



SYSTEMS WITH RELIABILITY, LLP
BROADCAST ANTENNAS AND TRANSMISSION LINE

PATTERN CERTIFICATION

DIRECTIONAL FM ANTENNA
WNEE
February 14, 2011

Call Sign	:	WNEE
Location	:	Patterson, GA
Frequency	:	88.1 MHz
Channel	:	201A
Antenna Model	:	FMI3/4-DA
Maximum Antenna Gain	:	
Horizontal	:	2.561 /4.085 dB
Vertical	:	2.561 /4.085 dB

ANTENNA DESCRIPTION

A custom designed **FMI3/4-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 and vertical parasitic system. The array is comprised of four bays, that are spaced a half wavelength apart, mounted to a tower pointing 190 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 16-inch 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 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 **98.4 %** of the **RMS** value of the pattern authorized in the related construction permit **BMPED-20100706GVQ**. The vertical component **RMS** value is **0.657**. The horizontal component **RMS** value is **0.659**. The circular polarized component **RMS** value is **0.723**.

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

Measured vertical polarized directivity:	2.314 / 3.640 dB
Measured horizontal polarized directivity:	2.303 / 3.620 dB
Measured circular polarized pattern directivity:	1.915 / 2.820 dB

Gain in each polarization was calculated using the following relation:

$$\text{GAIN} = \text{Azimuth Directivity} \times \text{Power Ratio Between Polarizations} \times \text{Elevation Directivity}$$

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

$$\begin{aligned}\text{V-Pol. Gain} &= (2.314)(.499)(2.219) = \mathbf{2.561 / 4.085 \text{ dB}} \\ \text{H-Pol. Gain} &= (2.303)(.501)(2.219) = \mathbf{2.561 / 4.085 \text{ dB}}\end{aligned}$$

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **39.16 meters (128.5 ft.)** above ground level. The antenna aperture is **16.75 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
1512D00	ELEVATION
1512D01	ANTENNA ORIENTATION WITH PARASITICS
1512D02	BAY 1 PARASITIC PLACEMENT
1512D03	BAY 2 PARASITIC PLACEMENT
1512D04	BAY 3 PARASITIC PLACEMENT
1512D05	BAY 4 PARASITIC PLACEMENT
2105A10	TEST RANGE SCHEMATIC

The array shall be mounted according to **DWG. 1512D00**. The antenna elements shall be aligned at the same heading as in **DWG. 1512D01**. This will ensure that the antenna is oriented properly at 190 degrees true north. Each bay's parasitic assembly is shown in **DWG. 1512D02 THRU 1512D05**.

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

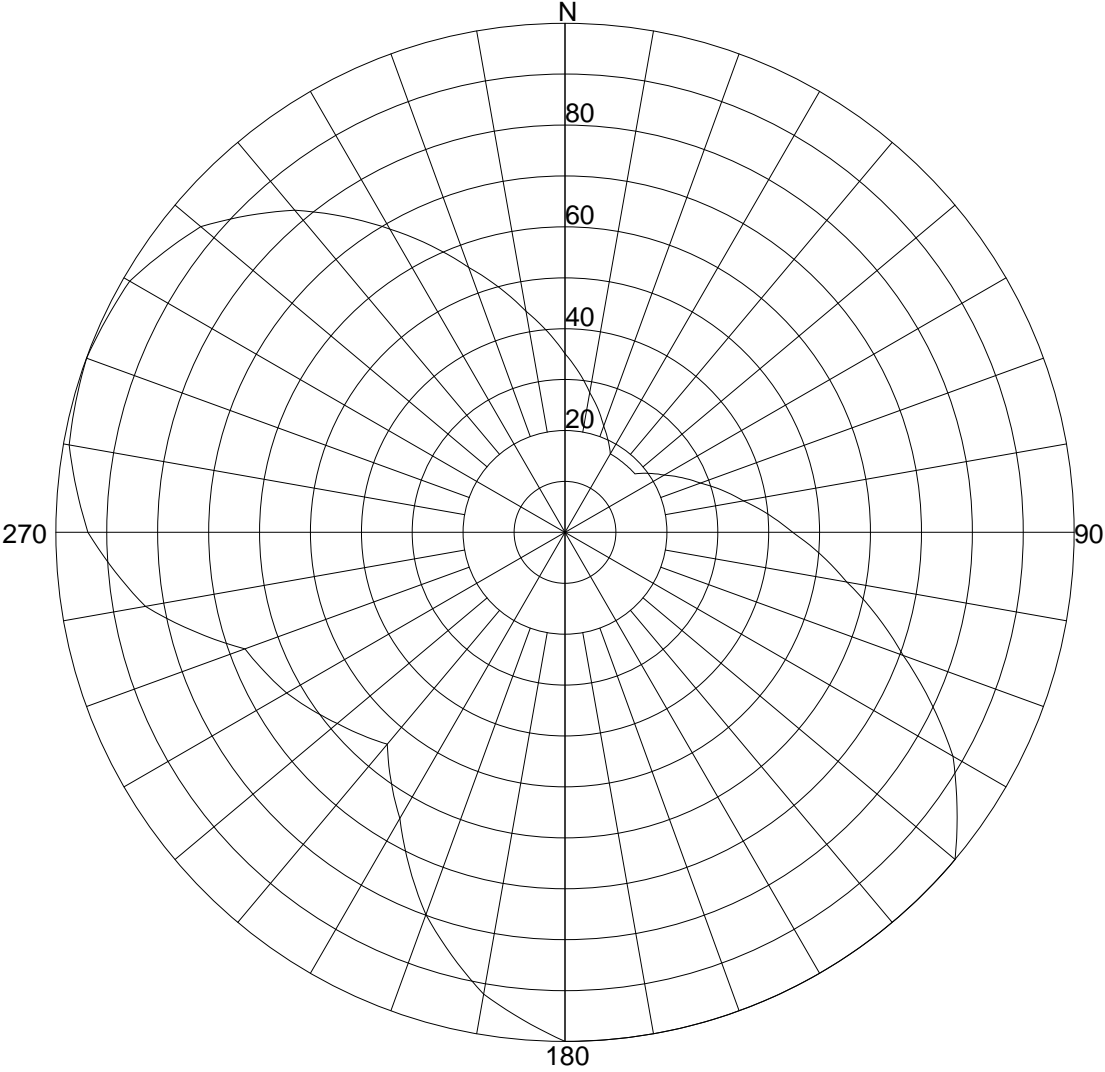
Network Analyzer	:	Hewlett Packard Model # 8753C Serial Number: 08753 – 69138 Calibrated 4/28/10, SWR, Inc.
Computer	:	Pentium 3, 450 MHz, Range Program
Printer	:	Hewlett-Packard Laser Jet 6L
Positioner	:	Orbit Positioner Calibrated 1/24/11, SWR, Inc.

Prepared by:



Mark A. Gergely
Electrical Engineer
Systems With Reliability LLP

Exhibit 1: Circular Polarized Azimuth Pattern (Composite)



Azimuth Pattern

Systems With Reliability

Scale: Linear
Unit: Relative Field

CLIENT: <i>WNEE / Community Public Radio (COMPOSITE)</i>	Date: 2/10/2011
ANTENNA TYPE: FMI3/4-DA	
FREQUENCY: 88.1 MHz	
PATTERN POL.: Circular	CIRCULARITY(+/-dB):
AZ. DIRECTIVITY: 1.91527 / 2.82dB	PATTERN RMS: 0.723

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	.3510 (-9.07)	180	1.0000 (0.01)
5	.3150 (-10.01)	185	.9605 (-0.34)
10	.2790 (-11.06)	190	.9210 (-0.71)
15	.2505 (-11.99)	195	.8600 (-1.3)
20	.2220 (-13.03)	200	.7990 (-1.94)
25	.2000 (-13.94)	205	.7240 (-2.79)
30	.1780 (-14.94)	210	.6490 (-3.74)
35	.1780 (-14.94)	215	.5960 (-4.48)
40	.1780 (-14.94)	220	.5430 (-5.29)
45	.1785 (-14.92)	225	.5635 (-4.97)
50	.1790 (-14.89)	230	.5840 (-4.66)
55	.2020 (-13.85)	235	.6075 (-4.31)
60	.2250 (-12.92)	240	.6310 (-3.99)
65	.2540 (-11.87)	245	.6500 (-3.73)
70	.2830 (-10.93)	250	.6690 (-3.48)
75	.3195 (-9.88)	255	.7530 (-2.45)
80	.3560 (-8.95)	260	.8370 (-1.54)
85	.4015 (-7.9)	265	.8870 (-1.03)
90	.4470 (-6.97)	270	.9370 (-0.56)
95	.5045 (-5.93)	275	.9630 (-0.32)
100	.5620 (-4.99)	280	.9890 (-0.09)
105	.6345 (-3.94)	285	.9945 (-0.04)
110	.7070 (-3)	290	1.0000 (0.01)
115	.7935 (-2)	295	.9935 (-0.05)
120	.8800 (-1.1)	300	.9870 (-0.1)
125	.9400 (-0.53)	305	.9605 (-0.34)
130	1.0000 (0.01)	310	.9340 (-0.58)
135	1.0000 (0.01)	315	.8800 (-1.1)
140	1.0000 (0.01)	320	.8260 (-1.65)
145	1.0000 (0.01)	325	.7570 (-2.41)
150	1.0000 (0.01)	330	.6880 (-3.24)
155	1.0000 (0.01)	335	.6210 (-4.12)
160	1.0000 (0.01)	340	.5540 (-5.11)
165	1.0000 (0.01)	345	.4975 (-6.05)
170	1.0000 (0.01)	350	.4410 (-7.09)
175	1.0000 (0.01)	355	.3960 (-8.02)

