SYSTEMS WITH RELIABILITY, LP

BROADCAST ANTENNAS AND TRANSMISSION LINE

PATTERN CERTIFICATION

DIRECTIONAL FM ANTENNA
WYBO
March 23, 2016

Call Sign	:	WYBO
Location	:	Waynesboro, GA
Frequency	:	92.9 MHz
Channel	:	225A
Antenna Model	:	FM3/2-0.75WS-DA
Maximum Antenna Gain		
Horizontal	:	**2.366 / 3.740 dB**
Vertical	**:**	**2.366 / 3.740 dB**

ANTENNA DESCRIPTION

A custom designed FM3/2-0.75WS-DA antenna was fabricated to conform to the prescribed directional azimuth pattern. The antenna consists of two (2) circularly polarized, cross-V dipole radiating elements 0.75 wave spaced mounted to a mast. The antenna points 155 degrees true north.

DESCRIPTION OF TEST PROCEDURE

The test antenna consisted of a single third-scale bay. The antenna was mounted to a third-scale pipe, which was mounted to a third-scale pole by use of third-scale brackets identical to those shipped with the final, full-scale antenna. For testing, the entire third-scale model was then mounted atop a 20' (foot) high platform, and all feed cables were properly grounded. Horizontal and vertical readings were taken. The desired directional pattern was obtained by adjusting the distance between the tower and the antenna, and modifying the direction of the azimuth heading. Parasitic elements were used for performance enhancement.

DESCRIPTION OF TEST PARAMETERS AND EQUIPMENT

Horizontal and vertical pattern readings were taken by mounting a source antenna - a vertical/horizontal dipole, Cavity Back Resonator (CBR) antenna bay - approximately 100' (feet) from the third-scale antenna model. The source antenna's height was adjusted to achieve a uniform field at the third-scale test antenna location. The CBR antenna was operated in receive mode, at frequency 278.7 MHz. The third-scale test antenna was then rotated clockwise in order to achieve 360° (degree) pattern readings. A gain reference was taken using a dipole tuned to 278.7 MHz. Nowhere did the received signal, or resultant documentation, exceed a maximum to minimum ratio of 15dB (decibels).

TEST RESULTS

The attached calculations verify that the **RMS** value of this antenna is ***93.1%*** of the **RMS** value of the pattern authorized in the related FCC file **BMPH-20151027ACV.** The vertical component **RMS** value is **0.698**. The horizontal component **RMS** value is **0.551**. The circular polarized component **RMS** value is **0.737**.

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

Measured vertical polarized directivity:	**2.053 / 3.12 dB**
Measured horizontal polarized directivity:	**3.297 / 5.18 dB**
Measured circular polarized pattern directivity:	**1.839 / 2.65 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 = (2.05289)(.6163)(1.870) **= 2.366 / 3.740 dB**
H-Pol. Gain = (3.29729)(.3837)(1.870) **= 2.366 / 3.740 dB**

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **100.58** ***meters (330 ft.)*** above ground level. The antenna aperture is **7.94 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 ***155 degrees*** true North.

The system's orientation and the mounting details are described in the following drawings:

DRAWING NO.	**TITLE**
1998D00	ELEVATION
1998D01	ANTENNA ORIENTATION
1998D02	PARASITIC PLACEMENT
1998D20	BEACON PLATE / LIGHTNING WAND ASSEMBLY
1998D25	CLIMBING LADDER
2105A10	TEST RANGE SCHEMATIC

The antenna elevation is shown on **DWG. 1998D00**.The antenna elements shall be aligned at the same heading as in **DWG. 1998D01**.This will ensure that the antenna is oriented properly at 155 degrees true north. The parasitic placement is shown on **DWG. 1998D02.** The beacon plate and lightning wand assembly is outlined in **DWG. 1998D20**. The climbing ladder is shown on **DWG. 1998D25**. The test range schematic **DWG. 2105A10** shows the mounting configuration of the antenna setup on our range.

DOCUMENT EXHIBITS

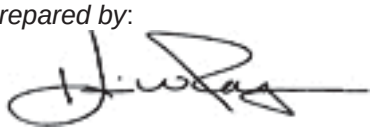
The following exhibits are included as part of this Certificate of Compliance:

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

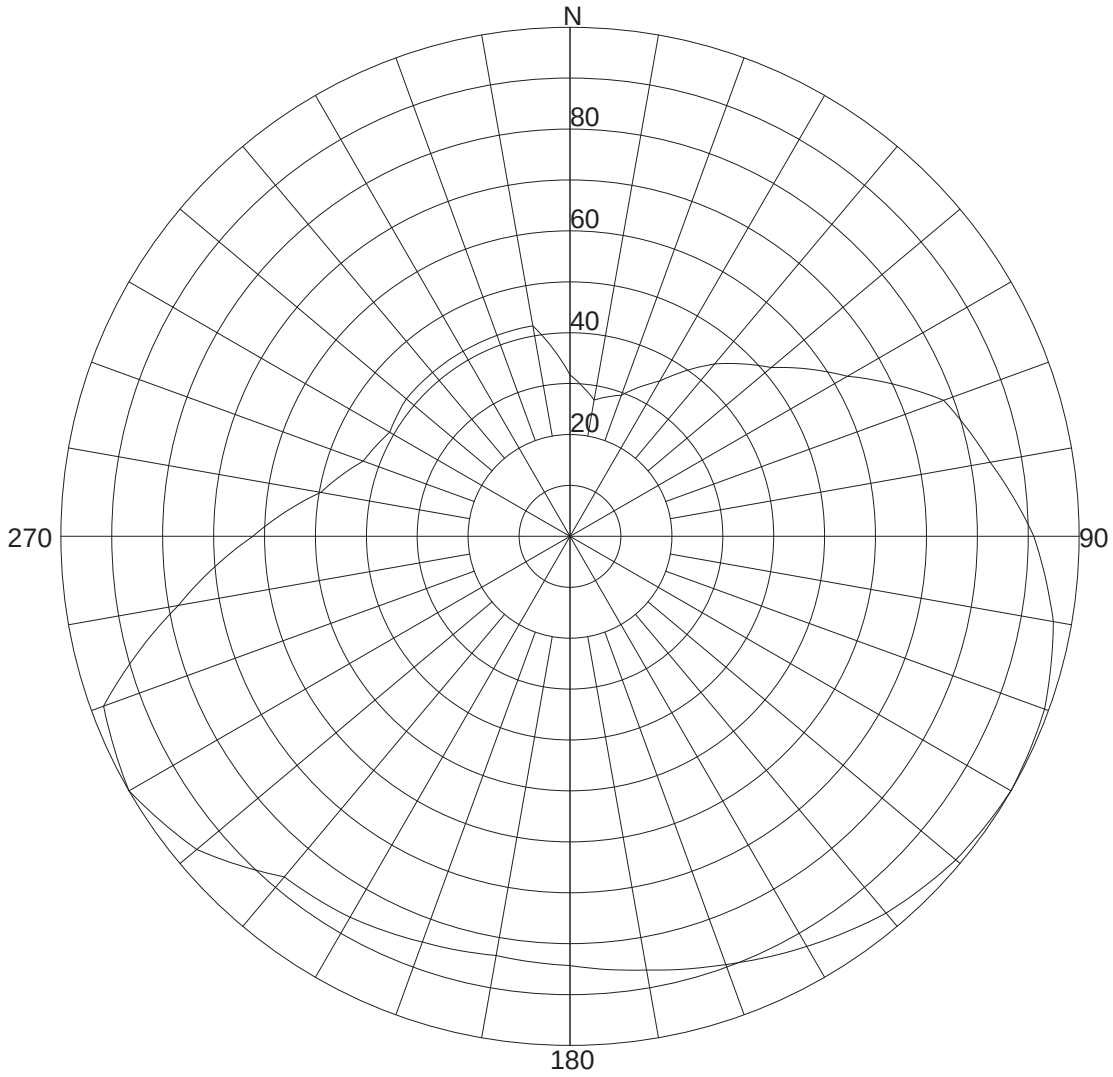
Network Analyzer	:	Hewlett Packard Model # 8753C Serial Number: 08753 – 69138
Computer	:	Pentium 3, 450 MHz, SAMS Range Program
Printer	:	Hewlett-Packard Laser Jet 6L
Positioner	:	Orbit Positioner
		All equipment is calibrated to ANSI/NCSL Z540-1-1994 specs

Prepared by:



Kevin W. Rager
Antenna Engineer
Systems With Reliability, LP

Exhibit 1: Circular Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WYBO / Waynesboro, GA*

