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DuBois, PA

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BROADCAST ANTENNAS

2022

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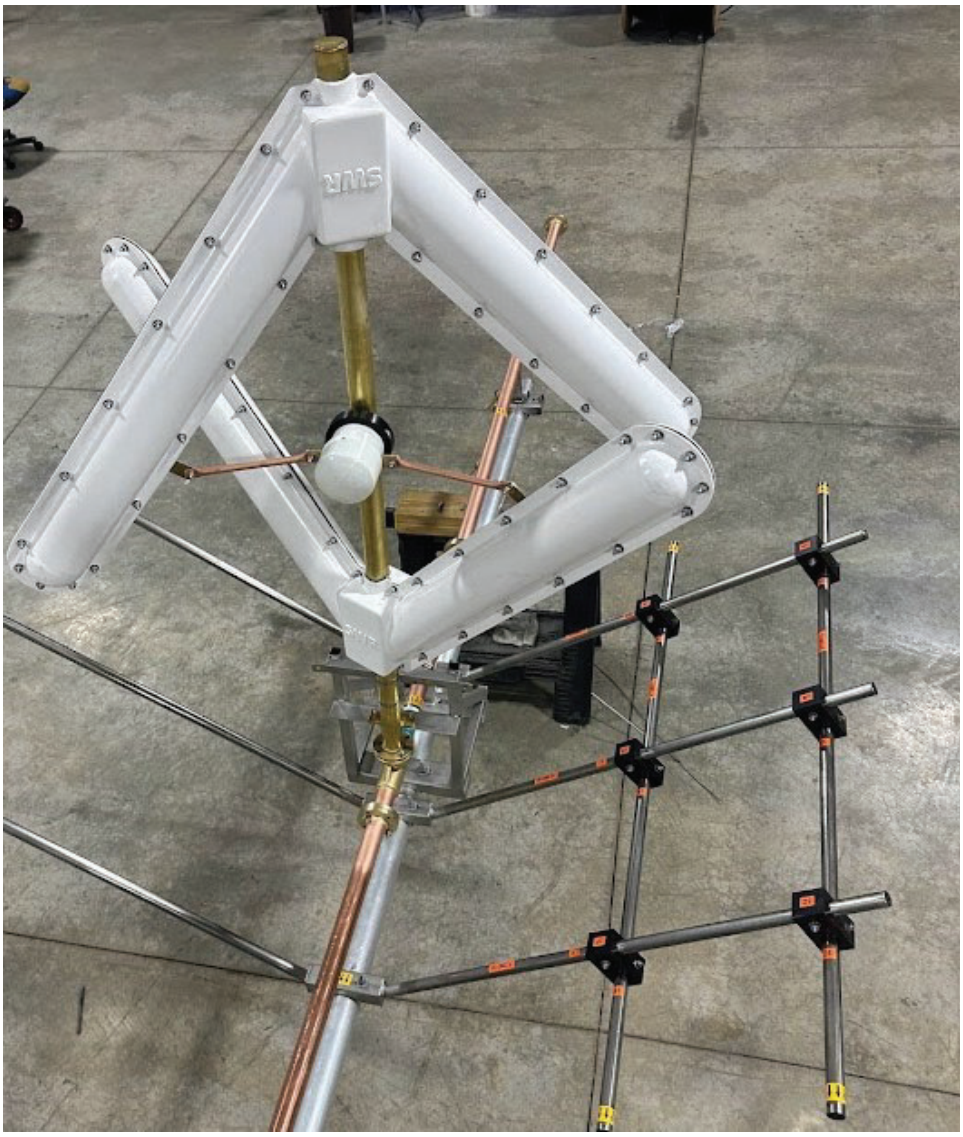
89.5 MHz



Installation Instructions

SWR LP

11/23/2022

WPMU,
DUBOIS,PA

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APPENDIX

i. Antenna Specification Summary / Installation & Assembly Drawing
ii. Test Range Schematic / System Block Diagram
iii. Parts List

SECTION I

GENERAL DESCRIPTION

INTRODUCTION

This technical manual contains information required to install, test, operate, and service the ***FM3 Series Medium Power FM Antennas***. This consists of various sections, which provides the following type of information:

A. **SECTION I**. ***GENERAL DESCRIPTION***. Provides a description of the equipment, identifies the major components, and lists the specifications.
B. **SECTION II.** ***PRINCIPLES OF OPERATION***. Provides a description of how the antenna operates.
C. **SECTION III.** ***INSTALLATION.*** Provides information relative to the installation of the antenna components and the installation of components on the tower.
D. **SECTION IV**. ***MAINTENANCE***. Provides information pertaining to preventive and scheduled maintenance.
E. **SECTION V.** ***TEST REPORT.*** Provides data measured at the SWR Antenna Test Site to demonstrate the measured electrical and radiation characteristics of the antenna. This section also provides other reports required by the customer specifications.

EQUIPMENT SUPPLIED

The FM3 antenna supplied is shown in the SWR installation drawing located at the Appendix, FM3 parts list, identify all major components supplied and the Antenna Specification Summary exhibits the Mechanical and Electrical Characteristics of the Antenna

GENERAL DESCRIPTION

The antenna system supplied is an FM3 Series Medium Power FM Antenna. The antenna is designed to meet the power handling and pattern specifications as requested.

SECTION II

PRINCIPLES OF OPERATION

2.1.0 INTRODUCTION

The ***FM3 SERIES FM Antenna*** provides superior performance for Stereo, SCA and Quadrophonic operation due to its wide VSWR bandwidth. This antenna type is available for frequencies ranging from 88-108 MHz. It is circularly polarized; to provide dual polarization necessary for whip antennas and other antennas not oriented to receive vertically or horizontally polarized signals. It has a 3 kW Full Power Rating per bay with a maximum of 15 kW for 5 bays or more.

2.2.0 FUNCTIONAL DESCRIPTION

2.2.1 The ***FM3 SERIES FM Antenna*** is a shunt fed system basically consisted of radiating elements attached to a supporting 1-5/8" transmission line section (Intermediate Bay).

2.2.2 It has four dipoles; each arm is about 1/4 wavelength and is shunt fed. These are supported in a four-arm structure. The dipoles overlap so that the current flow around the dipole or element is circular. Pattern circularity is +/- 2 dB for the 4 arm.

2.2.3 These radiators are stacked about one wavelength apart in a rigid coax feed line to obtain the necessary power gain.

2.3.0 PATTERN OPTIMIZATION

2.3.1 Like any of the FM antennas, its patterns are strongly affected by the supporting structure. The pole or tower tends to distort the radiation pattern, seriously affecting station coverage in some directions.

WARNING

IMPROPER ANTENNA INSTALLATION CAN CAUSE SERIOUS PATTERN PROBLEMS.

2.3.2 ***FM3*** antennas were adjusted for the best directional pattern possible or to proven minimum ERP values in particular azimuth directions.

SECTION III

INSTALLATION

3.1.0 INTRODUCTION

3.1.1 Installation of the antenna should be properly planned and carried out, to avoid delays and unwarranted costs. Make sure that all materials are on hand before calling for rigging services.

3.1.2 Riggers must be mechanically well equipped to do the job. They should also be knowledgeable about antennas and coax line and should inspect the tower and check the mounting design of the brackets, prior to the arrival of the entire crew.

3.2.0 RECEIVING AND UNPACKING

3.2.1 The antenna elements are normally shipped in boxes, usually numbered and the total number is indicated on each box; contact shipper if boxes are not all delivered, or if equipment received is damaged. **DO NOT STORE THE MATERIALS OUTDOORS, BOXED OR OTHERWISE.**

3.2.2 Once received, open and examine for shipping damages so that any necessary claims may be filed with the shipping company immediately. Check the material against the packing list and installation drawing.

3.2.3 The box with the installation drawing and instruction manual is usually ***Box # 1.*** Open it first so that the balance of the items may be easily identified and counted. Contact SWR for missing materials or for damages in the materials caused by shipping.

3.3.0 EXCHANGES

3.3.1 SWR, Inc. will repair any damages incurred from freighting. Contact the SWR Office for other details. Claims must be filed with the carrier.

3.4.0 INSTALLATION PRE-CHECK AND CAUTIONS

3.4.1 The antenna elements are shipped in boxes separated from the coax feed line sections.

3.4.2 The radiating elements are packed 4 to a box with the other hardware necessary for the installation. Check the contents of each box against the packing list.

NOTE

MAKE SURE THAT ALL THE MATERIALS ARE ON HAND BEFORE RIGGING JOB BEGINS.

3.3.4. Examine the elements for bent radiating arm and cracks. If cracked, file a claim with the freighting carrier and return prepaid to SWR for repair. The elements have been carefully packed to withstand strain and should not be damaged under normal truck handling.

3.3.5 The station engineer should inspect the antenna components before the riggers arrive. Any damaged part should be replaced in order to insure minimum delay in installation.

3.3.6 The coax feed line is shipped in suitable containers usually 2 to a box. Inspect the line for damage, looking carefully for large dents.

3.3.7 Keep all moisture, dirt or any foreign matter of coaxial parts and elements.

NOTE

DO NOT LEAVE THE ANTENNA PARTS WHERE RAIN OR MOISTURE CAN ENTER. STORE INDOORS AND KEEP UNITS CAPPED AS RECEIVED

3.3.8 Protect all antenna parts from physical damage and abuse. Do not allow any part of the antenna to bang against tower steel, concrete or permit it to drag in the dirt.

NOTE

HOIST ANTENNA MEMBERS CAREFULLY WITH A TAG LINE TO PREVENT DAMAGE BY STRIKING AGAINST THE TOWER.

3.5.0 MOUNTING INSTRUCTIONS

3.5.1 The FM3 antenna has been shipped with the complete hardware necessary for its installation.

3.5.2 Look at the installation drawing at the back of this manual. The drawing shows all the mounting dimensions. THEY SHOULD BE FOLLOWED WITHIN A +/- ½ INCH FOR BEST RESULTS.

3.5.3 Choose the tower leg or face in the direction where maximum signal is desired. Mark on this leg or face the location of the center of radiation of the antenna array.