Systems With Reliability

CLIENT: *WNEE / Community Public Radio (COMPOSITE)*

Date: 2/10/2011

ANTENNA TYPE: FMI3/4-DA

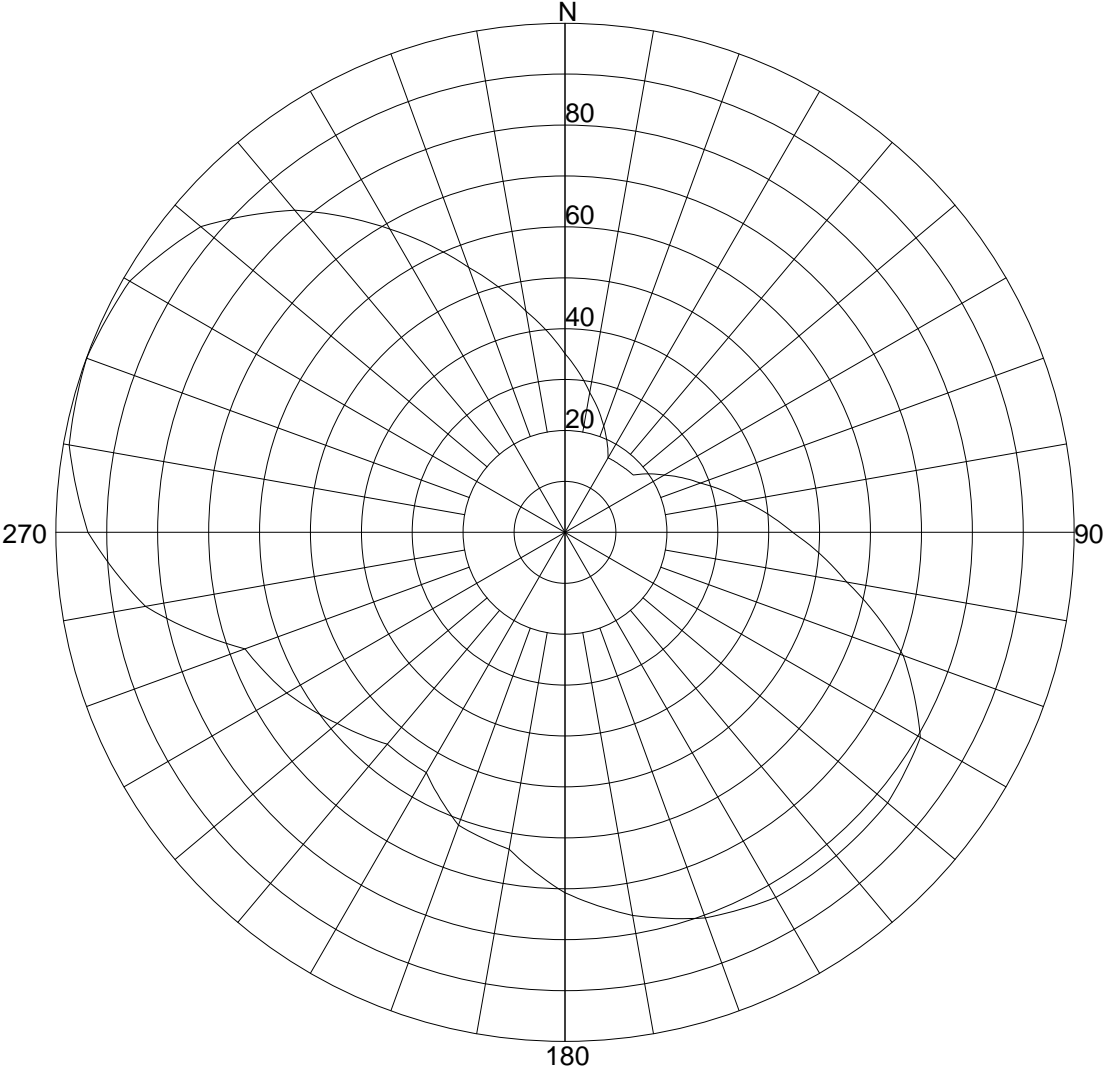
FREQUENCY: 88.1 MHz

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.91527 / 2.82dB

PATTERN RMS: 0.723



Azimuth Pattern

Systems With Reliability

Scale: Linear
Unit: Relative Field

CLIENT: <i>WNEE / Community Public Radio</i>	Date: 2/10/2011
ANTENNA TYPE: FMI3/4-DA	
FREQUENCY: 88.1 MHz	
PATTERN POL.: Horizontal	CIRCULARITY(+/-dB):
AZ. DIRECTIVITY: 2.30314 / 3.62dB	PATTERN RMS: 0.659

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	.3510 (-9.07)	180	.7080 (-2.99)
5	.3150 (-10.01)	185	.6700 (-3.47)
10	.2790 (-11.06)	190	.6320 (-3.97)
15	.2505 (-11.99)	195	.6220 (-4.11)
20	.2220 (-13.03)	200	.6120 (-4.25)
25	.1955 (-14.13)	205	.5785 (-4.74)
30	.1690 (-15.39)	210	.5450 (-5.26)
35	.1700 (-15.34)	215	.5440 (-5.27)
40	.1710 (-15.29)	220	.5430 (-5.29)
45	.1730 (-15.19)	225	.5635 (-4.97)
50	.1750 (-15.09)	230	.5840 (-4.66)
55	.2000 (-13.94)	235	.6075 (-4.31)
60	.2250 (-12.92)	240	.6310 (-3.99)
65	.2540 (-11.87)	245	.6500 (-3.73)
70	.2830 (-10.93)	250	.6690 (-3.48)
75	.3195 (-9.88)	255	.7530 (-2.45)
80	.3560 (-8.95)	260	.8370 (-1.54)
85	.4015 (-7.9)	265	.8870 (-1.03)
90	.4470 (-6.97)	270	.9370 (-0.56)
95	.5045 (-5.93)	275	.9630 (-0.32)
100	.5620 (-4.99)	280	.9890 (-0.09)
105	.6345 (-3.94)	285	.9945 (-0.04)
110	.7070 (-3)	290	1.0000 (0.01)
115	.7565 (-2.41)	295	.9935 (-0.05)
120	.8060 (-1.86)	300	.9870 (-0.1)
125	.8165 (-1.75)	305	.9605 (-0.34)
130	.8270 (-1.64)	310	.9340 (-0.58)
135	.8280 (-1.63)	315	.8800 (-1.1)
140	.8290 (-1.62)	320	.8260 (-1.65)
145	.8285 (-1.62)	325	.7570 (-2.41)
150	.8280 (-1.63)	330	.6880 (-3.24)
155	.8170 (-1.74)	335	.6210 (-4.12)
160	.8060 (-1.86)	340	.5540 (-5.11)
165	.7850 (-2.09)	345	.4975 (-6.05)
170	.7640 (-2.33)	350	.4410 (-7.09)
175	.7360 (-2.65)	355	.3960 (-8.02)

Systems With Reliability

CLIENT: *WNEE / Community Public Radio*

Date: 2/10/2011

ANTENNA TYPE: FMI3/4-DA

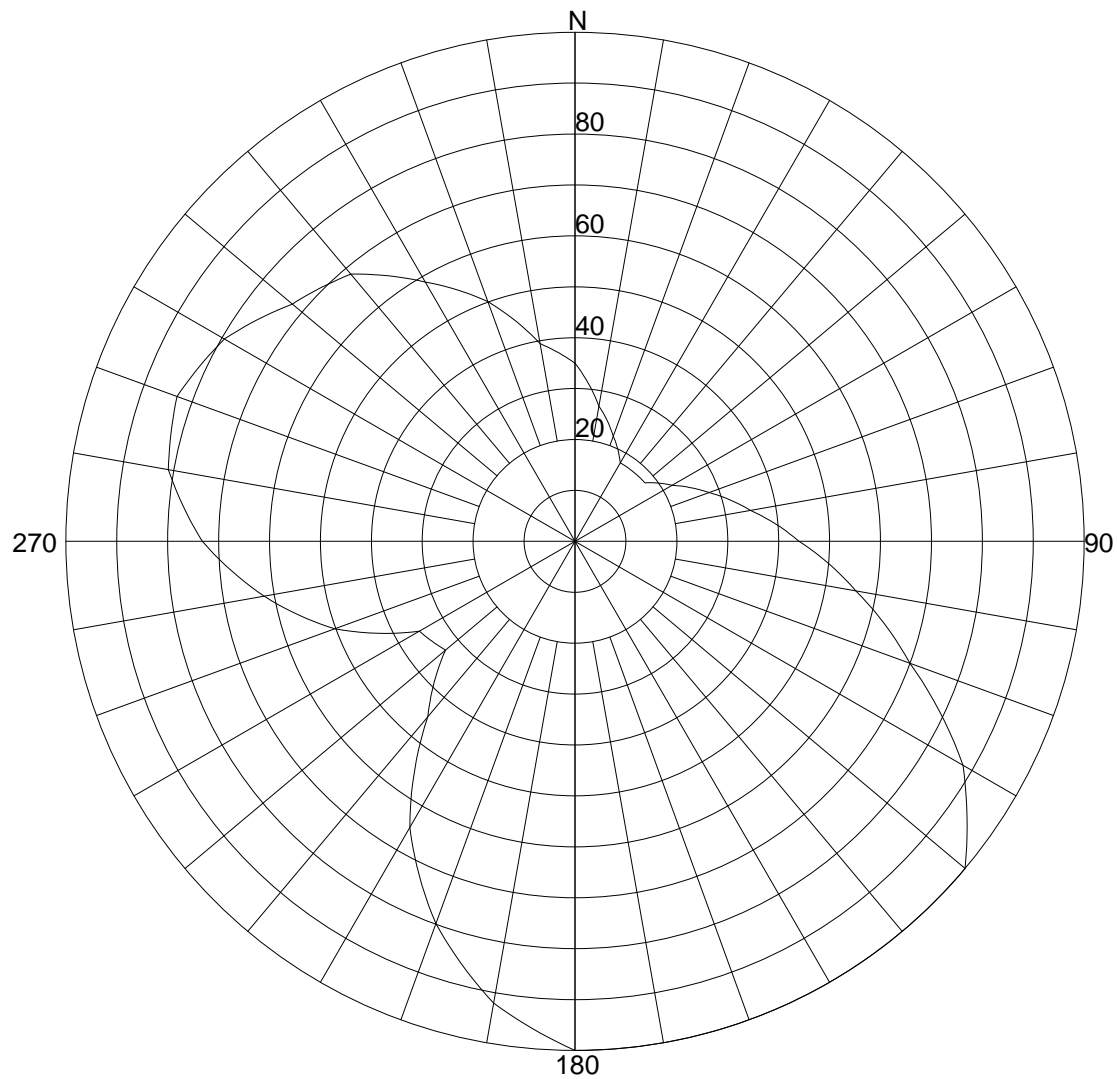
FREQUENCY: 88.1 MHz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.30314 / 3.62dB

