



## SYSTEMS WITH RELIABILITY, LP

BROADCAST ANTENNAS AND TRANSMISSION SYSTEMS

### PATTERN CERTIFICATION

DIRECTIONAL FM ANTENNA

WYFL

February 25, 2022

Call Sign	:	WYFL
Location	:	Henderson, NC
Frequency	:	92.5 MHz
Channel	:	223
Antenna Model	:	FM10R/8 -DA
Maximum Antenna Gain	:	
Horizontal	:	7.6007 / 8.8085 dB
Vertical	:	7.6007 / 8.8085 dB

### ANTENNA DESCRIPTION

A custom designed **FM10R/8-DA** antenna was used to produce the required directional azimuth pattern. Each antenna bay consists of a circularly polarized dipole-radiating element and horizontal and vertical parasitic elements that are used for directing the signal. The array is comprised of **eight** bays that are spaced a **full** wavelength apart. The array is mounted to the tower and orientated at **135** degrees from true north.

### DESCRIPTION OF TEST PROCEDURE

The antenna under test consists of an exactly replicated third scale single bay model that is circular polarized. The antenna 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 on 20 ft. high on a wooden platform. All feed cables are properly grounded during pattern testing. Horizontal and vertical readings were taken. The desired directional pattern was obtained by adjusting the distance between the tower and the antenna, modifying the direction of the azimuth heading. Parasitic elements were used for performance enhancement.

### DESCRIPTION OF TEST EQUIPMENT AND PARAMETERS

The antenna under test was operated in the transmit mode at a frequency of 277.5 MHz (92.5 MHz x 3 = 277.5 MHz). 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 277.5 MHZ. The third-scale test antenna was then rotated clockwise to achieve 360° (degree) pattern readings. A gain reference was taken using a dipole tuned to 277.5 MHz.

## DOCUMENT EXHIBITS

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

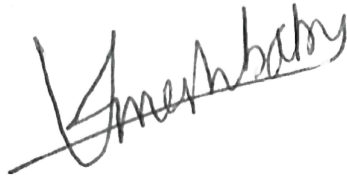
<b>Exhibit 1</b>	Circular Polarized Azimuth Pattern Field Strength Tabulations (Composite)
<b>Exhibit 2</b>	Measured Horizontal Polarized Azimuth Pattern Measured Field Strength Tabulations (Horizontal)
<b>Exhibit 3</b>	Measured Vertical Polarized Azimuth Pattern Measured Field Strength Tabulations (Vertical)
<b>Exhibit 4</b>	Elevation Pattern Elevation Tabulations
<b>Exhibit 5</b>	Antenna Data Sheet

## TEST EQUIPMENT

<b>Network Analyzer</b>	:	Hewlett Packard Model # 8753C Serial Number: 08753 – 69138
<b>Computer</b>	:	450 MHz Intel PIII
<b>Plotter</b>	:	Hewlett-Packard Laser Jet 6L
<b>Positioner</b>	:	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:*



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**Umesh Babu Manedi**  
Electrical and Computer Engineer  
Department of Engineering  
SWR, LP.

## TEST RESULTS

The attached calculations verify that the RMS value of this antenna is 91.2% of the RMS value of the pattern authorized in the related FCC file 0000162616. The vertical component RMS value is 0.705. The horizontal component RMS value is 0.798. The circular polarized component RMS value is 0.848.

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

Measured horizontal polarized directivity	:	1.56993 / 1.96dB
Measured vertical polarized directivity	:	2.01044 / 3.03dB
Measured composite azimuth pattern directivity	:	1.3899 / 1.43dB

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** = (1.5699) (8.622) (0.5615) = **7.6007 / 8.8085dB**

**V-Pol. Gain** = (2.0104) (8.622) (0.4385) = **7.6007 / 8.8085dB**

## INSTALLATION AND MOUNTING

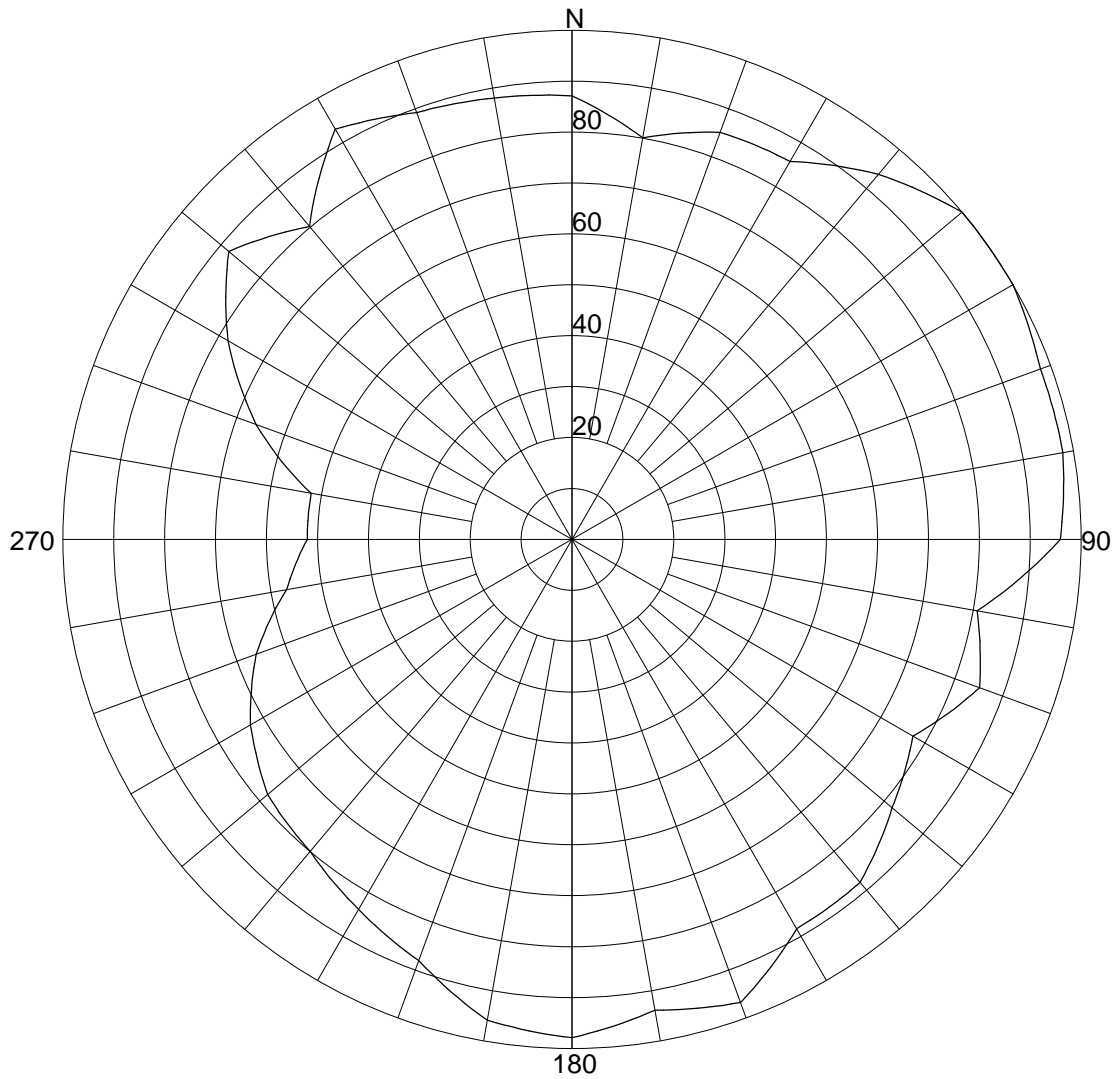
The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **935.65 feet (285.17 meters)** above ground level. The antenna aperture (Parasitic System included) is **85.06 feet (25.92 meters)**. No other antennas are to be mounted within **10 feet** 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 **135 degrees** true North.

The 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
0565C-C	ANTENNA ASSEMBLY
0565C11	ANTENNA ORIENTATION
0565C12	PARASITIC PLACEMENT (BAYS 1 THRU 4)
0565C13	PARASITIC PLACEMENT (BAYS 5 THRU 8)
2105A10	TEST RANGE SCHEMATIC

The array shall be mounted according to **DWG. 0565C-C**. The antenna elements shall be aligned at the same heading as in **DWG. 0565C11** to ensure that the antenna is oriented properly at **135** degrees true north. The Parasitic Assembly are shown in **DWG. 0565C12 & 0565C13**.

