



SYSTEMS WITH RELIABILITY, LP
BROADCAST ANTENNAS AND TRANSMISSION LINE

PATTERN CERTIFICATION
DIRECTIONAL FM ANTENNA
KKML
February 9, 2018

Call Sign	:	KKML
Location	:	Minden, LA
Frequency	:	90.9 MHz
Channel	:	215A
Antenna Model	:	FM3/1-DA
Maximum Antenna Gain	:	
Horizontal	:	0.958 / -0.185 dB
Vertical	:	0.958 / -0.185 dB

ANTENNA DESCRIPTION

A custom designed FM3/1-DA antenna was fabricated to conform to the prescribed directional azimuth pattern. The antenna consists of one (1) circularly polarized, cross-V dipole radiating element mounted to a 2" (inch) schedule 40 support pole. The support pole is mounted to a 42" (inch) face tower. The antenna points 350 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.

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 272.7 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 272.7 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 **90.2%** of the **RMS** value of the pattern authorized in the related FCC file **BNPED-20071015AFG**. The vertical component **RMS** value is **0.681**. The horizontal component **RMS** value is **0.676**. The circular polarized component **RMS** value is **0.755**.

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

Measured vertical polarized directivity:	2.154 / 3.332 dB
Measured horizontal polarized directivity:	2.188 / 3.401 dB
Measured circular polarized pattern directivity:	1.754/ 2.440 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 = (2.154)(.504)(0.883) =	0.958 / -0.185 dB
H-Pol. Gain = (2.188)(.496)(0.883) =	0.958 / -0.185 dB

INSTALLATION AND MOUNTING

The antenna is to be mounted in accordance with the supplied drawings. The antenna center of radiation is to be **98 meters (321.54 ft.)** above ground level. The antenna aperture is **6 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 **350 degrees** true North.

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

DRAWING NO.	TITLE
1764D10	ELEVATION
1764D11	ANTENNA ORIENTATION
2105A10	TEST RANGE SCHEMATIC

The antenna elevation is shown on **DWG. 1764D10**. The antenna elements shall be aligned at the same heading as in **DWG. 1764D11**. This will ensure that the antenna is oriented properly at **350** degrees true North. 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

Surveyor's Declaration

I, _____, subject to the penalties of perjury, do declare the following:

- 1.) I am a licensed surveyor in the state(s) of _____, _____ and _____.
- 2.) I have provided professional services to _____ (permit tee name), permit tee of KKML-FM, Minden (city of license), LA (state), during the installation of the KKML-FM directional antenna.
- 3.) I certify that the KKML-FM directional antenna has been oriented at the proper azimuth as authorized in the drawings section (Exhibit 7) of the Proof of Performance for KKML-FM. Namely Drawing #1764D11 shows the proper heading to be 350 degrees from true North.

Sign _____

Dated: _____mm/dd/yy

Engineer's Declaration

I, _____, subject to the penalties of perjury, do declare the following:

1.) I am the holder of a valid General Radio Telephone Operators License, Number _____ (FCC License No.)

2.) I have been a member of the Society of Broadcast Engineer's since _____(year)

3.) That I have been employed as a technical consultant with the firm of:

_____ (firm name), of

_____ (city state)

4.) That _____ (Firm's Name) was retained by _____ (Permit tee's Name) for the purpose of preparing its application for the construction permit of KKML-FM Minden (City), Louisiana (State), from which the underlying Construction Permit (FCC File Number BNPED-20071015AFG) was granted by the Commission.

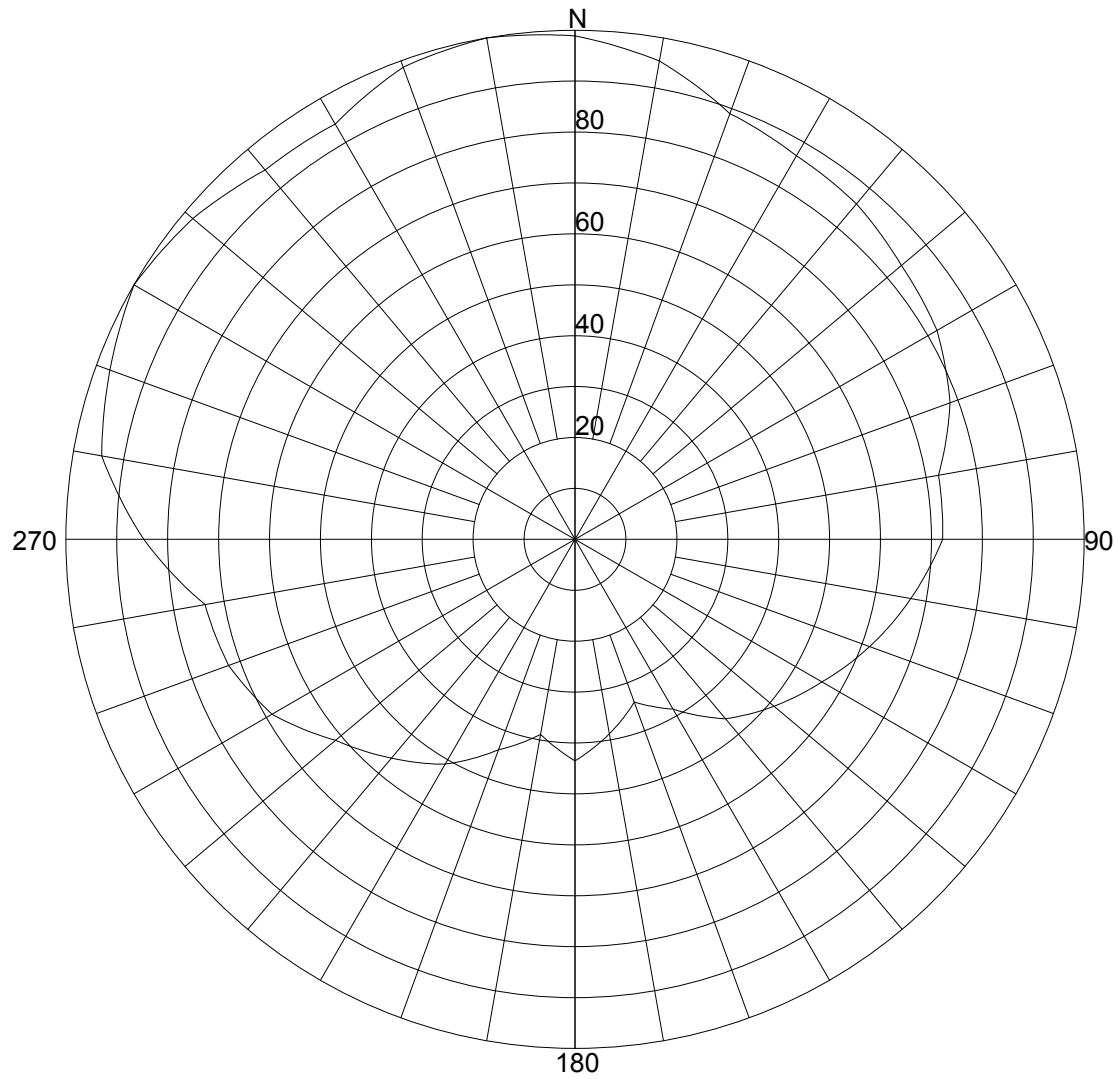
1.) That I am familiar with the terms and conditions of the KKML-FM Construction Permit.