PATTERN RMS: 0.659



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WNEE / Community Public Radio*

Date: 2/10/2011

ANTENNA TYPE: FMI3/4-DA

FREQUENCY: 88.1 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.31412 / 3.64dB

PATTERN RMS: 0.657

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	.3500 (-9.09)	180	1.0000 (0.01)
5	.3100 (-10.14)	185	.9605 (-0.34)
10	.2700 (-11.34)	190	.9210 (-0.71)
15	.2450 (-12.18)	195	.8600 (-1.3)
20	.2200 (-13.11)	200	.7990 (-1.94)
25	.1990 (-13.98)	205	.7240 (-2.79)
30	.1780 (-14.94)	210	.6490 (-3.74)
35	.1780 (-14.94)	215	.5495 (-5.18)
40	.1780 (-14.94)	220	.4500 (-6.92)
45	.1785 (-14.92)	225	.3910 (-8.13)
50	.1790 (-14.89)	230	.3320 (-9.55)
55	.1995 (-13.96)	235	.3425 (-9.28)
60	.2200 (-13.11)	240	.3530 (-9.02)
65	.2500 (-12.01)	245	.4275 (-7.36)
70	.2800 (-11.03)	250	.5020 (-5.97)
75	.3150 (-10.01)	255	.5610 (-5.01)
80	.3500 (-9.09)	260	.6200 (-4.14)
85	.3950 (-8.05)	265	.6760 (-3.39)
90	.4400 (-7.11)	270	.7320 (-2.7)
95	.5000 (-6)	275	.7715 (-2.24)
100	.5600 (-5.02)	280	.8110 (-1.81)
105	.6300 (-4)	285	.8215 (-1.7)
110	.7000 (-3.09)	290	.8320 (-1.59)
115	.7900 (-2.04)	295	.8135 (-1.78)
120	.8800 (-1.1)	300	.7950 (-1.98)
125	.9400 (-0.53)	305	.7600 (-2.37)
130	1.0000 (0.01)	310	.7250 (-2.78)
135	1.0000 (0.01)	315	.7050 (-3.02)
140	1.0000 (0.01)	320	.6850 (-3.27)
145	1.0000 (0.01)	325	.6365 (-3.91)
150	1.0000 (0.01)	330	.5880 (-4.6)
155	1.0000 (0.01)	335	.5445 (-5.26)
160	1.0000 (0.01)	340	.5010 (-5.99)
165	1.0000 (0.01)	345	.4475 (-6.96)
170	1.0000 (0.01)	350	.3940 (-8.07)
175	1.0000 (0.01)	355	.3720 (-8.57)

Systems With Reliability

CLIENT: *WNEE / Community Public Radio*

Date: 2/10/2011

ANTENNA TYPE: FMI3/4-DA

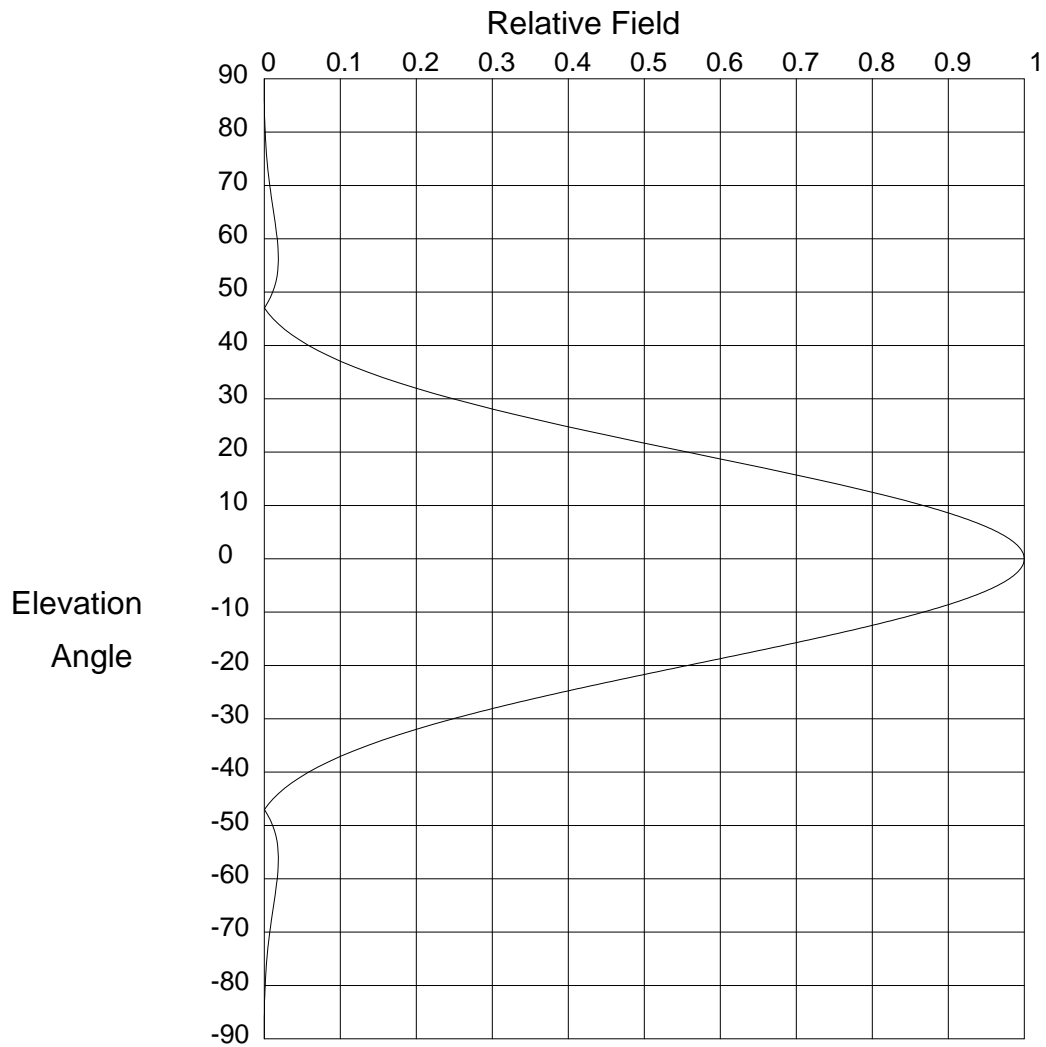
FREQUENCY: 88.1 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.31412 / 3.64dB

PATTERN RMS: 0.657



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: *WNEE / Community Public Radio*

Date: 2/10/2011

ANTENNA TYPE: FMI3/4-DA

FREQUENCY: 88.1 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.219/3.461 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.219/3.461 dBd

Null Fill(s)(%) : -30, 0, 0

Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
90.0	.00 (-50)	52.0	.016 (-36.184)	14.0	.754 (-2.447)
89.0	.00 (-50)	51.0	.014 (-37.311)	13.0	.785 (-2.105)
88.0	.00 (-91.952)	50.0	.011 (-39.03)	12.0	.814 (-1.79)
87.0	.00 (-83.93)	49.0	.008 (-41.821)	11.0	.841 (-1.501)
86.0	.00 (-78.054)	48.0	.004 (-47.233)	10.0	.867 (-1.239)
85.0	.00 (-73.383)	47.0	.00 (-75.55)	9.8	.872 (-1.189)
84.0	.00 (-69.491)	46.0	.006 (-45.186)	9.6	.877 (-1.141)
83.0	.00 (-66.147)	45.0	.012 (-38.614)	9.4	.882 (-1.094)
82.0	.001 (-63.214)	44.0	.019 (-34.466)	9.2	.886 (-1.047)
81.0	.001 (-60.6)	43.0	.027 (-31.337)	9.0	.891 (-1.002)
80.0	.001 (-58.243)	42.0	.036 (-28.778)	8.8	.896 (-0.958)
79.0	.002 (-56.097)	41.0	.047 (-26.59)	8.6	.90 (-0.914)
78.0	.002 (-54.131)	40.0	.058 (-24.663)	8.4	.904 (-0.872)
77.0	.002 (-52.318)	39.0	.071 (-22.933)	8.2	.909 (-0.831)
76.0	.003 (-50.638)	38.0	.086 (-21.359)	8.0	.913 (-0.791)
75.0	.004 (-49.077)	37.0	.101 (-19.911)	7.8	.917 (-0.751)
74.0	.004 (-47.622)	36.0	.118 (-18.569)	7.6	.921 (-0.713)
73.0	.005 (-46.263)	35.0	.136 (-17.317)	7.4	.925 (-0.676)
72.0	.006 (-44.993)	34.0	.156 (-16.145)	7.2	.929 (-0.64)
71.0	.006 (-43.804)	33.0	.177 (-15.043)	7.0	.933 (-0.605)
70.0	.007 (-42.693)	32.0	.199 (-14.005)	6.8	.936 (-0.57)
69.0	.008 (-41.654)	31.0	.223 (-13.023)	6.6	.94 (-0.537)
68.0	.009 (-40.685)	30.0	.248 (-12.095)	6.4	.944 (-0.505)
67.0	.01 (-39.784)	29.0	.275 (-11.215)	6.2	.947 (-0.474)
66.0	.011 (-38.949)	28.0	.303 (-10.381)	6.0	.95 (-0.444)
65.0	.012 (-38.18)	27.0	.332 (-9.589)	5.8	.953 (-0.415)
64.0	.013 (-37.477)	26.0	.361 (-8.838)	5.6	.956 (-0.386)
63.0	.014 (-36.841)	25.0	.392 (-8.125)	5.4	.959 (-0.359)
62.0	.015 (-36.275)	24.0	.424 (-7.449)	5.2	.962 (-0.333)
61.0	.016 (-35.78)	23.0	.457 (-6.808)	5.0	.965 (-0.308)
60.0	.017 (-35.361)	22.0	.49 (-6.201)	4.8	.968 (-0.284)
59.0	.018 (-35.024)	21.0	.523 (-5.627)	4.6	.97 (-0.261)
58.0	.018 (-34.778)	20.0	.557 (-5.084)	4.4	.973 (-0.238)
57.0	.019 (-34.631)	19.0	.591 (-4.572)	4.2	.975 (-0.217)
56.0	.019 (-34.6)	18.0	.624 (-4.089)	4.0	.978 (-0.197)
55.0	.018 (-34.703)	17.0	.658 (-3.636)	3.8	.98 (-0.178)
54.0	.018 (-34.969)	16.0	.691 (-3.212)	3.6	.982 (-0.159)
53.0	.017 (-35.441)	15.0	.723 (-2.816)	3.4	.984 (-0.142)