NOTE

THE INTERMEDIATE BAY MUST REMAIN PLUMB. IN THE CASE OF TAPERED SUPPORT TOWERS, SPECIAL MOUNTING BRACKETS WILL BE PROVIDED IF INDICATED WITH FACTORY PURCHASE ORDER

3.5.4 Utilize mounting brackets supplied with the antenna to secure the Intermediate Bay to the tower. Tighten all bracket connectors.

3.5.5 Install the radiating elements to their corresponding feed blocks. Element numbers are indicated on labels attached to the bay and Bay # 1 is the Bottom Bay unit.

3.5.6 Install the Intermediate bays and radiating elements at marked location. Riggers should lubricate "O" rings with small amount of silicone grease before mating.

3.5.7 The full complement of flange bolts must be used and they should be tightened to 210 inch lbs.

3.5.8 Tuners or individual element devices if used, should only be adjusted after the entire antenna has been completely installed and only if there is VSWR problem.

3.5.9 Install the Rigid Transmission Line (main transmission line) to the power input. Rigid transmission line should be properly installed with two hangers per 20ft (6m) length and with the inner conductor retaining pin on the top of each section.

3.5.10 If semi-flexible cable such as Heliax or Flexwell is used, it should be firmly tied down at least every 3ft of coax line.

WARNING

THE LINE MANUFACTURER'S HANGERS SHOULD BE USED. THE LINES SHOULD NOT BE ATTACHED TO THE TOWER USING WRAP-LOCK STRAPS.

3.5.11 Lines should be grounded every 200-ft (60m) on long vertical runs. It should also be grounded at the top and at the bottom of the vertical run and again at the front where it enters the equipment building. Grounding kits are available for all standard transmission line cables. These kits provide a low resistance method of connecting the ground system to the main transmission line.

3.5.12 Install the lightning rod one-foot (0.3m) higher than the uppermost part of the obstruction light.

3.5.13 The FM antenna itself should be firmly grounded on the tower.

3.5.14 A ground system should be located immediately around the base of the tower. This should have a direct current loss of less than 10 ohms to earth ground. This low resistance may be obtained using ground wires buried in the soil.

3.5.15 After the antenna is installed and the transmission line connected, the system should be purged with dry gas or dry air to remove trapped moisture before RF power is applied.

3.5.16 The main transmission line should be pressurized with dry air through a dehydrator, air pump or by using nitrogen gas.

NOTE

3 TO 5 psig OF DRY AIR OR GAS PRESSURE SHOULD BE MAINTAINED. IT IS THE RIGGERS RESPONSIBILITY TO MAKE SURE THAT THE ENTIRE COAX AND ANTENNA HOLDS AIR PRESSURE.

3.5.17 After the line has been pressurized, test measurements (Return Loss, TDR, & VSWR) should be performed by an experienced engineer / technician to ensure proper operation of the system. THESE MEASUREMENTS SHOULD BE DONE BEFORE ANY POWER FROM THE TRANSMISSION SYSTEM IS INTRODUCED TO THE SYSTEM.

SECTION IV

MAINTENANCE

4.1.0 SAFETY WARNING

WARNING

ONLY QUALIFIED PERSONNEL SHOULD BE ENGAGED TO PERFORM A "TOWER-TOP" INSPECTION OF THE ANTENNA. ONLY PERSONS WITH PREVIOUS FIELD EXPERIENCE IN TOWER CLIMBING AND ANTENNA INSPECTION SHOULD BE CONSIDERED QUALIFIED.

BEFORE CLIMBING INTO THE APERTURE OF THE ANTENNA AND PRIOR TO INSPECTION, ALL TRANSMITTER POWER MUST BE TURNED OFF. PRECAUTIONS SHOULD BE TAKEN TO PREVENT RESTORATION OF TRANSMITTER POWER DURING THE ANTENNA INSPECTION. THE DANGER FROM HIGH POWER RF RADIATION IS SEVERE AND EVEN MINIMAL EXPOSURE CAN CAUSE LONG LASTING EFFECTS.

IF TRANSMITTER POWER IS RESTORED DURING THE INSPECTION, THE INSPECTOR SHOULD IMMEDIATELY RETURN TO A POSITION BELOW TOWER TOP OR OUTSIDE THE ANTENNA APERTURE AND INSTRUCT THE OPERATOR TO TURN OFF THE TRANSMITTER POWER. UNDER NO CIRCUMSTANCES SHOULD HE CONTINUE THE INSPECTION UNTIL THE TRANSMITTER POWER IS TURNED OFF AND PRECAUTIONS HAVE BEEN TAKEN THAT THE POWER CAN BE RESTORED DURING FURTHER INSPECTIONS.

4.2.0 SERVICE INTERVALS

4.2.1 A qualified rigger should check the antenna system every time obstruction lights are replaced or if lights are not used, at least once a year. The rigger should look for vibration and storm damage, loose or broken coax hangers, missing or loose hardware.

4.2.2 Signs of arcing across exposed insulators should also be checked. Wipe clean all exposed insulators in each antenna element with a rag soaked in 91% isopropyl or other solvent alcohol (Denatured Alcohol).

WARNING
DO NOT USE CARBON TETRACHLORIDE!

4.3.0 PRESSURIZATION

4.3.1 If the antenna is operated without positive pressure of dry air or nitrogen, SWR will NOT ASSUME RESPONSIBILITY for failure under power.

WARNING

MOISTURE OR THE ACCUMULATION OF WATER IN THE TRANSMISSION LINE CAUSES THE VSWR TO INCREASE. ALSO, WITH THE PRESENCE OF SUFFICIENT AMOUNT OF MOISTURE, ARCING TAKES PLACE, BURNING THE LINE AND THE RADIATING ELEMENTS.

HIGH HUMIDITY OR MOISTURE WILL CAUSE THE INSIDE OF THE COAXIAL TRANSMISSION LINE TO CORRODE OVER TIME, THEREBY INCREASING LINE LOSS.

NOTE

IF EVIDENCE OF MOISTURE IS FOUND INSIDE THE ANTENNA COMPONENTS, THE ANTENNA WARRANTY WILL BE VOID.

4.3.2 Perform a quick check for major leaks. The system should be checked with a leak detector, or soapsuds. A pinched or missing O-ring is the most common cause of large leaks. Purge antenna with relief plug located at the top of antenna.

4.3.3 Once the system is known to hold pressure, it should be purged with dry air or gas. Either must be dry enough to have a dew point well below the coldest temperature expected to be encountered. When using nitrogen, it should be of the “oil-dried” type to remove nearly all moisture from the gas.

4.3.4 3 to 5 psig. (0.20 to 0.34 atmospheres) should be maintained in the system at all times to ensure no moisture will be able to enter. When the transmitter is turned off nightly, very small leaks will pull in moisture, if the pressure is lower than suggested.

4.4.0 FASTENERS AND HARDWARE

4.4.1 Structural Fasteners: High strength hot dip galvanized for bracket bolts and nuts with locking devices are recommended at all structural connections. Inspect for damaged or missing fasteners and replace.

4.5.0 CLIMBING FACILITIES

4.5.1 This antenna is not typically equipped with climbing devices. Access to the antenna can be accomplished via the support tower as required.

4.6.0 GENERAL CORROSION PROTECTION AND REPAIR (for Special Support Brackets Only)

4.6.1 Hot dip galvanized structural steel if the finish has been damaged due to handling, field welding etc., the following procedure should be followed to insure adequate corrosion protection:

A. Remove rust, scale, and old paint by wire brushing, sanding or sand blasting.
B. Apply Z.R.C. metal conditioner per label directions. Allow to set a minimum of 5 minutes prior to wiping.
C. Apply a heavy, brush coat of Z.R.C. cold galvanizing compound per label directions. Allow to dry for 12 hours.
D. Apply a second brush coat of Z.R.C. cold galvanizing compound. Allow ample cure time prior to applying any topcoat.

4.6.2 In areas of severe corrosion, additional protection can be provided by top coating with epoxy mastic such as Carbolines Carbomastic 15.

4.6.3 Aluminum: If the finish has been damaged due to handling, corrosion, etc. clean damaged area using a non-ferrous wire brush. Clean affected area using a suitable detergent or cleaning agent. Apply a protective coat of enamel or other suitable paint.

CAUTION

DO NOT APPLY PAINT TO TEFLON OR FIBERGLASS RADOME SURFACE OR ANY OTHER DIELECTRIC INSULATING SURFACE. ANTENNA OPERATION WILL BE DEGRADED IF RADOMES ARE PAINTED WITH CONDUCTIVE PAINT.

4.7.0 PROTECTIVE FIBERGLASS RADOMES

4.7.1 Fiberglass reinforced polyester radomes (if used) are coated with a tough exterior gel coat finish for years of protection. Inspect the finish for damage.

4.7.2 Radomes are usually supplied in two pieces, which are bolted together with stainless steel fasteners.

4.8.0 ELECTRICAL DEICING (OPTIONAL)

4.8.1 Refer to installation drawing for installation notes and operating voltages, etc.

DEICING SYSTEM SHOULD NOT BE OPERATED WHEN AMBIENT TEMPERATURE IS HIGHER THAN 40° F. DAMAGE TO ANTENNA OR DEICERS MAY RESULT.