2.) I hereby certify that I have overseen the installation of the KKML-FM directional antenna and that the installation was complete to the manufacturer's instructions outlined in the Proof of Performance Drawings section (Exhibit 7) for KKML-FM.

Sign _____

Dated: _____mm/dd/yy

Exhibit 1: Circular Polarized Azimuth Pattern (Composite)



Azimuth Pattern

Systems With Reliability

Scale: Linear

Unit: Relative Field

CLIENT: *KKML*

Date: 1/29/2018

ANTENNA TYPE: FM3/1-DA

FREQUENCY: 90.9 MHz

PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.7539 / 2.44dB

PATTERN RMS: 0.755

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.9890 (-0.1)	180	.4350 (-7.23)
5	.9715 (-0.25)	185	.4120 (-7.7)
10	.9540 (-0.41)	190	.3890 (-8.2)
15	.9220 (-0.71)	195	.4145 (-7.65)
20	.8900 (-1.01)	200	.4400 (-7.13)
25	.8800 (-1.11)	205	.4750 (-6.47)
30	.8700 (-1.21)	210	.5100 (-5.85)
35	.8650 (-1.26)	215	.5355 (-5.42)
40	.8600 (-1.31)	220	.5610 (-5.02)
45	.8485 (-1.43)	225	.5875 (-4.62)
50	.8370 (-1.55)	230	.6140 (-4.24)
55	.8290 (-1.63)	235	.6505 (-3.74)
60	.8210 (-1.71)	240	.6870 (-3.26)
65	.8025 (-1.91)	245	.7055 (-3.03)
70	.7840 (-2.11)	250	.7240 (-2.81)
75	.7545 (-2.45)	255	.7310 (-2.72)
80	.7250 (-2.79)	260	.7380 (-2.64)
85	.7235 (-2.81)	265	.7925 (-2.02)
90	.7220 (-2.83)	270	.8470 (-1.44)
95	.6960 (-3.15)	275	.8955 (-0.96)
100	.6700 (-3.48)	280	.9440 (-0.5)
105	.6430 (-3.84)	285	.9580 (-0.37)
110	.6160 (-4.21)	290	.9720 (-0.25)
115	.5880 (-4.61)	295	.9860 (-0.12)
120	.5600 (-5.04)	300	1.0000 (0)
125	.5350 (-5.43)	305	.9900 (-0.09)
130	.5100 (-5.85)	310	.9800 (-0.18)
135	.4850 (-6.29)	315	.9635 (-0.32)
140	.4600 (-6.74)	320	.9470 (-0.47)
145	.4225 (-7.48)	325	.9445 (-0.5)
150	.3850 (-8.29)	330	.9420 (-0.52)
155	.3625 (-8.81)	335	.9645 (-0.31)
160	.3400 (-9.37)	340	.9870 (-0.11)
165	.3640 (-8.78)	345	.9935 (-0.06)
170	.3880 (-8.22)	350	1.0000 (0)
175	.4115 (-7.71)	355	.9945 (-0.05)