Systems With Reliability

Page 1 of 3

CLIENT: *WNEE / Community Public Radio*

Date: 2/10/2011

ANTENNA TYPE: FMI3/4-DA

FREQUENCY: 88.1 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.219/3.461 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.219/3.461 dBd

Null Fill(s)(%) : -30, 0, 0

Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
3.2	.986 (-0.126)	-4.4	.973 (-0.238)	-12.0	.814 (-1.79)
3.0	.987 (-0.111)	-4.6	.97 (-0.261)	-12.2	.808 (-1.851)
2.8	.989 (-0.096)	-4.8	.968 (-0.284)	-12.4	.802 (-1.913)
2.6	.99 (-0.083)	-5.0	.965 (-0.308)	-12.6	.797 (-1.976)
2.4	.992 (-0.071)	-5.2	.962 (-0.333)	-12.8	.791 (-2.04)
2.2	.993 (-0.06)	-5.4	.959 (-0.359)	-13.0	.785 (-2.105)
2.0	.994 (-0.049)	-5.6	.956 (-0.386)	-13.2	.779 (-2.171)
1.8	.995 (-0.04)	-5.8	.953 (-0.415)	-13.4	.773 (-2.239)
1.6	.996 (-0.031)	-6.0	.95 (-0.444)	-13.6	.767 (-2.307)
1.4	.997 (-0.024)	-6.2	.947 (-0.474)	-13.8	.761 (-2.376)
1.2	.998 (-0.018)	-6.4	.944 (-0.505)	-14.0	.754 (-2.447)
1.0	.999 (-0.012)	-6.6	.94 (-0.537)	-14.2	.748 (-2.518)
.8	.999 (-0.008)	-6.8	.936 (-0.57)	-14.4	.742 (-2.591)
.6	.999 (-0.004)	-7.0	.933 (-0.605)	-14.6	.736 (-2.665)
.4	1.00 (-0.002)	-7.2	.929 (-0.64)	-14.8	.729 (-2.74)
.2	1.00 (0)	-7.4	.925 (-0.676)	-15.0	.723 (-2.816)
.0	1.00 (0)	-7.6	.921 (-0.713)	-15.2	.717 (-2.893)
-.2	1.00 (0)	-7.8	.917 (-0.751)	-15.4	.71 (-2.971)
-.4	1.00 (-0.002)	-8.0	.913 (-0.791)	-15.6	.704 (-3.05)
-.6	.999 (-0.004)	-8.2	.909 (-0.831)	-15.8	.697 (-3.131)
-.8	.999 (-0.008)	-8.4	.904 (-0.872)	-16.0	.691 (-3.212)
-1.0	.999 (-0.012)	-8.6	.90 (-0.914)	-16.2	.684 (-3.295)
-1.2	.998 (-0.018)	-8.8	.896 (-0.958)	-16.4	.678 (-3.378)
-1.4	.997 (-0.024)	-9.0	.891 (-1.002)	-16.6	.671 (-3.463)
-1.6	.996 (-0.031)	-9.2	.886 (-1.047)	-16.8	.665 (-3.549)
-1.8	.995 (-0.04)	-9.4	.882 (-1.094)	-17.0	.658 (-3.636)
-2.0	.994 (-0.049)	-9.6	.877 (-1.141)	-17.2	.651 (-3.725)
-2.2	.993 (-0.06)	-9.8	.872 (-1.189)	-17.4	.645 (-3.814)
-2.4	.992 (-0.071)	-10.0	.867 (-1.239)	-17.6	.638 (-3.905)
-2.6	.99 (-0.083)	-10.2	.862 (-1.289)	-17.8	.631 (-3.996)
-2.8	.989 (-0.096)	-10.4	.857 (-1.341)	-18.0	.624 (-4.089)
-3.0	.987 (-0.111)	-10.6	.852 (-1.393)	-18.2	.618 (-4.183)
-3.2	.986 (-0.126)	-10.8	.847 (-1.447)	-18.4	.611 (-4.279)
-3.4	.984 (-0.142)	-11.0	.841 (-1.501)	-18.6	.604 (-4.375)
-3.6	.982 (-0.159)	-11.2	.836 (-1.557)	-18.8	.598 (-4.473)
-3.8	.98 (-0.178)	-11.4	.83 (-1.614)	-19.0	.591 (-4.572)
-4.0	.978 (-0.197)	-11.6	.825 (-1.672)	-19.2	.584 (-4.672)
-4.2	.975 (-0.217)	-11.8	.819 (-1.73)	-19.4	.577 (-4.773)

Systems With Reliability

Page 2 of 3

CLIENT: *WNEE / Community Public Radio*

Date: 2/10/2011

ANTENNA TYPE: FMI3/4-DA

FREQUENCY: 88.1 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.219/3.461 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.219/3.461 dBd

Null Fill(s)(%) : -30, 0, 0

Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
-19.6	.57 (-4.875)	-27.2	.326 (-9.744)	-54.0	.018 (-34.969)
-19.8	.564 (-4.979)	-27.4	.32 (-9.901)	-55.0	.018 (-34.703)
-20.0	.557 (-5.084)	-27.6	.314 (-10.059)	-56.0	.019 (-34.6)
-20.2	.55 (-5.19)	-27.8	.308 (-10.219)	-57.0	.019 (-34.631)
-20.4	.543 (-5.297)	-28.0	.303 (-10.381)	-58.0	.018 (-34.778)
-20.6	.537 (-5.406)	-28.2	.297 (-10.544)	-59.0	.018 (-35.024)
-20.8	.53 (-5.516)	-28.4	.291 (-10.709)	-60.0	.017 (-35.361)
-21.0	.523 (-5.627)	-28.6	.286 (-10.876)	-61.0	.016 (-35.78)
-21.2	.516 (-5.739)	-28.8	.28 (-11.044)	-62.0	.015 (-36.275)
-21.4	.51 (-5.853)	-29.0	.275 (-11.215)	-63.0	.014 (-36.841)
-21.6	.503 (-5.967)	-29.2	.27 (-11.387)	-64.0	.013 (-37.477)
-21.8	.496 (-6.084)	-29.4	.264 (-11.561)	-65.0	.012 (-38.18)
-22.0	.49 (-6.201)	-29.6	.259 (-11.737)	-66.0	.011 (-38.949)
-22.2	.483 (-6.32)	-29.8	.254 (-11.915)	-67.0	.01 (-39.784)
-22.4	.476 (-6.44)	-30.0	.248 (-12.095)	-68.0	.009 (-40.685)
-22.6	.47 (-6.561)	-31.0	.223 (-13.023)	-69.0	.008 (-41.654)
-22.8	.463 (-6.684)	-32.0	.199 (-14.005)	-70.0	.007 (-42.693)
-23.0	.457 (-6.808)	-33.0	.177 (-15.043)	-71.0	.006 (-43.804)
-23.2	.45 (-6.934)	-34.0	.156 (-16.145)	-72.0	.006 (-44.993)
-23.4	.444 (-7.06)	-35.0	.136 (-17.317)	-73.0	.005 (-46.263)
-23.6	.437 (-7.189)	-36.0	.118 (-18.569)	-74.0	.004 (-47.622)
-23.8	.431 (-7.318)	-37.0	.101 (-19.911)	-75.0	.004 (-49.077)
-24.0	.424 (-7.449)	-38.0	.086 (-21.359)	-76.0	.003 (-50.638)
-24.2	.418 (-7.582)	-39.0	.071 (-22.933)	-77.0	.002 (-52.318)
-24.4	.411 (-7.715)	-40.0	.058 (-24.663)	-78.0	.002 (-54.131)
-24.6	.405 (-7.851)	-41.0	.047 (-26.59)	-79.0	.002 (-56.097)
-24.8	.399 (-7.987)	-42.0	.036 (-28.778)	-80.0	.001 (-58.243)
-25.0	.392 (-8.125)	-43.0	.027 (-31.337)	-81.0	.001 (-60.6)
-25.2	.386 (-8.265)	-44.0	.019 (-34.466)	-82.0	.001 (-63.214)
-25.4	.38 (-8.406)	-45.0	.012 (-38.614)	-83.0	.00 (-66.147)
-25.6	.374 (-8.548)	-46.0	.006 (-45.186)	-84.0	.00 (-69.491)
-25.8	.368 (-8.692)	-47.0	.00 (-75.55)	-85.0	.00 (-73.383)
-26.0	.361 (-8.838)	-48.0	.004 (-47.233)	-86.0	.00 (-78.054)
-26.2	.355 (-8.985)	-49.0	.008 (-41.821)	-87.0	.00 (-83.93)
-26.4	.349 (-9.134)	-50.0	.011 (-39.03)	-88.0	.00 (-91.952)
-26.6	.343 (-9.284)	-51.0	.014 (-37.311)	-89.0	.00 (-50)
-26.8	.337 (-9.436)	-52.0	.016 (-36.184)	-90.0	.00 (-50)
-27.0	.332 (-9.589)	-53.0	.017 (-35.441)	90.0	.00 (-50)

Systems With Reliability

Page 3 of 3

CLIENT: *WNEE / Community Public Radio*

Date: 2/10/2011

ANTENNA TYPE: FMI3/4-DA

FREQUENCY: 88.1 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 2.219/3.461 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 2.219/3.461 dBd

Null Fill(s)(%) : -30, 0, 0



SYSTEMS WITH RELIABILITY, LLP

BROADCAST ANTENNAS AND TRANSMISSION LINE

SYSTEM DATA SHEET

Customer	WNEE
Contact	Community Public Radio
Location	Patterson, GA
Antenna Model	FMI3/4 DA
Channel / Frequency	201A / 88.1 MHz