Date: 3/23/2016

ANTENNA TYPE: FM3/2-0.75WS

FREQUENCY: 92.9 MHz

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.83868 / 2.65dB

PATTERN RMS: *0.737*

Micro-Tek Eng. Ver. 2.52

Exhibit 1 (cont'd): Circular Polarized Azimuth Pattern Tabulations

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.3170 (-9.98)	180	.8430 (-1.48)
5	.2945 (-10.62)	185	.8395 (-1.52)
10	.2720 (-11.31)	190	.8360 (-1.56)
15	.2835 (-10.95)	195	.8420 (-1.49)
20	.2950 (-10.6)	200	.8480 (-1.43)
25	.3235 (-9.8)	205	.8560 (-1.35)
30	.3520 (-9.07)	210	.8640 (-1.27)
35	.3970 (-8.02)	215	.8685 (-1.22)
40	.4420 (-7.09)	220	.8730 (-1.18)
45	.4790 (-6.39)	225	.9150 (-0.77)
50	.5160 (-5.75)	230	.9570 (-0.38)
55	.5725 (-4.84)	235	.9785 (-0.19)
60	.6290 (-4.03)	240	1.0000 (0)
65	.7050 (-3.04)	245	.9875 (-0.11)
70	.7810 (-2.15)	250	.9750 (-0.22)
75	.8095 (-1.84)	255	.8780 (-1.13)
80	.8380 (-1.54)	260	.7810 (-2.15)
85	.8745 (-1.16)	265	.7020 (-3.07)
90	.9110 (-0.81)	270	.6230 (-4.11)
95	.9375 (-0.56)	275	.5600 (-5.04)
100	.9640 (-0.32)	280	.4970 (-6.07)
105	.9780 (-0.19)	285	.4645 (-6.66)
110	.9920 (-0.07)	290	.4320 (-7.29)
115	.9960 (-0.03)	295	.4205 (-7.52)
120	1.0000 (0)	300	.4090 (-7.77)
125	.9945 (-0.05)	305	.4145 (-7.65)
130	.9890 (-0.1)	310	.4200 (-7.54)
135	.9775 (-0.2)	315	.4200 (-7.54)
140	.9660 (-0.3)	320	.4200 (-7.54)
145	.9480 (-0.46)	325	.4200 (-7.54)
150	.9300 (-0.63)	330	.4200 (-7.54)
155	.9125 (-0.8)	335	.4200 (-7.54)
160	.8950 (-0.96)	340	.4200 (-7.54)
165	.8800 (-1.11)	345	.4200 (-7.54)
170	.8650 (-1.26)	350	.4200 (-7.54)
175	.8540 (-1.37)	355	.3685 (-8.67)

Systems With Reliability

CLIENT: *WYBO / Waynesboro, GA*

Date: 3/23/2016

ANTENNA TYPE: FM3/2-0.75WS

FREQUENCY: 92.9 MHz

PATTERN POL.: Circular

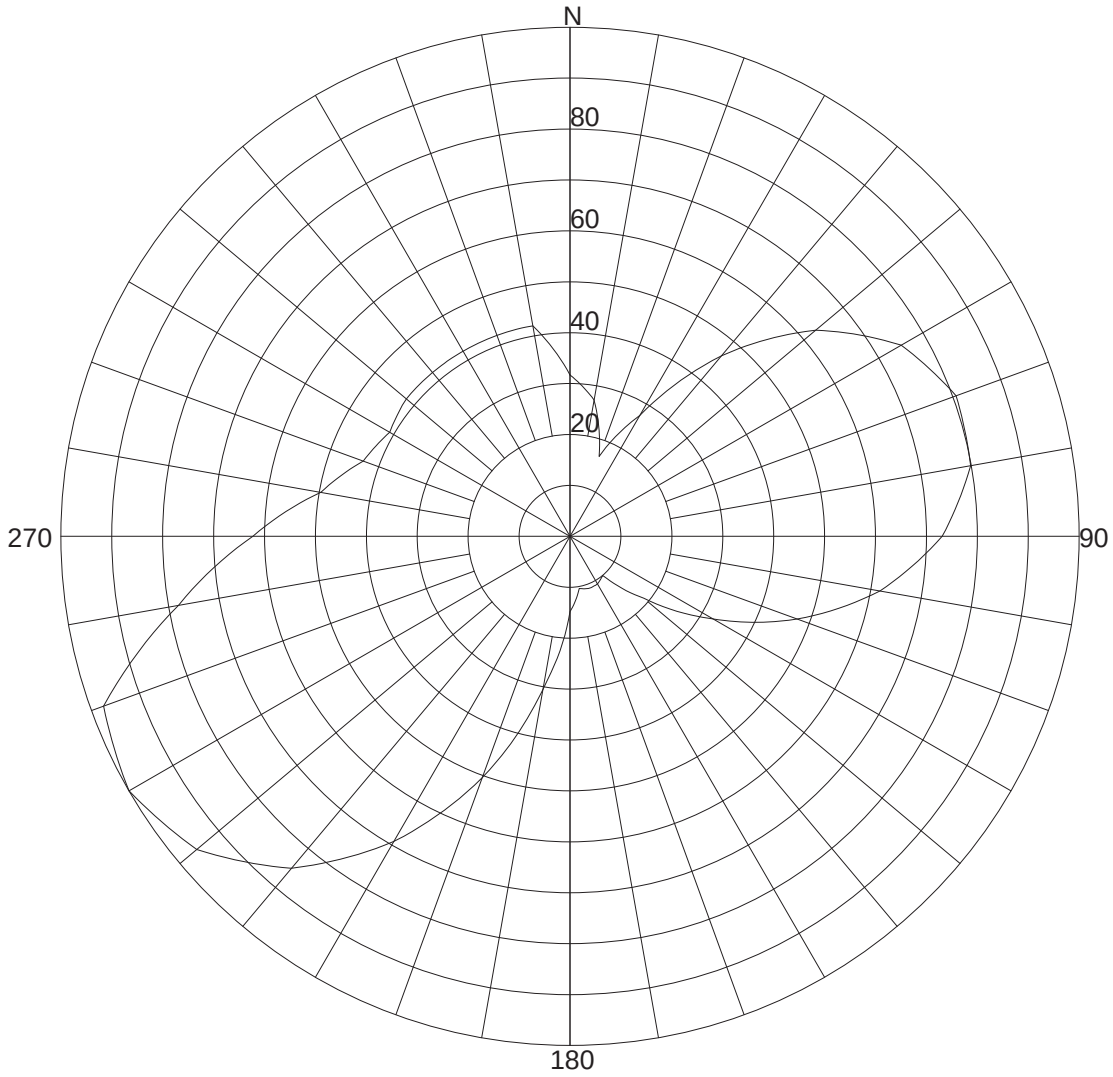
CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.83868 / 2.65dB

PATTERN RMS: *0.737*

Micro-Tek Eng. Ver. 2.52

Exhibit 2: Measured Horizontal Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WYBO / Waynesboro, GA*

Date: 3/23/2016

ANTENNA TYPE: FM3/2-0.75WS

FREQUENCY: 92.9 Mhz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 3.29729 / 5.18dB

PATTERN RMS: *0.551*

Micro-Tek Eng. Ver. 2.52

Exhibit 2 (cont'd): Measured Horizontal Polarized Azimuth Pattern Tabulations

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.3170 (-9.98)	180	.1480 (-16.59)
5	.2945 (-10.62)	185	.2255 (-12.94)
10	.2720 (-11.31)	190	.3030 (-10.37)
15	.2195 (-13.17)	195	.4040 (-7.87)
20	.1670 (-15.55)	200	.5050 (-5.93)
25	.2205 (-13.13)	205	.5985 (-4.46)
30	.2740 (-11.24)	210	.6920 (-3.2)
35	.3685 (-8.67)	215	.7715 (-2.25)
40	.4630 (-6.69)	220	.8510 (-1.4)
45	.5465 (-5.25)	225	.9040 (-0.88)
50	.6300 (-4.01)	230	.9570 (-0.38)
55	.6905 (-3.22)	235	.9785 (-0.19)
60	.7510 (-2.49)	240	1.0000 (0)
65	.7790 (-2.17)	245	.9875 (-0.11)
70	.8070 (-1.86)	250	.9750 (-0.22)
75	.8030 (-1.91)	255	.8780 (-1.13)
80	.7990 (-1.95)	260	.7810 (-2.15)
85	.7650 (-2.33)	265	.7020 (-3.07)
90	.7310 (-2.72)	270	.6230 (-4.11)
95	.6745 (-3.42)	275	.5600 (-5.04)
100	.6180 (-4.18)	280	.4970 (-6.07)
105	.5465 (-5.25)	285	.4645 (-6.66)
110	.4750 (-6.47)	290	.4320 (-7.29)
115	.3995 (-7.97)	295	.4205 (-7.52)
120	.3240 (-9.79)	300	.4090 (-7.77)
125	.2565 (-11.82)	305	.4145 (-7.65)
130	.1890 (-14.47)	310	.4200 (-7.54)
135	.1445 (-16.8)	315	.4200 (-7.54)
140	.1000 (-20)	320	.4200 (-7.54)
145	.1040 (-19.66)	325	.4200 (-7.54)
150	.1080 (-19.33)	330	.4200 (-7.54)
155	.1085 (-19.29)	335	.4200 (-7.54)
160	.1090 (-19.25)	340	.4200 (-7.54)
165	.1065 (-19.45)	345	.4200 (-7.54)
170	.1040 (-19.66)	350	.4200 (-7.54)
175	.1260 (-17.99)	355	.3685 (-8.67)