SECTION V

REPORTS

5.1.0 INTRODUCTION

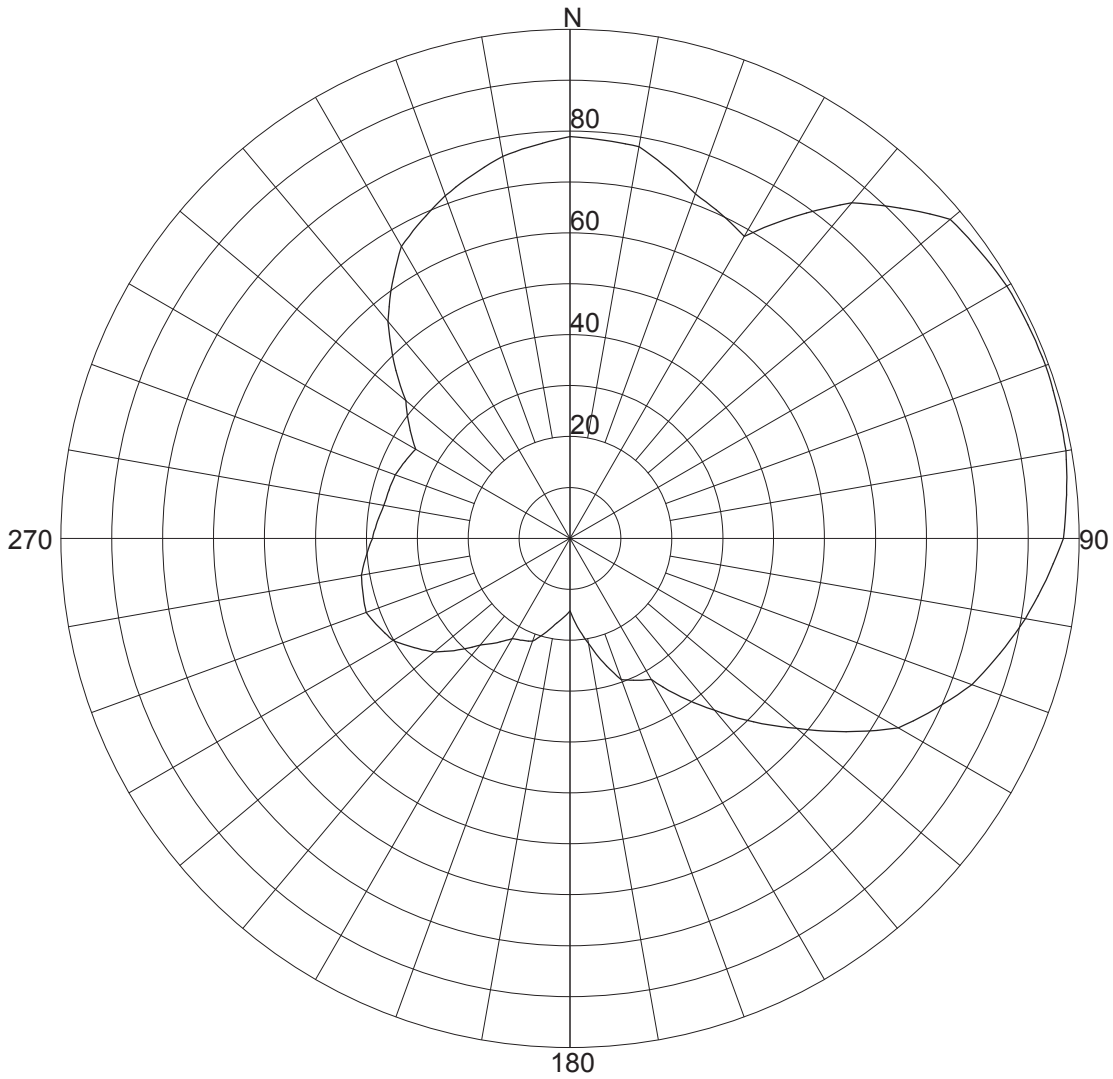
5.1.1 This section contains the technical manual reports.

5.2.0 ELEVATION PLANE PATTERN

A calculated elevation plane pattern is included. Measured elevation patterns are included in the FM Antenna Test Data Section.

5.2.1 VSWR MEASUREMENTS

Measured input impedance of the array is included in the FM Antenna Test Data Section and is recorded on an expanded Smith Chart plot. The plot is continuous across the frequency band of the channel.



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability (SWR, L.P.)

CLIENT: *WPMU(Composite)*

Date: 11/9/2022

ANTENNA TYPE: FM3RA/2-DA-EP

FREQUENCY: 89.5

PATTERN POL.: Elliptical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.56556 / 4.09dB

PATTERN RMS: *0.624*

Micro-Tek Eng. SWR_Multi_Access

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.7890 (-2.06)	180	.1420 (-16.95)
5	.7850 (-2.1)	185	.1570 (-16.08)
10	.7810 (-2.15)	190	.1720 (-15.29)
15	.7505 (-2.49)	195	.1935 (-14.27)
20	.7200 (-2.85)	200	.2150 (-13.35)
25	.7025 (-3.07)	205	.2210 (-13.11)
30	.6850 (-3.29)	210	.2270 (-12.88)
35	.7725 (-2.24)	215	.2500 (-12.04)
40	.8600 (-1.31)	220	.2730 (-11.28)
45	.9175 (-0.75)	225	.3100 (-10.17)
50	.9750 (-0.22)	230	.3470 (-9.19)
55	.9830 (-0.15)	235	.3740 (-8.54)
60	.9910 (-0.08)	240	.4010 (-7.94)
65	.9925 (-0.07)	245	.4135 (-7.67)
70	.9940 (-0.05)	250	.4260 (-7.41)
75	.9915 (-0.07)	255	.4210 (-7.51)
80	.9890 (-0.1)	260	.4160 (-7.62)
85	.9790 (-0.18)	265	.4020 (-7.92)
90	.9690 (-0.27)	270	.3880 (-8.22)
95	.9385 (-0.55)	275	.3795 (-8.42)
100	.9080 (-0.84)	280	.3710 (-8.61)
105	.8740 (-1.17)	285	.3680 (-8.68)
110	.8400 (-1.51)	290	.3650 (-8.75)
115	.7922 (-2.02)	295	.3575 (-8.93)
120	.7444 (-2.56)	300	.3500 (-9.12)
125	.6622 (-3.58)	305	.3855 (-8.28)
130	.5800 (-4.73)	310	.4210 (-7.51)
135	.5100 (-5.85)	315	.4885 (-6.22)
140	.4400 (-7.13)	320	.5560 (-5.1)
145	.3800 (-8.4)	325	.6090 (-4.31)
150	.3200 (-9.9)	330	.6620 (-3.58)
155	.3075 (-10.24)	335	.6890 (-3.24)
160	.2950 (-10.6)	340	.7160 (-2.9)
165	.2520 (-11.97)	345	.7390 (-2.63)
170	.2090 (-13.6)	350	.7620 (-2.36)
175	.1755 (-15.11)	355	.7755 (-2.21)

Systems With Reliability (SWR, L.P.)

CLIENT: *WPMU(Composite)*

Date: 11/9/2022

ANTENNA TYPE: FM3RA/2-DA-EP

FREQUENCY: 89.5

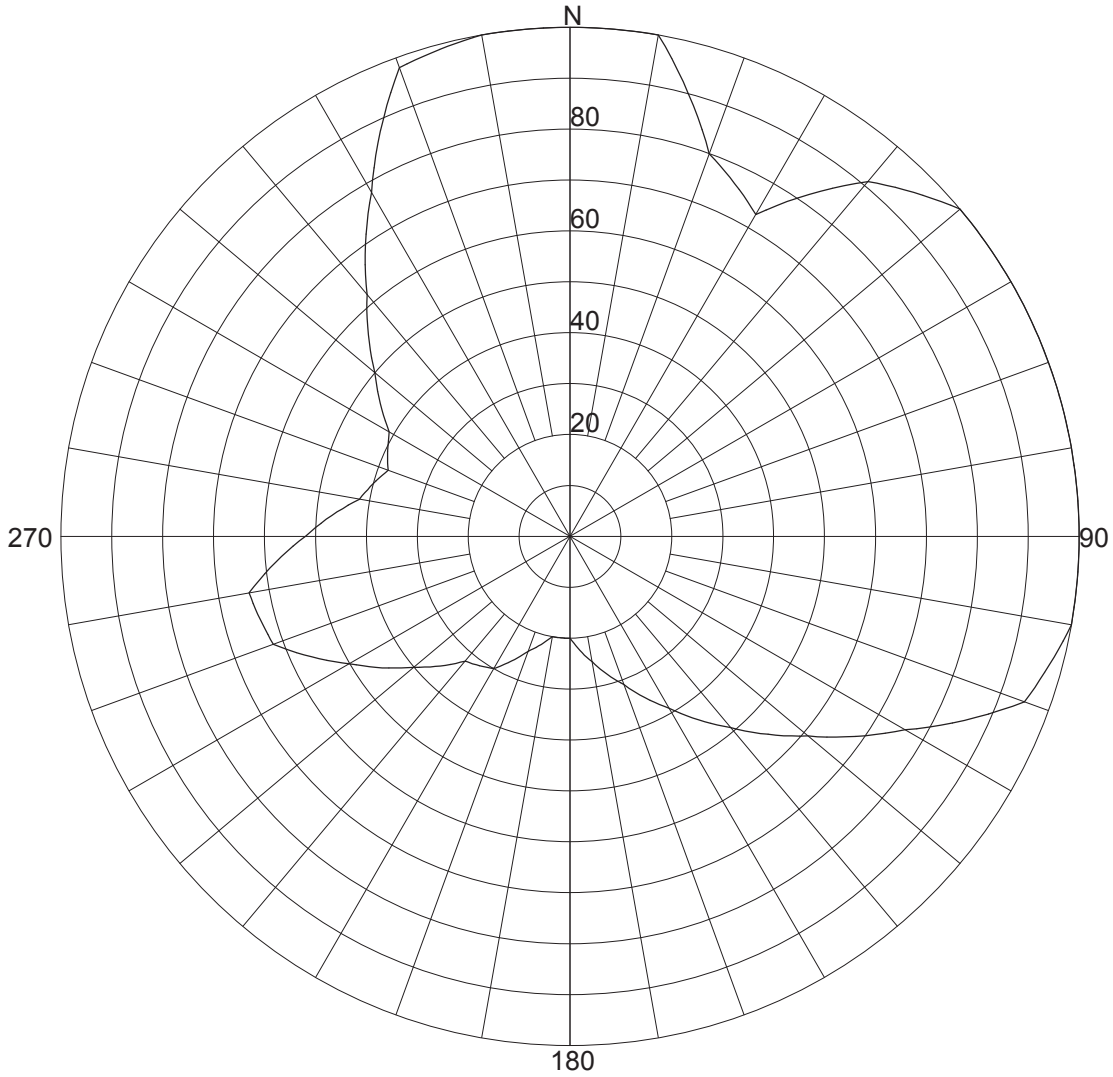
PATTERN POL.: Elliptical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.56556 / 4.09dB

PATTERN RMS: *0.624*

Micro-Tek Eng. SWR_Multi_Access



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability (SWR, L.P.)