ELECTRICAL SPECIFICATIONS

Antenna Specifications:

	H-POL			V. Pol.	
		dB			dB
License ERP (KW)	6.000	7.782 dB		6.000	7.782 dB
FCC Limit Pattern Directivity	1.855	2.683 dB		1.855	2.683 dB
Elevation Directivity	2.219	3.462 dB		2.219	3.462 dB
Azimuth Directivity	2.303	3.623 dB		2.314	3.644 dB
Composite Pattern	1.915	2.822 dB		1.915	2.822 dB
Polarization Ratio	0.501	-3.000 dB		0.499	-3.021 dB
RMS Comp./RMS Limit	98.41 %				
Antenna Efficiency %	100	0		100	0
Power Ratio (Pol. Ratio X Efficiency)	0.5012	0		0.4988	0
Antenna Gain	2.561	4.085 dB		2.561	4.085 dB

Antenna Input Power (KW)	2.342 kW	3.697 (dBK)
---------------------------------	----------	-------------

Feed Line Specifications:

Line Type	1 5/8" Air 50 Ω - Andrew HJ7-50A	
Attenuation Per 100 ft (dB)	0.193 dB	
Line Length (ft) AGL + 45' Horizontal Run	173.50 ft.	
Total Line Attenuation (dB)	0.3349 dB	
Line Efficiency	92.58 %	
Power Input to the Line (KW)	2.530 kW	4.032 (dBK)

MECHANICAL SPECIFICATIONS

No. Of Bays	4		
Antenna Aperture	16.75 ft.	5.11 meter	
Center of Radiation AGL	128.50 ft.	39.16 meter	
Antenna Weight with Pole	405.00 lbs.	184.09 kg	
Windload (50/33)	701.00 lbs.	Windload CaAc	20.00 ft^2

Prepared by:

David K. Edmiston Jr.
SWR, LLP

Exhibit 6: RMS Calculations



SYSTEMS WITH RELIABILITY, INC.
Broadcast Antennas and Transmission Systems

WNEE Antenna RMS Comparison

PROPOSED ANTENNA

Azimuth Heading	Relative Field
0	0.351
10	0.279
20	0.222
30	0.178
40	0.178
50	0.179
60	0.225
70	0.283
80	0.356
90	0.447
100	0.562
110	0.707
120	0.889
130	1.000
140	1.000
150	1.000
160	1.000
170	1.000
180	1.000
190	1.000
200	0.799
210	0.649
220	0.559
230	0.597
240	0.649
250	0.669
260	0.837
270	1.000
280	1.000
290	1.000
300	1.000
310	1.000
320	0.876
330	0.697
340	0.554
350	0.441

DESIGNED ANTENNA

Azimuth Heading	Relative Field
0	0.351
10	0.279
20	0.222
30	0.178
40	0.178
50	0.179
60	0.225
70	0.283
80	0.356
90	0.447
100	0.562
110	0.707
120	0.880
130	1.000
140	1.000
150	1.000
160	1.000
170	1.000
180	1.000
190	0.921
200	0.799
210	0.649
220	0.543
230	0.584
240	0.631
250	0.669
260	0.837
270	0.937
280	0.989
290	1.000
300	0.987
310	0.934
320	0.826
330	0.688
340	0.554
350	0.441

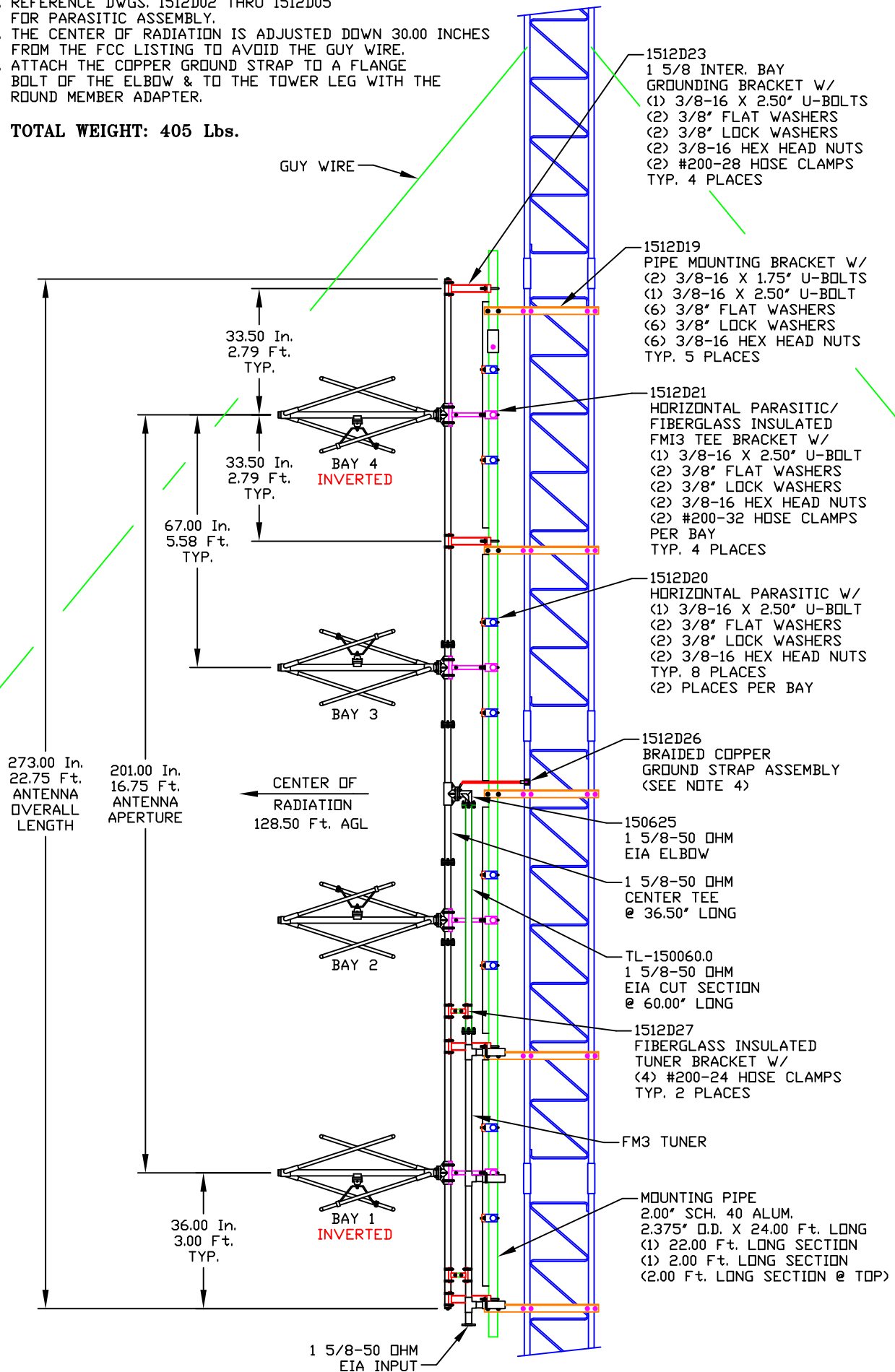
Sum of Relative Field Squared : 19.461
Sum Divided by 36 (Readings) : 0.541
Square Root : 0.735

Sum of Relative Field Squared : 18.843
Sum Divided by 36 (Readings) : 0.523
Square Root : 0.723

Percentage of Construction Permit Antenna Filled : **98.4%**

NOTES:

1. REFERENCE DWG. 1512D01 FOR ANTENNA ORIENTATION.
2. REFERENCE DWGS. 1512D02 THRU 1512D05 FOR PARASITIC ASSEMBLY.
3. THE CENTER OF RADIATION IS ADJUSTED DOWN 30.00 INCHES FROM THE FCC LISTING TO AVOID THE GUY WIRE.
4. ATTACH THE COPPER GROUND STRAP TO A FLANGE BOLT OF THE ELBOW & TO THE TOWER LEG WITH THE ROUND MEMBER ADAPTER.

TOTAL WEIGHT: 405 Lbs.

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

TITLE: FMI3/4-DA, FREQ. 88.1
WNEE, PATTERSON, GA

MATERIAL:

SIZE REV APPR. DATE

C

ENGINEER:

SCALE: NTS

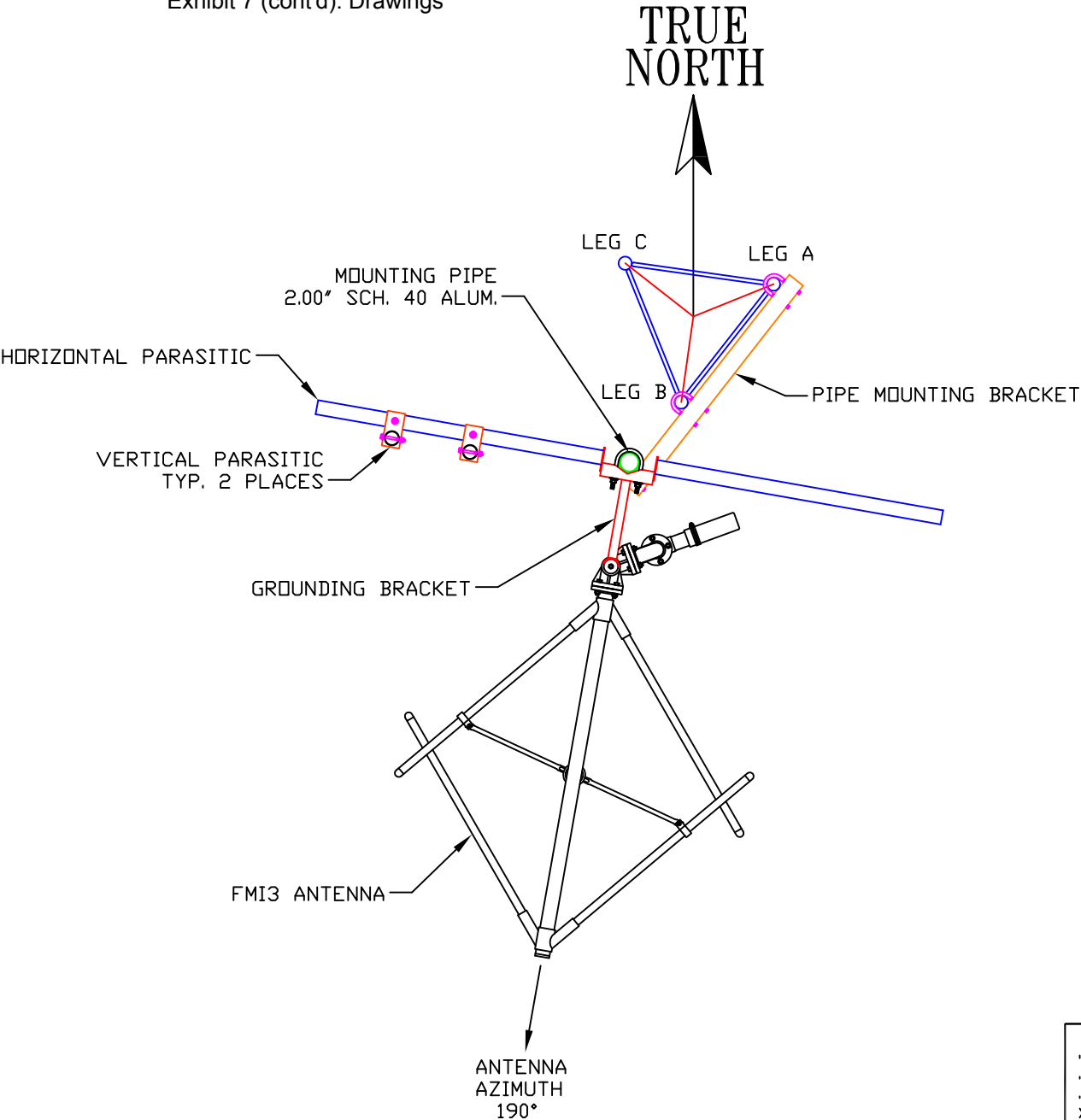
NAME: RAC

DATE: 2/14/11

DRAWING NUMBER:

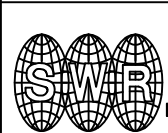
1512D00

SHEET 1 OF 1



TOWER LEG HEADINGS	
LEG	AZIMUTH
A	68°1'38"
B	188°1'38"
C	308°1'38"

TOLERANCES		REVISION RECORD		
.X	± .015	REV	APPROVAL	DATE
.XX	± .005			
.XXX	± .002			
X/X	± 1/32			
DEG.	± 1/2			
UNLESS OTHERWISE SPECIFIED				
		DRAWING NUMBER: 1512D01		
SCALE: NTS		NAME: RAC	DATE: 2/14/11	SHEET 1 OF 1



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

TITLE:	FMI3/4-DA, FREQ. 88.1 WNEE, PATTERSON, GA
MATERIAL:	ANTENNA ORIENTATION FROM TRUE NORTH

SIZE

A

NOTE:

Exhibit 7 (cont'd): Drawings

DRAWING
NUMBER:

1512D02

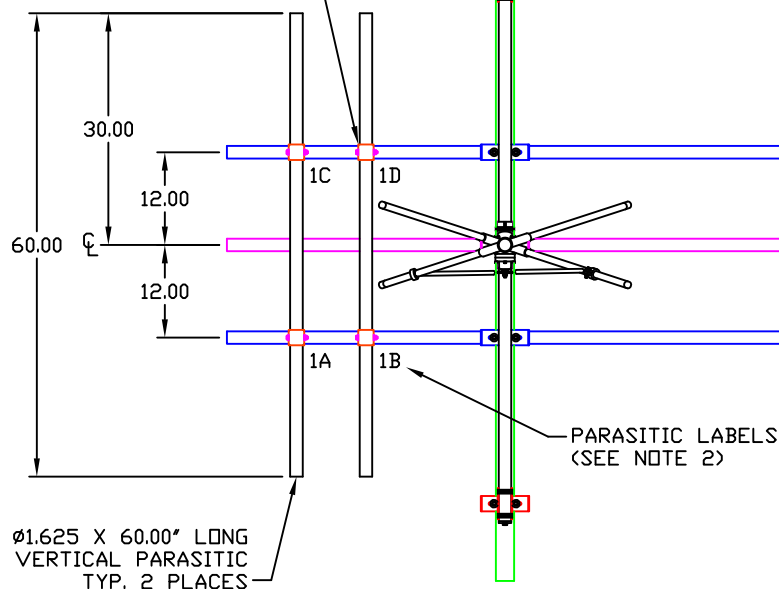
NOTES:

1. THE VERTICAL PARASITICS MOUNT IN FRONT OF THE HORIZONTAL PARASITICS AS SHOWN.
2. THE PARASITICS AND POLY BLOCKS ARE FACTORY DRILLED & LABELED, ASSEMBLE THE PARASITICS WITH CORRESPONDING LABELS AS SHOWN IN THE FRONT VIEW.

VERTICAL PARASITICS MOUNT IN
FRONT OF HORIZONTAL PARASITICS

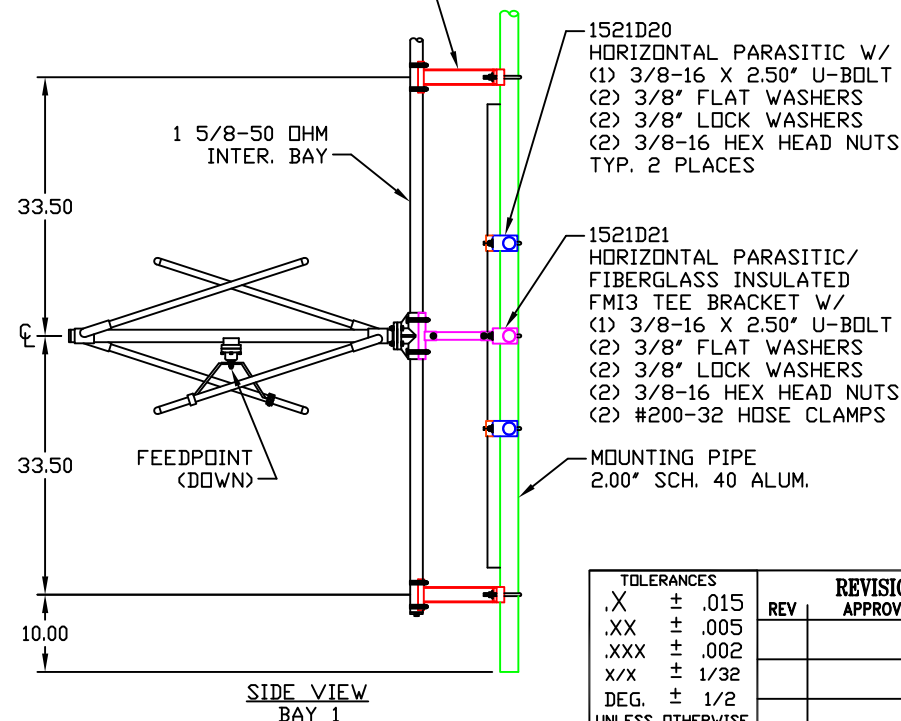
1278D03
PARASITIC POLY BLOCK W/
(1) 1/4-20 X 2.75" H.H.C.S.
(2) 1/4" FLAT WASHERS
(1) 1/4" LOCK WASHER
(1) 1/4-20 HEX HEAD NUT
TYP. 4 PLACES

TOP VIEW
BAY 1



FRONT VIEW
BAY 1

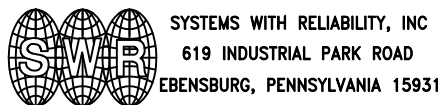
1521D23
INTER. BAY
GROUNDING BRACKET W/
(1) 3/8-16 X 2.50" U-BOLT
(2) 3/8" FLAT WASHERS
(2) 3/8" LOCK WASHERS
(2) 3/8-16 HEX HEAD NUTS
(2) #200-24 HOSE CLAMPS
TYP. 2 PLACES



SIDE VIEW
BAY 1

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:

FMI3/4-DA, FREQ. 88.1
WNEE, PATTERSON, GA

MATERIAL:

BAY 1
PARASITIC PLACEMENT

SIZE

A

PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: RAC

DATE: 2/14/11

SHEET 1 OF 1

DRAWING
NUMBER:

1512D02

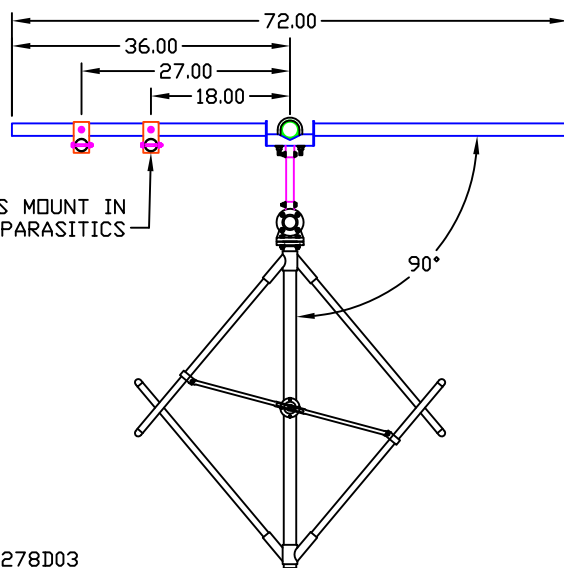
NOTE:

Exhibit 7 (cont'd): Drawings

DRAWING
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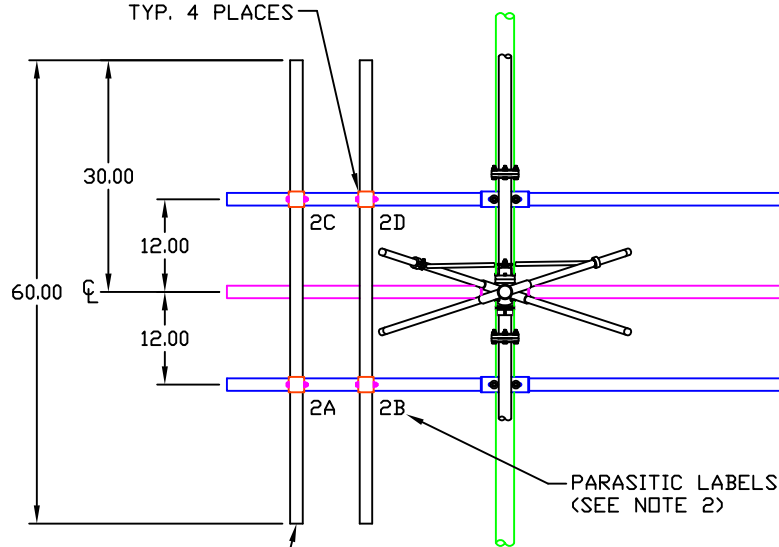
1512D03