Systems With Reliability

CLIENT: *KKML*

Date: 1/29/2018

ANTENNA TYPE: FM3/1-DA

FREQUENCY: 90.9 MHz

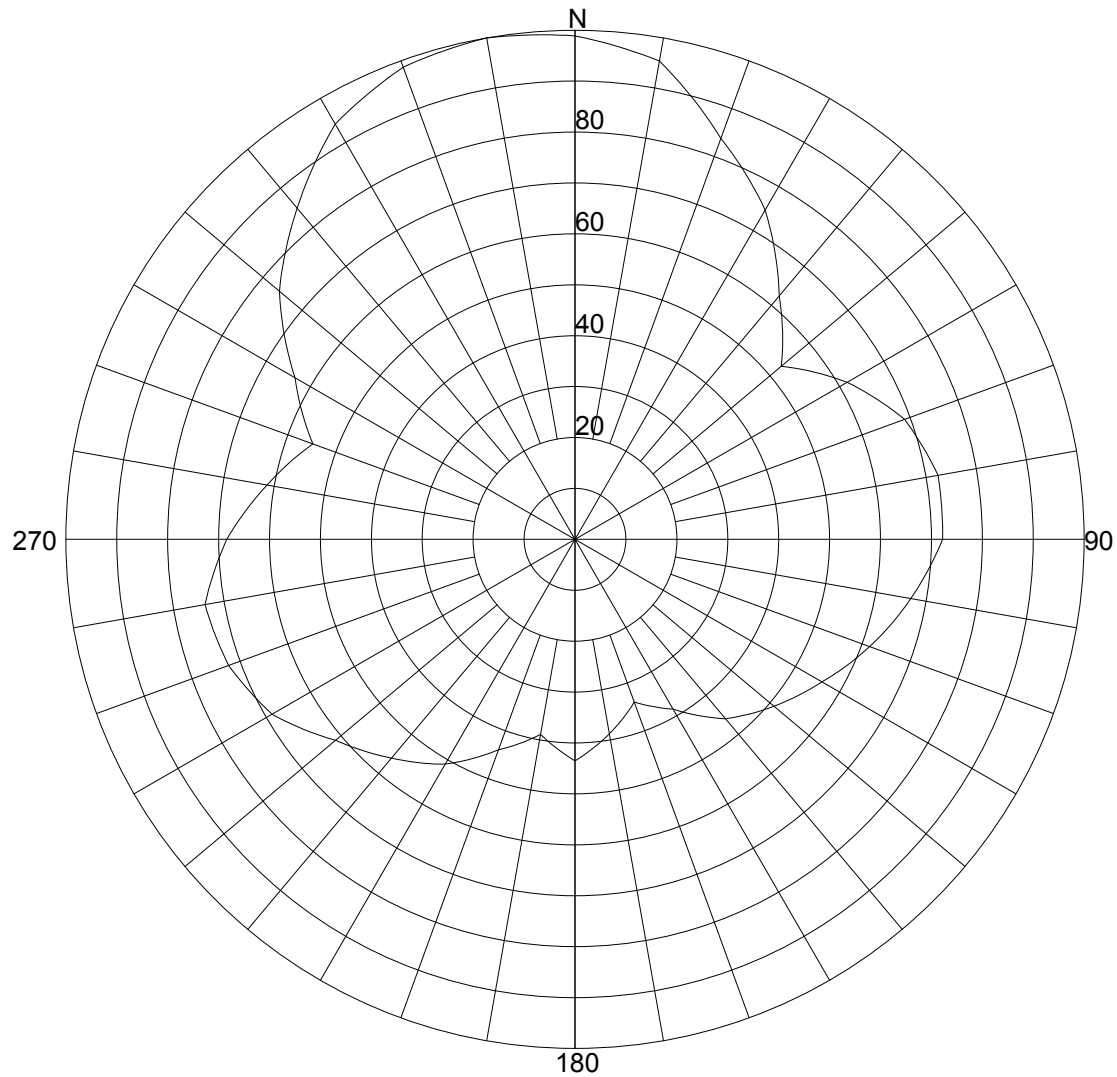
PATTERN POL.: Circular

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 1.7539 / 2.44dB

PATTERN RMS: 0.755

Exhibit 2: Measured Horizontally Polarized Azimuth Pattern



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability

CLIENT: *KKML*

Date: 1/29/2018

ANTENNA TYPE: FM3/1-DA

FREQUENCY: 90.9 MHz

PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.18822 / 3.4dB

PATTERN RMS: 0.676

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.9890 (-0.1)	180	.4350 (-7.23)
5	.9715 (-0.25)	185	.4120 (-7.7)
10	.9540 (-0.41)	190	.3890 (-8.2)
15	.8960 (-0.95)	195	.4145 (-7.65)
20	.8380 (-1.54)	200	.4400 (-7.13)
25	.7925 (-2.02)	205	.4750 (-6.47)
30	.7470 (-2.53)	210	.5100 (-5.85)
35	.6855 (-3.28)	215	.5355 (-5.42)
40	.6240 (-4.1)	220	.5610 (-5.02)
45	.5765 (-4.78)	225	.5875 (-4.62)
50	.5290 (-5.53)	230	.6140 (-4.24)
55	.5730 (-4.84)	235	.6505 (-3.74)
60	.6170 (-4.19)	240	.6870 (-3.26)
65	.6530 (-3.7)	245	.7055 (-3.03)
70	.6890 (-3.24)	250	.7240 (-2.81)
75	.7065 (-3.02)	255	.7310 (-2.72)
80	.7240 (-2.81)	260	.7380 (-2.64)
85	.7230 (-2.82)	265	.7110 (-2.96)
90	.7220 (-2.83)	270	.6840 (-3.3)
95	.6960 (-3.15)	275	.6490 (-3.76)
100	.6700 (-3.48)	280	.6140 (-4.24)
105	.6430 (-3.84)	285	.5810 (-4.72)
110	.6160 (-4.21)	290	.5480 (-5.22)
115	.5880 (-4.61)	295	.5915 (-4.56)
120	.5600 (-5.04)	300	.6350 (-3.94)
125	.5350 (-5.43)	305	.6965 (-3.14)
130	.5100 (-5.85)	310	.7580 (-2.41)
135	.4850 (-6.29)	315	.8035 (-1.9)
140	.4600 (-6.74)	320	.8490 (-1.42)
145	.4225 (-7.48)	325	.8955 (-0.96)
150	.3850 (-8.29)	330	.9420 (-0.52)
155	.3625 (-8.81)	335	.9645 (-0.31)
160	.3400 (-9.37)	340	.9870 (-0.11)
165	.3640 (-8.78)	345	.9935 (-0.06)
170	.3880 (-8.22)	350	1.0000 (0)
175	.4115 (-7.71)	355	.9945 (-0.05)