CLIENT: WPMU(FCC)

Date: 9/28/2022

ANTENNA TYPE: FM3R*A*/2-EP-DA

FREQUENCY: 89.5

PATTERN POL.: Elliptical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.01736 / 3.05dB

PATTERN RMS: *0.704*

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	1.0000 (0)	180	.2000 (-13.98)
5	1.0000 (0)	185	.2000 (-13.98)
10	1.0000 (0)	190	.2000 (-13.98)
15	.9000 (-0.92)	195	.2200 (-13.15)
20	.8000 (-1.94)	200	.2400 (-12.4)
25	.7650 (-2.33)	205	.2700 (-11.37)
30	.7300 (-2.73)	210	.3000 (-10.46)
35	.8200 (-1.72)	215	.3100 (-10.17)
40	.9100 (-0.82)	220	.3200 (-9.9)
45	.9550 (-0.4)	225	.3600 (-8.87)
50	1.0000 (0)	230	.4000 (-7.96)
55	1.0000 (0)	235	.4500 (-6.94)
60	1.0000 (0)	240	.5000 (-6.02)
65	1.0000 (0)	245	.5600 (-5.04)
70	1.0000 (0)	250	.6200 (-4.15)
75	1.0000 (0)	255	.6300 (-4.01)
80	1.0000 (0)	260	.6400 (-3.88)
85	1.0000 (0)	265	.5800 (-4.73)
90	1.0000 (0)	270	.5200 (-5.68)
95	1.0000 (0)	275	.4700 (-6.56)
100	1.0000 (0)	280	.4200 (-7.54)
105	.9750 (-0.22)	285	.4000 (-7.96)
110	.9500 (-0.45)	290	.3800 (-8.4)
115	.8550 (-1.36)	295	.3950 (-8.07)
120	.7600 (-2.38)	300	.4100 (-7.74)
125	.6850 (-3.29)	305	.4550 (-6.84)
130	.6100 (-4.29)	310	.5000 (-6.02)
135	.5500 (-5.19)	315	.5600 (-5.04)
140	.4900 (-6.2)	320	.6200 (-4.15)
145	.4400 (-7.13)	325	.7000 (-3.1)
150	.3900 (-8.18)	330	.7800 (-2.16)
155	.3500 (-9.12)	335	.8800 (-1.11)
160	.3100 (-10.17)	340	.9800 (-0.18)
165	.2800 (-11.06)	345	.9900 (-0.09)
170	.2500 (-12.04)	350	1.0000 (0)
175	.2250 (-12.96)	355	1.0000 (0)

Systems With Reliability (SWR, L.P.)

CLIENT: WPMU(FCC)

Date: 9/28/2022

ANTENNA TYPE: FM3R*A*/2-EP-DA

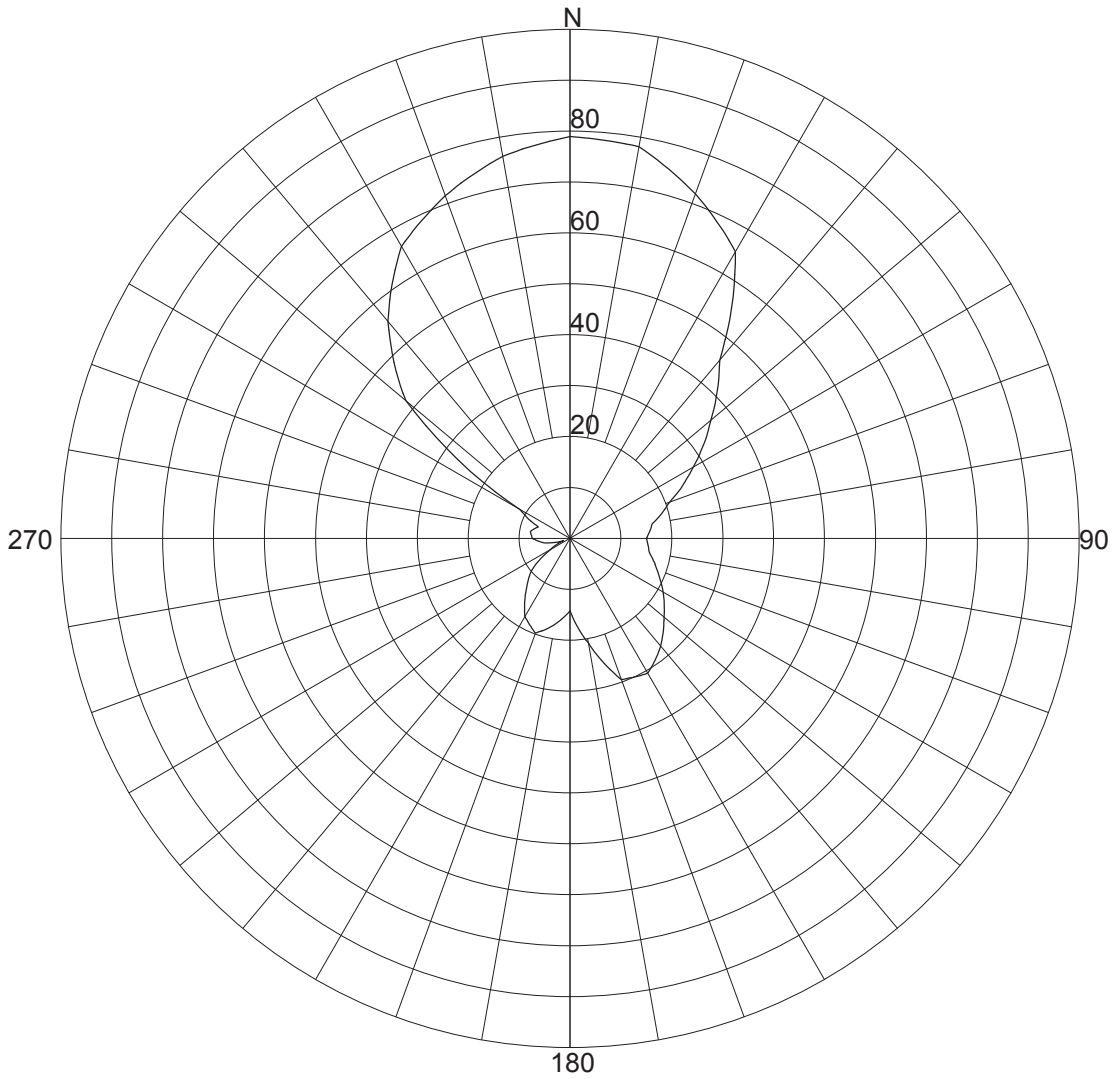
FREQUENCY: 89.5

PATTERN POL.: Elliptical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.01736 / 3.05dB

PATTERN RMS: *0.704*



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability (SWR, L.P.)

CLIENT: *WPMU(HORIZONTAL)*

Date: 11/9/2022

ANTENNA TYPE: FM3RA/2-DA-EP

FREQUENCY: 89.5

PATTERN POL.: Elliptical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 6.78423 / 8.32dB

PATTERN RMS: *0.384*

Micro-Tek Eng. SWR_Multi_Access

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.7890 (-2.06)	180	.1420 (-16.95)
5	.7850 (-2.1)	185	.1570 (-16.08)
10	.7810 (-2.15)	190	.1720 (-15.29)
15	.7505 (-2.49)	195	.1850 (-14.66)
20	.7200 (-2.85)	200	.1980 (-14.07)
25	.6850 (-3.29)	205	.1875 (-14.54)
30	.6500 (-3.74)	210	.1770 (-15.04)
35	.5535 (-5.14)	215	.1555 (-16.17)
40	.4570 (-6.8)	220	.1340 (-17.46)
45	.4090 (-7.77)	225	.1160 (-18.71)
50	.3610 (-8.85)	230	.0980 (-20.18)
55	.3200 (-9.9)	235	.0715 (-22.91)
60	.2790 (-11.09)	240	.0450 (-26.94)
65	.2435 (-12.27)	245	.0290 (-30.75)
70	.2080 (-13.64)	250	.0130 (-37.72)
75	.1860 (-14.61)	255	.0320 (-29.9)
80	.1640 (-15.7)	260	.0510 (-25.85)
85	.1570 (-16.08)	265	.0625 (-24.08)
90	.1500 (-16.48)	270	.0740 (-22.62)
95	.1540 (-16.25)	275	.0765 (-22.33)
100	.1580 (-16.03)	280	.0790 (-22.05)
105	.1700 (-15.39)	285	.0725 (-22.79)
110	.1820 (-14.8)	290	.0660 (-23.61)
115	.1965 (-14.13)	295	.0895 (-20.96)
120	.2110 (-13.51)	300	.1130 (-18.94)
125	.2260 (-12.92)	305	.2670 (-11.47)
130	.2410 (-12.36)	310	.4210 (-7.51)
135	.2590 (-11.73)	315	.4885 (-6.22)
140	.2770 (-11.15)	320	.5560 (-5.1)
145	.2915 (-10.71)	325	.6090 (-4.31)
150	.3060 (-10.29)	330	.6620 (-3.58)
155	.3005 (-10.44)	335	.6890 (-3.24)
160	.2950 (-10.6)	340	.7160 (-2.9)
165	.2520 (-11.97)	345	.7390 (-2.63)
170	.2090 (-13.6)	350	.7620 (-2.36)
175	.1755 (-15.11)	355	.7755 (-2.21)

Systems With Reliability (SWR, L.P.)

