



SYSTEMS WITH RELIABILITY, LTD.
Broadcast Antenna and Transmission Systems

PATTERN CERTIFICATION

DIRECTIONAL FM ANTENNA WHMA May 2, 2005

Call Sign	:	WHMA
Location	:	Hobson City, AL
Frequency	:	95.5 MHz
Channel	:	238
Antenna Model	:	FM3/4-DA
Maximum Antenna Gain	:	
Horizontal	:	4.146/ 6.177 dB
Vertical	:	4.146/ 6.177 dB

ANTENNA DESCRIPTION

A custom designed **FM3/4-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 vertical and horizontal parasitic system. The array is comprised of **four** bays, that are spaced a full wavelength apart, mounted to a tower pointing **42** degrees true north.

DESCRIPTION OF TEST PROCEDURE

Mounting

The antenna under test consists of an exactly replicated third scale single bay model that is circular polarized. The test model was mounted to an exact replicated third-scale model tower in accordance with tower drawings supplied by the customer. Mounting brackets that were used in the modeling were supplied with the finalized antenna. The tower was placed 20 ft. high on a wooden platform. All feed cables are properly grounded during pattern testing. The receive antenna is a Cavity Back Resonator mounted 100 feet from the test antenna on a wooden tower. The height of the receiver was adjusted to provide a uniform field at the test antenna location.

Test Procedure

The vertical and horizontal azimuth patterns were measured and recorded independently using a manual vertical / horizontal switch connected to the receive antenna. The antenna under test was operated in the transmit mode at a frequency of 286.5 MHz ($95.5 \text{ MHz} \times 3 = 286.5 \text{ MHz}$). A gain reference was made using a dipole tuned to 286.5 MHz. The antenna under test was rotated in a clockwise direction and the measured values were recorded and plotted onto a circular graph at every 5 degrees in the vertical and horizontal fields. Vertical and horizontal parasitics were used to achieve the desired FCC file number **BPH-20040521AEP** construction permit pattern. At no point does the received signal exceed a maximum to minimum ratio of 15 dB.

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

TEST EQUIPMENT

Network Analyzer	:	Hewlett Packard Model # 8753C Serial Number : 08753 – 69138
Computer	:	450 MHz Intel PIII
Plotter	:	Hewlett-Packard Laser Jet 6L
Positioner	:	Antenna Positioner Orbit AL-860-1 Position Controller Orbit AL-4901-3A

The test equipment is calibrated in accordance to ANSI / NCSL Z540-1-1994

Prepared by:



Jagannath G Shanbhag
Electrical Engineer
Department of Engineering
SWR Inc.

TEST RESULTS

The attached calculations verify that the **RMS** value of this antenna is **89.59 %** of the **RMS** value of the pattern authorized in the related construction permit **BPH-20040521AEP**. The vertical component **RMS** value is **0.622** and the horizontal component **RMS** value is **0.774**.

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

Measured horizontal polarized directivity	:	1.66802 / 2.22 dB
Measured vertical polarized directivity	:	2.58808 / 4.13 dB
Measured composite azimuth pattern directivity	:	2.5755 / 4.1086 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:

H-Pol. Gain = (1.66802)(4.088)(0.608087) = **4.146 / 6.177 dB**

V-Pol. Gain = (2.58808)(4.088)(0.391913) = **4.146 / 6.177 dB**

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **30 meters** above ground level. The antenna (parasitic system included) aperture is **30.89 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 **42 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
0405D00	ELEVATION WITH PARASITICS
0405D01	ANTENNA ORIENTATION
0405D05	PARASITIC PLACEMENT
2105A10	TEST RANGE SCHEMATIC

The array shall be mounted according to **DWG. 0405D00**. The parasitic assembly is shown in **DWG. 0405D01 AND DWG. 0405D05**. The antenna elements shall be aligned at the same heading as in **DWG. 0405D01**. This will ensure that the antenna is oriented properly at **42** degrees true north.



SYSTEMS WITH RELIABILITY, INC.
Broadcast Antennas and Transmission Systems

WHMA Antenna RMS Comparison

PROPOSED ANTENNA

Azimuth Heading	Relative Field
0	1.000
10	1.000
20	1.000
30	1.000
40	1.000
50	1.000
60	1.000
70	0.950
80	0.890
90	0.870
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	0.827
210	0.657
220	0.522
230	0.415
240	0.330
250	0.290
260	0.300

DESIGNED ANTENNA

Azimuth Heading	Relative Field
0	1.000
10	1.000
20	1.000
30	1.000
40	0.994
50	0.960
60	0.914
70	0.860
80	0.798
90	0.763
100	0.784
110	0.835
120	0.902
130	0.952
140	0.971
150	0.967
160	0.932
170	0.830
180	0.737
190	0.636
200	0.568
210	0.472
220	0.385
230	0.329
240	0.264
250	0.269
260	0.295

PROPOSED ANTENNA

Azimuth Heading	Relative Field
270	0.350
280	0.440
290	0.553
300	0.696
310	0.876
320	1.000
330	1.000
340	1.000
350	1.000

Sum of Relative Field Squared : 27.168

Sum Divided by 36 (Readings) : 0.755

Square Root : 0.869

Percentage of Construction Permit Antenna Filled :

DESIGNED ANTENNA

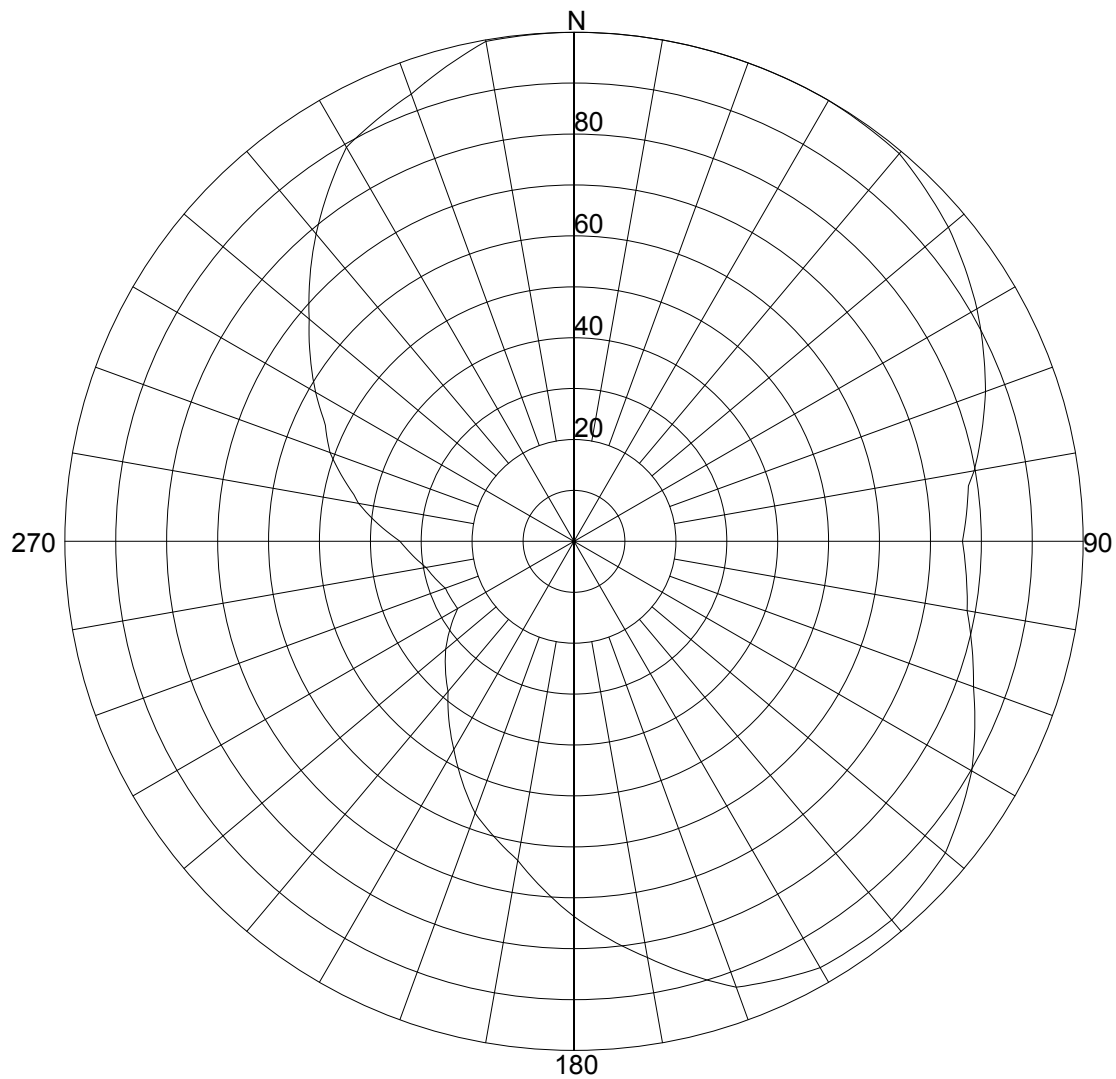
Azimuth Heading	Relative Field
270	0.342
280	0.430
290	0.510
300	0.586
310	0.679
320	0.788
330	0.894
340	0.935
350	0.997