Systems With Reliability

CLIENT: *KKML*

Date: 1/29/2018

ANTENNA TYPE: FM3/1-DA

FREQUENCY: 90.9 MHz

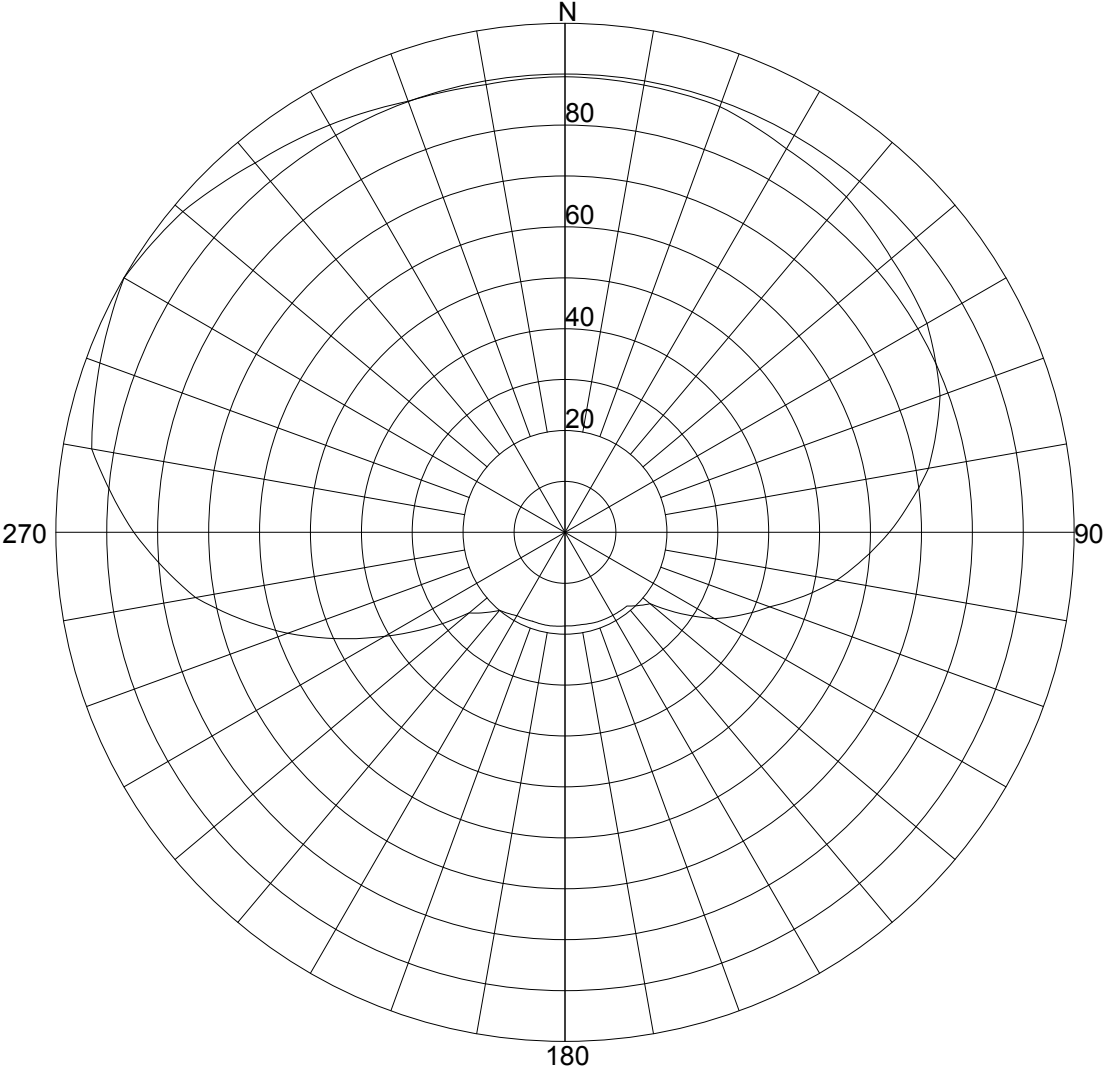
PATTERN POL.: Horizontal

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.18822 / 3.4dB

PATTERN RMS: 0.676

Exhibit 3: Measured Vertically Polarized Azimuth Pattern



Azimuth Pattern

Systems With Reliability

Scale: Linear
Unit: Relative Field

CLIENT: <i>KKML</i>	Date: 1/29/2018
ANTENNA TYPE: FM3/1-DA	
FREQUENCY: 90.9 MHz	
PATTERN POL.: Vertical	CIRCULARITY(+/-dB):
AZ. DIRECTIVITY: 2.15357 / 3.33dB	PATTERN RMS: 0.681

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.8950 (-0.96)	180	.1840 (-14.7)
5	.8935 (-0.98)	185	.1850 (-14.66)
10	.8920 (-0.99)	190	.1860 (-14.61)
15	.8910 (-1)	195	.1860 (-14.61)
20	.8900 (-1.01)	200	.1860 (-14.61)
25	.8800 (-1.11)	205	.1875 (-14.54)
30	.8700 (-1.21)	210	.1890 (-14.47)
35	.8650 (-1.26)	215	.1945 (-14.22)
40	.8600 (-1.31)	220	.2000 (-13.98)
45	.8485 (-1.43)	225	.2230 (-13.03)
50	.8370 (-1.55)	230	.2460 (-12.18)
55	.8290 (-1.63)	235	.3270 (-9.71)
60	.8210 (-1.71)	240	.4080 (-7.79)
65	.8025 (-1.91)	245	.4940 (-6.13)
70	.7840 (-2.11)	250	.5800 (-4.73)
75	.7545 (-2.45)	255	.6585 (-3.63)
80	.7250 (-2.79)	260	.7370 (-2.65)
85	.6810 (-3.34)	265	.7920 (-2.03)
90	.6370 (-3.92)	270	.8470 (-1.44)
95	.5895 (-4.59)	275	.8955 (-0.96)
100	.5420 (-5.32)	280	.9440 (-0.5)
105	.4850 (-6.29)	285	.9580 (-0.37)
110	.4280 (-7.37)	290	.9720 (-0.25)
115	.3835 (-8.32)	295	.9860 (-0.12)
120	.3390 (-9.4)	300	1.0000 (0)
125	.2785 (-11.1)	305	.9900 (-0.09)
130	.2180 (-13.23)	310	.9800 (-0.18)
135	.2035 (-13.83)	315	.9635 (-0.32)
140	.1890 (-14.47)	320	.9470 (-0.47)
145	.1885 (-14.49)	325	.9355 (-0.58)
150	.1880 (-14.52)	330	.9240 (-0.69)
155	.1875 (-14.54)	335	.9125 (-0.8)
160	.1870 (-14.56)	340	.9010 (-0.91)
165	.1855 (-14.63)	345	.8970 (-0.94)
170	.1840 (-14.7)	350	.8930 (-0.98)
175	.1840 (-14.7)	355	.8940 (-0.97)

Systems With Reliability

CLIENT: *KKML*

Date: 1/29/2018

ANTENNA TYPE: FM3/1-DA

FREQUENCY: 90.9 MHz

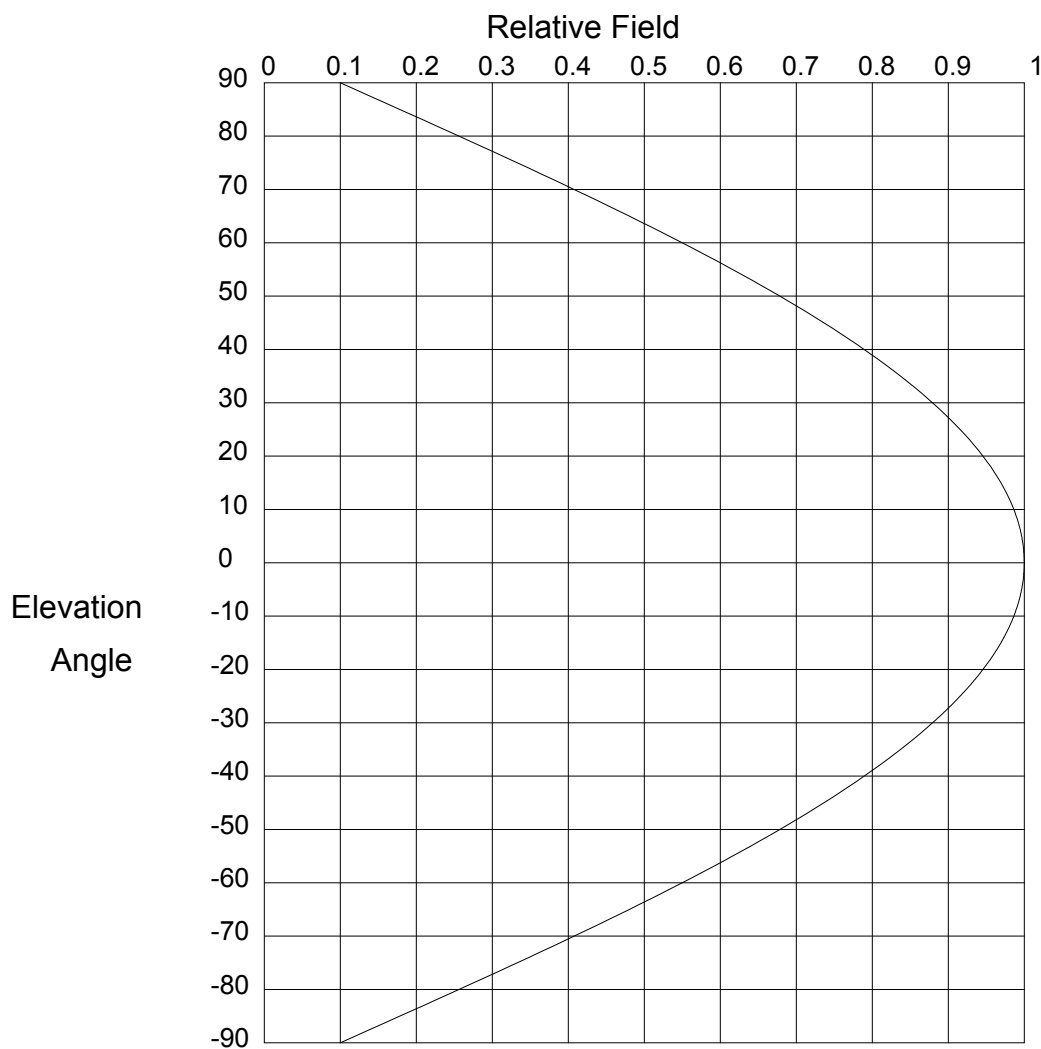
PATTERN POL.: Vertical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.15357 / 3.33dB