EXHIBIT 1



## Azimuth Pattern

### Systems With Reliability (SWR, L.P.)

Scale: Linear

Unit: Relative Field

CLIENT: WYFL (Composite)

Date: 2/25/2022

ANTENNA TYPE: FM10R/8-DA

FREQUENCY: 92.5

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.3899 / 1.43dB

PATTERN RMS: 0.848

## Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.8710 (-1.2 )	180	.9790 (-0.18 )
5	.8360 (-1.56 )	185	.9690 (-0.27 )
10	.8010 (-1.93 )	190	.9590 (-0.36 )
15	.8260 (-1.66 )	195	.9195 (-0.73 )
20	.8510 (-1.4 )	200	.8800 (-1.11 )
25	.8540 (-1.37 )	205	.8595 (-1.32 )
30	.8570 (-1.34 )	210	.8390 (-1.52 )
35	.8965 (-0.95 )	215	.8195 (-1.73 )
40	.9360 (-0.57 )	220	.8000 (-1.94 )
45	.9680 (-0.28 )	225	.7900 (-2.05 )
50	1.0000 ( 0 )	230	.7800 (-2.16 )
55	1.0000 ( 0 )	235	.7545 (-2.45 )
60	1.0000 ( 0 )	240	.7290 (-2.75 )
65	.9895 (-0.09 )	245	.6945 (-3.17 )
70	.9790 (-0.18 )	250	.6600 (-3.61 )
75	.9790 (-0.18 )	255	.6145 (-4.23 )
80	.9790 (-0.18 )	260	.5690 (-4.9 )
85	.9690 (-0.27 )	265	.5445 (-5.28 )
90	.9590 (-0.36 )	270	.5200 (-5.68 )
95	.8835 (-1.08 )	275	.5200 (-5.68 )
100	.8080 (-1.85 )	280	.5200 (-5.68 )
105	.8300 (-1.62 )	285	.5900 (-4.58 )
110	.8520 (-1.39 )	290	.6600 (-3.61 )
115	.8125 (-1.8 )	295	.7200 (-2.85 )
120	.7730 (-2.24 )	300	.7800 (-2.16 )
125	.7970 (-1.97 )	305	.8300 (-1.62 )
130	.8210 (-1.71 )	310	.8800 (-1.11 )
135	.8505 (-1.41 )	315	.8410 (-1.5 )
140	.8800 (-1.11 )	320	.8020 (-1.92 )
145	.8815 (-1.1 )	325	.8660 (-1.25 )
150	.8830 (-1.08 )	330	.9300 (-0.63 )
155	.9255 (-0.67 )	335	.9110 (-0.81 )
160	.9680 (-0.28 )	340	.8920 (-0.99 )
165	.9535 (-0.41 )	345	.8860 (-1.05 )
170	.9390 (-0.55 )	350	.8800 (-1.11 )
175	.9590 (-0.36 )	355	.8755 (-1.15 )

## Systems With Reliability (SWR, L.P.)

CLIENT: WYFL (Composite)

Date: 2/25/2022

ANTENNA TYPE: FM10R/8-DA

FREQUENCY: 92.5

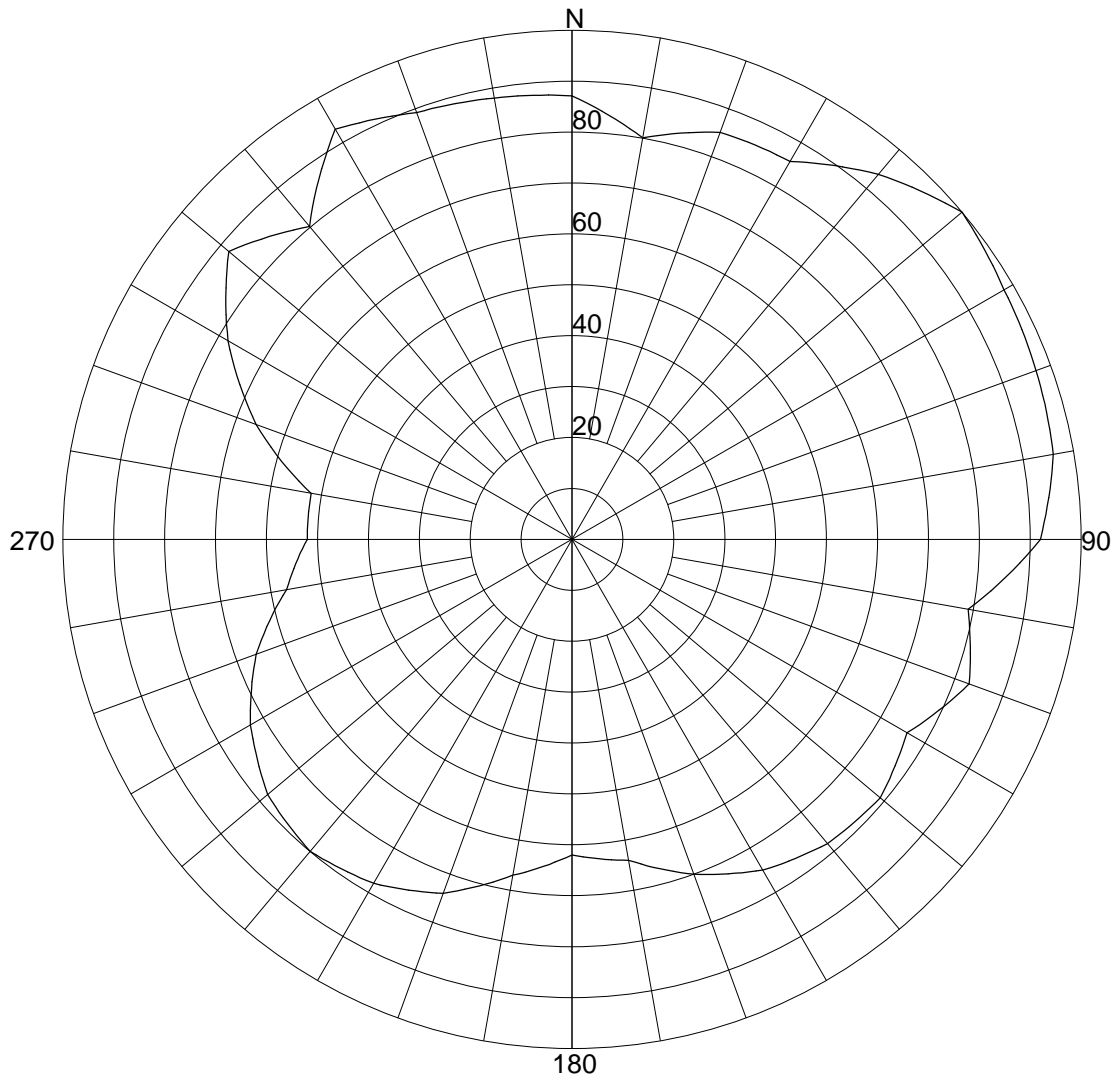
PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.3899 / 1.43dB

PATTERN RMS: 0.848

EXHIBIT 2



## Azimuth Pattern

### Systems With Reliability (SWR, L.P.)

Scale: Linear

Unit: Relative Field

CLIENT: WYFL (HORIZONTAL)

Date: 2/25/2022

ANTENNA TYPE: FM10R/8-DA

FREQUENCY: 92.5

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.56993 / 1.96dB

PATTERN RMS: 0.798

## Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.8710 (-1.2 )	180	.6200 (-4.15 )
5	.8360 (-1.56 )	185	.6450 (-3.81 )
10	.8010 (-1.93 )	190	.6700 (-3.48 )
15	.8260 (-1.66 )	195	.7050 (-3.04 )
20	.8510 (-1.4 )	200	.7400 (-2.62 )
25	.8540 (-1.37 )	205	.7600 (-2.38 )
30	.8570 (-1.34 )	210	.7800 (-2.16 )
35	.8965 (-0.95 )	215	.7900 (-2.05 )
40	.9360 (-0.57 )	220	.8000 (-1.94 )
45	.9680 (-0.28 )	225	.7900 (-2.05 )
50	1.0000 ( 0 )	230	.7800 (-2.16 )
55	.9900 (-0.09 )	235	.7545 (-2.45 )
60	.9800 (-0.18 )	240	.7290 (-2.75 )
65	.9750 (-0.22 )	245	.6945 (-3.17 )
70	.9700 (-0.26 )	250	.6600 (-3.61 )
75	.9650 (-0.31 )	255	.6145 (-4.23 )
80	.9600 (-0.35 )	260	.5690 (-4.9 )
85	.9400 (-0.54 )	265	.5445 (-5.28 )
90	.9200 (-0.72 )	270	.5200 (-5.68 )
95	.8550 (-1.36 )	275	.5200 (-5.68 )
100	.7900 (-2.05 )	280	.5200 (-5.68 )
105	.8100 (-1.83 )	285	.5900 (-4.58 )
110	.8300 (-1.62 )	290	.6600 (-3.61 )
115	.7950 (-1.99 )	295	.7200 (-2.85 )
120	.7600 (-2.38 )	300	.7800 (-2.16 )
125	.7750 (-2.21 )	305	.8300 (-1.62 )
130	.7900 (-2.05 )	310	.8800 (-1.11 )
135	.7850 (-2.1 )	315	.8410 (-1.5 )
140	.7800 (-2.16 )	320	.8020 (-1.92 )
145	.7650 (-2.33 )	325	.8660 (-1.25 )
150	.7500 (-2.5 )	330	.9300 (-0.63 )
155	.7250 (-2.79 )	335	.9110 (-0.81 )
160	.7000 (-3.1 )	340	.8920 (-0.99 )
165	.6700 (-3.48 )	345	.8860 (-1.05 )
170	.6400 (-3.88 )	350	.8800 (-1.11 )
175	.6300 (-4.01 )	355	.8755 (-1.15 )