Systems With Reliability

CLIENT: *WYBO / Waynesboro, GA*

Date: 3/23/2016

ANTENNA TYPE: FM3/2-0.75WS

FREQUENCY: 92.9 Mhz

PATTERN POL.: Horizontal

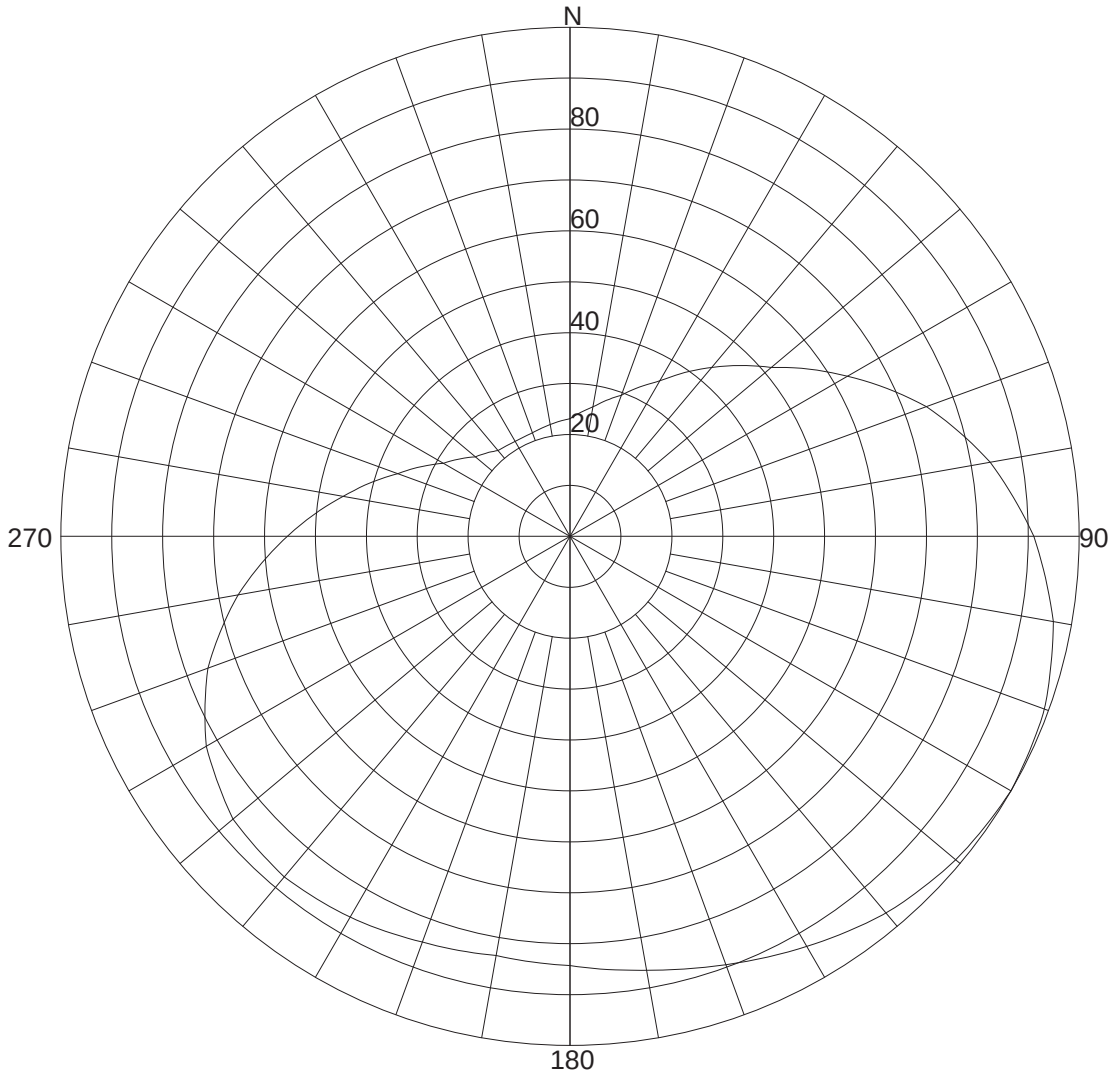
CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 3.29729 / 5.18dB

PATTERN RMS: *0.551*

Micro-Tek Eng. Ver. 2.52

Exhibit 3: Measured Vertical Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *WYBO / Waynesboro, GA*

Date: 3/23/2016

ANTENNA TYPE: FM3/2-0.75WS

FREQUENCY: 92.9 MHz

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.05289 / 3.12dB

PATTERN RMS: *0.698*

Micro-Tek Eng. Ver. 2.52

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

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.2310 (-12.73)	180	.8430 (-1.48)
5	.2445 (-12.23)	185	.8395 (-1.52)
10	.2580 (-11.77)	190	.8360 (-1.56)
15	.2765 (-11.17)	195	.8420 (-1.49)
20	.2950 (-10.6)	200	.8480 (-1.43)
25	.3235 (-9.8)	205	.8560 (-1.35)
30	.3520 (-9.07)	210	.8640 (-1.27)
35	.3925 (-8.12)	215	.8685 (-1.22)
40	.4330 (-7.27)	220	.8730 (-1.18)
45	.4745 (-6.48)	225	.8685 (-1.22)
50	.5160 (-5.75)	230	.8640 (-1.27)
55	.5725 (-4.84)	235	.8445 (-1.47)
60	.6290 (-4.03)	240	.8250 (-1.67)
65	.6870 (-3.26)	245	.7910 (-2.04)
70	.7450 (-2.56)	250	.7570 (-2.42)
75	.7915 (-2.03)	255	.7095 (-2.98)
80	.8380 (-1.54)	260	.6620 (-3.58)
85	.8745 (-1.16)	265	.6085 (-4.31)
90	.9110 (-0.81)	270	.5550 (-5.11)
95	.9375 (-0.56)	275	.5035 (-5.96)
100	.9640 (-0.32)	280	.4520 (-6.9)
105	.9780 (-0.19)	285	.4060 (-7.83)
110	.9920 (-0.07)	290	.3600 (-8.87)
115	.9960 (-0.03)	295	.3235 (-9.8)
120	1.0000 (0)	300	.2870 (-10.84)
125	.9945 (-0.05)	305	.2650 (-11.54)
130	.9890 (-0.1)	310	.2430 (-12.29)
135	.9775 (-0.2)	315	.2315 (-12.71)
140	.9660 (-0.3)	320	.2200 (-13.15)
145	.9480 (-0.46)	325	.2175 (-13.25)
150	.9300 (-0.63)	330	.2150 (-13.35)
155	.9125 (-0.8)	335	.2155 (-13.33)
160	.8950 (-0.96)	340	.2160 (-13.31)
165	.8800 (-1.11)	345	.2195 (-13.17)
170	.8650 (-1.26)	350	.2230 (-13.03)
175	.8540 (-1.37)	355	.2270 (-12.88)

Systems With Reliability

CLIENT: *WYBO / Waynesboro, GA*

Date: 3/23/2016

ANTENNA TYPE: FM3/2-0.75WS

FREQUENCY: 92.9 MHz

PATTERN POL.: Vertical

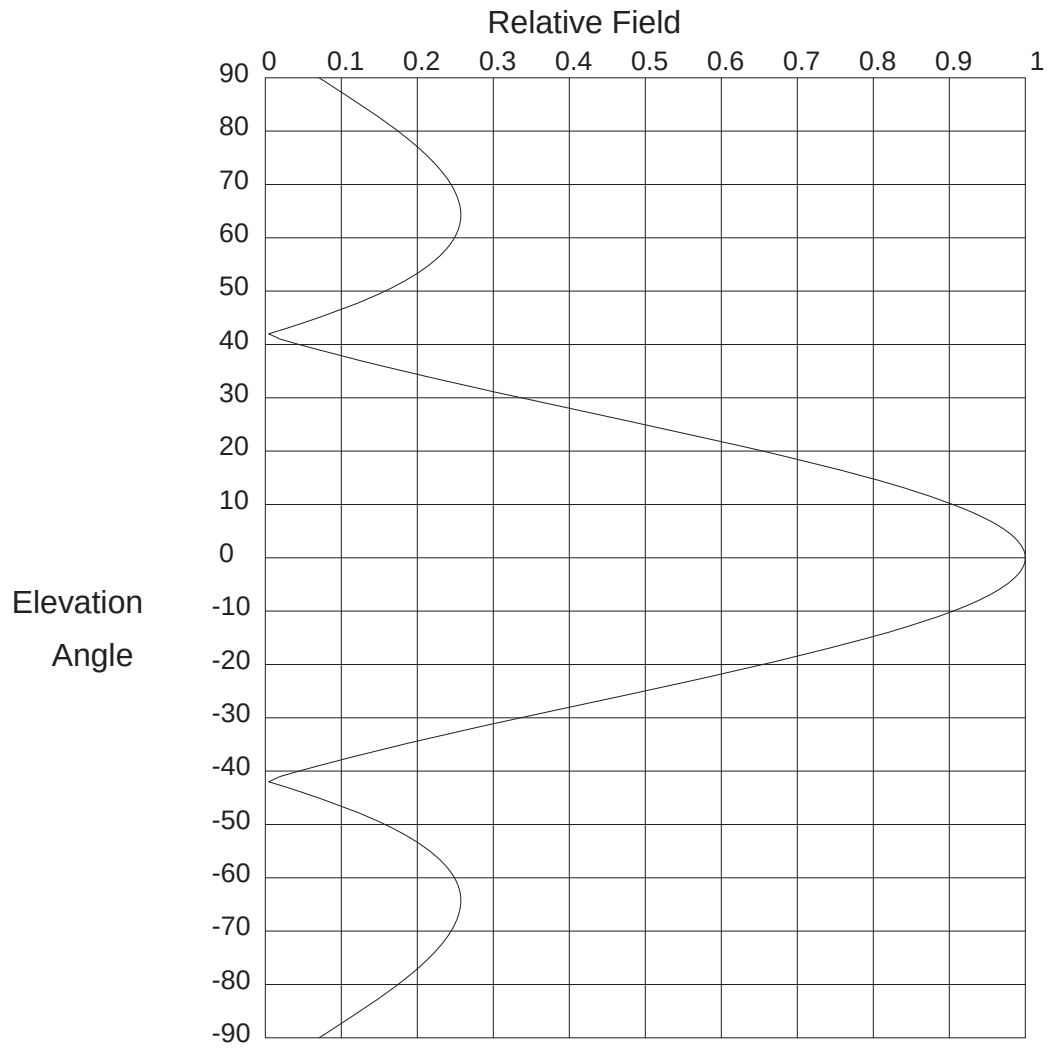
CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.05289 / 3.12dB