VERTICAL PARASITICS MOUNT IN
FRONT OF HORIZONTAL PARASITICS



TOP VIEW
BAY 2

1278D03
PARASITIC POLY BLOCK W/
(1) 1/4-20 X 2.75" H.H.C.S.
(2) 1/4" FLAT WASHERS
(1) 1/4" LOCK WASHER
(1) 1/4-20 HEX HEAD NUT
TYP. 4 PLACES



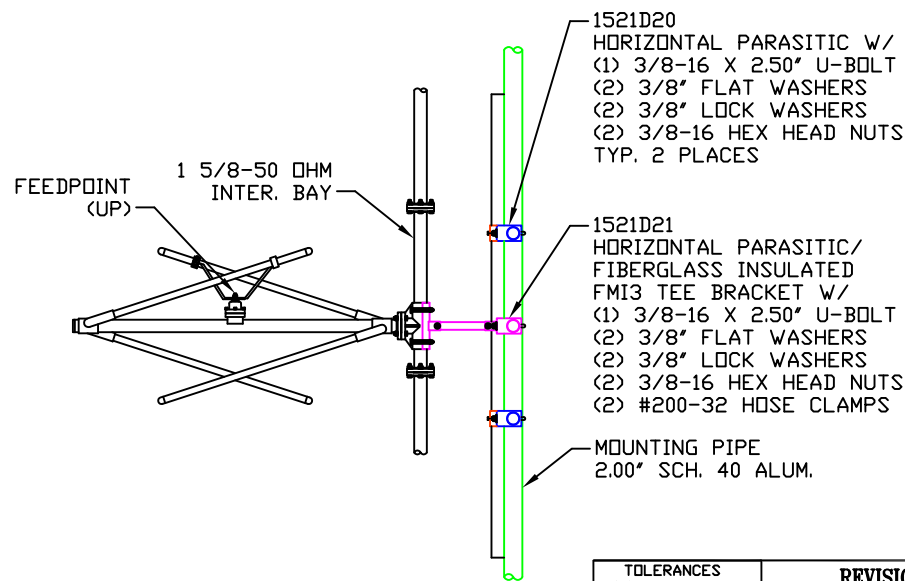
FRONT VIEW
BAY 2

Ø1.625 X 60.00" LONG
VERTICAL PARASITIC
TYP. 2 PLACES

PARASITIC LABELS
(SEE NOTE 2)

NOTES:

1. THE VERTICAL PARASITICS MOUNT IN FRONT OF THE HORIZONTAL PARASITICS AS SHOWN.
2. THE PARASITICS AND POLY BLOCKS ARE FACTORY DRILLED & LABELED, ASSEMBLE THE PARASITICS WITH CORRESPONDING LABELS AS SHOWN IN THE FRONT VIEW.



SIDE VIEW
BAY 2

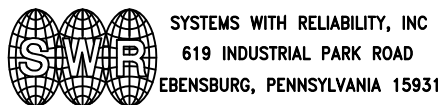
1521D20
HORIZONTAL PARASITIC W/
(1) 3/8-16 X 2.50" U-BOLT
(2) 3/8" FLAT WASHERS
(2) 3/8" LOCK WASHERS
(2) 3/8-16 HEX HEAD NUTS
TYP. 2 PLACES

1521D21
HORIZONTAL PARASITIC/
FIBERGLASS INSULATED
FMI3 TEE BRACKET W/
(1) 3/8-16 X 2.50" U-BOLT
(2) 3/8" FLAT WASHERS
(2) 3/8" LOCK WASHERS
(2) 3/8-16 HEX HEAD NUTS
(2) #200-32 HOSE CLAMPS

MOUNTING PIPE
2.00" SCH. 40 ALUM.

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:

FMI3/4-DA, FREQ. 88.1
WNEE, PATTERSON, GA

MATERIAL:

BAY 2
PARASITIC PLACEMENT

SIZE

A

PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: RAC

DATE: 2/14/11

SHEET 1 OF 1

DRAWING
NUMBER:

1512D03

NOTE:

Exhibit 7 (cont'd): Drawings

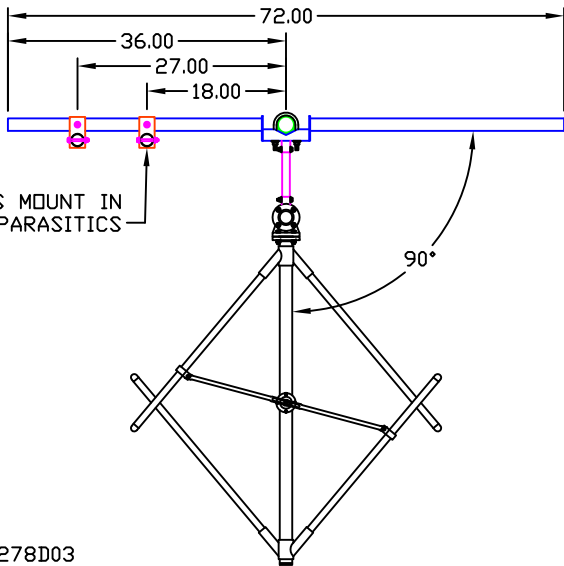
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NUMBER:

1512D04

NOTES:

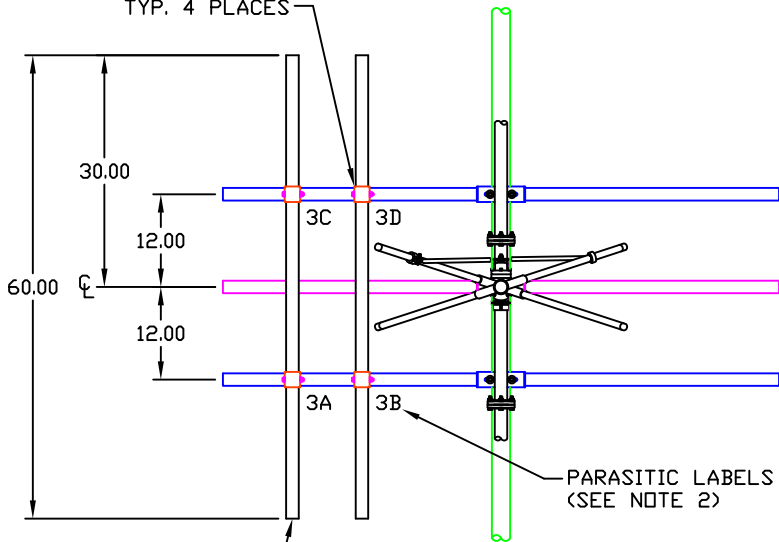
1. THE VERTICAL PARASITICS MOUNT IN FRONT OF THE HORIZONTAL PARASITICS AS SHOWN.
2. THE PARASITICS AND POLY BLOCKS ARE FACTORY DRILLED & LABELED, ASSEMBLE THE PARASITICS WITH CORRESPONDING LABELS AS SHOWN IN THE FRONT VIEW.

VERTICAL PARASITICS MOUNT IN
FRONT OF HORIZONTAL PARASITICS



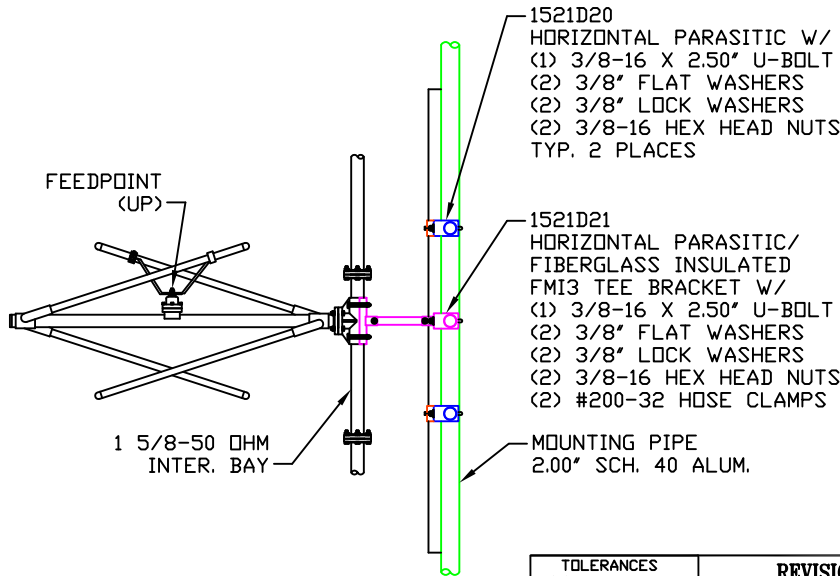
TOP VIEW
BAY 3

1278D03
PARASITIC POLY BLOCK W/
(1) 1/4-20 X 2.75" H.H.C.S.
(2) 1/4" FLAT WASHERS
(1) 1/4" LOCK WASHER
(1) 1/4-20 HEX HEAD NUT
TYP. 4 PLACES



Ø1.625 X 60.00" LONG
VERTICAL PARASITIC
TYP. 2 PLACES

FRONT VIEW
BAY 3



SIDE VIEW
BAY 3

TOLERANCES		REVISION RECORD	
.X ± .015	REV	APPROVAL	DATE
.XX ± .005			
.XXX ± .002			
x/x ± 1/32			
DEG. ± 1/2			
UNLESS OTHERWISE SPECIFIED			
DRAWING NUMBER: 1512D04			
DATE: 2/14/11		SHEET 1 OF 1	



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

TITLE:

FMI3/4-DA, FREQ. 88.1
WNEE, PATTERSON, GA

MATERIAL:

BAY 3
PARASITIC PLACEMENT

SIZE

A

PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: RAC

DATE _____

2/14/11 SHEET 1 OF 1

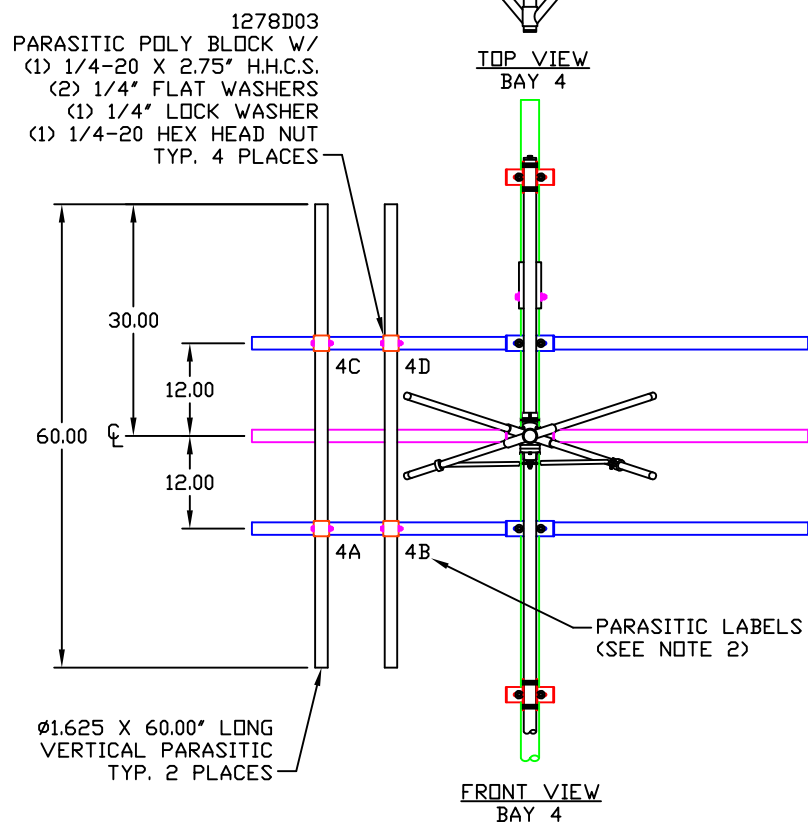
NOTE:

Exhibit 7 (cont'd): Drawings

DRAWING
NUMBER:

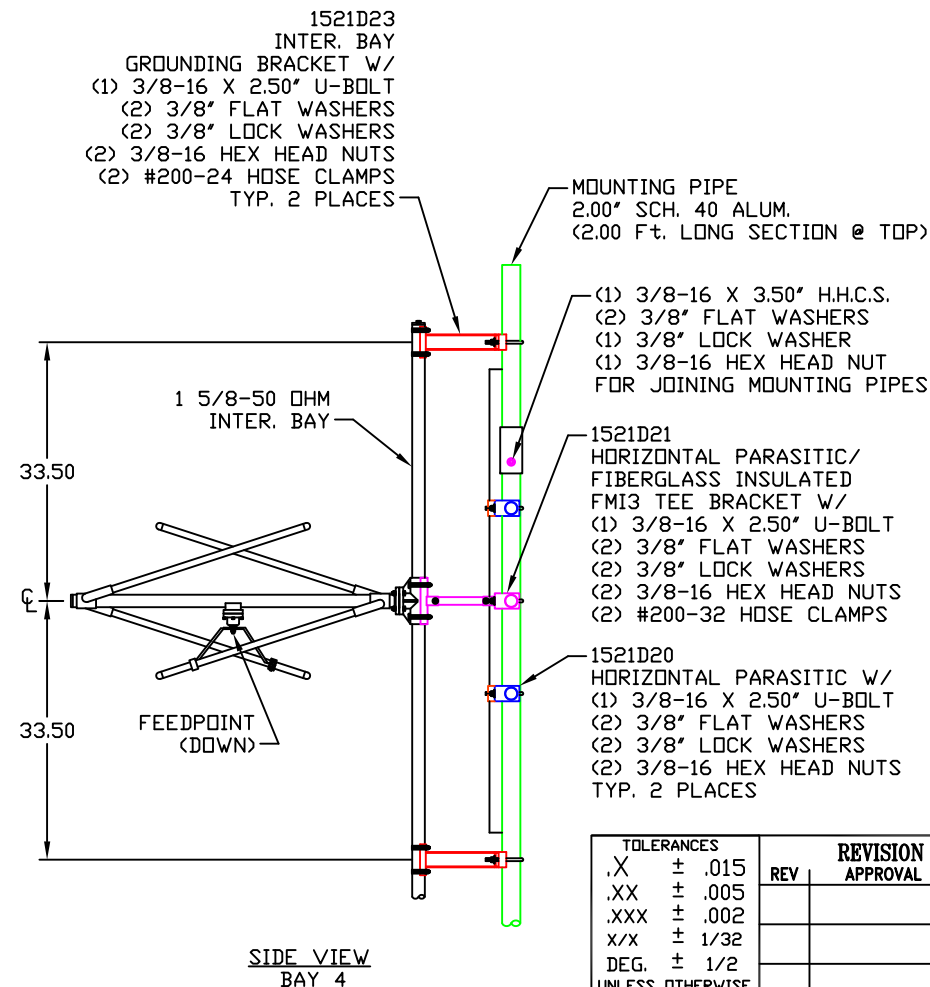
1512D05

VERTICAL PARASITICS MOUNT IN
FRONT OF HORIZONTAL PARASITICS



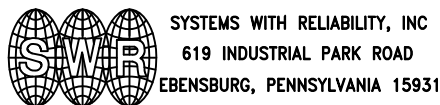
NOTES:

1. THE VERTICAL PARASITICS MOUNT IN FRONT OF THE HORIZONTAL PARASITICS AS SHOWN.
2. THE PARASITICS AND POLY BLOCKS ARE FACTORY DRILLED & LABELED, ASSEMBLE THE PARASITICS WITH CORRESPONDING LABELS AS SHOWN IN THE FRONT VIEW.



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

REVISION RECORD		
REV	APPROVAL	DATE



TITLE:	FMI3/4-DA, FREQ. 88.1 WNEE, PATTERSON, GA
MATERIAL:	BAY 4 PARASITIC PLACEMENT

SIZE
A

PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: RAC

DATE: 2/14/11

SHEET 1 OF 1

DRAWING
NUMBER:

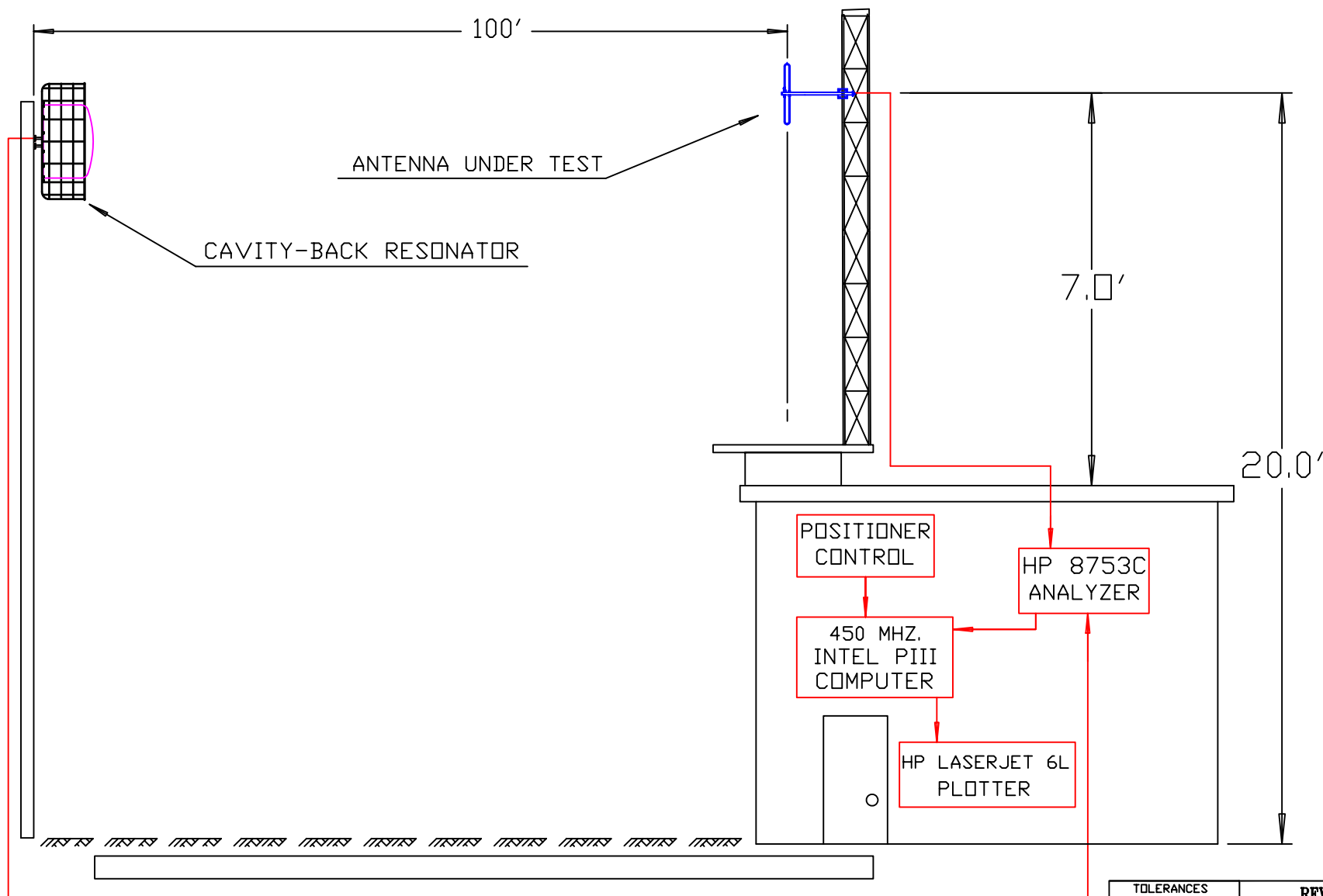
1512D05

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