## Systems With Reliability (SWR, L.P.)

CLIENT: WYFL (HORIZONTAL)

Date: 2/25/2022

ANTENNA TYPE: FM10R/8-DA

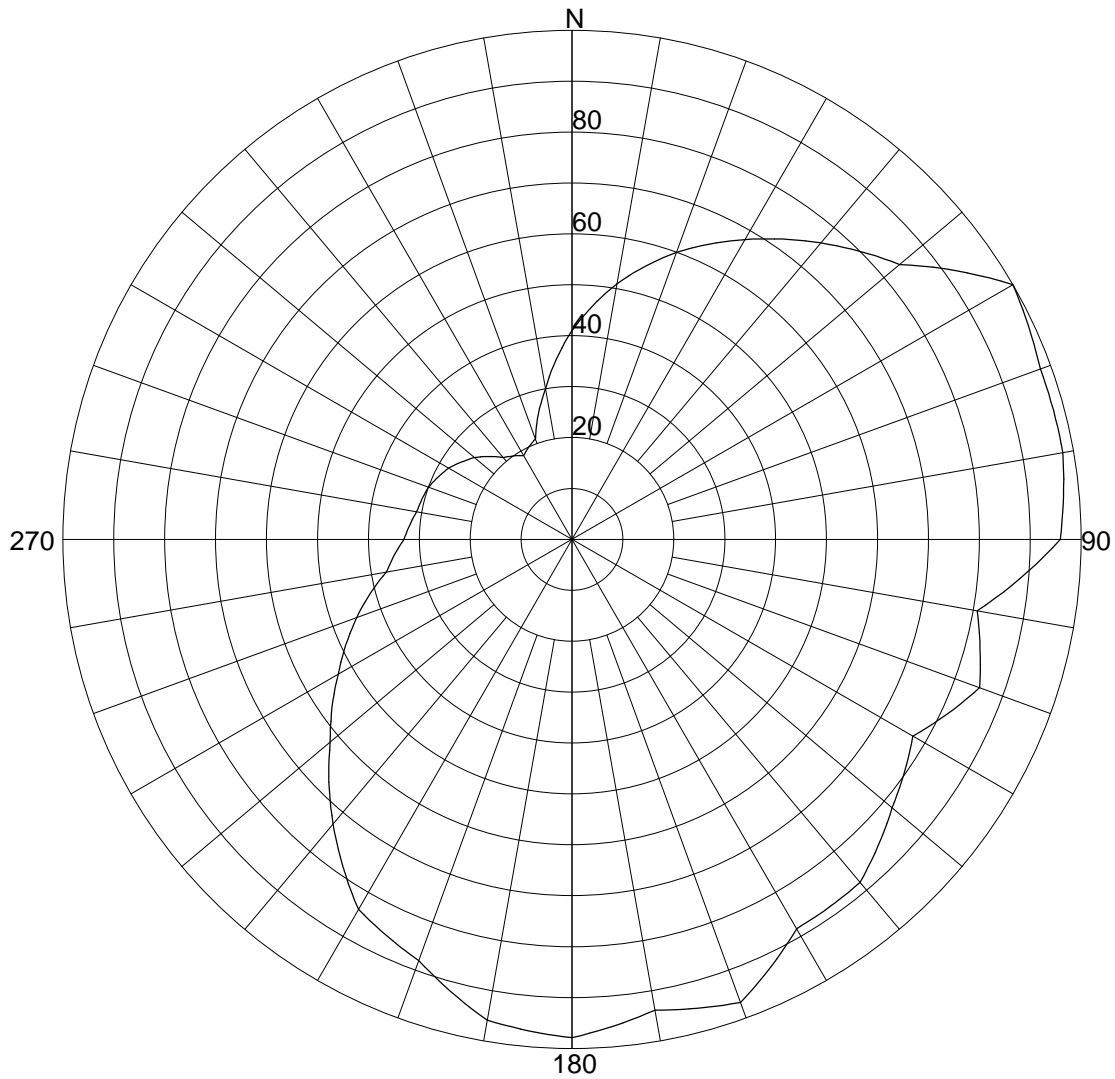
FREQUENCY: 92.5

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.56993 / 1.96dB

PATTERN RMS: 0.798



## Azimuth Pattern

### Systems With Reliability (SWR, L.P.)

Scale: Linear

Unit: Relative Field

CLIENT: WYFL (VERTICAL)

Date: 2/25/2022

ANTENNA TYPE: FM10R/8-DA

FREQUENCY: 92.5

PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.01044 / 3.03dB

PATTERN RMS: 0.705



## Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.4100 (-7.74 )	180	.9790 (-0.18 )
5	.4600 (-6.74 )	185	.9690 (-0.27 )
10	.5100 (-5.85 )	190	.9590 (-0.36 )
15	.5550 (-5.11 )	195	.9195 (-0.73 )
20	.6000 (-4.44 )	200	.8800 (-1.11 )
25	.6400 (-3.88 )	205	.8595 (-1.32 )
30	.6800 (-3.35 )	210	.8390 (-1.52 )
35	.7200 (-2.85 )	215	.7845 (-2.11 )
40	.7600 (-2.38 )	220	.7300 (-2.73 )
45	.8000 (-1.94 )	225	.6750 (-3.41 )
50	.8400 (-1.51 )	230	.6200 (-4.15 )
55	.9200 (-0.72 )	235	.5750 (-4.81 )
60	1.0000 ( 0 )	240	.5300 (-5.51 )
65	.9895 (-0.09 )	245	.4900 (-6.2 )
70	.9790 (-0.18 )	250	.4500 (-6.94 )
75	.9790 (-0.18 )	255	.4100 (-7.74 )
80	.9790 (-0.18 )	260	.3700 (-8.64 )
85	.9690 (-0.27 )	265	.3500 (-9.12 )
90	.9590 (-0.36 )	270	.3300 (-9.63 )
95	.8835 (-1.08 )	275	.3200 (-9.9 )
100	.8080 (-1.85 )	280	.3100 (-10.17 )
105	.8300 (-1.62 )	285	.3050 (-10.31 )
110	.8520 (-1.39 )	290	.3000 (-10.46 )
115	.8125 (-1.8 )	295	.2900 (-10.75 )
120	.7730 (-2.24 )	300	.2800 (-11.06 )
125	.7970 (-1.97 )	305	.2650 (-11.54 )
130	.8210 (-1.71 )	310	.2500 (-12.04 )
135	.8505 (-1.41 )	315	.2300 (-12.77 )
140	.8800 (-1.11 )	320	.2100 (-13.56 )
145	.8815 (-1.1 )	325	.2000 (-13.98 )
150	.8830 (-1.08 )	330	.1900 (-14.42 )
155	.9255 (-0.67 )	335	.2000 (-13.98 )
160	.9680 (-0.28 )	340	.2100 (-13.56 )
165	.9535 (-0.41 )	345	.2550 (-11.87 )
170	.9390 (-0.55 )	350	.3000 (-10.46 )
175	.9590 (-0.36 )	355	.3550 (-9 )

## Systems With Reliability (SWR, L.P.)

CLIENT: WYFL (VERTICAL)