Sum of Relative Field Squared : 21.804

Sum Divided by 36 (Readings) : 0.606

Square Root : 0.778

89.59%



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *Energy-Onix, WHMA*

Date: 4/29/2005

ANTENNA TYPE: FM3/4-DA

FREQUENCY: 95.5

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.5755 / 4.1086dB

PATTERN RMS: 0.623

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	1.0000 (0.01)	180	.7370 (-2.64)
5	1.0000 (0.01)	185	.6865 (-3.25)
10	1.0000 (0.01)	190	.6360 (-3.92)
15	1.0000 (0.01)	195	.6020 (-4.39)
20	1.0000 (0.01)	200	.5680 (-4.9)
25	1.0000 (0.01)	205	.5200 (-5.66)
30	1.0000 (0.01)	210	.4720 (-6.5)
35	.9970 (-0.02)	215	.4285 (-7.34)
40	.9940 (-0.04)	220	.3850 (-8.27)
45	.9770 (-0.19)	225	.3570 (-8.92)
50	.9600 (-0.35)	230	.3290 (-9.63)
55	.9370 (-0.56)	235	.2965 (-10.53)
60	.9140 (-0.77)	240	.2640 (-11.54)
65	.8870 (-1.03)	245	.2665 (-11.45)
70	.8600 (-1.3)	250	.2690 (-11.37)
75	.8290 (-1.62)	255	.2820 (-10.96)
80	.7980 (-1.95)	260	.2950 (-10.57)
85	.7750 (-2.2)	265	.3181 (-9.92)
90	.7630 (-2.34)	270	.3420 (-9.29)
95	.7735 (-2.22)	275	.3856 (-8.25)
100	.7840 (-2.1)	280	.4300 (-7.31)
105	.8095 (-1.82)	285	.4675 (-6.59)
110	.8350 (-1.56)	290	.5100 (-5.83)
115	.8685 (-1.21)	295	.5390 (-5.35)
120	.9020 (-0.89)	300	.5860 (-4.63)
125	.9270 (-0.65)	305	.6325 (-3.97)
130	.9520 (-0.42)	310	.6790 (-3.35)
135	.9615 (-0.33)	315	.7335 (-2.68)
140	.9710 (-0.25)	320	.7880 (-2.06)
145	.9690 (-0.26)	325	.8410 (-1.49)
150	.9670 (-0.28)	330	.8940 (-0.96)
155	.9495 (-0.44)	335	.9145 (-0.77)
160	.9320 (-0.6)	340	.9350 (-0.57)
165	.8810 (-1.09)	345	.9660 (-0.29)
170	.8300 (-1.61)	350	.9970 (-0.02)
175	.7835 (-2.11)	355	.9985 (0)

