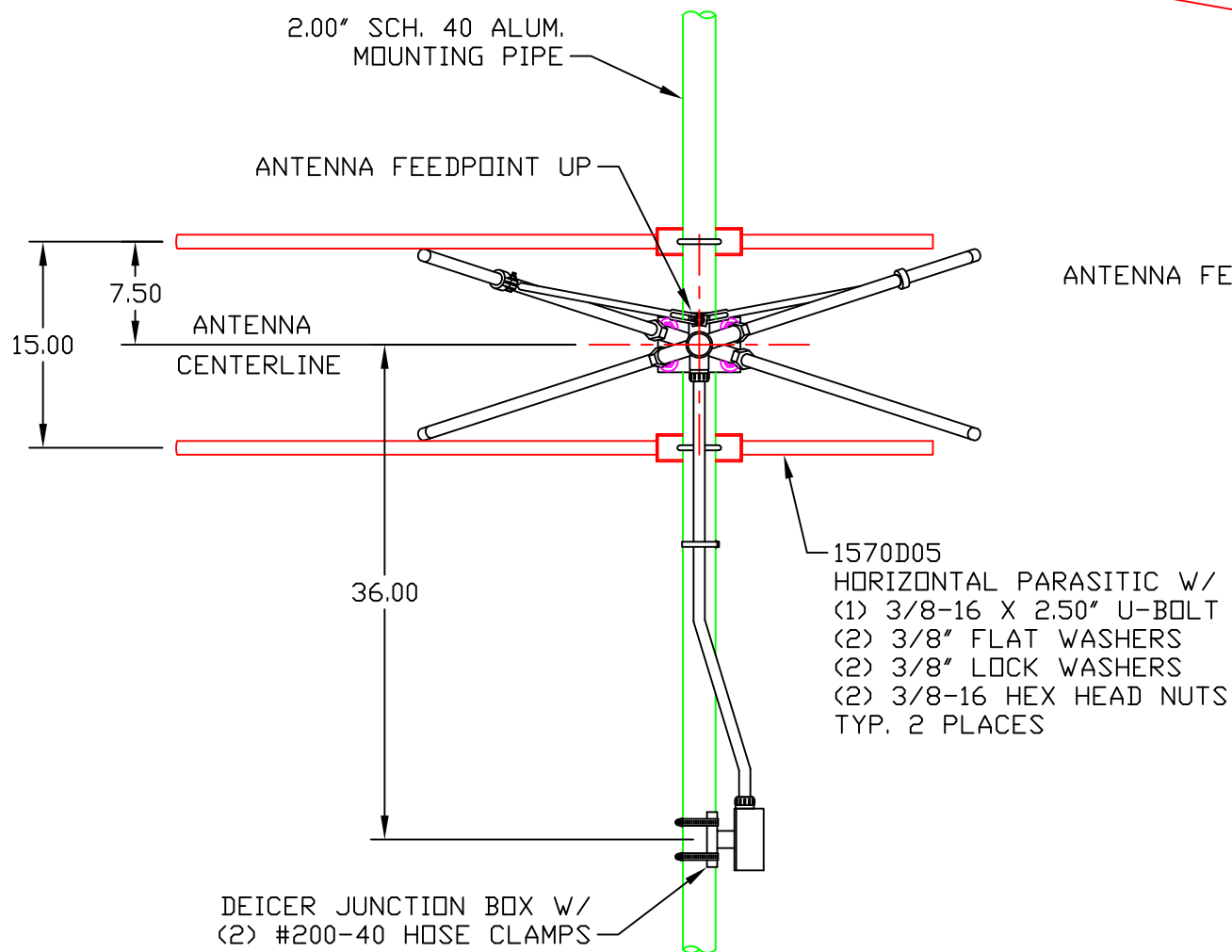
NOTE:

THIS ASSEMBLY TYPICAL FOR ALL BAYS.