Date: 2/25/2022

ANTENNA TYPE: FM10R/8-DA

FREQUENCY: 92.5

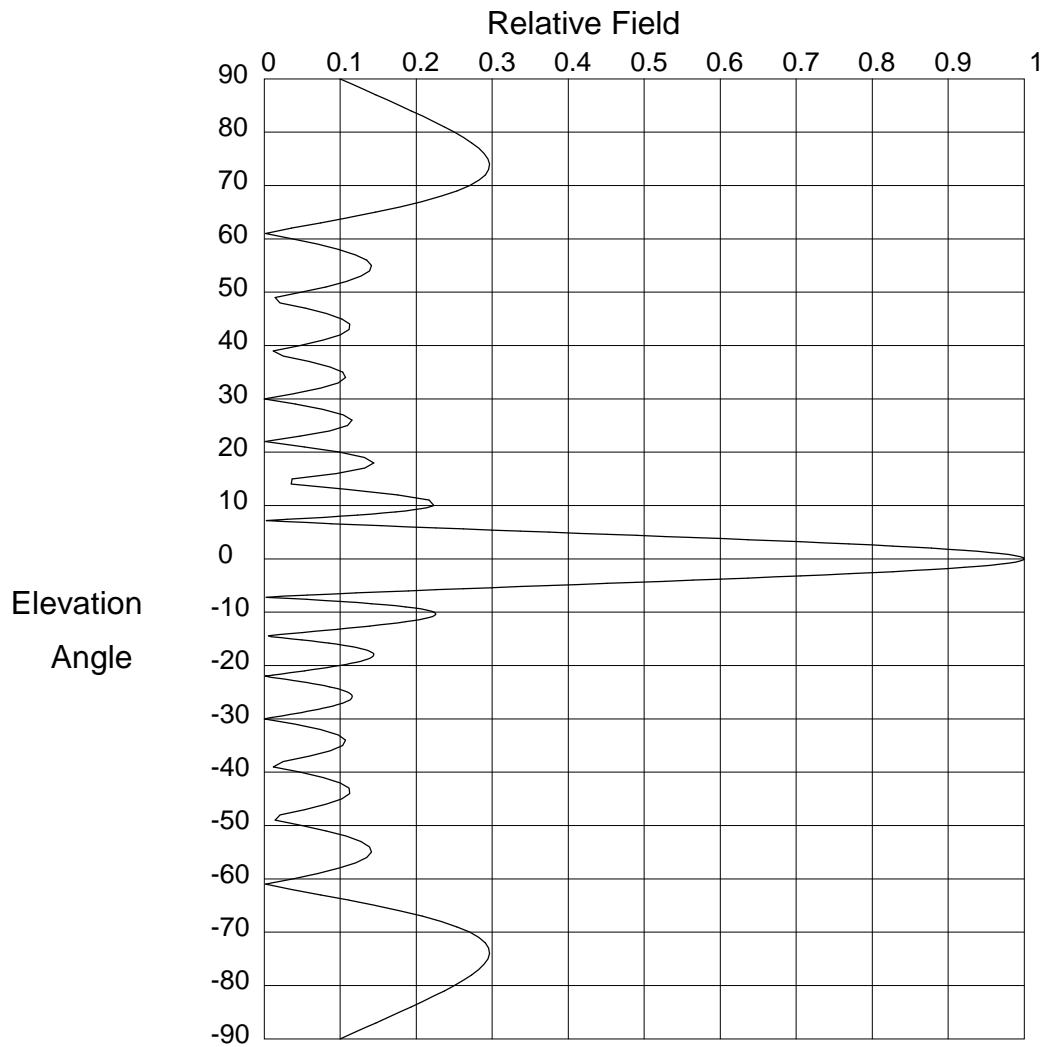
PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.01044 / 3.03dB

PATTERN RMS: 0.705

# EXHIBIT 4



## Elevation Pattern

### Systems With Reliability (SWR, L.P.)

Scale: Linear

Units: Field, Relative

CLIENT: WYFL (Exhibit 4)

Date: 2/24/2022

ANTENNA TYPE: FM10R/8-DA

FREQUENCY: 92.5

PATTERN POL.: Circular

DIRECTIVITY(Peak): 8.622/9.356 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 8.622/9.356 dBd

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

# Relative Field Tabulation

Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)	Elev. Angle	Rel. Fld(dB)
90.0	.10 (-20)	52.0	.108 (-19.327)	14.0	.036 (-28.97)
89.0	.116 (-18.733)	51.0	.082 (-21.775)	13.0	.111 (-19.115)
88.0	.131 (-17.628)	50.0	.05 (-26.085)	12.0	.176 (-15.105)
87.0	.147 (-16.649)	49.0	.015 (-36.694)	11.0	.217 (-13.265)
86.0	.163 (-15.773)	48.0	.021 (-33.623)	10.0	.223 (-13.02)
85.0	.178 (-14.983)	47.0	.054 (-25.364)	9.8	.22 (-13.169)
84.0	.193 (-14.268)	46.0	.082 (-21.744)	9.6	.214 (-13.393)
83.0	.208 (-13.619)	45.0	.102 (-19.835)	9.4	.207 (-13.7)
82.0	.223 (-13.032)	44.0	.112 (-18.995)	9.2	.197 (-14.099)
81.0	.237 (-12.504)	43.0	.112 (-19.045)	9.0	.186 (-14.606)
80.0	.25 (-12.034)	42.0	.10 (-20.017)	8.8	.173 (-15.238)
79.0	.262 (-11.623)	41.0	.078 (-22.192)	8.6	.158 (-16.023)
78.0	.273 (-11.273)	40.0	.047 (-26.495)	8.4	.141 (-17.001)
77.0	.282 (-10.987)	39.0	.012 (-38.571)	8.2	.123 (-18.233)
76.0	.289 (-10.769)	38.0	.025 (-31.984)	8.0	.102 (-19.824)
75.0	.294 (-10.625)	37.0	.059 (-24.535)	7.8	.08 (-21.965)
74.0	.296 (-10.564)	36.0	.087 (-21.252)	7.6	.056 (-25.08)
73.0	.295 (-10.593)	35.0	.103 (-19.712)	7.4	.03 (-30.453)
72.0	.291 (-10.726)	34.0	.107 (-19.392)	7.2	.003 (-51.343)
71.0	.283 (-10.977)	33.0	.097 (-20.245)	7.0	.026 (-31.659)
70.0	.27 (-11.364)	32.0	.074 (-22.611)	6.8	.056 (-24.975)
69.0	.254 (-11.913)	31.0	.04 (-27.906)	6.6	.088 (-21.11)
68.0	.233 (-12.656)	30.0	.00 (-50)	6.4	.121 (-18.355)
67.0	.208 (-13.643)	29.0	.041 (-27.668)	6.2	.155 (-16.204)
66.0	.179 (-14.944)	28.0	.078 (-22.159)	6.0	.19 (-14.435)
65.0	.147 (-16.68)	27.0	.104 (-19.636)	5.8	.226 (-12.932)
64.0	.111 (-19.068)	26.0	.116 (-18.73)	5.6	.262 (-11.627)
63.0	.074 (-22.6)	25.0	.11 (-19.19)	5.4	.299 (-10.474)
62.0	.036 (-28.862)	24.0	.086 (-21.292)	5.2	.337 (-9.446)
61.0	.002 (-55.548)	23.0	.047 (-26.472)	5.0	.375 (-8.518)
60.0	.038 (-28.489)	22.0	.001 (-58.057)	4.8	.413 (-7.677)
59.0	.07 (-23.053)	21.0	.053 (-25.538)	4.6	.451 (-6.911)
58.0	.098 (-20.142)	20.0	.099 (-20.078)	4.4	.489 (-6.209)
57.0	.12 (-18.397)	19.0	.132 (-17.6)	4.2	.527 (-5.564)
56.0	.135 (-17.404)	18.0	.144 (-16.819)	4.0	.564 (-4.971)
55.0	.141 (-17.006)	17.0	.132 (-17.577)	3.8	.601 (-4.425)
54.0	.139 (-17.157)	16.0	.095 (-20.433)	3.6	.637 (-3.922)
53.0	.127 (-17.89)	15.0	.037 (-28.714)	3.4	.672 (-3.458)

## Systems With Reliability (SWR, L.P.)

Page 1 of 3

CLIENT: WYFL (Exhibit 4)