PATTERN RMS: *0.698*

Micro-Tek Eng. Ver. 2.52

Exhibit 4: Elevation Pattern



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: *WYBO_Waynesboro, GA*

Date: 2/17/2016

ANTENNA TYPE: FM3/2-0.75WS-DA

FREQUENCY: 92.9 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 1.87/2.719 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 1.87/2.719 dBd

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

Micro-Tek Eng. Ver. 2.6

Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
90.0	.071 (-23.01)	52.0	.184 (-14.681)	14.0	.819 (-1.73)
89.0	.082 (-21.746)	51.0	.172 (-15.314)	13.0	.843 (-1.485)
88.0	.093 (-20.65)	50.0	.157 (-16.058)	12.0	.865 (-1.259)
87.0	.104 (-19.686)	49.0	.142 (-16.942)	11.0	.886 (-1.054)
86.0	.114 (-18.828)	48.0	.126 (-18.003)	10.0	.905 (-0.868)
85.0	.125 (-18.059)	47.0	.108 (-19.302)	9.8	.909 (-0.833)
84.0	.135 (-17.364)	46.0	.09 (-20.937)	9.6	.912 (-0.799)
83.0	.146 (-16.734)	45.0	.07 (-23.09)	9.4	.916 (-0.765)
82.0	.156 (-16.161)	44.0	.049 (-26.15)	9.2	.919 (-0.733)
81.0	.165 (-15.637)	43.0	.027 (-31.25)	9.0	.923 (-0.701)
80.0	.175 (-15.158)	42.0	.004 (-47.007)	8.8	.926 (-0.669)
79.0	.184 (-14.72)	41.0	.019 (-34.211)	8.6	.929 (-0.639)
78.0	.192 (-14.32)	40.0	.044 (-27.054)	8.4	.932 (-0.609)
77.0	.201 (-13.955)	39.0	.07 (-23.066)	8.2	.935 (-0.58)
76.0	.208 (-13.622)	38.0	.097 (-20.263)	8.0	.938 (-0.552)
75.0	.216 (-13.32)	37.0	.125 (-18.088)	7.8	.941 (-0.524)
74.0	.223 (-13.047)	36.0	.153 (-16.305)	7.6	.944 (-0.498)
73.0	.229 (-12.802)	35.0	.182 (-14.79)	7.4	.947 (-0.472)
72.0	.235 (-12.585)	34.0	.212 (-13.474)	7.2	.95 (-0.446)
71.0	.24 (-12.394)	33.0	.242 (-12.309)	7.0	.953 (-0.422)
70.0	.245 (-12.23)	32.0	.273 (-11.266)	6.8	.955 (-0.398)
69.0	.249 (-12.091)	31.0	.305 (-10.321)	6.6	.958 (-0.374)
68.0	.252 (-11.979)	30.0	.337 (-9.459)	6.4	.96 (-0.352)
67.0	.254 (-11.893)	29.0	.369 (-8.669)	6.2	.963 (-0.33)
66.0	.256 (-11.833)	28.0	.401 (-7.94)	6.0	.965 (-0.309)
65.0	.257 (-11.8)	27.0	.433 (-7.265)	5.8	.967 (-0.289)
64.0	.257 (-11.795)	26.0	.466 (-6.638)	5.6	.97 (-0.269)
63.0	.256 (-11.819)	25.0	.498 (-6.055)	5.4	.972 (-0.25)
62.0	.255 (-11.873)	24.0	.53 (-5.512)	5.2	.974 (-0.232)
61.0	.252 (-11.958)	23.0	.562 (-5.005)	5.0	.976 (-0.214)
60.0	.249 (-12.078)	22.0	.593 (-4.532)	4.8	.978 (-0.197)
59.0	.245 (-12.233)	21.0	.624 (-4.09)	4.6	.979 (-0.181)
58.0	.239 (-12.428)	20.0	.655 (-3.676)	4.4	.981 (-0.166)
57.0	.233 (-12.664)	19.0	.685 (-3.291)	4.2	.983 (-0.151)
56.0	.225 (-12.948)	18.0	.714 (-2.931)	4.0	.984 (-0.137)
55.0	.217 (-13.284)	17.0	.742 (-2.597)	3.8	.986 (-0.124)
54.0	.207 (-13.679)	16.0	.769 (-2.285)	3.6	.987 (-0.111)
53.0	.196 (-14.141)	15.0	.795 (-1.997)	3.4	.989 (-0.099)

Systems With Reliability

CLIENT: *WYBO_Waynesboro, GA*
Date: 2/17/2016
ANTENNA TYPE: FM3/2-0.75WS-DA
FREQUENCY: 92.9 MHz
PATTERN POL.: Circular
DIRECTIVITY(Peak): 1.87/2.719 dBd
Beam Tilt (Deg.) : *0*
DIRECTIVITY(Horiz): 1.87/2.719 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	.99 (-0.088)	-4.4	.981 (-0.166)	-12.0	.865 (-1.259)
3.0	.991 (-0.077)	-4.6	.979 (-0.181)	-12.2	.861 (-1.303)
2.8	.992 (-0.067)	-4.8	.978 (-0.197)	-12.4	.856 (-1.347)
2.6	.993 (-0.058)	-5.0	.976 (-0.214)	-12.6	.852 (-1.392)
2.4	.994 (-0.049)	-5.2	.974 (-0.232)	-12.8	.847 (-1.438)
2.2	.995 (-0.041)	-5.4	.972 (-0.25)	-13.0	.843 (-1.485)
2.0	.996 (-0.034)	-5.6	.97 (-0.269)	-13.2	.838 (-1.532)
1.8	.997 (-0.028)	-5.8	.967 (-0.289)	-13.4	.834 (-1.58)
1.6	.997 (-0.022)	-6.0	.965 (-0.309)	-13.6	.829 (-1.629)
1.4	.998 (-0.017)	-6.2	.963 (-0.33)	-13.8	.824 (-1.679)
1.2	.999 (-0.012)	-6.4	.96 (-0.352)	-14.0	.819 (-1.73)
1.0	.999 (-0.009)	-6.6	.958 (-0.374)	-14.2	.815 (-1.782)
.8	.999 (-0.005)	-6.8	.955 (-0.398)	-14.4	.81 (-1.834)
.6	1.00 (-0.003)	-7.0	.953 (-0.422)	-14.6	.805 (-1.888)
.4	1.00 (-0.001)	-7.2	.95 (-0.446)	-14.8	.80 (-1.942)
.2	1.00 (0)	-7.4	.947 (-0.472)	-15.0	.795 (-1.997)
.0	1.00 (0)	-7.6	.944 (-0.498)	-15.2	.79 (-2.053)
-.2	1.00 (0)	-7.8	.941 (-0.524)	-15.4	.784 (-2.11)
-.4	1.00 (-0.001)	-8.0	.938 (-0.552)	-15.6	.779 (-2.167)
-.6	1.00 (-0.003)	-8.2	.935 (-0.58)	-15.8	.774 (-2.226)
-.8	.999 (-0.005)	-8.4	.932 (-0.609)	-16.0	.769 (-2.285)
-1.0	.999 (-0.009)	-8.6	.929 (-0.639)	-16.2	.763 (-2.346)
-1.2	.999 (-0.012)	-8.8	.926 (-0.669)	-16.4	.758 (-2.407)
-1.4	.998 (-0.017)	-9.0	.923 (-0.701)	-16.6	.753 (-2.469)
-1.6	.997 (-0.022)	-9.2	.919 (-0.733)	-16.8	.747 (-2.533)
-1.8	.997 (-0.028)	-9.4	.916 (-0.765)	-17.0	.742 (-2.597)
-2.0	.996 (-0.034)	-9.6	.912 (-0.799)	-17.2	.736 (-2.662)
-2.2	.995 (-0.041)	-9.8	.909 (-0.833)	-17.4	.73 (-2.728)
-2.4	.994 (-0.049)	-10.0	.905 (-0.868)	-17.6	.725 (-2.795)
-2.6	.993 (-0.058)	-10.2	.901 (-0.904)	-17.8	.719 (-2.863)
-2.8	.992 (-0.067)	-10.4	.897 (-0.94)	-18.0	.714 (-2.931)
-3.0	.991 (-0.077)	-10.6	.894 (-0.977)	-18.2	.708 (-3.001)
-3.2	.99 (-0.088)	-10.8	.89 (-1.015)	-18.4	.702 (-3.072)
-3.4	.989 (-0.099)	-11.0	.886 (-1.054)	-18.6	.696 (-3.144)
-3.6	.987 (-0.111)	-11.2	.882 (-1.093)	-18.8	.69 (-3.217)
-3.8	.986 (-0.124)	-11.4	.878 (-1.134)	-19.0	.685 (-3.291)
-4.0	.984 (-0.137)	-11.6	.873 (-1.175)	-19.2	.679 (-3.366)
-4.2	.983 (-0.151)	-11.8	.869 (-1.217)	-19.4	.673 (-3.442)