CLIENT: *WPMU(HORIZONTAL)*

Date: 11/9/2022

ANTENNA TYPE: FM3RA/2-DA-EP

FREQUENCY: 89.5

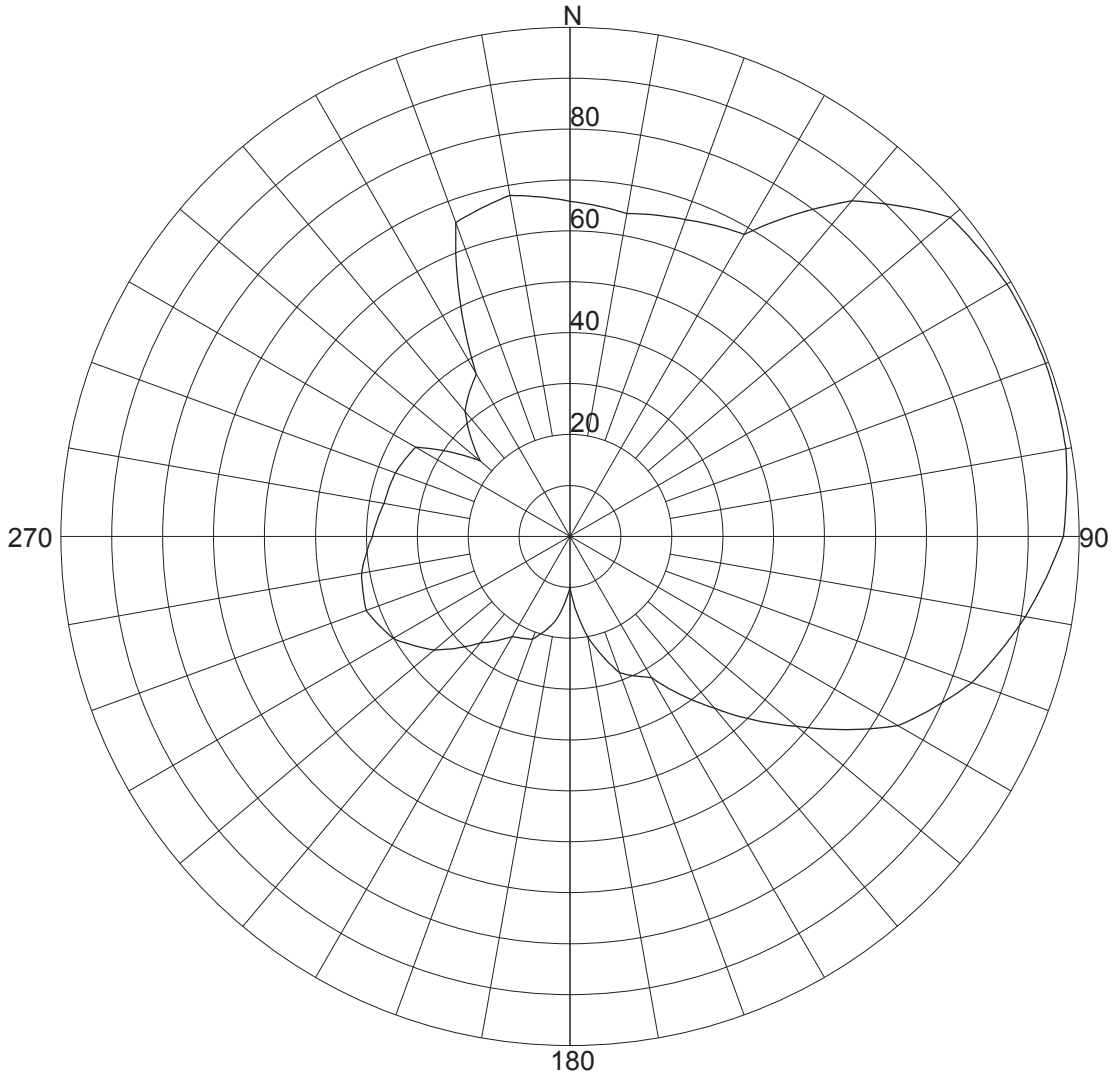
PATTERN POL.: Elliptical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 6.78423 / 8.32dB

PATTERN RMS: *0.384*

Micro-Tek Eng. SWR_Multi_Access



Azimuth Pattern

Scale: Linear

Unit: Relative Field

Systems With Reliability (SWR, L.P.)

CLIENT: *WPMU(VERTICAL)*

Date: 11/9/2022

ANTENNA TYPE: FM3RA/2-DA-EP

FREQUENCY: 89.5

PATTERN POL.: Elliptical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.83464 / 4.52dB

PATTERN RMS: *0.594*

Micro-Tek Eng. SWR_Multi_Access

Relative Field Tabulation(Azimuth)

Azimuth Heading	Normalized Field(dB)	Azimuth Heading	Normalized Field(dB)
0	.6580 (-3.64)	180	.1000 (-20)
5	.6510 (-3.73)	185	.1350 (-17.39)
10	.6440 (-3.82)	190	.1700 (-15.39)
15	.6530 (-3.7)	195	.1925 (-14.31)
20	.6620 (-3.58)	200	.2150 (-13.35)
25	.6735 (-3.43)	205	.2210 (-13.11)
30	.6850 (-3.29)	210	.2270 (-12.88)
35	.7725 (-2.24)	215	.2500 (-12.04)
40	.8600 (-1.31)	220	.2730 (-11.28)
45	.9175 (-0.75)	225	.3100 (-10.17)
50	.9750 (-0.22)	230	.3470 (-9.19)
55	.9830 (-0.15)	235	.3740 (-8.54)
60	.9910 (-0.08)	240	.4010 (-7.94)
65	.9925 (-0.07)	245	.4135 (-7.67)
70	.9940 (-0.05)	250	.4260 (-7.41)
75	.9915 (-0.07)	255	.4210 (-7.51)
80	.9890 (-0.1)	260	.4160 (-7.62)
85	.9790 (-0.18)	265	.4020 (-7.92)
90	.9690 (-0.27)	270	.3880 (-8.22)
95	.9385 (-0.55)	275	.3795 (-8.42)
100	.9080 (-0.84)	280	.3710 (-8.61)
105	.8740 (-1.17)	285	.3680 (-8.68)
110	.8400 (-1.51)	290	.3650 (-8.75)
115	.7920 (-2.03)	295	.3575 (-8.93)
120	.7440 (-2.57)	300	.3500 (-9.12)
125	.6620 (-3.58)	305	.2900 (-10.75)
130	.5800 (-4.73)	310	.2300 (-12.77)
135	.5100 (-5.85)	315	.2755 (-11.2)
140	.4400 (-7.13)	320	.3210 (-9.87)
145	.3800 (-8.4)	325	.3445 (-9.26)
150	.3200 (-9.9)	330	.3680 (-8.68)
155	.3025 (-10.39)	335	.5120 (-5.81)
160	.2850 (-10.9)	340	.6560 (-3.66)
165	.2425 (-12.31)	345	.6680 (-3.5)
170	.2000 (-13.98)	350	.6800 (-3.35)
175	.1500 (-16.48)	355	.6690 (-3.49)

Systems With Reliability (SWR, L.P.)

CLIENT: *WPMU(VERTICAL)*

Date: 11/9/2022

ANTENNA TYPE: FM3RA/2-DA-EP

FREQUENCY: 89.5

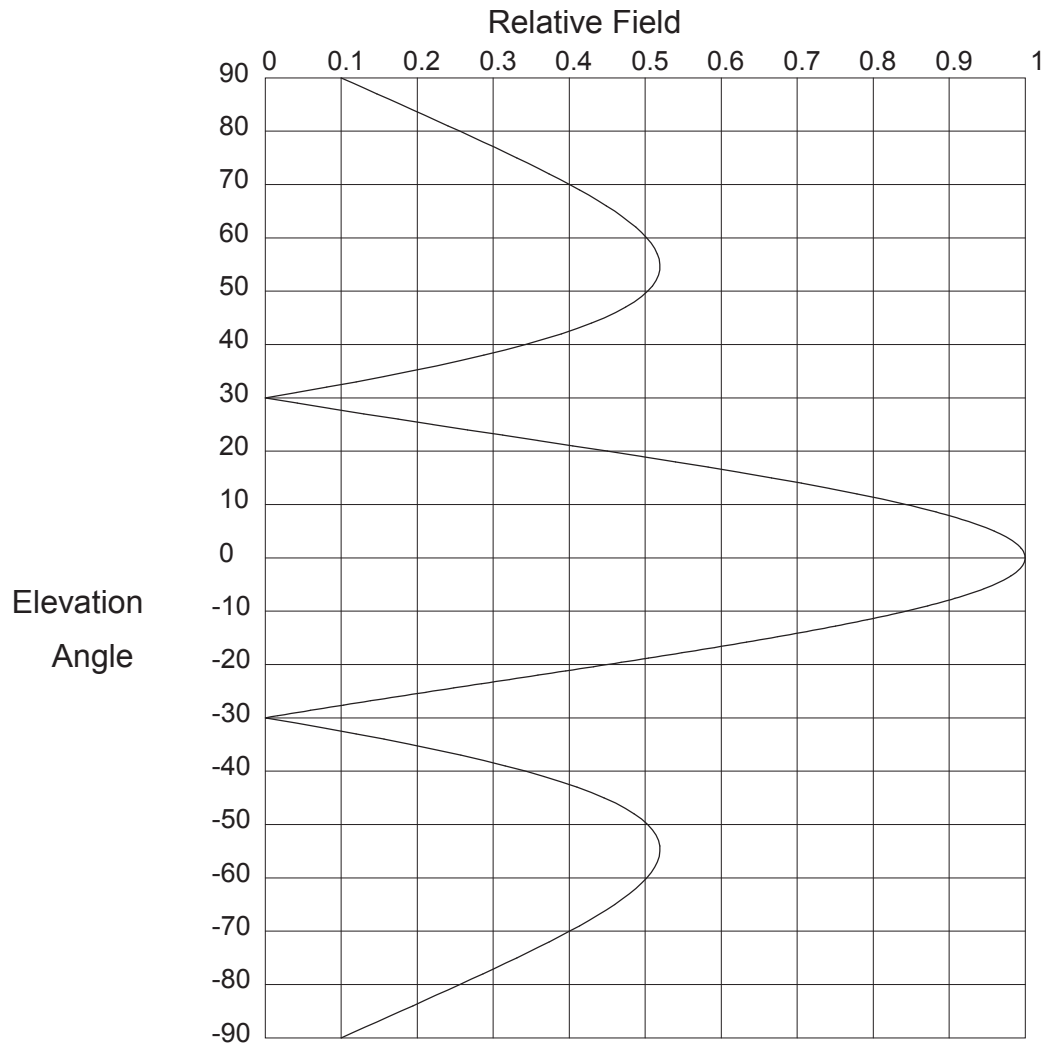
PATTERN POL.: Elliptical

CIRCULARITY(+/-dB):

AZ. DIRECTIVITY: 2.83464 / 4.52dB

PATTERN RMS: *0.594*

Micro-Tek Eng. SWR_Multi_Access



Elevation Pattern

Scale: Linear

Units: Field, Relative

Systems With Reliability (SWR, L.P.)