Date: 2/24/2022

ANTENNA TYPE: FM10R/8-DA

FREQUENCY: 92.5

PATTERN POL.: Circular

DIRECTIVITY(Peak): 8.622/9.356 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 8.622/9.356 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	.705 (-3.031)	-4.4	.489 (-6.209)	-12.0	.176 (-15.105 )
3.0	.738 (-2.639)	-4.6	.451 (-6.911)	-12.2	.164 (-15.695 )
2.8	.769 (-2.279)	-4.8	.413 (-7.677)	-12.4	.152 (-16.375 )
2.6	.799 (-1.949)	-5.0	.375 (-8.518)	-12.6	.139 (-17.159 )
2.4	.827 (-1.649)	-5.2	.337 (-9.446)	-12.8	.125 (-18.064 )
2.2	.853 (-1.377)	-5.4	.299 (-10.474)	-13.0	.111 (-19.115 )
2.0	.878 (-1.131)	-5.6	.262 (-11.627)	-13.2	.096 (-20.347 )
1.8	.90 (-0.911)	-5.8	.226 (-12.932)	-13.4	.081 (-21.815 )
1.6	.921 (-0.717)	-6.0	.19 (-14.435)	-13.6	.066 (-23.607 )
1.4	.939 (-0.547)	-6.2	.155 (-16.204)	-13.8	.051 (-25.883 )
1.2	.955 (-0.4)	-6.4	.121 (-18.355)	-14.0	.036 (-28.97 )
1.0	.969 (-0.277)	-6.6	.088 (-21.11)	-14.2	.021 (-33.751 )
.8	.98 (-0.177)	-6.8	.056 (-24.975)	-14.4	.006 (-44.915 )
.6	.989 (-0.099)	-7.0	.026 (-31.659)	-14.6	.009 (-41.046 )
.4	.995 (-0.044)	-7.2	.003 (-51.343)	-14.8	.023 (-32.762 )
.2	.999 (-0.011)	-7.4	.03 (-30.453)	-15.0	.037 (-28.714 )
.0	1.00 (0)	-7.6	.056 (-25.08)	-15.2	.05 (-26.062 )
-.2	.999 (-0.011)	-7.8	.08 (-21.965)	-15.4	.062 (-24.121 )
-.4	.995 (-0.044)	-8.0	.102 (-19.824)	-15.6	.074 (-22.618 )
-.6	.989 (-0.099)	-8.2	.123 (-18.233)	-15.8	.085 (-21.415 )
-.8	.98 (-0.177)	-8.4	.141 (-17.001)	-16.0	.095 (-20.433 )
-1.0	.969 (-0.277)	-8.6	.158 (-16.023)	-16.2	.104 (-19.623 )
-1.2	.955 (-0.4)	-8.8	.173 (-15.238)	-16.4	.113 (-18.952 )
-1.4	.939 (-0.547)	-9.0	.186 (-14.606)	-16.6	.12 (-18.398 )
-1.6	.921 (-0.717)	-9.2	.197 (-14.099)	-16.8	.127 (-17.943 )
-1.8	.90 (-0.911)	-9.4	.207 (-13.7)	-17.0	.132 (-17.577 )
-2.0	.878 (-1.131)	-9.6	.214 (-13.393)	-17.2	.137 (-17.289 )
-2.2	.853 (-1.377)	-9.8	.22 (-13.169)	-17.4	.14 (-17.074 )
-2.4	.827 (-1.649)	-10.0	.223 (-13.02)	-17.6	.142 (-16.926 )
-2.6	.799 (-1.949)	-10.2	.225 (-12.941)	-17.8	.144 (-16.842 )
-2.8	.769 (-2.279)	-10.4	.226 (-12.928)	-18.0	.144 (-16.819 )
-3.0	.738 (-2.639)	-10.6	.224 (-12.979)	-18.2	.144 (-16.856 )
-3.2	.705 (-3.031)	-10.8	.222 (-13.091)	-18.4	.142 (-16.952 )
-3.4	.672 (-3.458)	-11.0	.217 (-13.265)	-18.6	.14 (-17.107 )
-3.6	.637 (-3.922)	-11.2	.211 (-13.501)	-18.8	.136 (-17.323 )
-3.8	.601 (-4.425)	-11.4	.204 (-13.799)	-19.0	.132 (-17.6 )
-4.0	.564 (-4.971)	-11.6	.196 (-14.164)	-19.2	.127 (-17.944 )
-4.2	.527 (-5.564)	-11.8	.186 (-14.597)	-19.4	.121 (-18.356 )

## Systems With Reliability (SWR, L.P.)

Page 2 of 3

CLIENT: WYFL (Exhibit 4)

Date: 2/24/2022

ANTENNA TYPE: FM10R/8-DA

FREQUENCY: 92.5

PATTERN POL.: Circular

DIRECTIVITY(Peak): 8.622/9.356 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 8.622/9.356 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	.114 (-18.844)	-27.2	.10 (-19.992)	-54.0	.139 (-17.157 )
-19.8	.107 (-19.415)	-27.4	.095 (-20.416)	-55.0	.141 (-17.006 )
-20.0	.099 (-20.078)	-27.6	.09 (-20.912)	-56.0	.135 (-17.404 )
-20.2	.091 (-20.849)	-27.8	.084 (-21.49)	-57.0	.12 (-18.397 )
-20.4	.082 (-21.746)	-28.0	.078 (-22.159)	-58.0	.098 (-20.142 )
-20.6	.072 (-22.797)	-28.2	.071 (-22.936)	-59.0	.07 (-23.053 )
-20.8	.063 (-24.04)	-28.4	.064 (-23.838)	-60.0	.038 (-28.489 )
-21.0	.053 (-25.538)	-28.6	.057 (-24.896)	-61.0	.002 (-55.548 )
-21.2	.043 (-27.393)	-28.8	.049 (-26.151)	-62.0	.036 (-28.862 )
-21.4	.032 (-29.794)	-29.0	.041 (-27.668)	-63.0	.074 (-22.6 )
-21.6	.022 (-33.154)	-29.2	.033 (-29.556)	-64.0	.111 (-19.068 )
-21.8	.012 (-38.714)	-29.4	.025 (-32.022)	-65.0	.147 (-16.68 )
-22.0	.001 (-58.057)	-29.6	.017 (-35.527)	-66.0	.179 (-14.944 )
-22.2	.009 (-40.939)	-29.8	.008 (-41.548)	-67.0	.208 (-13.643 )
-22.4	.019 (-34.416)	-30.0	.00 (-50)	-68.0	.233 (-12.656 )
-22.6	.029 (-30.806)	-31.0	.04 (-27.906)	-69.0	.254 (-11.913 )
-22.8	.038 (-28.331)	-32.0	.074 (-22.611)	-70.0	.27 (-11.364 )
-23.0	.047 (-26.472)	-33.0	.097 (-20.245)	-71.0	.283 (-10.977 )
-23.2	.056 (-25.004)	-34.0	.107 (-19.392)	-72.0	.291 (-10.726 )
-23.4	.064 (-23.81)	-35.0	.103 (-19.712)	-73.0	.295 (-10.593 )
-23.6	.072 (-22.82)	-36.0	.087 (-21.252)	-74.0	.296 (-10.564 )
-23.8	.08 (-21.991)	-37.0	.059 (-24.535)	-75.0	.294 (-10.625 )
-24.0	.086 (-21.292)	-38.0	.025 (-31.984)	-76.0	.289 (-10.769 )
-24.2	.092 (-20.703)	-39.0	.012 (-38.571)	-77.0	.282 (-10.987 )
-24.4	.098 (-20.208)	-40.0	.047 (-26.495)	-78.0	.273 (-11.273 )
-24.6	.102 (-19.797)	-41.0	.078 (-22.192)	-79.0	.262 (-11.623 )
-24.8	.106 (-19.459)	-42.0	.10 (-20.017)	-80.0	.25 (-12.034 )
-25.0	.11 (-19.19)	-43.0	.112 (-19.045)	-81.0	.237 (-12.504 )
-25.2	.112 (-18.984)	-44.0	.112 (-18.995)	-82.0	.223 (-13.032 )
-25.4	.114 (-18.837)	-45.0	.102 (-19.835)	-83.0	.208 (-13.619 )
-25.6	.116 (-18.747)	-46.0	.082 (-21.744)	-84.0	.193 (-14.268 )
-25.8	.116 (-18.711)	-47.0	.054 (-25.364)	-85.0	.178 (-14.983 )
-26.0	.116 (-18.73)	-48.0	.021 (-33.623)	-86.0	.163 (-15.773 )
-26.2	.115 (-18.801)	-49.0	.015 (-36.694)	-87.0	.147 (-16.649 )
-26.4	.113 (-18.926)	-50.0	.05 (-26.085)	-88.0	.131 (-17.628 )
-26.6	.111 (-19.106)	-51.0	.082 (-21.775)	-89.0	.116 (-18.733 )
-26.8	.108 (-19.342)	-52.0	.108 (-19.327)	-90.0	.10 (-20 )
-27.0	.104 (-19.636)	-53.0	.127 (-17.89)	90.0	.00 (-50 )

## Systems With Reliability (SWR, L.P.)

Page 3 of 3

CLIENT: WYFL (Exhibit 4)

Date: 2/24/2022

ANTENNA TYPE: FM10R/8-DA

FREQUENCY: 92.5

PATTERN POL.: Circular

DIRECTIVITY(Peak): 8.622/9.356 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 8.622/9.356 dBd