Systems With Reliability

CLIENT: *WYBO_Waynesboro, GA*
Date: 2/17/2016
ANTENNA TYPE: FM3/2-0.75WS-DA
FREQUENCY: 92.9 MHz
PATTERN POL.: Circular
DIRECTIVITY(Peak): 1.87/2.719 dBd
Beam Tilt (Deg.) : *0*
DIRECTIVITY(Horiz): 1.87/2.719 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	.667 (-3.519)	-27.2	.427 (-7.396)	-54.0	.207 (-13.679)
-19.8	.661 (-3.597)	-27.4	.42 (-7.529)	-55.0	.217 (-13.284)
-20.0	.655 (-3.676)	-27.6	.414 (-7.663)	-56.0	.225 (-12.948)
-20.2	.649 (-3.757)	-27.8	.407 (-7.8)	-57.0	.233 (-12.664)
-20.4	.643 (-3.838)	-28.0	.401 (-7.94)	-58.0	.239 (-12.428)
-20.6	.637 (-3.921)	-28.2	.394 (-8.081)	-59.0	.245 (-12.233)
-20.8	.631 (-4.005)	-28.4	.388 (-8.224)	-60.0	.249 (-12.078)
-21.0	.624 (-4.09)	-28.6	.382 (-8.37)	-61.0	.252 (-11.958)
-21.2	.618 (-4.176)	-28.8	.375 (-8.518)	-62.0	.255 (-11.873)
-21.4	.612 (-4.263)	-29.0	.369 (-8.669)	-63.0	.256 (-11.819)
-21.6	.606 (-4.351)	-29.2	.362 (-8.822)	-64.0	.257 (-11.795)
-21.8	.60 (-4.441)	-29.4	.356 (-8.977)	-65.0	.257 (-11.8)
-22.0	.593 (-4.532)	-29.6	.349 (-9.135)	-66.0	.256 (-11.833)
-22.2	.587 (-4.624)	-29.8	.343 (-9.296)	-67.0	.254 (-11.893)
-22.4	.581 (-4.717)	-30.0	.337 (-9.459)	-68.0	.252 (-11.979)
-22.6	.575 (-4.812)	-31.0	.305 (-10.321)	-69.0	.249 (-12.091)
-22.8	.568 (-4.908)	-32.0	.273 (-11.266)	-70.0	.245 (-12.23)
-23.0	.562 (-5.005)	-33.0	.242 (-12.309)	-71.0	.24 (-12.394)
-23.2	.556 (-5.104)	-34.0	.212 (-13.474)	-72.0	.235 (-12.585)
-23.4	.549 (-5.204)	-35.0	.182 (-14.79)	-73.0	.229 (-12.802)
-23.6	.543 (-5.305)	-36.0	.153 (-16.305)	-74.0	.223 (-13.047)
-23.8	.537 (-5.408)	-37.0	.125 (-18.088)	-75.0	.216 (-13.32)
-24.0	.53 (-5.512)	-38.0	.097 (-20.263)	-76.0	.208 (-13.622)
-24.2	.524 (-5.618)	-39.0	.07 (-23.066)	-77.0	.201 (-13.955)
-24.4	.517 (-5.725)	-40.0	.044 (-27.054)	-78.0	.192 (-14.32)
-24.6	.511 (-5.834)	-41.0	.019 (-34.211)	-79.0	.184 (-14.72)
-24.8	.504 (-5.944)	-42.0	.004 (-47.007)	-80.0	.175 (-15.158)
-25.0	.498 (-6.055)	-43.0	.027 (-31.25)	-81.0	.165 (-15.637)
-25.2	.492 (-6.169)	-44.0	.049 (-26.15)	-82.0	.156 (-16.161)
-25.4	.485 (-6.284)	-45.0	.07 (-23.09)	-83.0	.146 (-16.734)
-25.6	.479 (-6.4)	-46.0	.09 (-20.937)	-84.0	.135 (-17.364)
-25.8	.472 (-6.518)	-47.0	.108 (-19.302)	-85.0	.125 (-18.059)
-26.0	.466 (-6.638)	-48.0	.126 (-18.003)	-86.0	.114 (-18.828)
-26.2	.459 (-6.76)	-49.0	.142 (-16.942)	-87.0	.104 (-19.686)
-26.4	.453 (-6.883)	-50.0	.157 (-16.058)	-88.0	.093 (-20.65)
-26.6	.446 (-7.009)	-51.0	.172 (-15.314)	-89.0	.082 (-21.746)
-26.8	.44 (-7.136)	-52.0	.184 (-14.681)	-90.0	.071 (-23.01)
-27.0	.433 (-7.265)	-53.0	.196 (-14.141)	90.0	.00 (-50)

Systems With Reliability

CLIENT: *WYBO_Waynesboro, GA*
Date: 2/17/2016

ANTENNA TYPE: FM3/2-0.75WS-DA
FREQUENCY: 92.9 MHz
PATTERN POL.: Circular
DIRECTIVITY(Peak): 1.87/2.719 dBd
Beam Tilt (Deg.) : *0*
DIRECTIVITY(Horiz): 1.87/2.719 dBd
Null Fill(s)(%) : *0, 0, 0*

Exhibit 5: Antenna Data Sheet

SYSTEMS WITH RELIABILITY, LP

BROADCAST ANTENNAS AND TRANSMISSION LINE

SYSTEM DATA SHEET

Customer	WYBO
Contact	Dan Sessler
Location	Waynesboro, GA
Antenna Model	FM3/2-0.75WS-DA
Channel / Frequency	92.9 MHz

ELECTRICAL SPECIFICATIONS

Antenna Specifications:

		H-POL	dB		V. Pol.	dB	
License ERP (KW)		6.000			6.000		
FCC Limit Pattern Directivity		1.595	2.027	**dB**	1.595	2.027	**dB**
Elevation Directivity		1.870	2.718	**dB**	1.870	2.718	**dB**
Azimuth Directivity		3.297	5.182	**dB**	2.053	3.124	**dB**
Composite Pattern		1.839	2.645	**dB**	1.839	2.645	**dB**
Polarization Ratio		0.384			0.616		
RMS Comp./RMS Limit	93.1 **%**						
Antenna Efficiency %		100			100		
Power Ratio (Pol. Ratio X Efficiency)		0.3837			0.6163		
Antenna Gain		2.366	3.740	**dB**	2.366	3.740	**dB**

Antenna Input Power (KW) 2.536 **kW** 4.042 **(dBK)**

Feed Line Specifications:

Line Type: RFS	1 5/8" Air	**50 Ω**	**HCA158-50J**
Attenuation Per 100 ft (dB)	0.19 **dB**		
Line Length (ft) AGL + 25' Horizontal Run	355.00 **ft.**		
Total Line Attenuation (dB)	0.6745 **dB**		
Line Efficiency	85.62 **%**		
Power Input to the Line (KW)	2.962 **kW**	4.716 **(dBK)**	

Prepared by:

Kevin W. Rager
SWR, LP

Exhibit 6: RMS Calculations

SYSTEMS WITH RELIABILITY, INC.
Broadcast Antennas and Transmission Systems

WYBO Antenna RMS Comparison

PROPOSED ANTENNA		DESIGNED ANTENNA	
Azimuth Heading	Relative Field	Azimuth Heading	Relative Field
0	0.420	0	0.317
10	0.420	10	0.272
20	0.420	20	0.295
30	0.420	30	0.352
40	0.445	40	0.442
50	0.520	50	0.516
60	0.630	60	0.629
70	0.787	70	0.781
80	0.980	80	0.838
90	1.000	90	0.911
100	1.000	100	0.964
110	1.000	110	0.992
120	1.000	120	1.000
130	1.000	130	0.989
140	1.000	140	0.966
150	1.000	150	0.930
160	1.000	160	0.895
170	1.000	170	0.865
180	1.000	180	0.843
190	1.000	190	0.836
200	1.000	200	0.848
210	1.000	210	0.864
220	1.000	220	0.873
230	1.000	230	0.957
240	1.000	240	1.000
250	0.976	250	0.975
260	0.781	260	0.781
270	0.625	270	0.623
280	0.500	280	0.497
290	0.435	290	0.432
300	0.420	300	0.409
310	0.420	310	0.420
320	0.420	320	0.420
330	0.420	330	0.420
340	0.420	340	0.420
350	0.420	350	0.420