CLIENT: WPMU

Date: 9/28/2022

ANTENNA TYPE: FM3R*A*/2-EP-DA

FREQUENCY: 89.5

PATTERN POL.: Elliptical

DIRECTIVITY(Peak): 1.918/2.828 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 1.918/2.828 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	.514 (-5.775)	14.0	.705 (-3.031)
89.0	.116 (-18.733)	51.0	.51 (-5.855)	13.0	.743 (-2.581)
88.0	.131 (-17.627)	50.0	.503 (-5.963)	12.0	.779 (-2.174)
87.0	.147 (-16.648)	49.0	.495 (-6.101)	11.0	.812 (-1.809)
86.0	.163 (-15.768)	48.0	.486 (-6.272)	10.0	.843 (-1.482)
85.0	.178 (-14.971)	47.0	.474 (-6.479)	9.8	.849 (-1.421)
84.0	.194 (-14.242)	46.0	.461 (-6.724)	9.6	.855 (-1.361)
83.0	.21 (-13.571)	45.0	.446 (-7.013)	9.4	.861 (-1.303)
82.0	.225 (-12.951)	44.0	.429 (-7.349)	9.2	.866 (-1.246)
81.0	.241 (-12.374)	43.0	.41 (-7.738)	9.0	.872 (-1.191)
80.0	.256 (-11.835)	42.0	.39 (-8.189)	8.8	.877 (-1.137)
79.0	.271 (-11.332)	41.0	.367 (-8.709)	8.6	.883 (-1.084)
78.0	.286 (-10.859)	40.0	.342 (-9.31)	8.4	.888 (-1.033)
77.0	.301 (-10.415)	39.0	.316 (-10.008)	8.2	.893 (-0.983)
76.0	.316 (-9.997)	38.0	.288 (-10.824)	8.0	.898 (-0.935)
75.0	.331 (-9.603)	37.0	.257 (-11.786)	7.8	.903 (-0.887)
74.0	.345 (-9.231)	36.0	.225 (-12.937)	7.6	.908 (-0.841)
73.0	.36 (-8.881)	35.0	.192 (-14.343)	7.4	.912 (-0.797)
72.0	.374 (-8.551)	34.0	.156 (-16.113)	7.2	.917 (-0.753)
71.0	.387 (-8.24)	33.0	.119 (-18.454)	7.0	.921 (-0.711)
70.0	.401 (-7.948)	32.0	.081 (-21.828)	6.8	.926 (-0.67)
69.0	.413 (-7.673)	31.0	.041 (-27.712)	6.6	.93 (-0.631)
68.0	.426 (-7.417)	30.0	.00 (-50)	6.4	.934 (-0.593)
67.0	.438 (-7.178)	29.0	.042 (-27.469)	6.2	.938 (-0.556)
66.0	.449 (-6.956)	28.0	.086 (-21.343)	6.0	.942 (-0.52)
65.0	.46 (-6.751)	27.0	.13 (-17.727)	5.8	.946 (-0.485)
64.0	.47 (-6.563)	26.0	.175 (-15.145)	5.6	.949 (-0.452)
63.0	.479 (-6.392)	25.0	.22 (-13.135)	5.4	.953 (-0.42)
62.0	.488 (-6.239)	24.0	.266 (-11.491)	5.2	.956 (-0.389)
61.0	.495 (-6.103)	23.0	.312 (-10.103)	5.0	.959 (-0.36)
60.0	.502 (-5.986)	22.0	.359 (-8.906)	4.8	.963 (-0.331)
59.0	.508 (-5.887)	21.0	.405 (-7.858)	4.6	.966 (-0.304)
58.0	.512 (-5.807)	20.0	.45 (-6.929)	4.4	.969 (-0.278)
57.0	.516 (-5.747)	19.0	.495 (-6.1)	4.2	.971 (-0.253)
56.0	.518 (-5.708)	18.0	.54 (-5.356)	4.0	.974 (-0.229)
55.0	.519 (-5.69)	17.0	.583 (-4.685)	3.8	.976 (-0.207)
54.0	.519 (-5.694)	16.0	.625 (-4.078)	3.6	.979 (-0.186)
53.0	.517 (-5.722)	15.0	.666 (-3.528)	3.4	.981 (-0.165)

Systems With Reliability (SWR, L.P.)

Date: 9/28/2022

CLIENT: *WPMU*
ANTENNA TYPE: FM3R*A*/2-EP-DA
FREQUENCY: 89.5
PATTERN POL.: Elliptical
DIRECTIVITY(Peak): 1.918/2.828 dBd
DIRECTIVITY(Horiz): 1.918/2.828 dBd

Beam Tilt (Deg.) : *0*
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	.983 (-0.146)	-4.4	.969 (-0.278)	-12.0	.779 (-2.174)
3.0	.985 (-0.129)	-4.6	.966 (-0.304)	-12.2	.772 (-2.252)
2.8	.987 (-0.112)	-4.8	.963 (-0.331)	-12.4	.765 (-2.332)
2.6	.989 (-0.097)	-5.0	.959 (-0.36)	-12.6	.757 (-2.413)
2.4	.991 (-0.082)	-5.2	.956 (-0.389)	-12.8	.75 (-2.496)
2.2	.992 (-0.069)	-5.4	.953 (-0.42)	-13.0	.743 (-2.581)
2.0	.993 (-0.057)	-5.6	.949 (-0.452)	-13.2	.736 (-2.667)
1.8	.995 (-0.046)	-5.8	.946 (-0.485)	-13.4	.728 (-2.755)
1.6	.996 (-0.037)	-6.0	.942 (-0.52)	-13.6	.721 (-2.845)
1.4	.997 (-0.028)	-6.2	.938 (-0.556)	-13.8	.713 (-2.937)
1.2	.998 (-0.021)	-6.4	.934 (-0.593)	-14.0	.705 (-3.031)
1.0	.998 (-0.014)	-6.6	.93 (-0.631)	-14.2	.698 (-3.126)
.8	.999 (-0.009)	-6.8	.926 (-0.67)	-14.4	.69 (-3.224)
.6	.999 (-0.005)	-7.0	.921 (-0.711)	-14.6	.682 (-3.323)
.4	1.00 (-0.002)	-7.2	.917 (-0.753)	-14.8	.674 (-3.425)
.2	1.00 (-0.001)	-7.4	.912 (-0.797)	-15.0	.666 (-3.528)
.0	1.00 (0)	-7.6	.908 (-0.841)	-15.2	.658 (-3.634)
-.2	1.00 (-0.001)	-7.8	.903 (-0.887)	-15.4	.65 (-3.742)
-.4	1.00 (-0.002)	-8.0	.898 (-0.935)	-15.6	.642 (-3.851)
-.6	.999 (-0.005)	-8.2	.893 (-0.983)	-15.8	.634 (-3.963)
-.8	.999 (-0.009)	-8.4	.888 (-1.033)	-16.0	.625 (-4.078)
-1.0	.998 (-0.014)	-8.6	.883 (-1.084)	-16.2	.617 (-4.194)
-1.2	.998 (-0.021)	-8.8	.877 (-1.137)	-16.4	.609 (-4.313)
-1.4	.997 (-0.028)	-9.0	.872 (-1.191)	-16.6	.60 (-4.435)
-1.6	.996 (-0.037)	-9.2	.866 (-1.246)	-16.8	.592 (-4.558)
-1.8	.995 (-0.046)	-9.4	.861 (-1.303)	-17.0	.583 (-4.685)
-2.0	.993 (-0.057)	-9.6	.855 (-1.361)	-17.2	.575 (-4.814)
-2.2	.992 (-0.069)	-9.8	.849 (-1.421)	-17.4	.566 (-4.945)
-2.4	.991 (-0.082)	-10.0	.843 (-1.482)	-17.6	.557 (-5.079)
-2.6	.989 (-0.097)	-10.2	.837 (-1.544)	-17.8	.549 (-5.216)
-2.8	.987 (-0.112)	-10.4	.831 (-1.608)	-18.0	.54 (-5.356)
-3.0	.985 (-0.129)	-10.6	.825 (-1.674)	-18.2	.531 (-5.499)
-3.2	.983 (-0.146)	-10.8	.818 (-1.74)	-18.4	.522 (-5.644)
-3.4	.981 (-0.165)	-11.0	.812 (-1.809)	-18.6	.513 (-5.793)
-3.6	.979 (-0.186)	-11.2	.805 (-1.879)	-18.8	.504 (-5.945)
-3.8	.976 (-0.207)	-11.4	.799 (-1.95)	-19.0	.495 (-6.1)
-4.0	.974 (-0.229)	-11.6	.792 (-2.023)	-19.2	.486 (-6.259)
-4.2	.971 (-0.253)	-11.8	.785 (-2.098)	-19.4	.477 (-6.421)

Systems With Reliability (SWR, L.P.)