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

# EXHIBIT 5



**SYSTEMS WITH RELIABILITY, LP**  
Broadcast Antennas & Transmission Systems

## SYSTEM DATA SHEET



Call Sign	WYFL
Customer	Bible Broadcasting Network
Location	Henderson, NC
Antenna Model	FM10R/8-DA
Channel/Frequency	223 / 92.5 MHz
Polarization Type	Circular

### Antenna Specifications:

	H. Pol.	dB	V. Pol.	dB
License ERP (KW)	100.0000	20.0000	100.0000	20.0000
FCC Limit Pattern Directivity	1.1548	0.6251	1.1548	0.6251
Elevation Directivity	8.6220	9.3561	8.6220	9.3561
Azimuth Directivity	1.5699	1.9588	2.0104	3.0329
Composite Pattern	1.3899	1.4298	1.3899	1.4298
Polarization Ratio	0.5615	-2.5064	0.4385	-3.5805
<b>RMS FCC vs Comp</b>	<b>91.20%</b>			
Antenna Efficiency	1.0000	0.0000	1.0000	0.0000
Antenna Gain	7.6007	8.8085	7.6007	8.8085
Antenna Input Power (KW)	13.1567	11.1915 <b>dBK</b>	13.1567	11.1915 <b>dBK</b>

### Physical Specifications:

No. of Bays	8		
Antenna Aperture	85.07	ft	25.9464 m
Antenna Total Length	88.07	ft	24.2100 m
Center of Radiation	922	ft	281.2100 m
Antenna Weight	980	lbs	445.4545 kg
Wind load ( 50/33,)	1750	lbs	795.4545 kg



**SYSTEMS WITH RELIABILITY, LP**  
*Broadcast Antennas and Transmission Systems*

## WYFL Antenna RMS Comparison

### PROPOSED ANTENNA

Azimuth Heading	Relative Field
--------------------	-------------------

0	1
10	1
20	1
30	1
40	1
50	1
60	1
70	1
80	1
90	1
100	1
110	1
120	1
130	1
140	1
150	1
160	1
170	1
180	1
190	1
200	0.9
210	0.9
220	0.88
230	0.83
240	0.75
250	0.67
260	0.615
270	0.56
280	0.53
290	0.66
300	0.83
310	1
320	1
330	1
340	1
350	1

### DESIGNED ANTENNA

Azimuth Heading	Relative Field
--------------------	-------------------

0	0.871
10	0.801
20	0.851
30	0.857
40	0.936
50	1
60	1
70	0.979
80	0.979
90	0.959
100	0.808
110	0.852
120	0.773
130	0.821
140	0.88
150	0.883
160	0.968
170	0.939
180	0.979
190	0.959
200	0.88
210	0.839
220	0.8
230	0.78
240	0.729
250	0.66
260	0.569
270	0.52
280	0.52
290	0.66
300	0.78
310	0.88
320	0.802
330	0.93
340	0.892
350	0.88

Sum of Relative Field Squared : 31.192  
Sum Divided by 36 (Readings) : 0.866  
Square Root : 0.931

Sum of Relative Field Squared : 25.928  
Sum Divided by 36 (Readings) : 0.720  
Square Root : 0.849

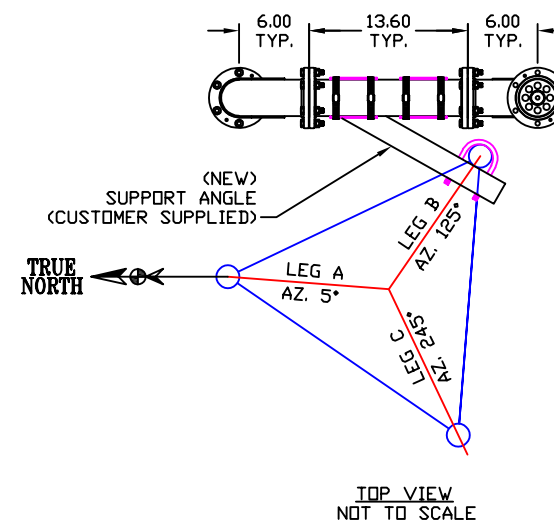
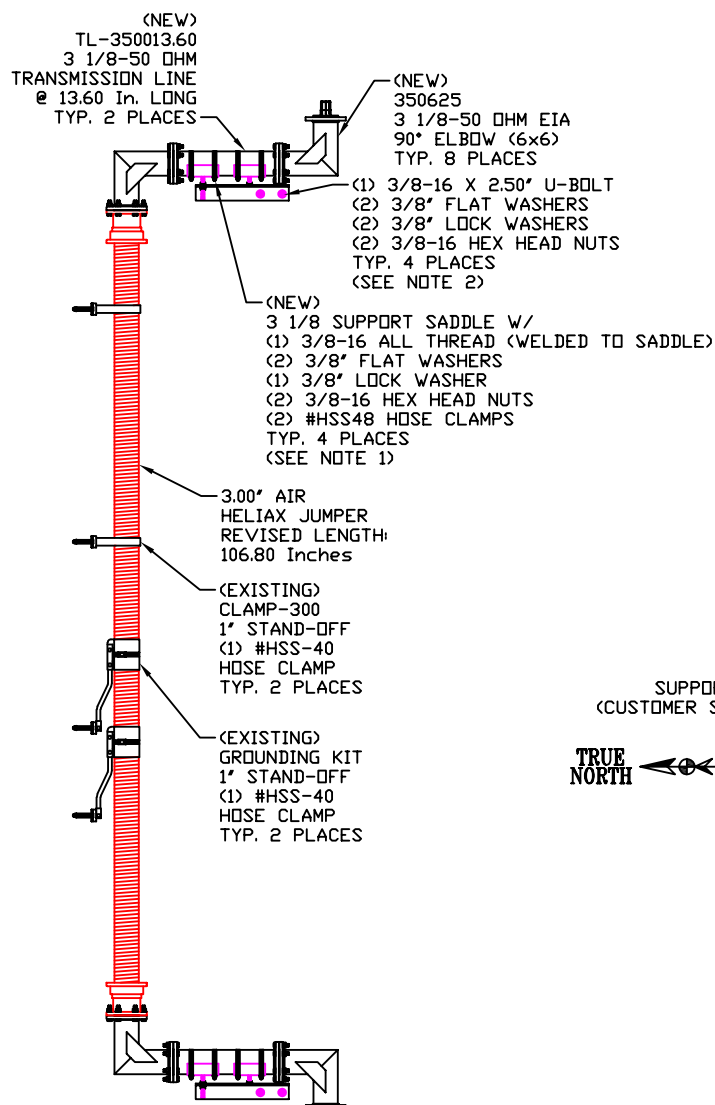
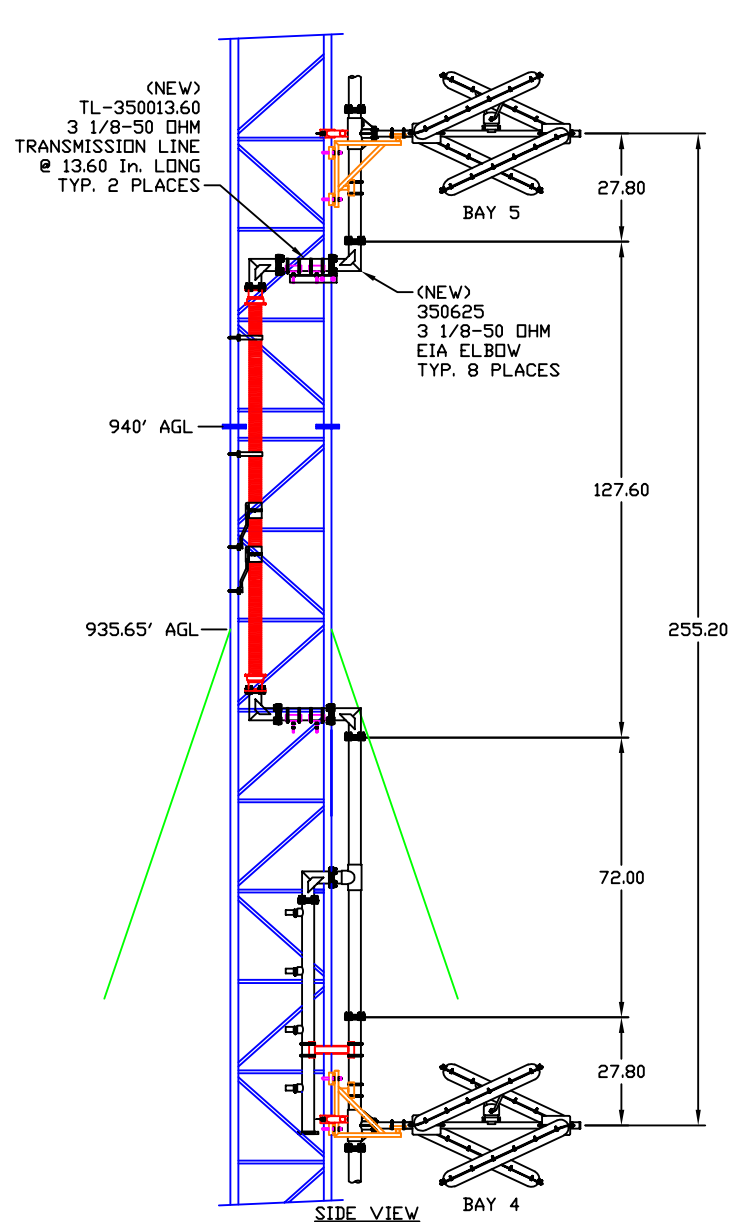
Percentage of Construction Permit Antenna Filled :

**91.2%**

S.O. #21362

**NOTES:**

1. THE (4) SADDLES WITH HARDWARE LOCATIONS TO BE FIELD DETERMINED.
2. THE (4) U-BOLTS ARE PROVIDED FOR THE CUSTOMER SUPPLIED SUPPORT ANGLES.