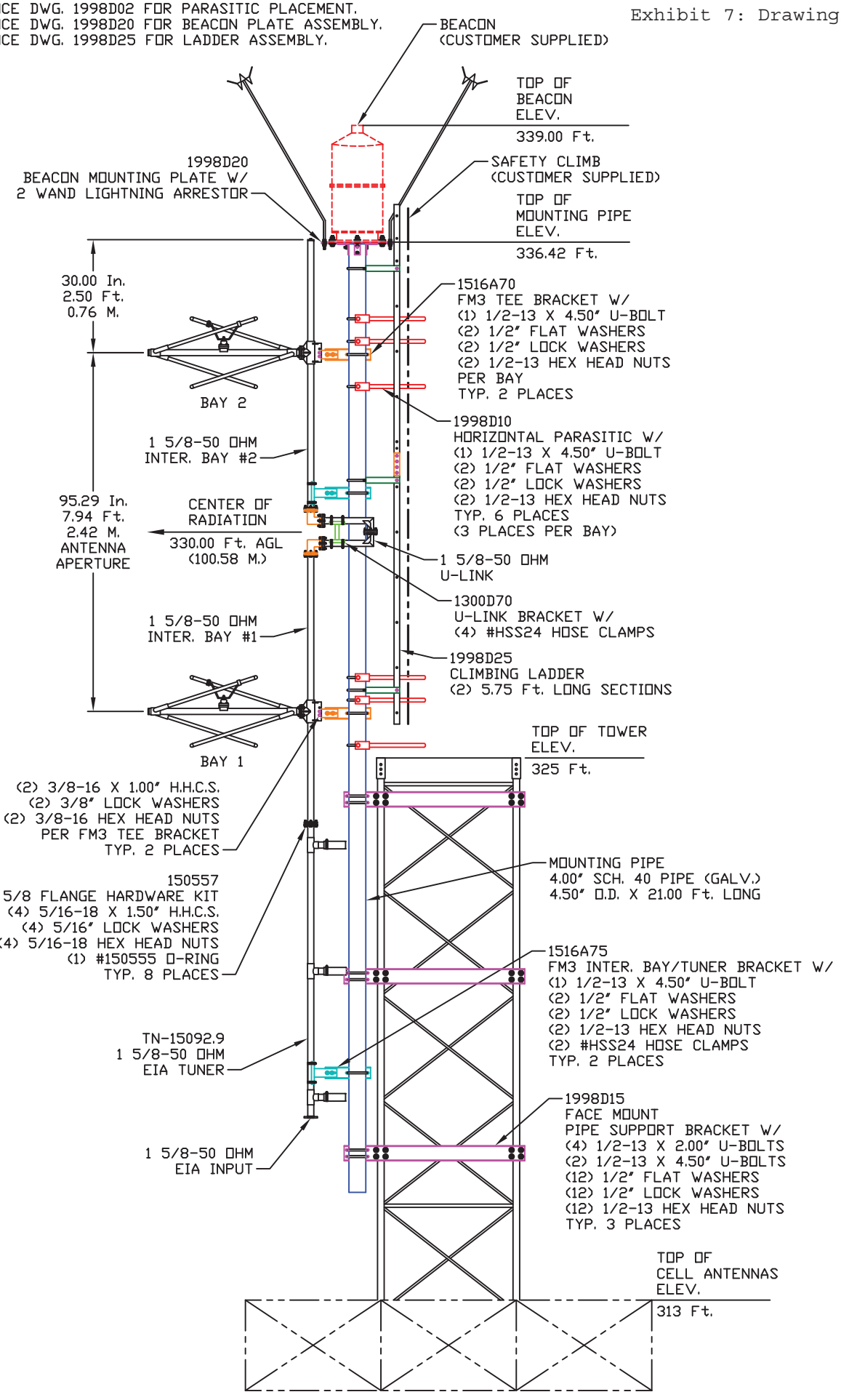
Sum of Relative Field Squared :	**22.601**	**Sum of Relative Field Squared :**	**19.608**
Sum Divided by 36 (Readings) :	**0.628**	**Sum Divided by 36 (Readings) :**	**0.545**
Square Root :	**0.792**	**Square Root :**	**0.738**

Percentage of Construction Permit Antenna Filled : **93.1%**

NOTES:
1. REFERENCE DWG. 1998D01 FOR ANTENNA ORIENTATION.
2. REFERENCE DWG. 1998D02 FOR PARASITIC PLACEMENT.
3. REFERENCE DWG. 1998D20 FOR BEACON PLATE ASSEMBLY.
4. REFERENCE DWG. 1998D25 FOR LADDER ASSEMBLY.

DRAWING NUMBER: 1998D00

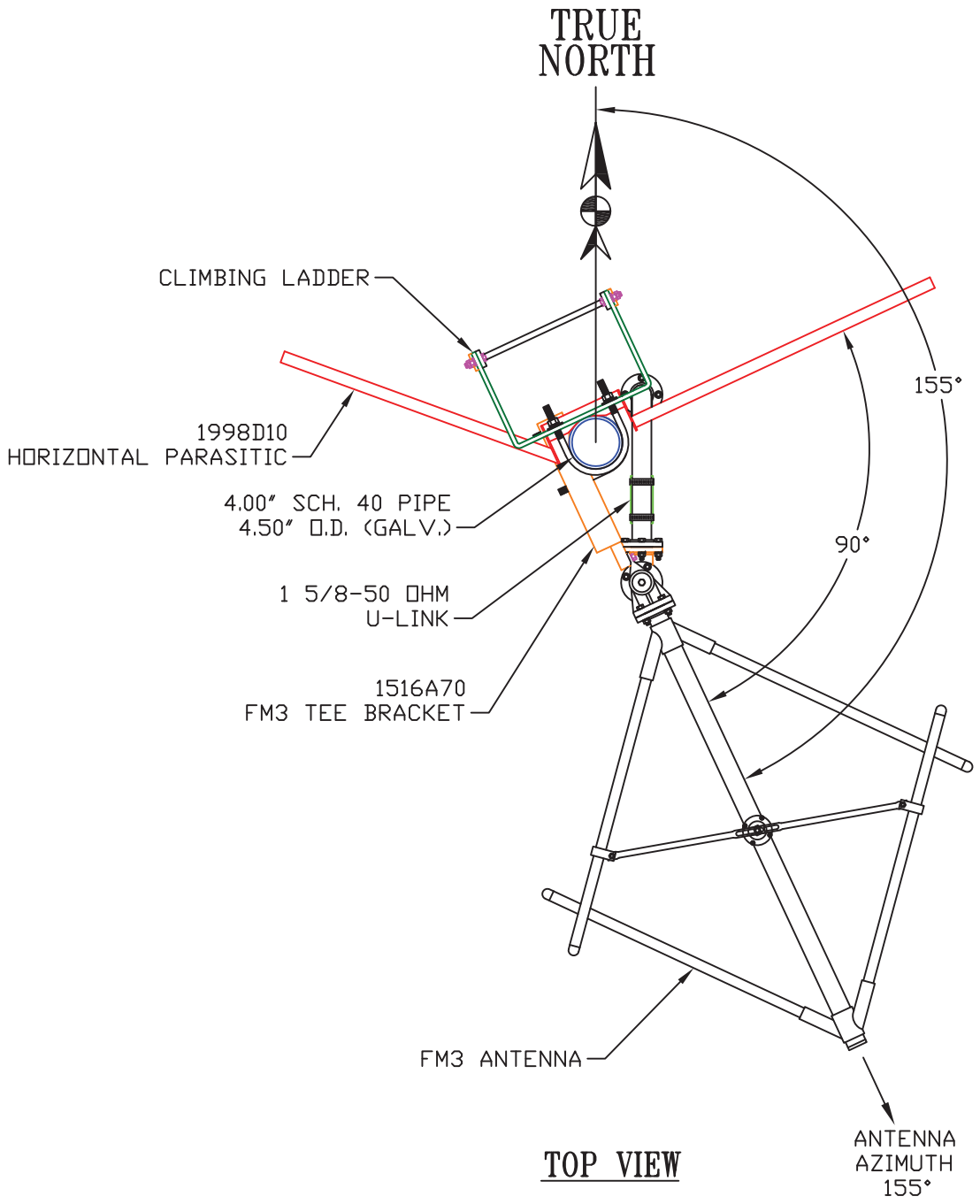
Exhibit 7: Drawings



SYSTEMS WITH RELIABILITY, LP 619 INDUSTRIAL PARK ROAD EBENSBURG, PENNSYLVANIA 15931	TITLE: FM3/2-0.75WS-DA, FREQ. 92.9 WYBO, WAYNESBORO, GA MATERIAL:	SIZE C	REV 1 2 3	APPR.	DATE 3/23/16	ENGINEER:	DRAWING NUMBER: 1998D00	
						SCALE: NTS	NAME: RAC	DATE: 3/9/16 SHEET 1 OF 1

NOTE:

DRAWING NUMBER: 1998D01



TOP VIEW

Exhibit 7 (cont'd): Drawings

REVISION RECORD		
REV	APPROVAL	DATE
1		3/23/16

DRAWING NUMBER: 1998D01

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

TITLE: FM3/2-0.75WS-DA, FREQ. 92.9 WYBO, WAYNESBORO, GA

MATERIAL: ANTENNA ORIENTATION FROM TRUE NORTH

SIZE A

PARTS MADE BY THIS DRAWING

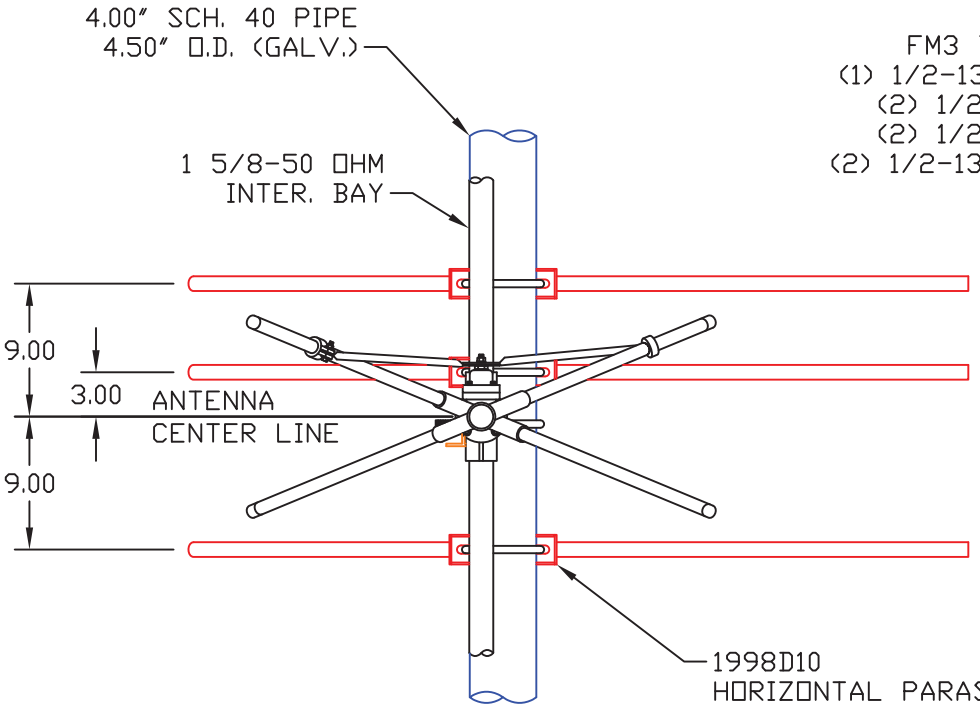
SCALE: NTS | NAME: RAC | DATE: 3/9/16 | SHEET 1 OF 1

Exhibit 7 (cont'd) : Drawings

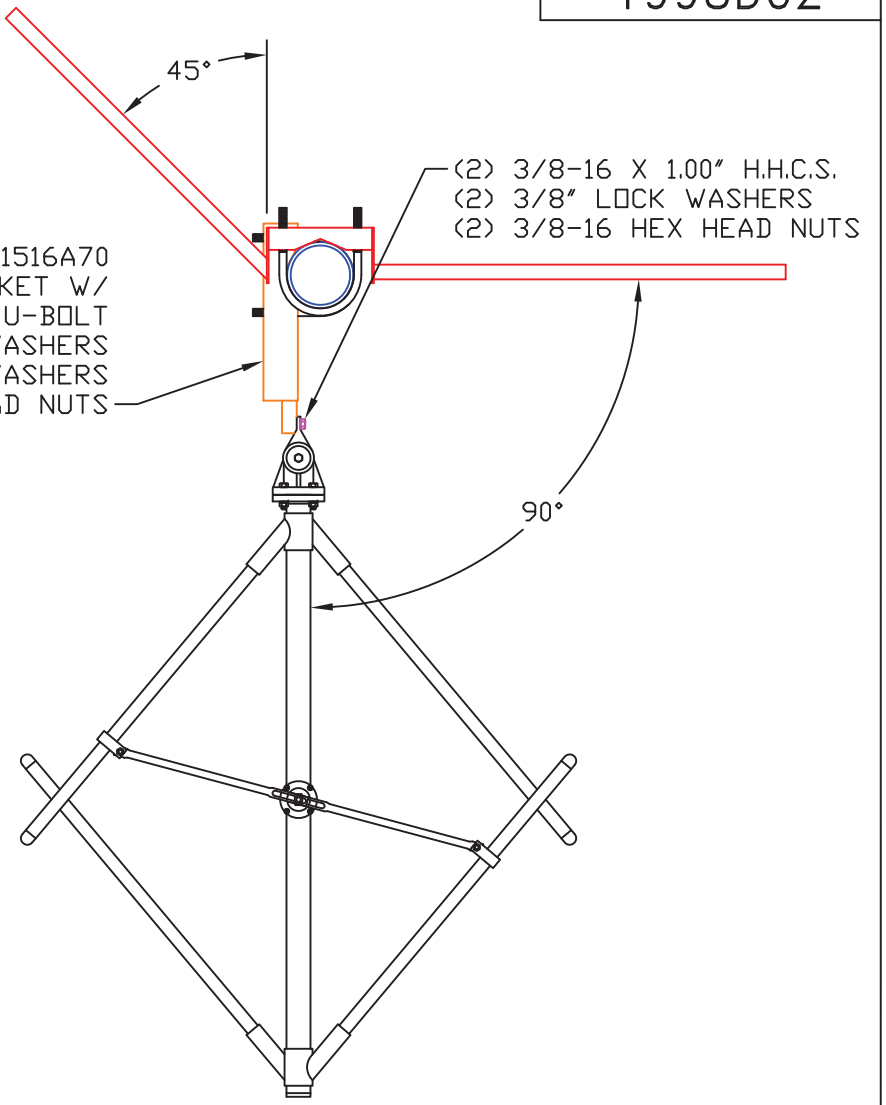
NOTE:

THIS ASSEMBLY IS TYPICAL FOR BOTH BAYS.