PATTERN RMS: 0.681

Exhibit 4: Elevation Pattern



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability

CLIENT: *KKML*

Date: 1/29/2018

ANTENNA TYPE: FM3/1-DA

FREQUENCY: 90.9 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 0.883/-0.539 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	.654 (-3.687)	14.0	.973 (-0.235)
89.0	.116 (-18.733)	51.0	.666 (-3.525)	13.0	.977 (-0.203)
88.0	.131 (-17.627)	50.0	.679 (-3.369)	12.0	.98 (-0.173)
87.0	.147 (-16.648)	49.0	.69 (-3.217)	11.0	.983 (-0.145)
86.0	.163 (-15.768)	48.0	.702 (-3.071)	10.0	.986 (-0.12)
85.0	.178 (-14.97)	47.0	.714 (-2.928)	9.8	.987 (-0.115)
84.0	.194 (-14.241)	46.0	.725 (-2.791)	9.6	.987 (-0.11)
83.0	.21 (-13.569)	45.0	.736 (-2.658)	9.4	.988 (-0.106)
82.0	.225 (-12.946)	44.0	.747 (-2.529)	9.2	.988 (-0.101)
81.0	.241 (-12.367)	43.0	.758 (-2.404)	9.0	.989 (-0.097)
80.0	.256 (-11.826)	42.0	.769 (-2.283)	8.8	.989 (-0.093)
79.0	.272 (-11.317)	41.0	.779 (-2.167)	8.6	.99 (-0.088)
78.0	.287 (-10.839)	40.0	.789 (-2.054)	8.4	.99 (-0.084)
77.0	.302 (-10.387)	39.0	.799 (-1.944)	8.2	.991 (-0.08)
76.0	.318 (-9.959)	38.0	.809 (-1.839)	8.0	.991 (-0.076)
75.0	.333 (-9.553)	37.0	.819 (-1.737)	7.8	.992 (-0.073)
74.0	.348 (-9.167)	36.0	.828 (-1.638)	7.6	.992 (-0.069)
73.0	.363 (-8.799)	35.0	.837 (-1.543)	7.4	.993 (-0.065)
72.0	.378 (-8.448)	34.0	.846 (-1.451)	7.2	.993 (-0.062)
71.0	.393 (-8.112)	33.0	.855 (-1.363)	7.0	.993 (-0.058)
70.0	.408 (-7.791)	32.0	.863 (-1.277)	6.8	.994 (-0.055)
69.0	.423 (-7.483)	31.0	.871 (-1.195)	6.6	.994 (-0.052)
68.0	.437 (-7.187)	30.0	.879 (-1.116)	6.4	.994 (-0.049)
67.0	.452 (-6.904)	29.0	.887 (-1.04)	6.2	.995 (-0.046)
66.0	.466 (-6.631)	28.0	.895 (-0.967)	6.0	.995 (-0.043)
65.0	.48 (-6.369)	27.0	.902 (-0.897)	5.8	.995 (-0.04)
64.0	.495 (-6.116)	26.0	.909 (-0.83)	5.6	.996 (-0.037)
63.0	.509 (-5.873)	25.0	.916 (-0.765)	5.4	.996 (-0.035)
62.0	.523 (-5.638)	24.0	.922 (-0.704)	5.2	.996 (-0.032)
61.0	.536 (-5.411)	23.0	.928 (-0.645)	5.0	.997 (-0.03)
60.0	.55 (-5.193)	22.0	.934 (-0.589)	4.8	.997 (-0.027)
59.0	.564 (-4.982)	21.0	.94 (-0.535)	4.6	.997 (-0.025)
58.0	.577 (-4.778)	20.0	.946 (-0.485)	4.4	.997 (-0.023)
57.0	.59 (-4.58)	19.0	.951 (-0.437)	4.2	.998 (-0.021)
56.0	.603 (-4.39)	18.0	.956 (-0.391)	4.0	.998 (-0.019)
55.0	.616 (-4.205)	17.0	.961 (-0.348)	3.8	.998 (-0.017)
54.0	.629 (-4.027)	16.0	.965 (-0.308)	3.6	.998 (-0.015)
53.0	.642 (-3.854)	15.0	.969 (-0.271)	3.4	.998 (-0.014)