MODIFICATION DETAIL  
NOT TO SCALE



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

TITLE:	FM10RA/8-DA, FREQ. 92.5 WYFL, HENDERSON, NC
MATERIAL:	OPTION B HELIAX MODIFICATION

SIZE	C
------	---

REV	APPROVAL	DATE	REV	APPROVAL	DATE	ENGINEER:		DRAWING NUMBER:	
1		12/3/21						0565C-C	
						SCALE:	NAME:	DATE:	SHEET
						NTS	BJH	2/10/22	1 OF 1



DRAWING  
NUMBER:

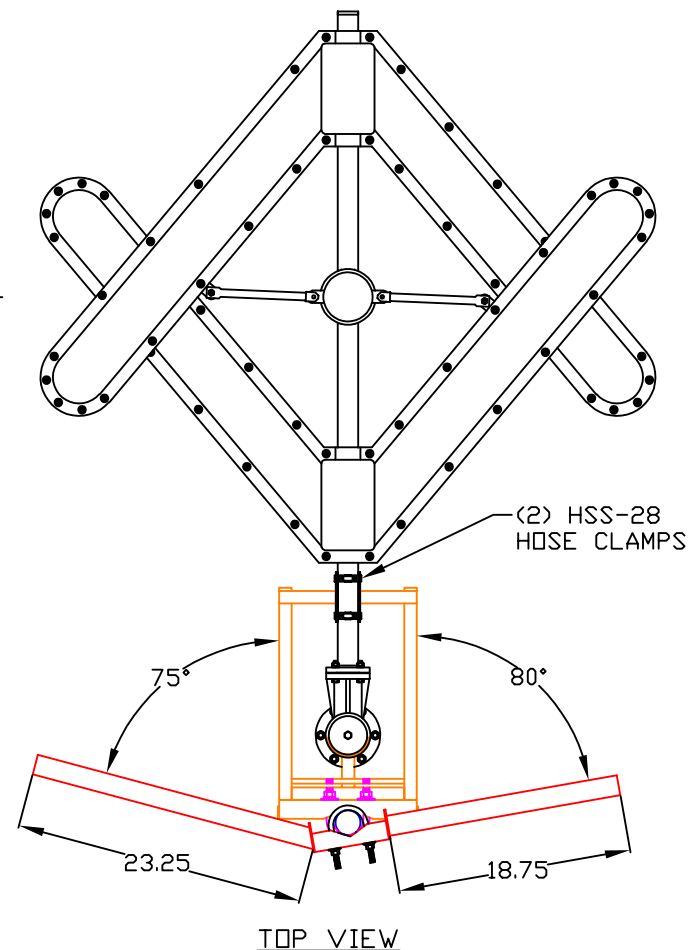
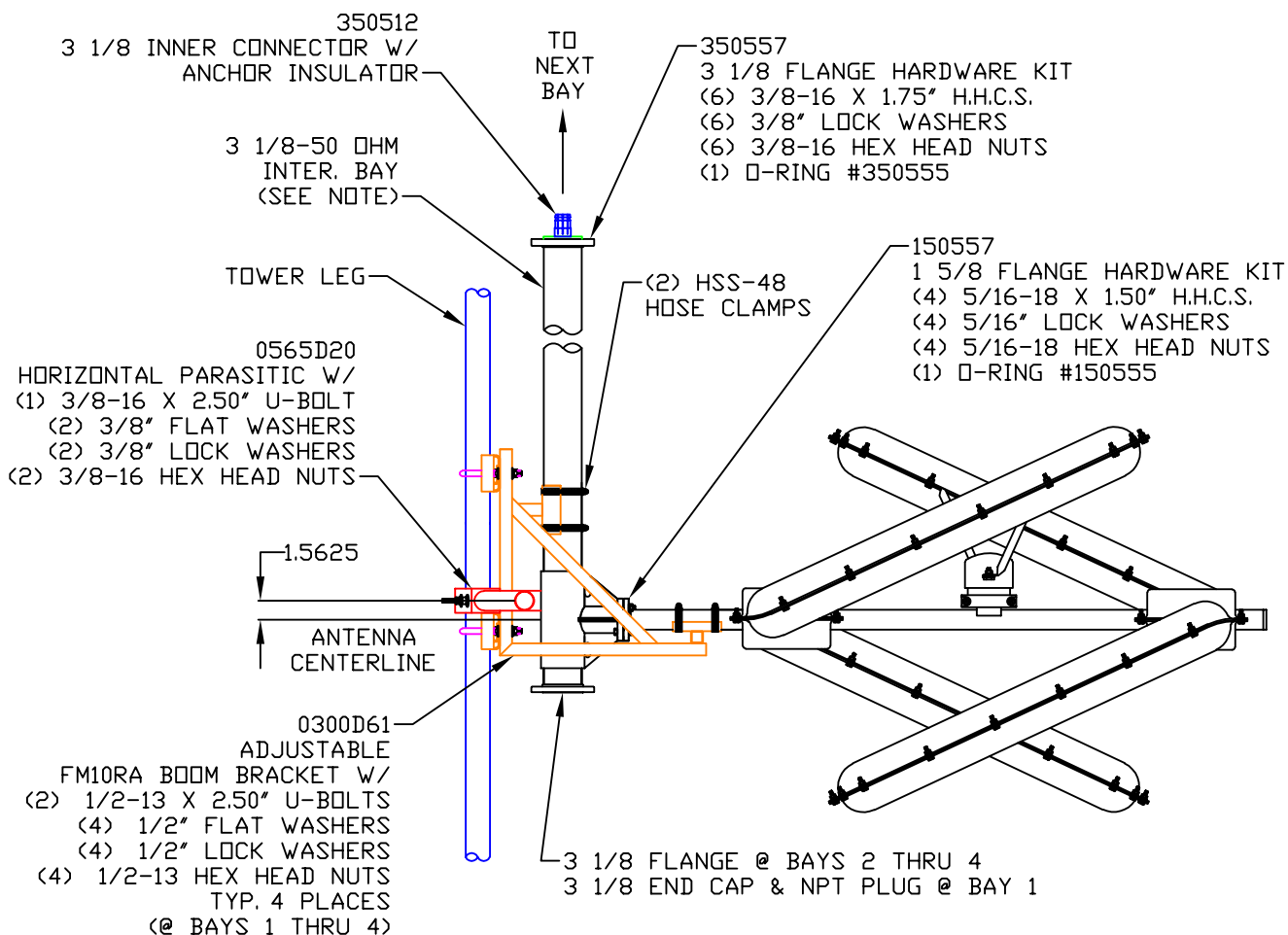
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.XX ± .005			
.XXX ± .002			
X/X ± 1/32			
DEG. ± 1/2			
UNLESS OTHERWISE SPECIFIED			
BY THIS DRAWING		DRAWING NUMBER: 0565C11	
NAME: BJH	DATE: 11/3/21	SHEET 1 OF 1	

# NOTE:

EACH INTER. BAY AND RADOME ARE NUMBER LABELED.  
DURING INSTALLATION, MATCH EACH INTER. BAY NUMBER  
WITH THE CORRESPONDING RADOME BAY NUMBER.