DRAWING NUMBER: 1998D02



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
1		3/23/16

DRAWING NUMBER: 1998D02

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

TITLE: FM3/2-0.75WS-DA, FREQ. 92.9
WYBO, WAYNESBORO, GA

MATERIAL: PARASITIC PLACEMENT

SIZE: A

PARTS MADE BY THIS DRAWING

SCALE: NTS | NAME: RAC | DATE: 3/9/16 | SHEET 1 OF 1

DRAWING NUMBER: 1998D20

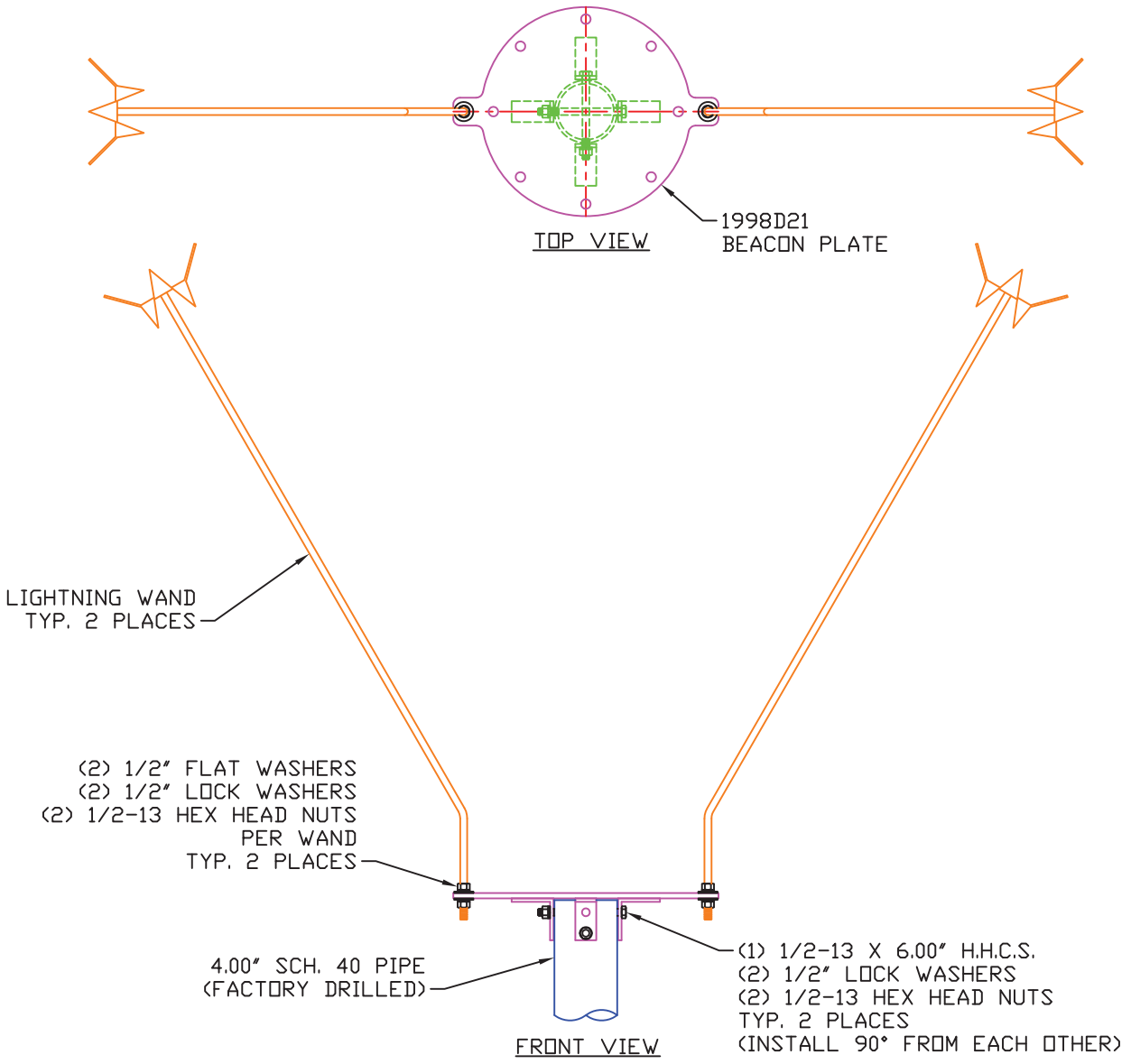


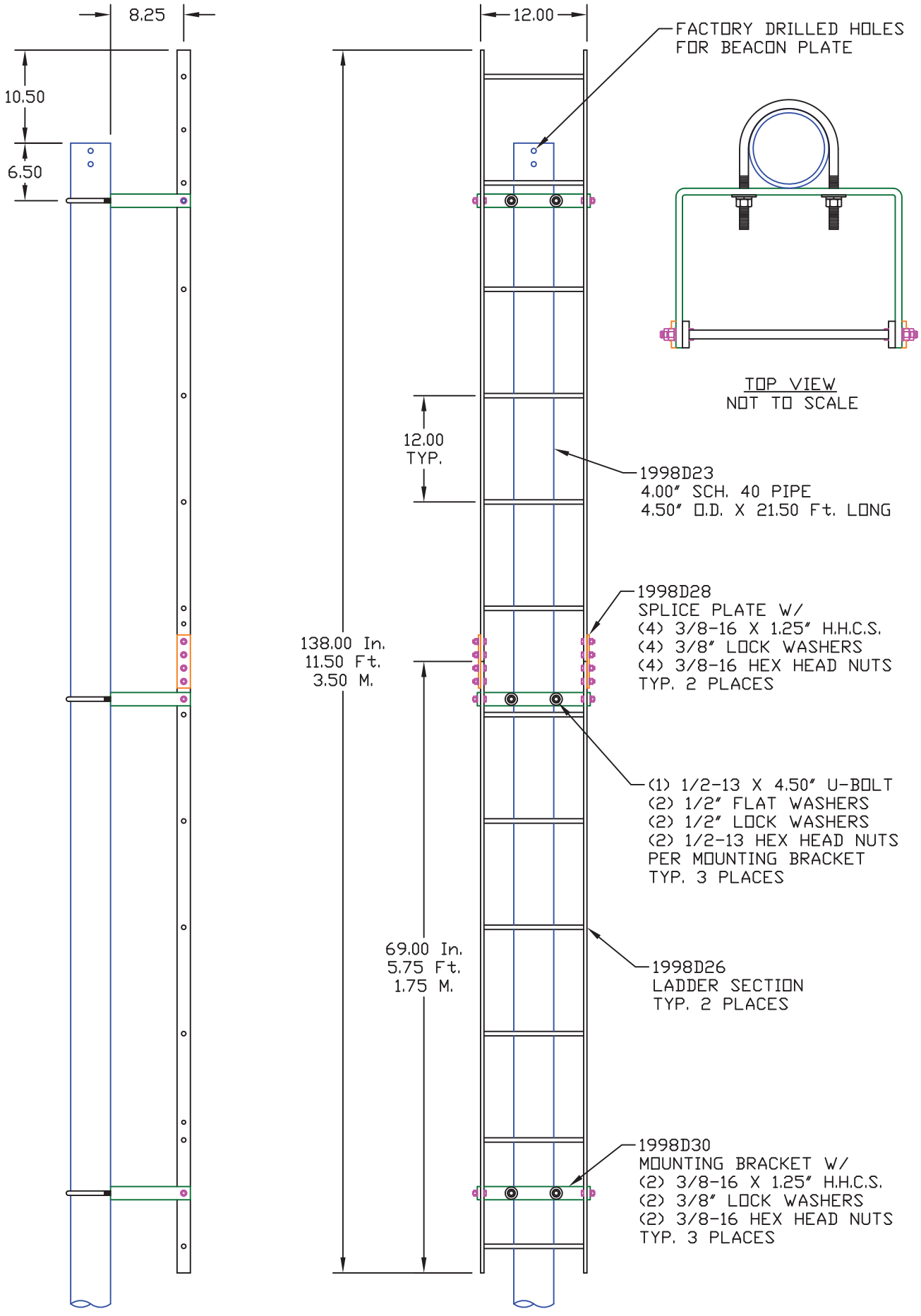
Exhibit 7 (cont'd): Drawings

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

TITLE:	BEACON PLATE/LIGHTNING WAND ASSEMBLY FOR 4.00" SCH. 40 PIPE
MATERIAL:	
SIZE	C
ENGINEER:	
DRAWING NUMBER:	1998D20
SCALE:	NTS
NAME:	RAC
DATE:	3/9/16
SHEET	1 OF 1

REV	APPROVAL	DATE	REV	APPROVAL	DATE

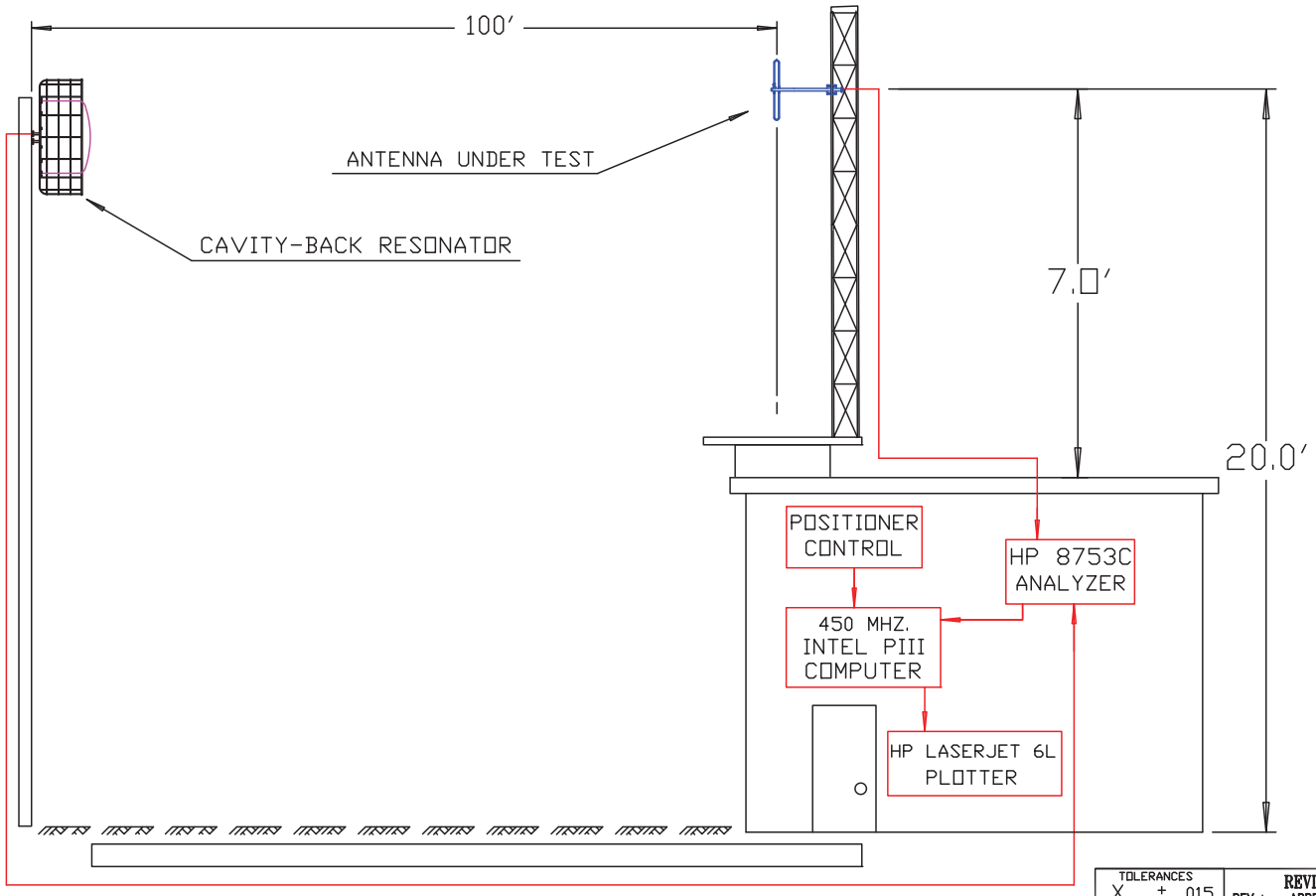
DRAWING NUMBER: 1998D25



SYSTEMS WITH RELIABILITY, LP 619 INDUSTRIAL PARK ROAD EBENSBURG, PENNSYLVANIA 15931	TITLE: CLIMBING LADDER FOR 4.00" SCH. 40 PIPE MATERIAL: A36 STEEL HOT DIP GALVANIZED	SIZE C	REV	APPR.	DATE	ENGINEER:	DRAWING NUMBER: 1998D25
			1			SCALE: NTS	NAME: RAC
			2			DATE: 3/9/16	SHEET 1 OF 1
			3				

NOTE: Exhibit 7 (cont'd): Drawings

DRAWING NUMBER: 2105A10



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

UNLESS OTHERWISE SPECIFIED

REVISION RECORD

REV	APPROVAL	DATE
2		10/7/05
1		4/30/02

DRAWING NUMBER: 2105A10

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

TITLE: TEST RANGE SCHEMATIC

MATERIAL:

SIZE: A

PARTS MADE BY THIS DRAWING

SCALE: NTS | NAME: JRM | DATE: 11/1/98 | SHEET 1 OF 1