Systems With Reliability

CLIENT: *Energy-Onix, WHMA*

Date: 4/29/2005

ANTENNA TYPE: FM3/4-DA

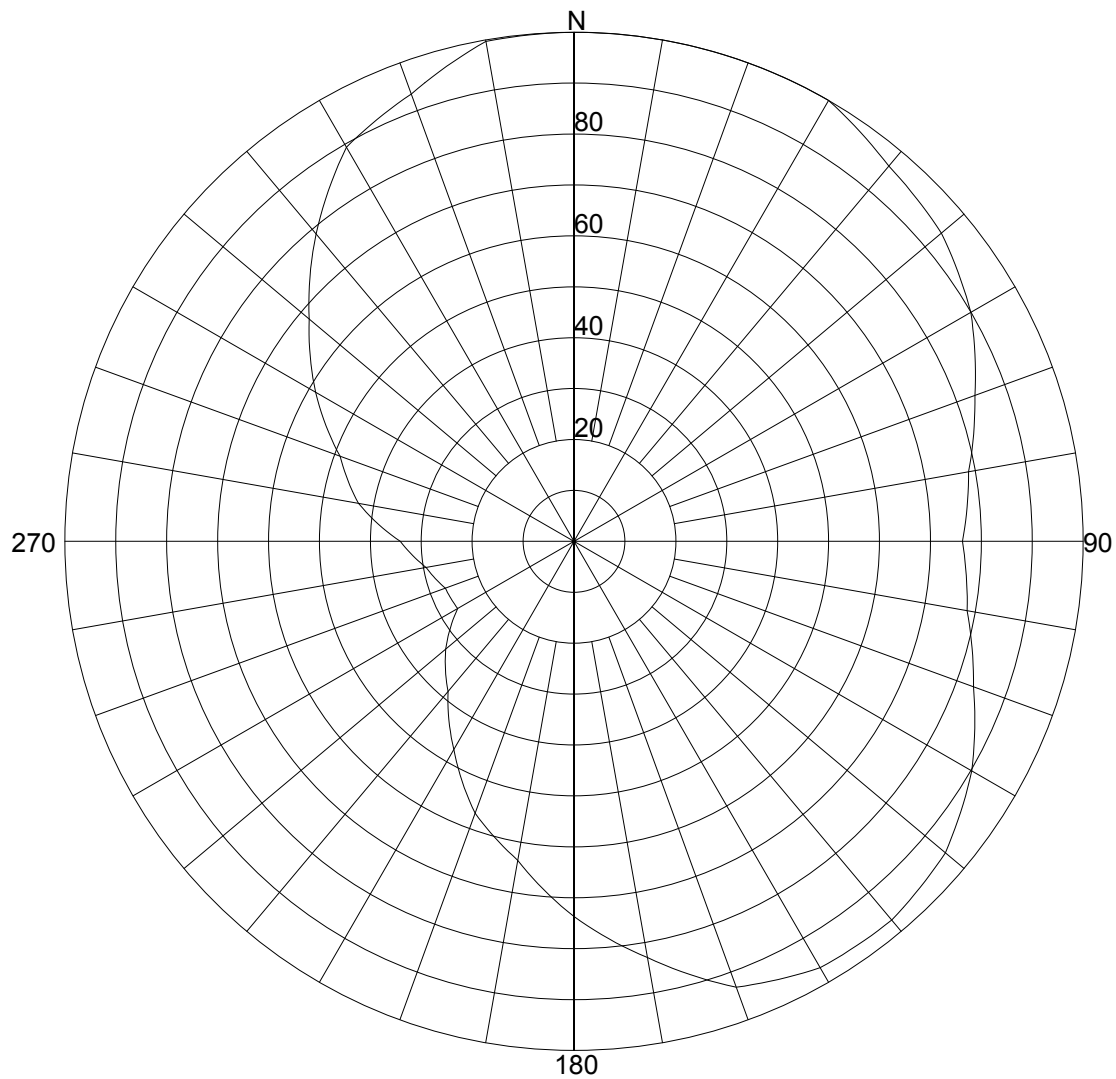
FREQUENCY: 95.5

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.5755 / 4.1086dB

PATTERN RMS: 0.623



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *Energy-Onix, WHMA*

Date: 4/29/2005

ANTENNA TYPE: FM3/4-DA

FREQUENCY: 95.5

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.66802 / 2.22dB

PATTERN RMS: 0.774

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	1.0000 (0.01)	180	.7370 (-2.64)
5	1.0000 (0.01)	185	.6865 (-3.25)
10	1.0000 (0.01)	190	.6360 (-3.92)
15	1.0000 (0.01)	195	.6020 (-4.39)
20	1.0000 (0.01)	200	.5680 (-4.9)
25	1.0000 (0.01)	205	.5200 (-5.66)
30	1.0000 (0.01)	210	.4720 (-6.5)
35	.9810 (-0.16)	215	.4285 (-7.34)
40	.9620 (-0.33)	220	.3850 (-8.27)
45	.9520 (-0.42)	225	.3570 (-8.92)
50	.9420 (-0.51)	230	.3290 (-9.63)
55	.9210 (-0.71)	235	.2965 (-10.53)
60	.9000 (-0.91)	240	.2640 (-11.54)
65	.8690 (-1.21)	245	.2665 (-11.45)
70	.8380 (-1.52)	250	.2690 (-11.37)
75	.8125 (-1.79)	255	.2820 (-10.96)
80	.7870 (-2.07)	260	.2950 (-10.57)
85	.7750 (-2.2)	265	.3181 (-9.92)
90	.7630 (-2.34)	270	.3412 (-9.31)
95	.7735 (-2.22)	275	.3856 (-8.25)
100	.7840 (-2.1)	280	.4300 (-7.31)
105	.8095 (-1.82)	285	.4595 (-6.74)
110	.8350 (-1.56)	290	.4890 (-6.2)
115	.8685 (-1.21)	295	.5375 (-5.38)
120	.9020 (-0.89)	300	.5860 (-4.63)
125	.9270 (-0.65)	305	.6325 (-3.97)
130	.9520 (-0.42)	310	.6790 (-3.35)
135	.9615 (-0.33)	315	.7335 (-2.68)
140	.9710 (-0.25)	320	.7880 (-2.06)
145	.9690 (-0.26)	325	.8410 (-1.49)
150	.9670 (-0.28)	330	.8940 (-0.96)
155	.9495 (-0.44)	335	.9145 (-0.77)
160	.9320 (-0.6)	340	.9350 (-0.57)
165	.8810 (-1.09)	345	.9660 (-0.29)
170	.8300 (-1.61)	350	.9970 (-0.02)
175	.7835 (-2.11)	355	.9985 (0)