CLIENT: *WPMU*

Date: 9/28/2022

ANTENNA TYPE: FM3R*A*/2-EP-DA

FREQUENCY: 89.5

PATTERN POL.: Elliptical

DIRECTIVITY(Peak): 1.918/2.828 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 1.918/2.828 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	.468 (-6.587)	-27.2	.121 (-18.344)	-54.0	.519 (-5.694)
-19.8	.459 (-6.756)	-27.4	.112 (-19.006)	-55.0	.519 (-5.69)
-20.0	.45 (-6.929)	-27.6	.103 (-19.721)	-56.0	.518 (-5.708)
-20.2	.441 (-7.106)	-27.8	.094 (-20.496)	-57.0	.516 (-5.747)
-20.4	.432 (-7.288)	-28.0	.086 (-21.343)	-58.0	.512 (-5.807)
-20.6	.423 (-7.473)	-28.2	.077 (-22.278)	-59.0	.508 (-5.887)
-20.8	.414 (-7.663)	-28.4	.068 (-23.322)	-60.0	.502 (-5.986)
-21.0	.405 (-7.858)	-28.6	.06 (-24.503)	-61.0	.495 (-6.103)
-21.2	.396 (-8.057)	-28.8	.051 (-25.863)	-62.0	.488 (-6.239)
-21.4	.386 (-8.261)	-29.0	.042 (-27.469)	-63.0	.479 (-6.392)
-21.6	.377 (-8.471)	-29.2	.034 (-29.429)	-64.0	.47 (-6.563)
-21.8	.368 (-8.686)	-29.4	.025 (-31.951)	-65.0	.46 (-6.751)
-22.0	.359 (-8.906)	-29.6	.017 (-35.496)	-66.0	.449 (-6.956)
-22.2	.349 (-9.132)	-29.8	.008 (-41.54)	-67.0	.438 (-7.178)
-22.4	.34 (-9.365)	-30.0	.00 (-50)	-68.0	.426 (-7.417)
-22.6	.331 (-9.604)	-31.0	.041 (-27.712)	-69.0	.413 (-7.673)
-22.8	.322 (-9.85)	-32.0	.081 (-21.828)	-70.0	.401 (-7.948)
-23.0	.312 (-10.103)	-33.0	.119 (-18.454)	-71.0	.387 (-8.24)
-23.2	.303 (-10.364)	-34.0	.156 (-16.113)	-72.0	.374 (-8.551)
-23.4	.294 (-10.632)	-35.0	.192 (-14.343)	-73.0	.36 (-8.881)
-23.6	.285 (-10.909)	-36.0	.225 (-12.937)	-74.0	.345 (-9.231)
-23.8	.276 (-11.195)	-37.0	.257 (-11.786)	-75.0	.331 (-9.603)
-24.0	.266 (-11.491)	-38.0	.288 (-10.824)	-76.0	.316 (-9.997)
-24.2	.257 (-11.797)	-39.0	.316 (-10.008)	-77.0	.301 (-10.415)
-24.4	.248 (-12.113)	-40.0	.342 (-9.31)	-78.0	.286 (-10.859)
-24.6	.239 (-12.441)	-41.0	.367 (-8.709)	-79.0	.271 (-11.332)
-24.8	.23 (-12.781)	-42.0	.39 (-8.189)	-80.0	.256 (-11.835)
-25.0	.22 (-13.135)	-43.0	.41 (-7.738)	-81.0	.241 (-12.374)
-25.2	.211 (-13.503)	-44.0	.429 (-7.349)	-82.0	.225 (-12.951)
-25.4	.202 (-13.887)	-45.0	.446 (-7.013)	-83.0	.21 (-13.571)
-25.6	.193 (-14.287)	-46.0	.461 (-6.724)	-84.0	.194 (-14.242)
-25.8	.184 (-14.706)	-47.0	.474 (-6.479)	-85.0	.178 (-14.971)
-26.0	.175 (-15.145)	-48.0	.486 (-6.272)	-86.0	.163 (-15.768)
-26.2	.166 (-15.606)	-49.0	.495 (-6.101)	-87.0	.147 (-16.648)
-26.4	.157 (-16.092)	-50.0	.503 (-5.963)	-88.0	.131 (-17.627)
-26.6	.148 (-16.605)	-51.0	.51 (-5.855)	-89.0	.116 (-18.733)
-26.8	.139 (-17.149)	-52.0	.514 (-5.775)	-90.0	.10 (-20)
-27.0	.13 (-17.727)	-53.0	.517 (-5.722)	90.0	.00 (-50)

Systems With Reliability (SWR, L.P.)

CLIENT: *WPMU*

Date: 9/28/2022

ANTENNA TYPE: FM3R*A*/2-EP-DA

FREQUENCY: 89.5

PATTERN POL.: Elliptical

DIRECTIVITY(Peak): 1.918/2.828 dBd

Beam Tilt (Deg.) : *0*

DIRECTIVITY(Horiz): 1.918/2.828 dBd

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

SYSTEMS WITH RELIABILITY, LP
Broadcast Antennas & Transmission Systems
619 Industrial Park Road, Ebensburg, PA 15931
Phone 814.472.5436 Fax 814.472.5552 www.swr-rf.com

Certified Proof of Performance

Customer:	Lightner Electronics WPMU
Date:	11/21/2022
Antenna Model:	FM3RA/2 – EP - DA – 89.5
Frequencies Tested:	89.5 MHz (+/- 200 KHz)
Return Loss:	- 37.514 dB
Shop Order	22261
Input:	1 5/8” EIA Flange

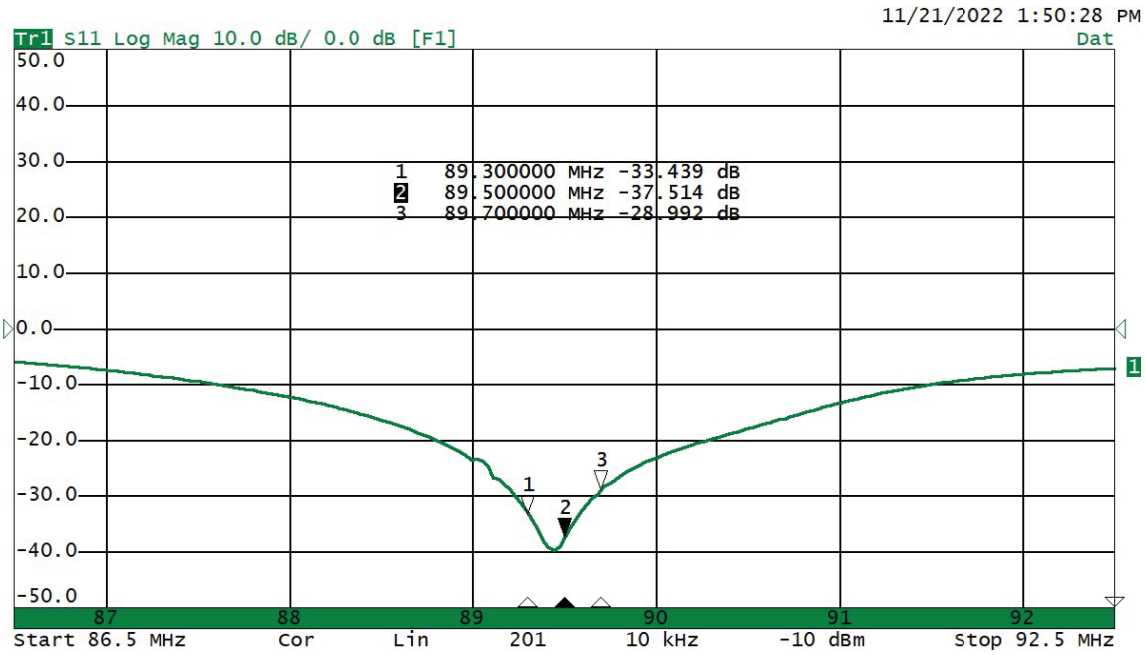
A reading of –26.4 dB is indicative of a 1.1:1 VSWR. The component specified has met or exceeds this 1.1:1 VSWR performance specification.

Computer / Vector Network Analyzer plots are enclosed to verify antenna performance.

Test Performed by:

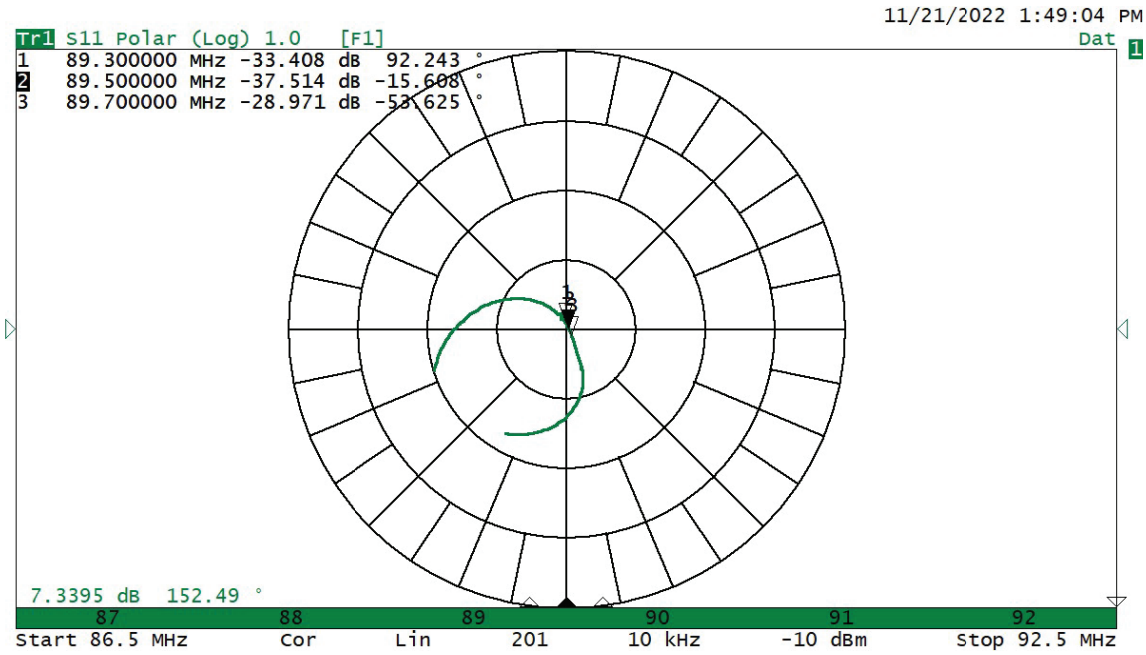
Charles Edmiston Jr.
Technician

SYSTEMS WITH RELIABILITY, LP
Broadcast Antennas & Transmission Systems
619 Industrial Park Road, Ebensburg, PA 15931
Phone 814.472.5436 Fax 814.472.5552 www.swr-rf.com