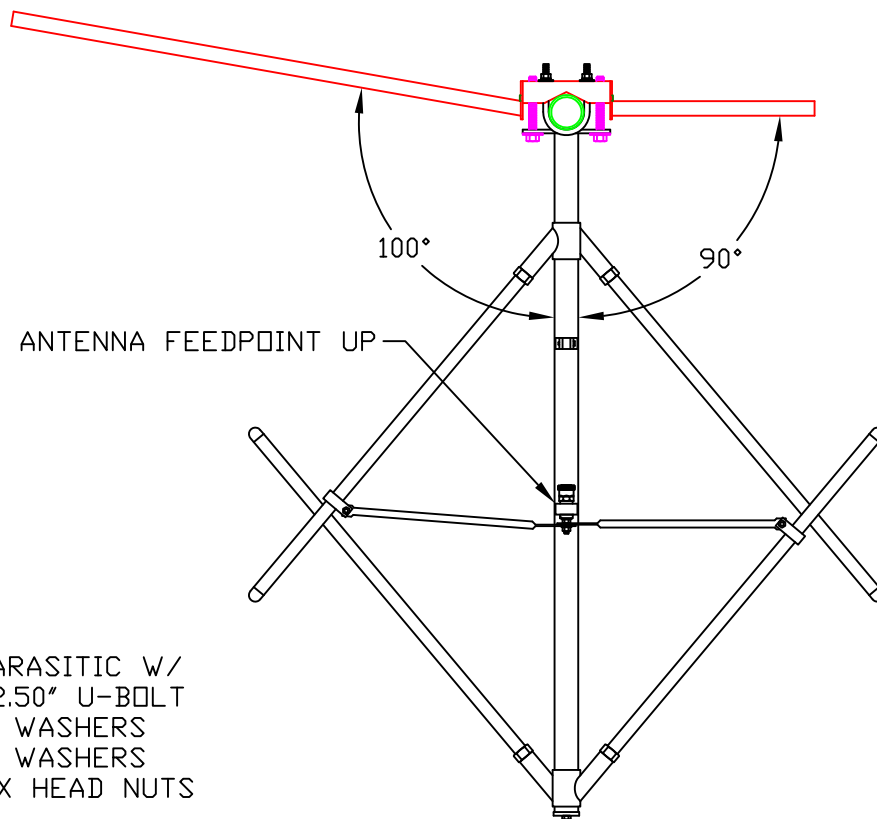
Exhibit 7(Continued): Drawings

DRAWING
NUMBER:

1570D02



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

DRAWING
NUMBER: 1570D02

SIZE

A

PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: RAC

DATE: 8/24/11

SHEET 1 OF 1



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

TITLE:

FMECD/3-DA-0.8WS, FREQ. 88.5
WRKC, WILKES BARRE, PA

MATERIAL:

PARASITIC
PLACEMENT

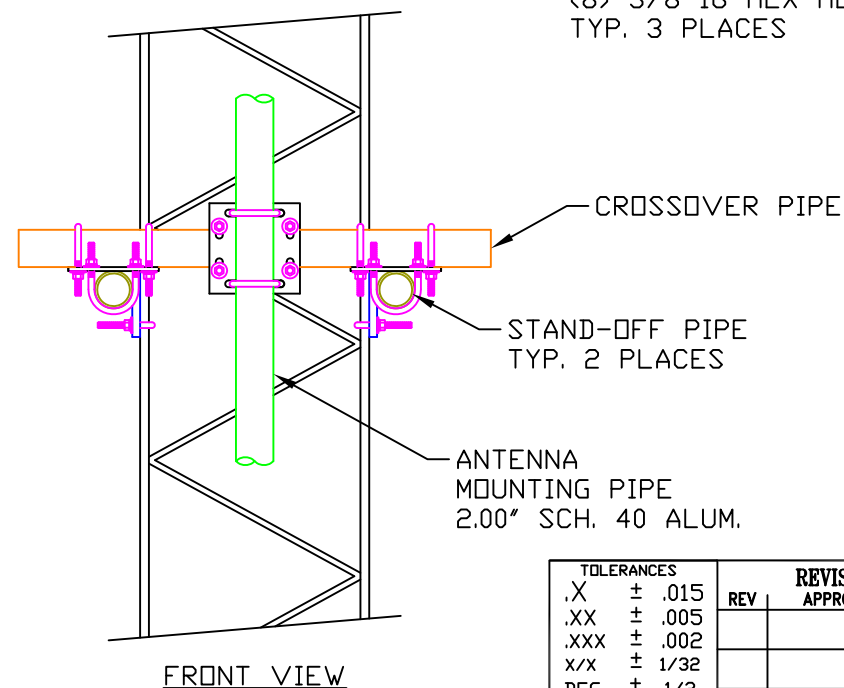
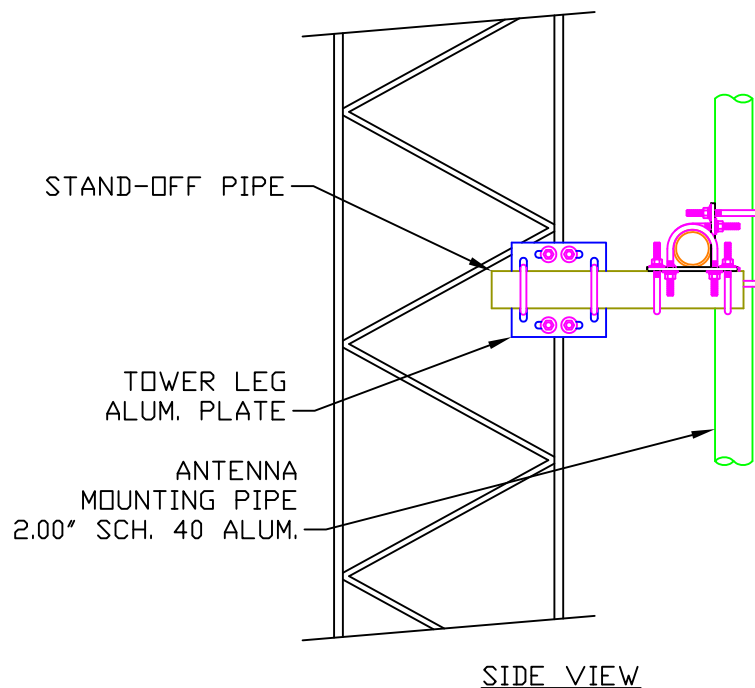
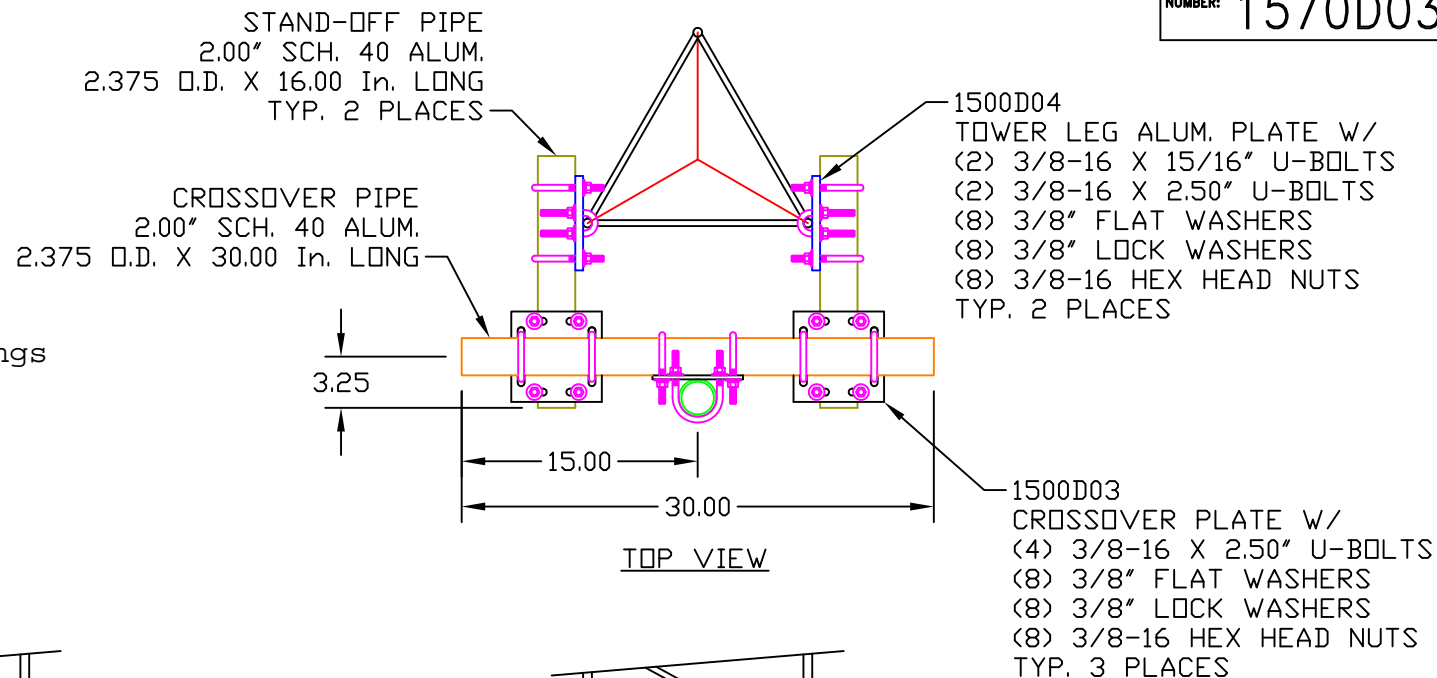
NOTE:

(4) ASSEMBLIES REQUIRED.
REFERENCE DWG. 1570D00.