Systems With Reliability

CLIENT: *Energy-Onix, WHMA*

Date: 4/29/2005

ANTENNA TYPE: FM3/4-DA

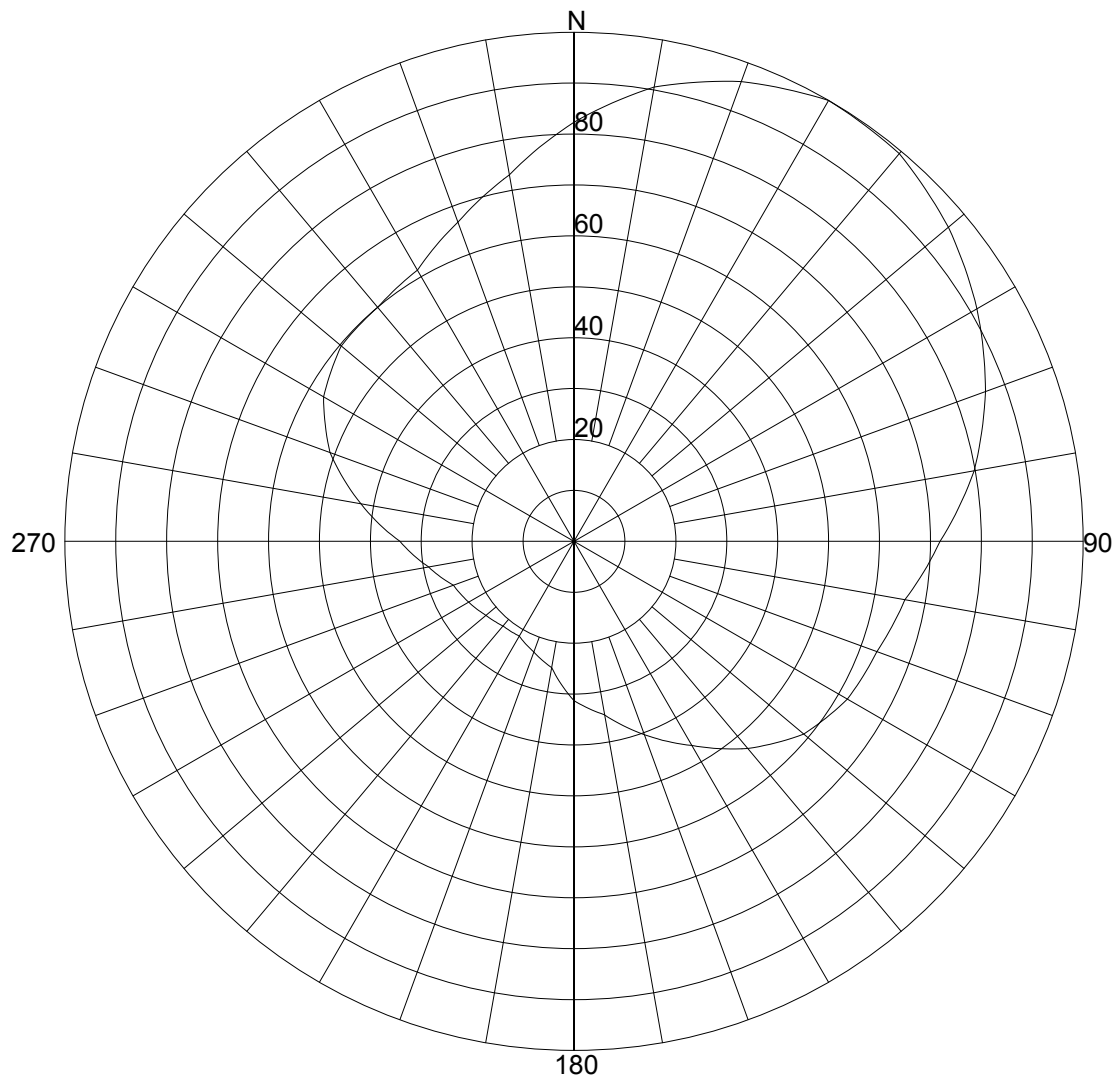
FREQUENCY: 95.5

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.66802 / 2.22dB

PATTERN RMS: 0.774



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *Energy-Onix, WHMA*

Date: 4/28/2005

ANTENNA TYPE: FM3/4-DA

FREQUENCY: 95.5

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.58808 / 4.13dB

PATTERN RMS: 0.622

Relative Field Tabulation(Azimuth)

Azimuth Heading	Relative Field(dB)	Azimuth Heading	Relative Field(dB)
0	.8230 (-1.68)	180	.3130 (-10.06)
5	.8645 (-1.25)	185	.2825 (-10.95)
10	.9060 (-0.85)	190	.2520 (-11.94)
15	.9335 (-0.59)	195	.2415 (-12.31)
20	.9610 (-0.34)	200	.2310 (-12.69)
25	.9805 (-0.16)	205	.2230 (-13)
30	1.0000 (0.01)	210	.2150 (-13.31)
35	.9970 (-0.02)	215	.2160 (-13.27)
40	.9940 (-0.04)	220	.2170 (-13.23)
45	.9770 (-0.19)	225	.2215 (-13.05)
50	.9600 (-0.35)	230	.2260 (-12.88)
55	.9370 (-0.56)	235	.2325 (-12.63)
60	.9140 (-0.77)	240	.2390 (-12.4)
65	.8870 (-1.03)	245	.2455 (-12.16)
70	.8600 (-1.3)	250	.2520 (-11.94)
75	.8290 (-1.62)	255	.2710 (-11.31)
80	.7980 (-1.95)	260	.2900 (-10.72)
85	.7585 (-2.39)	265	.3160 (-9.98)
90	.7190 (-2.85)	270	.3420 (-9.29)
95	.6895 (-3.22)	275	.3835 (-8.3)
100	.6600 (-3.6)	280	.4250 (-7.41)
105	.6465 (-3.78)	285	.4675 (-6.59)
110	.6330 (-3.96)	290	.5100 (-5.83)
115	.6265 (-4.05)	295	.5390 (-5.35)
120	.6200 (-4.14)	300	.5680 (-4.9)
125	.6045 (-4.36)	305	.5825 (-4.68)
130	.5890 (-4.58)	310	.5970 (-4.47)
135	.5600 (-5.02)	315	.5985 (-4.44)
140	.5310 (-5.48)	320	.6000 (-4.42)
145	.4970 (-6.06)	325	.6075 (-4.31)
150	.4630 (-6.67)	330	.6150 (-4.21)
155	.4335 (-7.24)	335	.6410 (-3.85)
160	.4040 (-7.85)	340	.6670 (-3.5)
165	.3750 (-8.5)	345	.6990 (-3.1)
170	.3460 (-9.19)	350	.7310 (-2.71)
175	.3295 (-9.62)	355	.7770 (-2.18)