Systems With Reliability

Page 1 of 3

CLIENT: *KKML*

Date: 1/29/2018

ANTENNA TYPE: FM3/1-DA

FREQUENCY: 90.9 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 0.883/-0.539 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	.999 (-0.012)	-4.4	.997 (-0.023)	-12.0	.98 (-0.173)
3.0	.999 (-0.011)	-4.6	.997 (-0.025)	-12.2	.98 (-0.178)
2.8	.999 (-0.009)	-4.8	.997 (-0.027)	-12.4	.979 (-0.184)
2.6	.999 (-0.008)	-5.0	.997 (-0.03)	-12.6	.978 (-0.19)
2.4	.999 (-0.007)	-5.2	.996 (-0.032)	-12.8	.978 (-0.196)
2.2	.999 (-0.006)	-5.4	.996 (-0.035)	-13.0	.977 (-0.203)
2.0	.999 (-0.005)	-5.6	.996 (-0.037)	-13.2	.976 (-0.209)
1.8	1.00 (-0.004)	-5.8	.995 (-0.04)	-13.4	.975 (-0.215)
1.6	1.00 (-0.003)	-6.0	.995 (-0.043)	-13.6	.975 (-0.222)
1.4	1.00 (-0.002)	-6.2	.995 (-0.046)	-13.8	.974 (-0.229)
1.2	1.00 (-0.002)	-6.4	.994 (-0.049)	-14.0	.973 (-0.235)
1.0	1.00 (-0.001)	-6.6	.994 (-0.052)	-14.2	.973 (-0.242)
.8	1.00 (-0.001)	-6.8	.994 (-0.055)	-14.4	.972 (-0.249)
.6	1.00 (0)	-7.0	.993 (-0.058)	-14.6	.971 (-0.256)
.4	1.00 (0)	-7.2	.993 (-0.062)	-14.8	.97 (-0.263)
.2	1.00 (0)	-7.4	.993 (-0.065)	-15.0	.969 (-0.271)
.0	1.00 (0)	-7.6	.992 (-0.069)	-15.2	.969 (-0.278)
-.2	1.00 (0)	-7.8	.992 (-0.073)	-15.4	.968 (-0.285)
-.4	1.00 (0)	-8.0	.991 (-0.076)	-15.6	.967 (-0.293)
-.6	1.00 (0)	-8.2	.991 (-0.08)	-15.8	.966 (-0.3)
-.8	1.00 (-0.001)	-8.4	.99 (-0.084)	-16.0	.965 (-0.308)
-1.0	1.00 (-0.001)	-8.6	.99 (-0.088)	-16.2	.964 (-0.316)
-1.2	1.00 (-0.002)	-8.8	.989 (-0.093)	-16.4	.963 (-0.324)
-1.4	1.00 (-0.002)	-9.0	.989 (-0.097)	-16.6	.962 (-0.332)
-1.6	1.00 (-0.003)	-9.2	.988 (-0.101)	-16.8	.962 (-0.34)
-1.8	1.00 (-0.004)	-9.4	.988 (-0.106)	-17.0	.961 (-0.348)
-2.0	.999 (-0.005)	-9.6	.987 (-0.11)	-17.2	.96 (-0.357)
-2.2	.999 (-0.006)	-9.8	.987 (-0.115)	-17.4	.959 (-0.365)
-2.4	.999 (-0.007)	-10.0	.986 (-0.12)	-17.6	.958 (-0.374)
-2.6	.999 (-0.008)	-10.2	.986 (-0.124)	-17.8	.957 (-0.383)
-2.8	.999 (-0.009)	-10.4	.985 (-0.129)	-18.0	.956 (-0.391)
-3.0	.999 (-0.011)	-10.6	.985 (-0.134)	-18.2	.955 (-0.4)
-3.2	.999 (-0.012)	-10.8	.984 (-0.14)	-18.4	.954 (-0.409)
-3.4	.998 (-0.014)	-11.0	.983 (-0.145)	-18.6	.953 (-0.418)
-3.6	.998 (-0.015)	-11.2	.983 (-0.15)	-18.8	.952 (-0.427)
-3.8	.998 (-0.017)	-11.4	.982 (-0.156)	-19.0	.951 (-0.437)
-4.0	.998 (-0.019)	-11.6	.982 (-0.161)	-19.2	.95 (-0.446)
-4.2	.998 (-0.021)	-11.8	.981 (-0.167)	-19.4	.949 (-0.456)

Systems With Reliability

Page 2 of 3

CLIENT: *KKML*

Date: 1/29/2018

ANTENNA TYPE: FM3/1-DA

FREQUENCY: 90.9 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 0.883/-0.539 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	.948 (-0.465)	-27.2	.90 (-0.911)	-54.0	.629 (-4.027)
-19.8	.947 (-0.475)	-27.4	.899 (-0.924)	-55.0	.616 (-4.205)
-20.0	.946 (-0.485)	-27.6	.898 (-0.939)	-56.0	.603 (-4.39)
-20.2	.945 (-0.495)	-27.8	.896 (-0.953)	-57.0	.59 (-4.58)
-20.4	.944 (-0.505)	-28.0	.895 (-0.967)	-58.0	.577 (-4.778)
-20.6	.942 (-0.515)	-28.2	.893 (-0.981)	-59.0	.564 (-4.982)
-20.8	.941 (-0.525)	-28.4	.892 (-0.996)	-60.0	.55 (-5.193)
-21.0	.94 (-0.535)	-28.6	.89 (-1.01)	-61.0	.536 (-5.411)
-21.2	.939 (-0.546)	-28.8	.889 (-1.025)	-62.0	.523 (-5.638)
-21.4	.938 (-0.556)	-29.0	.887 (-1.04)	-63.0	.509 (-5.873)
-21.6	.937 (-0.567)	-29.2	.886 (-1.055)	-64.0	.495 (-6.116)
-21.8	.936 (-0.578)	-29.4	.884 (-1.07)	-65.0	.48 (-6.369)
-22.0	.934 (-0.589)	-29.6	.883 (-1.085)	-66.0	.466 (-6.631)
-22.2	.933 (-0.6)	-29.8	.881 (-1.101)	-67.0	.452 (-6.904)
-22.4	.932 (-0.611)	-30.0	.879 (-1.116)	-68.0	.437 (-7.187)
-22.6	.931 (-0.622)	-31.0	.871 (-1.195)	-69.0	.423 (-7.483)
-22.8	.93 (-0.633)	-32.0	.863 (-1.277)	-70.0	.408 (-7.791)
-23.0	.928 (-0.645)	-33.0	.855 (-1.363)	-71.0	.393 (-8.112)
-23.2	.927 (-0.656)	-34.0	.846 (-1.451)	-72.0	.378 (-8.448)
-23.4	.926 (-0.668)	-35.0	.837 (-1.543)	-73.0	.363 (-8.799)
-23.6	.925 (-0.68)	-36.0	.828 (-1.638)	-74.0	.348 (-9.167)
-23.8	.923 (-0.692)	-37.0	.819 (-1.737)	-75.0	.333 (-9.553)
-24.0	.922 (-0.704)	-38.0	.809 (-1.839)	-76.0	.318 (-9.959)
-24.2	.921 (-0.716)	-39.0	.799 (-1.944)	-77.0	.302 (-10.387)
-24.4	.92 (-0.728)	-40.0	.789 (-2.054)	-78.0	.287 (-10.839)
-24.6	.918 (-0.74)	-41.0	.779 (-2.167)	-79.0	.272 (-11.317)
-24.8	.917 (-0.753)	-42.0	.769 (-2.283)	-80.0	.256 (-11.826)
-25.0	.916 (-0.765)	-43.0	.758 (-2.404)	-81.0	.241 (-12.367)
-25.2	.914 (-0.778)	-44.0	.747 (-2.529)	-82.0	.225 (-12.946)
-25.4	.913 (-0.791)	-45.0	.736 (-2.658)	-83.0	.21 (-13.569)
-25.6	.912 (-0.803)	-46.0	.725 (-2.791)	-84.0	.194 (-14.241)
-25.8	.91 (-0.816)	-47.0	.714 (-2.928)	-85.0	.178 (-14.97)
-26.0	.909 (-0.83)	-48.0	.702 (-3.071)	-86.0	.163 (-15.768)
-26.2	.908 (-0.843)	-49.0	.69 (-3.217)	-87.0	.147 (-16.648)
-26.4	.906 (-0.856)	-50.0	.679 (-3.369)	-88.0	.131 (-17.627)
-26.6	.905 (-0.87)	-51.0	.666 (-3.525)	-89.0	.116 (-18.733)
-26.8	.903 (-0.883)	-52.0	.654 (-3.687)	-90.0	.10 (-20)
-27.0	.902 (-0.897)	-53.0	.642 (-3.854)	90.0	.00 (-50)