DRAWING
NUMBER:

1570D03

Exhibit 7(Continued): Drawings



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: FMECD/3-DA-0.8WS, FREQ. 88.5
WRKC, WILKES BARRE, PA
MATERIAL: ADJUSTABLE BRACKET
ASSEMBLY

SIZE
A

PARTS MADE BY THIS DRAWING

SCALE: NTS

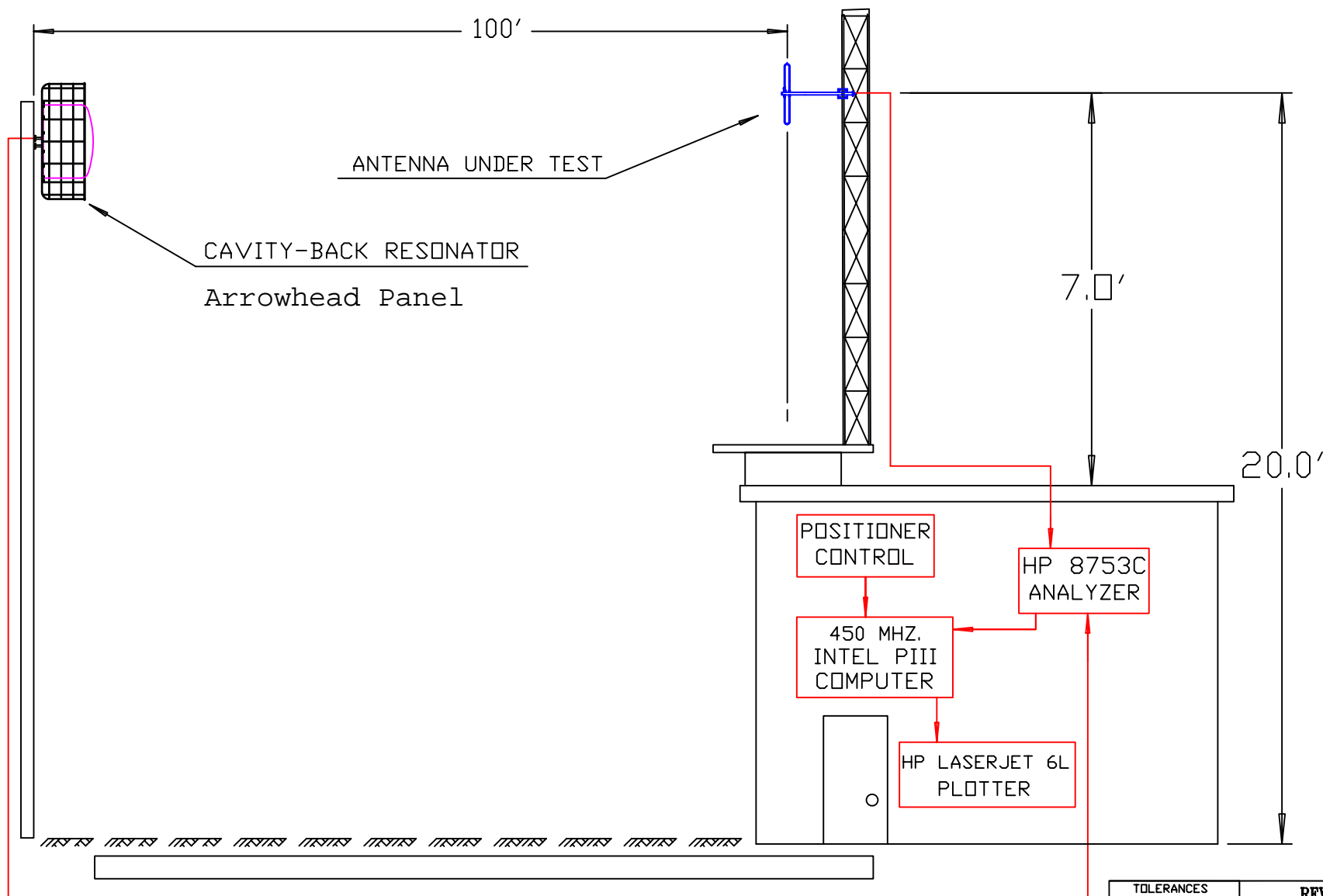
NAME: RAC

DATE: 8/24/11

SHEET 1 OF 1

DRAWING
NUMBER:

1570D03



TOLERANCES			REVISION RECORD		
REV	APPROVAL	DATE			
2		10/7/05			
1		4/30/02			
			DRAWING NUMBER: 2105A10		
			SHEET 1 OF 1		



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