Systems With Reliability

CLIENT: *Energy-Onix, WHMA*

Date: 4/28/2005

ANTENNA TYPE: FM3/4-DA

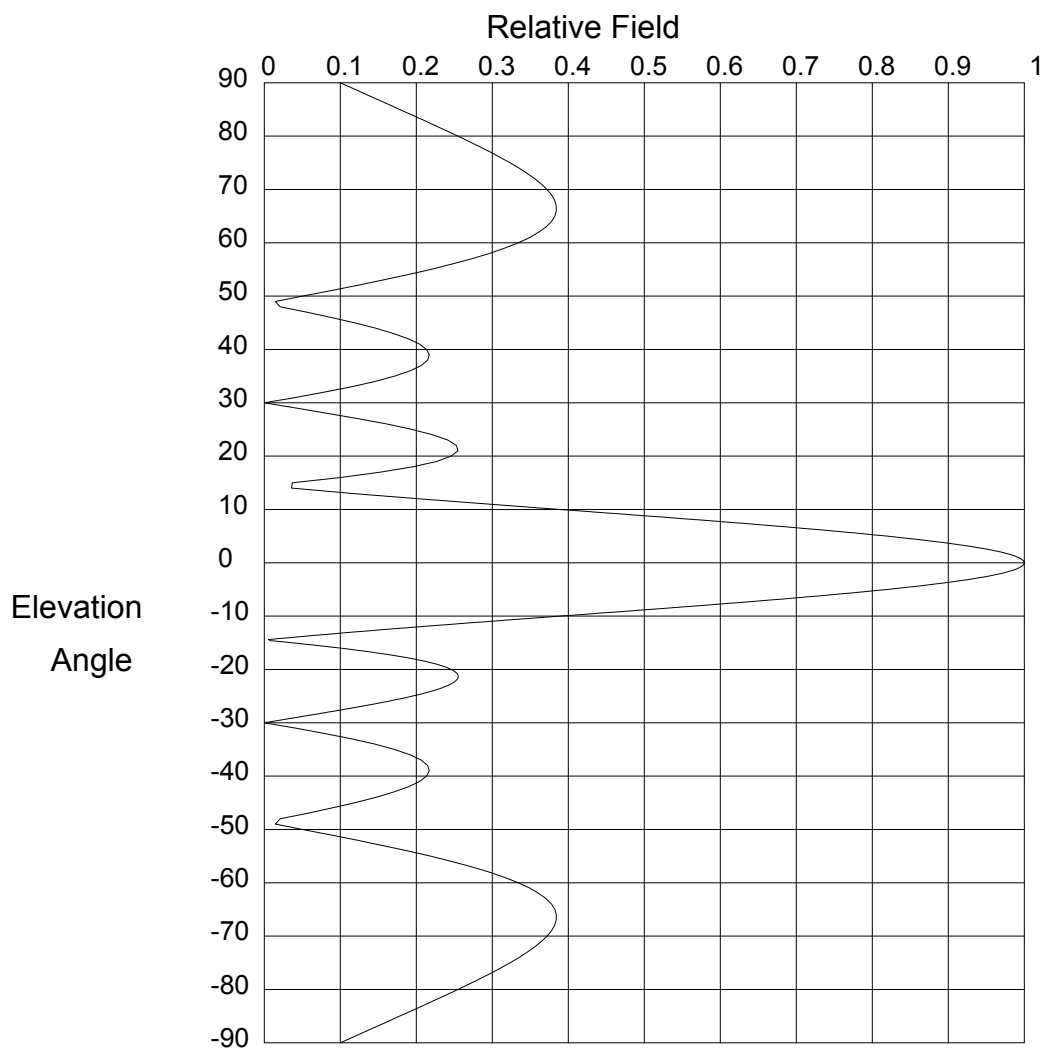
FREQUENCY: 95.5

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.58808 / 4.13dB

PATTERN RMS: 0.622



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: *Energy-Onix, WHMA*

Date: 2/11/2005

ANTENNA TYPE: FM3/4-DA

FREQUENCY: 95.5

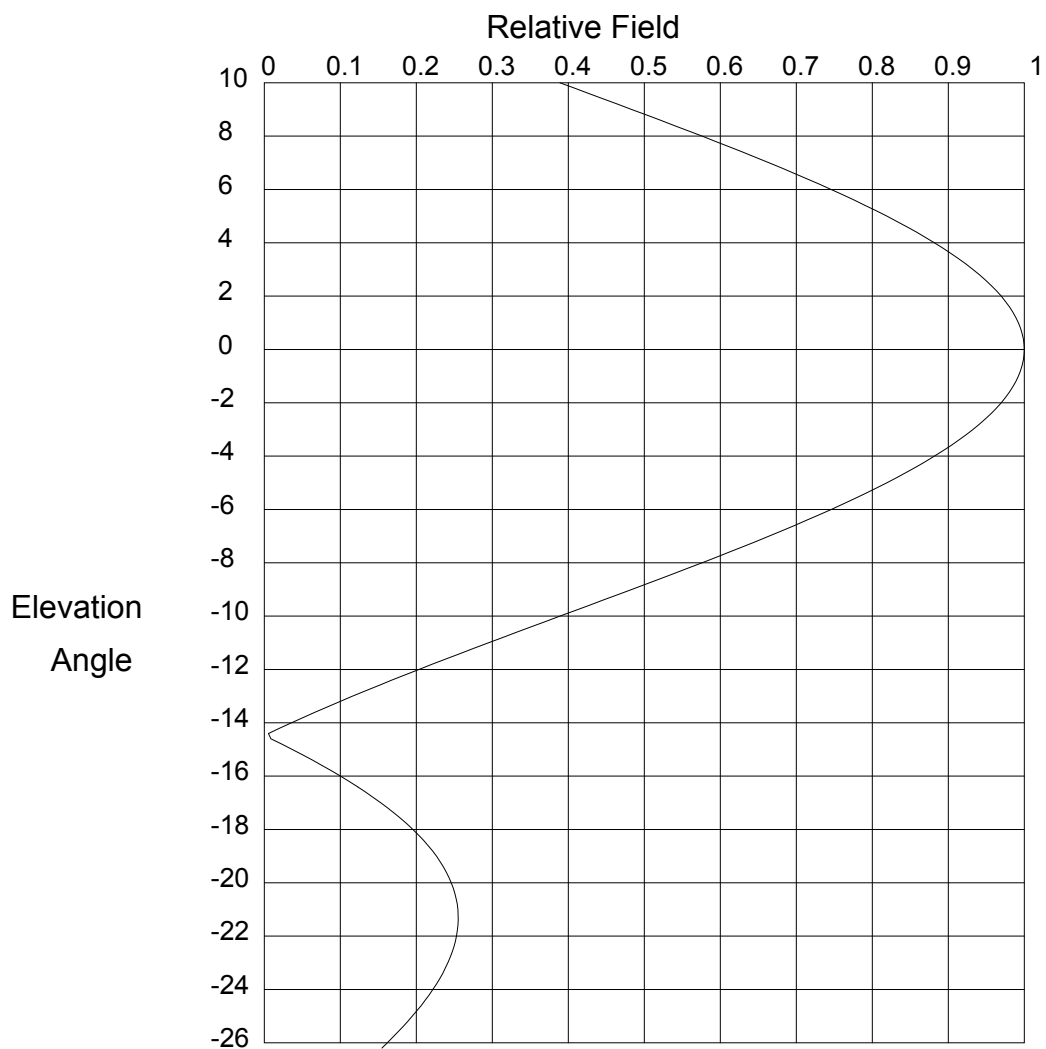
PATTERN POL.: Circular

DIRECTIVITY(Peak): 4.088/6.115 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 4.088/6.115 dBd

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



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: *Energy-Onix, WHMA*

Date: 2/11/2005

ANTENNA TYPE: FM3/4-DA

FREQUENCY: 95.5

PATTERN POL.: Circular

DIRECTIVITY(Peak): 4.088/6.115 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 4.088/6.115 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	.923 (-0.692)	-4.4	.858 (-1.329)	-12.0	.203 (-13.829)
3.0	.933 (-0.607)	-4.6	.846 (-1.457)	-12.2	.186 (-14.626)
2.8	.941 (-0.528)	-4.8	.833 (-1.591)	-12.4	.168 (-15.493)
2.6	.949 (-0.454)	-5.0	.819 (-1.733)	-12.6	.151 (-16.444)
2.4	.956 (-0.386)	-5.2	.805 (-1.881)	-12.8	.133 (-17.497)
2.2	.963 (-0.324)	-5.4	.791 (-2.036)	-13.0	.116 (-18.677)
2.0	.97 (-0.268)	-5.6	.776 (-2.199)	-13.2	.10 (-20.021)
1.8	.975 (-0.216)	-5.8	.761 (-2.368)	-13.4	.083 (-21.584)
1.6	.981 (-0.171)	-6.0	.746 (-2.546)	-13.6	.067 (-23.455)
1.4	.985 (-0.131)	-6.2	.73 (-2.731)	-13.8	.051 (-25.792)
1.2	.989 (-0.096)	-6.4	.714 (-2.924)	-14.0	.036 (-28.925)
1.0	.992 (-0.067)	-6.6	.698 (-3.125)	-14.2	.021 (-33.736)
.8	.995 (-0.043)	-6.8	.681 (-3.335)	-14.4	.006 (-44.914)
.6	.997 (-0.024)	-7.0	.664 (-3.554)	-14.6	.009 (-41.043)
.4	.999 (-0.011)	-7.2	.647 (-3.782)	-14.8	.023 (-32.742)
.2	1.00 (-0.003)	-7.4	.63 (-4.019)	-15.0	.037 (-28.661)
.0	1.00 (0)	-7.6	.612 (-4.266)	-15.2	.05 (-25.959)
-.2	1.00 (-0.003)	-7.8	.594 (-4.524)	-15.4	.063 (-23.954)
-.4	.999 (-0.011)	-8.0	.576 (-4.792)	-15.6	.076 (-22.37)
-.6	.997 (-0.024)	-8.2	.558 (-5.071)	-15.8	.088 (-21.07)
-.8	.995 (-0.043)	-8.4	.539 (-5.362)	-16.0	.10 (-19.974)
-1.0	.992 (-0.067)	-8.6	.521 (-5.665)	-16.2	.112 (-19.034)
-1.2	.989 (-0.096)	-8.8	.502 (-5.981)	-16.4	.123 (-18.214)
-1.4	.985 (-0.131)	-9.0	.484 (-6.311)	-16.6	.133 (-17.493)
-1.6	.981 (-0.171)	-9.2	.465 (-6.656)	-16.8	.144 (-16.854)
-1.8	.975 (-0.216)	-9.4	.446 (-7.015)	-17.0	.153 (-16.282)
-2.0	.97 (-0.268)	-9.6	.427 (-7.391)	-17.2	.163 (-15.77)
-2.2	.963 (-0.324)	-9.8	.408 (-7.785)	-17.4	.172 (-15.308)
-2.4	.956 (-0.386)	-10.0	.389 (-8.198)	-17.6	.18 (-14.891)
-2.6	.949 (-0.454)	-10.2	.37 (-8.63)	-17.8	.188 (-14.514)
-2.8	.941 (-0.528)	-10.4	.351 (-9.085)	-18.0	.196 (-14.173)
-3.0	.933 (-0.607)	-10.6	.333 (-9.563)	-18.2	.203 (-13.864)
-3.2	.923 (-0.692)	-10.8	.314 (-10.068)	-18.4	.209 (-13.584)
-3.4	.914 (-0.783)	-11.0	.295 (-10.601)	-18.6	.215 (-13.331)
-3.6	.904 (-0.88)	-11.2	.276 (-11.166)	-18.8	.221 (-13.103)
-3.8	.893 (-0.983)	-11.4	.258 (-11.767)	-19.0	.226 (-12.899)
-4.0	.882 (-1.092)	-11.6	.24 (-12.407)	-19.2	.231 (-12.716)
-4.2	.87 (-1.207)	-11.8	.222 (-13.092)	-19.4	.236 (-12.553)