Systems With Reliability

Page 3 of 3

CLIENT: *KKML*

Date: 1/29/2018

ANTENNA TYPE: FM3/1-DA

FREQUENCY: 90.9 MHz

PATTERN POL.: Circular

DIRECTIVITY(Peak): 0.883/-0.539 dBd

Beam Tilt (Deg.) : 0

DIRECTIVITY(Horiz): 0.883/-0.539 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	KKML
Contact	Tommy Moore
Location	Minden, LA
Antenna Model	FM3/1-DA
Channel / Frequency	215A / 90.9 MHz

ELECTRICAL SPECIFICATIONS

Antenna Specifications:

	H-POL			V. Pol.	
License ERP (KW)	0.210			0.210	
FCC Limit Pattern Directivity	1.426	1.541	dB	1.426	1.541 dB
Elevation Directivity	0.883	-0.540	dB	0.883	-0.540 dB
Azimuth Directivity	2.188	3.400	dB	2.154	3.332 dB
Composite Pattern	1.754	2.440	dB	1.754	2.440 dB
Polarization Ratio	0.496			0.504	
RMS Comp./RMS Limit	90.2 %				
Antenna Efficiency %	100			100	
Power Ratio (Pol. Ratio X Efficiency)	0.4961			0.5039	
Antenna Gain	0.958	-0.184	dB	0.958	-0.184 dB

Antenna Input Power (KW)	0.219 kW	-6.593 (dBK)
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Feed Line Specifications:

Line Type: RFS	7/8" Foam 50 Ω LDF5-50A
Attenuation Per 100 ft (dB)	0.346 dB
Line Length (ft) AGL + Horizontal Run	346.54 ft.
Total Line Attenuation (dB)	1.1990 dB
Line Efficiency	75.87 %
Power Input to the Line (KW)	0.289 kW -5.394 (dBK)

MECHANICAL SPECIFICATIONS

No. Of Bays	1		
Antenna Aperture	6.00	ft.	1.83 meter
Center of Radiation AGL	321.54	ft.	98.00 meter
Antenna Weight (Everything)	85.00	lbs.	38.64 kg
Windload (50/33) (Antenna + Mount)	135.00	lbs.	Windload CaAc 4.00 ft^2

Prepared by:

Kevin W. Rager
 SWR, LP ENGINEERING

Exhibit 6: RMS Calculations



SYSTEMS WITH RELIABILITY, INC.
Broadcast Antennas and Transmission Systems

KKML 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	0.980
80	0.910
90	0.830
100	0.740
110	0.640
120	0.560
130	0.510
140	0.470
150	0.460
160	0.450
170	0.440
180	0.440
190	0.450
200	0.490
210	0.550
220	0.650
230	0.750
240	0.840
250	0.910
260	0.980
270	1.000
280	1.000
290	1.000
300	1.000
310	1.000
320	1.000
330	1.000
340	1.000
350	1.000

DESIGNED ANTENNA

Azimuth Heading	Relative Field
0	0.989
10	0.954
20	0.890
30	0.870
40	0.860
50	0.837
60	0.821
70	0.784
80	0.725
90	0.722
100	0.670
110	0.616
120	0.560
130	0.510
140	0.460
150	0.385
160	0.340
170	0.388
180	0.435
190	0.389
200	0.440
210	0.510
220	0.561
230	0.614
240	0.687
250	0.724
260	0.738
270	0.847
280	0.944
290	0.972
300	1.000
310	0.980
320	0.947
330	0.942
340	0.987
350	1.000

Sum of Relative Field Squared : 25.255
Sum Divided by 36 (Readings) : 0.702
Square Root : 0.838

Sum of Relative Field Squared : 20.540
Sum Divided by 36 (Readings) : 0.571
Square Root : 0.755

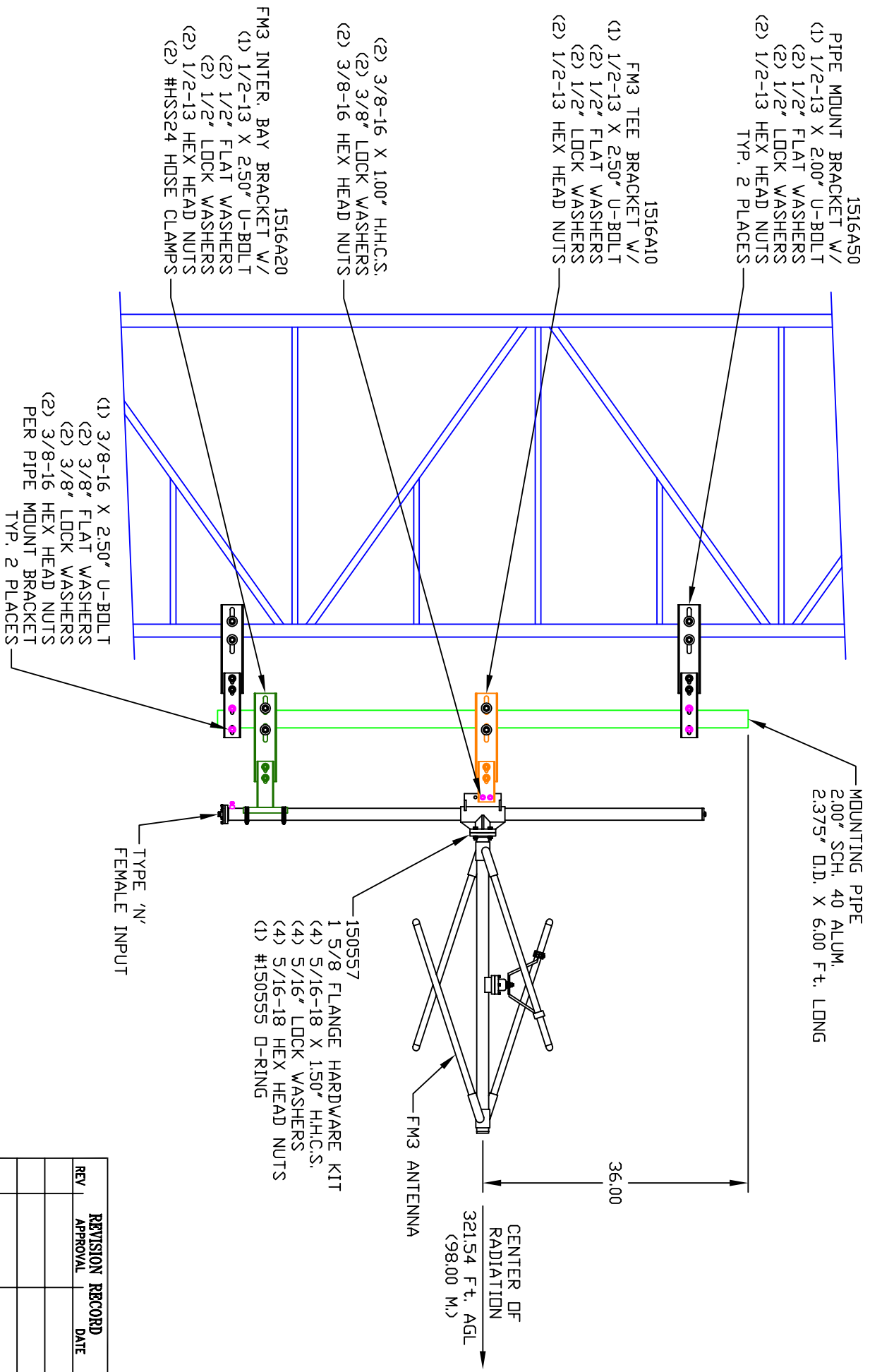
Percentage of Construction Permit Antenna Filled :