DRAWING  
NUMBER:

0565C12



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

TITLE:

FM10RA/8-DA, FREQ. 92.5  
WYFL, HENDERSON, NC

MATERIAL:

BAYS 1 THRU 4  
INSTALLATION

SIZE

A

PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: BJH

DATE: 11/3/21

SHEET 1 OF 1

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

## REVISION RECORD

REV	APPROVAL	DATE

DRAWING  
NUMBER:

0565C12

DRAWING  
NUMBER: 0565C13

350512  
3 1/8 INNER CONNECTOR W/  
ANCHOR INSULATOR

0565D20  
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

ANTENNA  
CENTERLINE

TO  
NEXT  
BAY

-350557  
3 1/8 FLANGE HARDWARE KIT  
(6) 3/8-16 X 1.75" H.H.C.S.  
(6) 3/8" LOCK WASHERS  
(6) 3/8-16 HEX HEAD NUTS  
(1) O-RING #350555

-3 1/8 FLANGE @ BAYS 5 THRU 7  
3 1/8 END CAP & NPT PLUG @ BAY 8

0300D61  
ADJUSTABLE  
FM10RA BOOM BRACKET W/  
(2) 1/2-13 X 2.5" U-BOLTS  
(4) 1/2" FLAT WASHERS  
(4) 1/2" LOCK WASHERS  
(4) 1/2-13 HEX HEAD NUTS  
(@ BAYS 5 THRU 8)

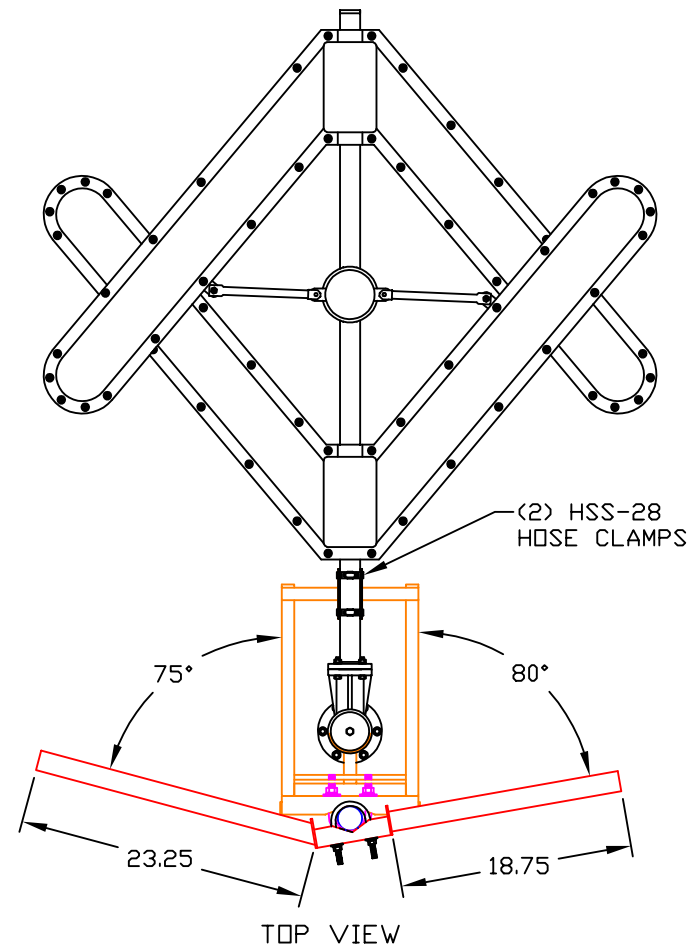
-150557  
1 5/8 FLANGE HARDWARE KIT  
(4) 5/16-18 X 1.50" H.H.C.S.  
(4) 5/16" LOCK WASHERS  
(4) 5/16-18 HEX HEAD NUTS  
(1) O-RING #150555

- (2) HSS-48  
HOSE CLAMPS

TOWER LEG-

-3 1/8-50 QHM  
INTER. BAY  
(SEE NOTE)

SIDE VIEW



TOLERANCES		REVISION RECORD	
.X ± .015	REV	APPROVAL	DATE
.XX ± .005			
.XXX ± .002			
X/X ± 1/32			
DEG. ± 1/2			
UNLESS OTHERWISE SPECIFIED			
BY THIS DRAWING		DRAWING NUMBER: 0565C13	
NAME: BJH	DATE: 11/3/21	SHEET 1 OF 1	



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

**TITLE:**

FM10RA/8-DA, FREQ. 92.5  
WYFL, HENDERSON, NC

**MATERIAL:**

BAYS 5 THRU 8  
INSTALLATION

**SIZE**

A

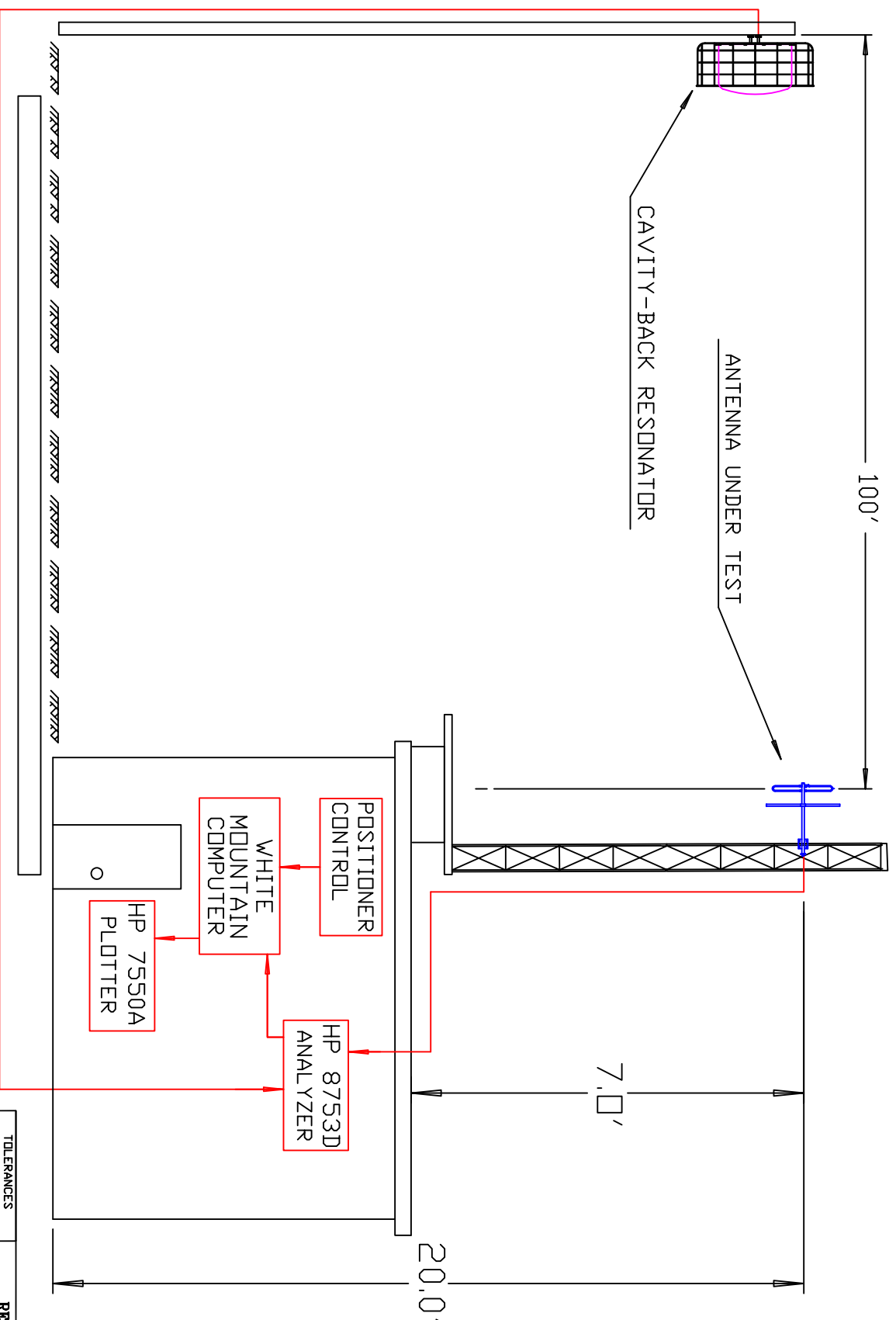
PARTS MADE BY THIS DRAWING

SCALE: NTS

NAME: BJH

DATE: 11/3/21

SHEET 1 OF 1
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TOLERANCES	REVISION RECORD	
	REV	APPROVAL DATE
.X ± .015		
.XX ± .005		
.XXX ± .002		
X/XX ± 1/32		
DEC. ± 1/2		
UNLESS OTHERWISE SPECIFIED		

TITLE: TEST RANGE SCHEMATIC									
MATERIAL:									
SIZE									
A									
PARTS MADE BY THIS DRAWING									
DRAWING NUMBER: 2105A10									
SCALE: NTS NAME: JRM DATE: 11/1/98 SHEET 1 OF 1									