Systems With Reliability

Page 1 of 2

CLIENT: *Energy-Onix, WHMA*

Date: 2/11/2005

ANTENNA TYPE: FM3/4-DA

FREQUENCY: 95.5

PATTERN POL.: Circular

DIRECTIVITY(Peak): 4.088/6.115 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 4.088/6.115 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	.24 (-12.41)	-27.2	.117 (-18.664)	-54.0	.188 (-14.511)
-19.8	.243 (-12.285)	-27.4	.109 (-19.281)	-55.0	.219 (-13.205)
-20.0	.246 (-12.177)	-27.6	.101 (-19.954)	-56.0	.247 (-12.148)
-20.2	.249 (-12.087)	-27.8	.092 (-20.691)	-57.0	.273 (-11.282)
-20.4	.251 (-12.012)	-28.0	.084 (-21.504)	-58.0	.296 (-10.571)
-20.6	.253 (-11.952)	-28.2	.076 (-22.408)	-59.0	.317 (-9.989)
-20.8	.254 (-11.908)	-28.4	.067 (-23.424)	-60.0	.334 (-9.515)
-21.0	.255 (-11.878)	-28.6	.059 (-24.581)	-61.0	.349 (-9.134)
-21.2	.255 (-11.862)	-28.8	.051 (-25.921)	-62.0	.362 (-8.836)
-21.4	.255 (-11.861)	-29.0	.042 (-27.509)	-63.0	.371 (-8.611)
-21.6	.255 (-11.873)	-29.2	.034 (-29.455)	-64.0	.378 (-8.452)
-21.8	.254 (-11.899)	-29.4	.025 (-31.965)	-65.0	.382 (-8.352)
-22.0	.253 (-11.938)	-29.6	.017 (-35.502)	-66.0	.384 (-8.305)
-22.2	.251 (-11.99)	-29.8	.008 (-41.542)	-67.0	.384 (-8.309)
-22.4	.25 (-12.056)	-30.0	.00 (-50)	-68.0	.382 (-8.359)
-22.6	.247 (-12.136)	-31.0	.041 (-27.75)	-69.0	.378 (-8.453)
-22.8	.245 (-12.228)	-32.0	.08 (-21.983)	-70.0	.372 (-8.587)
-23.0	.242 (-12.335)	-33.0	.115 (-18.8)	-71.0	.365 (-8.759)
-23.2	.238 (-12.455)	-34.0	.146 (-16.728)	-72.0	.356 (-8.968)
-23.4	.235 (-12.588)	-35.0	.172 (-15.306)	-73.0	.346 (-9.212)
-23.6	.231 (-12.737)	-36.0	.192 (-14.331)	-74.0	.335 (-9.491)
-23.8	.226 (-12.899)	-37.0	.207 (-13.7)	-75.0	.323 (-9.803)
-24.0	.222 (-13.076)	-38.0	.215 (-13.353)	-76.0	.311 (-10.149)
-24.2	.217 (-13.269)	-39.0	.217 (-13.261)	-77.0	.298 (-10.528)
-24.4	.212 (-13.478)	-40.0	.214 (-13.409)	-78.0	.284 (-10.941)
-24.6	.206 (-13.703)	-41.0	.204 (-13.798)	-79.0	.269 (-11.39)
-24.8	.201 (-13.945)	-42.0	.19 (-14.446)	-80.0	.255 (-11.875)
-25.0	.195 (-14.205)	-43.0	.17 (-15.39)	-81.0	.24 (-12.4)
-25.2	.189 (-14.484)	-44.0	.146 (-16.7)	-82.0	.225 (-12.967)
-25.4	.182 (-14.783)	-45.0	.119 (-18.507)	-83.0	.209 (-13.581)
-25.6	.176 (-15.103)	-46.0	.088 (-21.083)	-84.0	.194 (-14.247)
-25.8	.169 (-15.446)	-47.0	.055 (-25.123)	-85.0	.178 (-14.973)
-26.0	.162 (-15.813)	-48.0	.021 (-33.591)	-86.0	.163 (-15.769)
-26.2	.155 (-16.207)	-49.0	.015 (-36.679)	-87.0	.147 (-16.648)
-26.4	.147 (-16.629)	-50.0	.051 (-25.907)	-88.0	.131 (-17.628)
-26.6	.14 (-17.082)	-51.0	.087 (-21.259)	-89.0	.116 (-18.733)
-26.8	.132 (-17.569)	-52.0	.122 (-18.296)	-90.0	.10 (-20)
-27.0	.125 (-18.095)	-53.0	.156 (-16.155)	90.0	.00 (-50)

Systems With Reliability

Page 2 of 2

CLIENT: *Energy-Onix, WHMA*

Date: 2/11/2005

ANTENNA TYPE: FM3/4-DA

FREQUENCY: 95.5

PATTERN POL.: Circular

DIRECTIVITY(Peak): 4.088/6.115 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 4.088/6.115 dBd

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



SYSTEMS WITH RELIABILITY, Inc.
Broadcast Antenna & Transmission Systems

SYSTEM DATA SHEET

Customer	Williams Communications, WHMA		
Contact	Walt Williams		
Location	Hobson City, AL		
Antenna Model	FM3/4-DA		
Channel / Frequency	95.5	MHz	
Shop Order No.	05111		

Polarization Type	Circular		
Polarization Ratio			
	H-Pol. (PRH)	60.8087	%
	V-Pol. (PRV)	39.1913	%
Elevation Directivity (ED)		4.088	
Azimuth Directivity (AD) H-Pol.		1.668	
Azimuth Directivity (AD) V-Pol.		2.588	
Antenna Gain (GH)			
	H-Pol. (GH)	4.146	
	V-Pol. (GV)	4.146	
dB Gain (AG)			
	H-Pol (AGH)	6.177	
	V-Pol (AGV)	6.177	
ERP			
	H-Pol. (ERPH)	0.530	kW
	V-Pol. (ERPV)	0.530	kW
Line Type	1 5/8-50 OHM AIR	HJ7-50A	
Attenuation per 100 ft.	0.202	dB/100ft	
Line Length (LL)	125.00	ft.	
Total Line Attenuation	0.25	dB	
Line Efficiency (LE)	94.35	%	
Line Loss (LPL)	0.01	kW	
Antenna Input Power (AIP)	0.13	kW	
Req'd. Transmitter Output Power	0.14	kW	