90.2%

NOTE:

1. REFERENCE DWG. 1764D11 FOR ANTENNA ORIENTATION.

Exhibit 7: Drawings





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

TITLE: FM3/1-DA, FREQ. 90.9
KKML, MINDEN, LA

SIZE: A

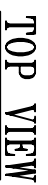
PARTS MADE BY THIS DRAWING		
SCALE:	NAME:	DATE:
NTS	RAC	2/9/18

REVISION RECORD		
REV	APPROVAL	DATE

DRAWING NUMBER: 1764D10

SHEET 1 OF 1

Exhibit 7(cont'd): Drawings



REVISION RECORD
REV | APPROVAL | DATE

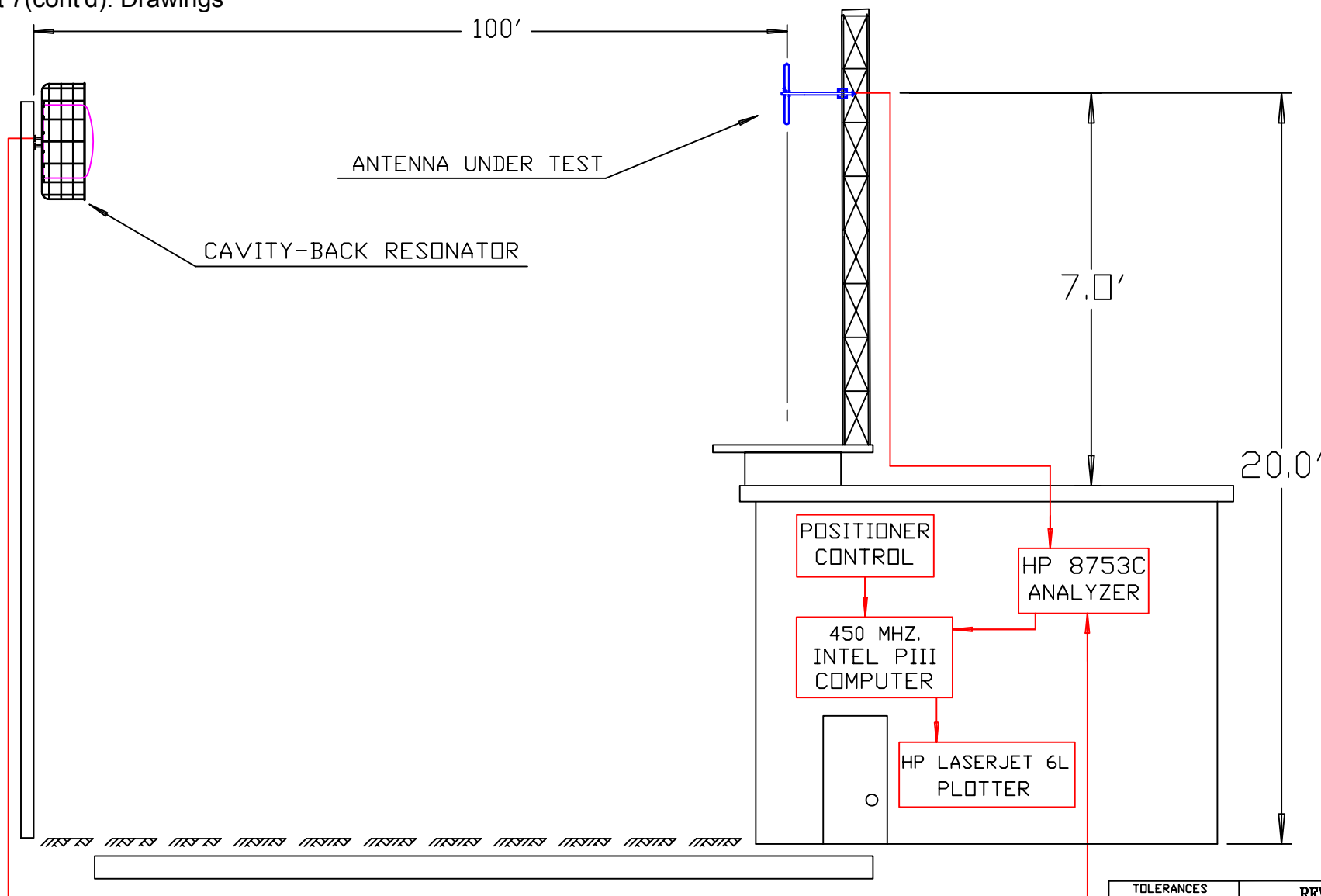
TITLE:		FM3/1-DA, FREQ. 90.9					
MATERIAL:		KKML, MINDEN, LA					
ANTENNA ORIENTATION		FROM TRUE NORTH					
SIZE		A					
PARTS MADE BY THIS DRAWING		DRAWING NUMBER: 1764D11					
SCALE:	NTS	NAME:	RAC	DATE:	2/9/18	SHEET	1 OF 1

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