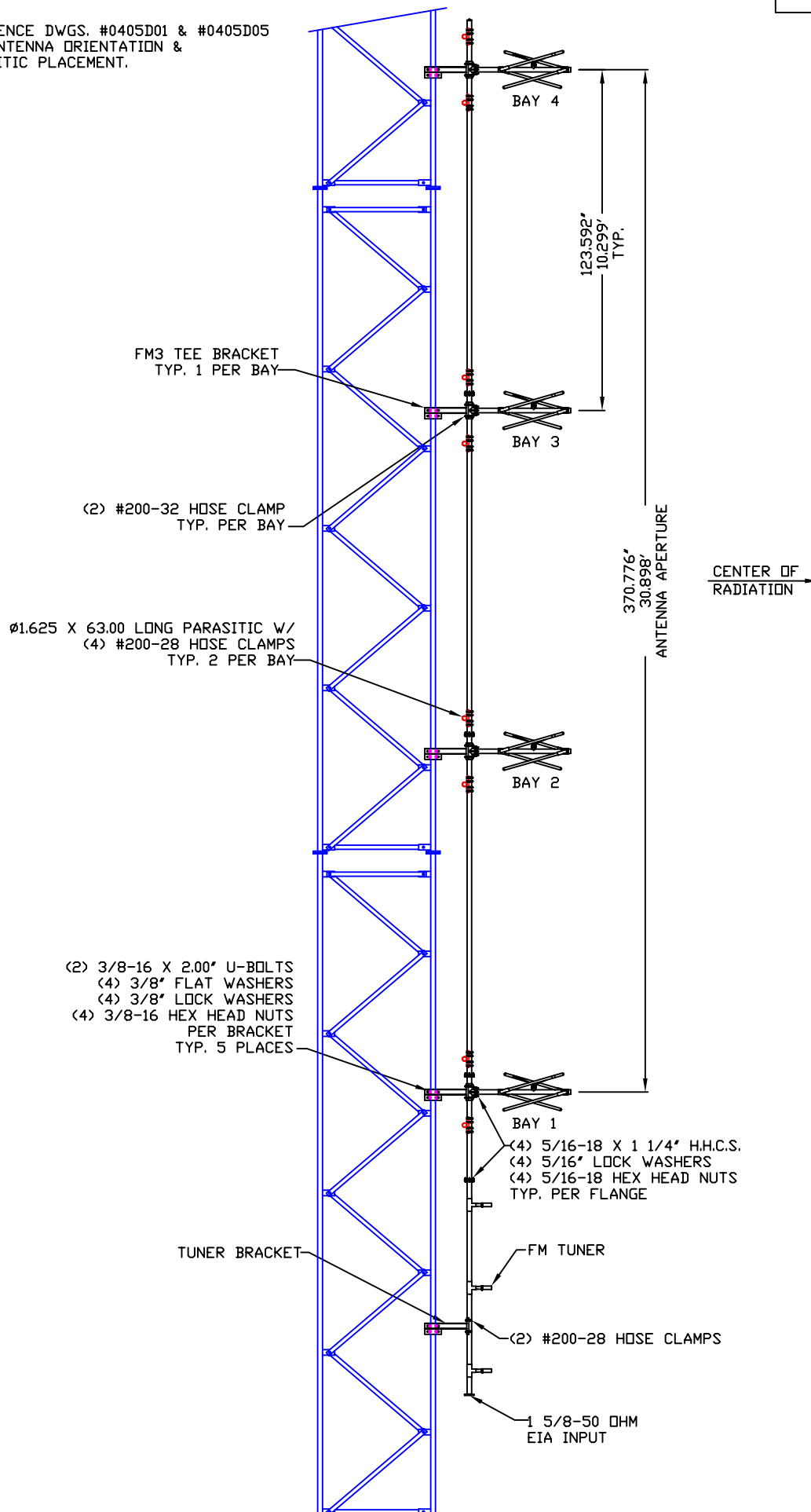
No. Of Bays	4			
Antenna Aperture	30.898	ft.	9.42	m
Center of Radiation AGL	98.40	ft.	30.00	m
Antenna Weight	140.00	lbs.	63.64	kg
Windload (50/33)	180.79	lbs.	82.18	kg
Total Wind Exposure Area	7.77	sq. ft	0.72186	sq. m.

Prepared by:

Jason Duncan

NOTE:

REFERENCE DWGS. #0405D01 & #0405D05
FOR ANTENNA ORIENTATION &
PARASITIC PLACEMENT.



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

TITLE: FM3/4-DA, FREQ. 95.5
WHMA, HOBSON CITY, AL

MATERIAL:

SIZE REV APPR. DATE
C 1
2
3

ENGINEER:

SCALE: NTS

NAME: RAC

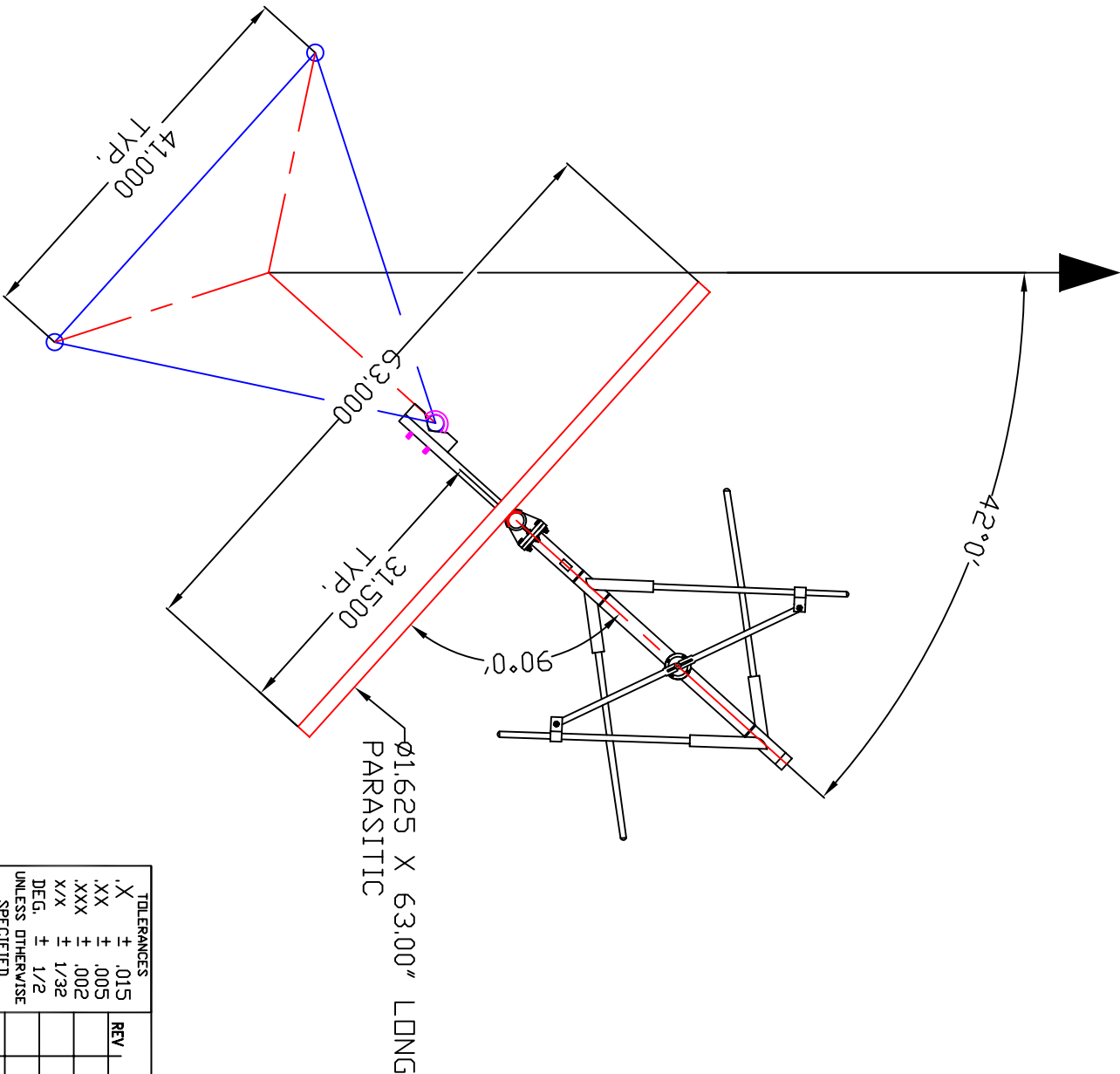
DATE: 5/3/05

SHEET 1 OF 1

DRAWING
NUMBER: 0405D00

NOTE:

TRUE
NORTH



TITLE:

FM3/4-DA, FREQ. 95.5
WHMA, HOBSON CITY, AL

MATERIAL:

ANTENNA
ORIENTATION

SIZE

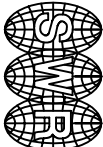
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TOLERANCES	
.X	± .015
.XX	± .005
.XXX	± .002
X/X	± 1/32
DEG.	± 1/2
UNLESS OTHERWISE SPECIFIED	

REVISION RECORD		
REV	APPROVAL	DATE

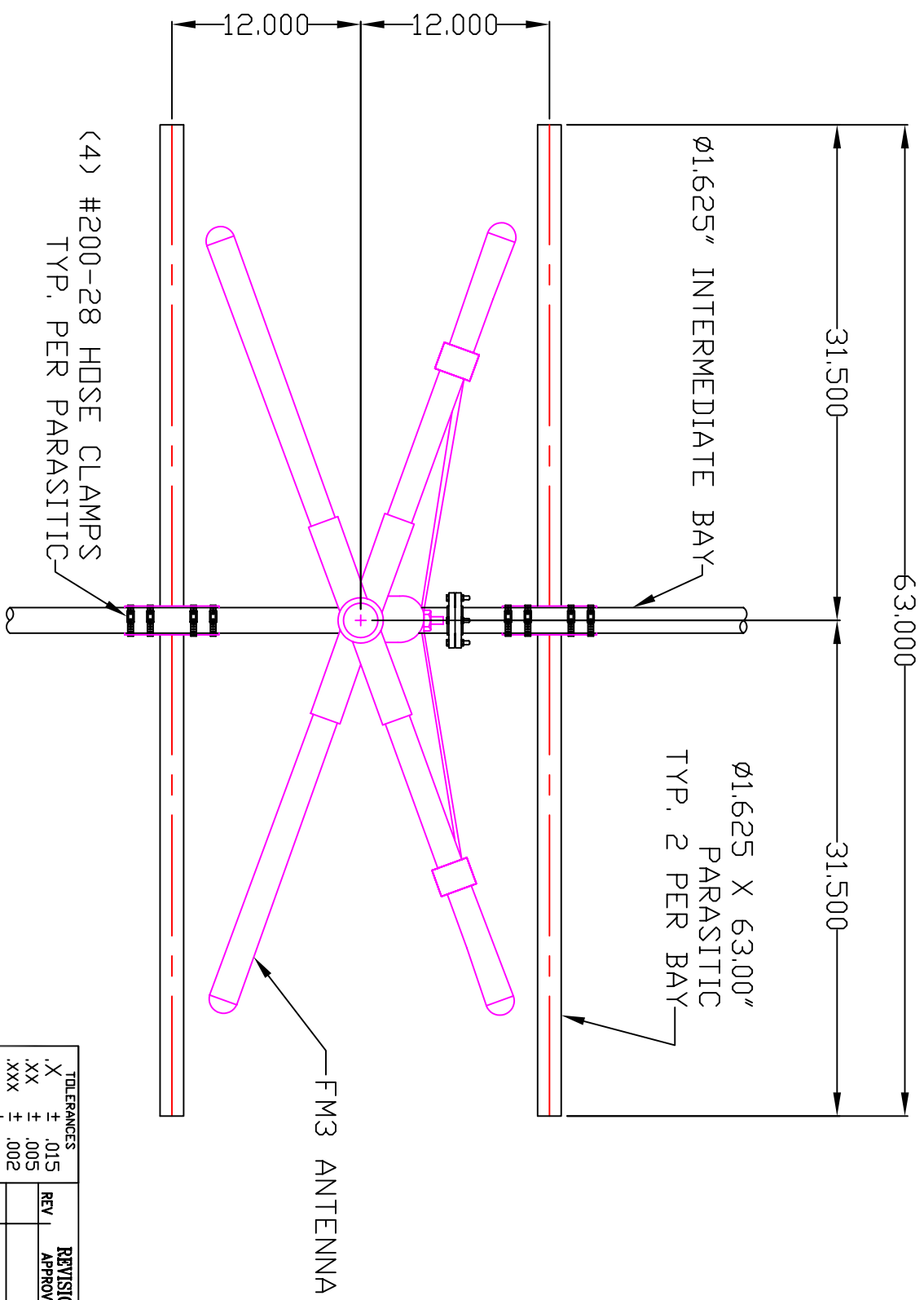
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SCALE:	NTS	NAME:	RAC
DATE:	5/2/05	SHEET	1 OF 1

DRAWING
NUMBER:
0405D01



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

DRAWING
NUMBER:
0405D01



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

SWIREB

TITLE:
FM3/4-DA, FREQ. 95.5
WHMA, HOBSON CITY, AL
PARASITIC PLACEMENT
FRONT VIEW

SIZE:
A

SCALE:
NTS

NAME:
RAC

DATE:
5/2/05

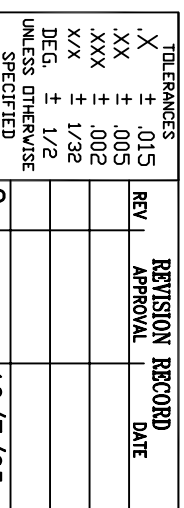
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1 OF 1

REVISION RECORD

REV	APPROVAL	DATE

PARTS MADE BY THIS DRAWING

DRAWING NUMBER:
0405D05



REVISION RECORD	
REV	DATE

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

UNLESS OTHERWISE SPECIFIED

TITLE:

SYSTEMS WITH RELIABILITY, INC
540 INDUSTRIAL PARK ROAD

619 INDUSTRIAL PARK ROAD

MATERIAL:

SIZE

A

PARTS MADE BY THIS DRAWING

SCALE: 1/100

NAME: IDA /

DATE: 1/1/00

SHEET

10



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