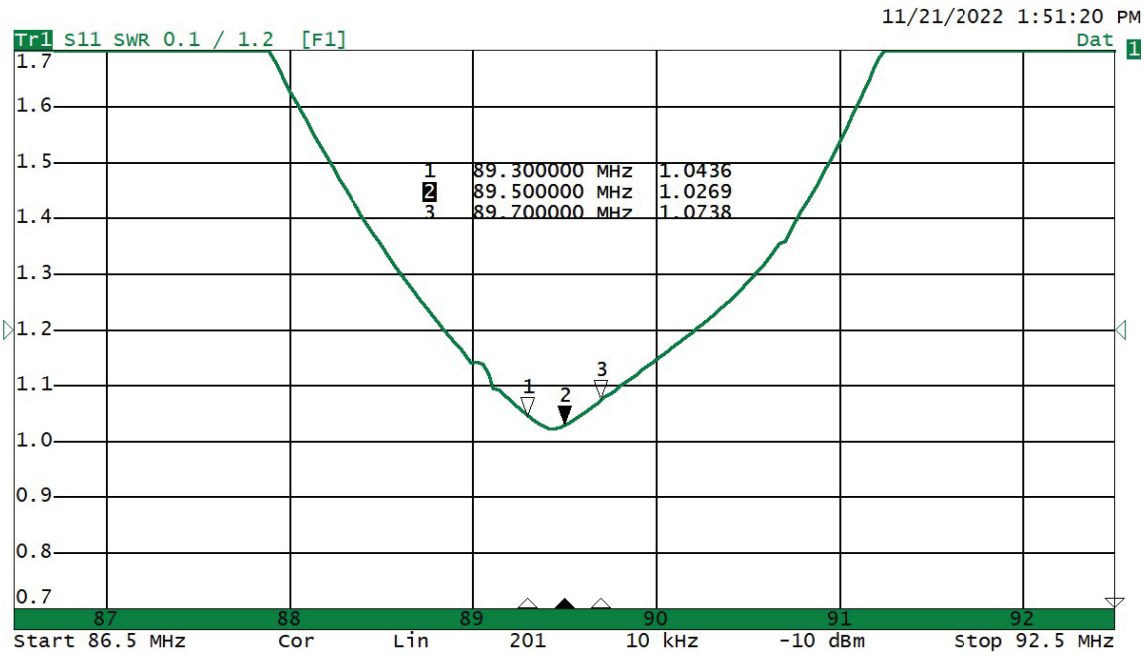
Plot 1: Return Loss

SYSTEMS WITH RELIABILITY, LP
Broadcast Antennas & Transmission Systems
619 Industrial Park Road, Ebensburg, PA 15931
Phone 814.472.5436 Fax 814.472.5552 www.swr-rf.com



Plot 2: Polar

SYSTEMS WITH RELIABILITY, LP
Broadcast Antennas & Transmission Systems
619 Industrial Park Road, Ebensburg, PA 15931
Phone 814.472.5436 Fax 814.472.5552 www.swr-rf.com



Plot 3: VSWR

SYSTEMS WITH RELIABILITY, LP
Broadcast Antennas & Transmission Systems
619 Industrial Park Road, Ebensburg, PA 15931
Phone 814.472.5436 Fax 814.472.5552 www.swr-rf.com

Probe:

#1: 2.250”
#2: 2.750” OUT
#3: 2.750” OUT
#4: 2.500”

SYSTEMS WITH RELIABILITY, LP

Broadcast Antennas & Transmission Systems

SYSTEM DATA SHEET

CUSTOMER	WPMU
CONTACT	Matt Lightner
LOCATION	Dubois, PA
ANTENNA MODEL	FM3RA/2-EP-DA (COMPOSITE)
FREQUENCY	89.5 MHz

ELECTRICAL SPECIFICATIONS

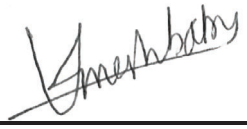
Polarization Type		Elliptical	
Polarization Ratio			
V-Pol. (PRV)		65.00	**%**
H-Pol. (PRH)		35.00	**%**
Elevation Directivity (ED)		1.918	
Azimuth Directivity (AD) V-Pol.		2.566	
Azimuth Directivity (AD) H-Pol.		2.566	
Antenna Efficiency		100.00	**%**
Antenna Gain (GH)			
V-Pol. (GV)		3.198	
H-Pol. (GH)		1.722	
dB Gain (AG)			
V-Pol (AGV)		5.049	**dB**
H-Pol (AGH)		2.361	**dB**
Beam Tilt		0.00	**Degree**
Null Fill		0.000	**%**
ERP (Below Horizontal Plane)			
V-Pol. (ERPV)		6.000	**kW**
H-Pol. (ERPH)		3.231	**kW**
Line Type		7/8" Air	**HCA78-50J**
Attenuation		0.340	**dB/100'**
Line length	**AGL+100'	** 306.69	**ft.**
Total line attenuation		1.043	**dB**
Line Efficiency (LE)		78.65	**%**
Line Loss (LPL)		0.509	**kW**
Antenna Input Power (AIP)		1.876	**kW**
Req'd. Transmitter Output Power		2.385	**kW**

MECHANICAL SPECIFICATIONS

No. Of Bays	2	**#**		
Center of Radiation AGL	206.69	**ft.**	63.00	**m**
Antenna Aperture	10.99	**ft.**	3.35	**m**
Antenna Total Length	13.88	**ft.**	4.23	**m**
Antenna Weight	143.00	**lbs.**	65.00	**kg**
Windload: 50/33 psf / CaAc	560.00	**lbs.**	15.40	**ft.^2**

Specifications will be certified upon final construction and testing.
The given values can be used for system planning.

Prepared by:



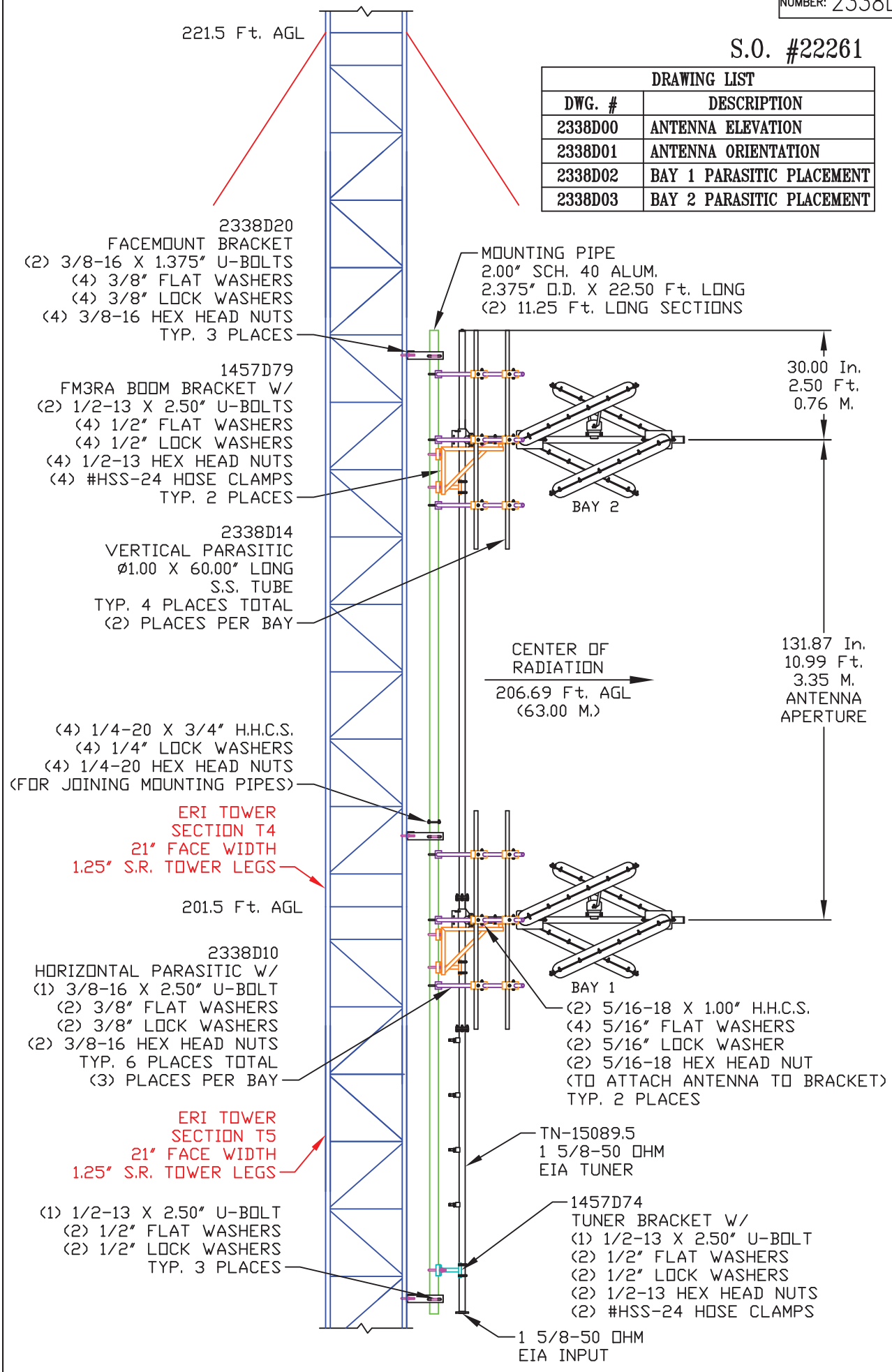
Umesh Manedi
Director of Engineering

APPENDIX

DRAWING NUMBER: 2338D00

S.O. #22261

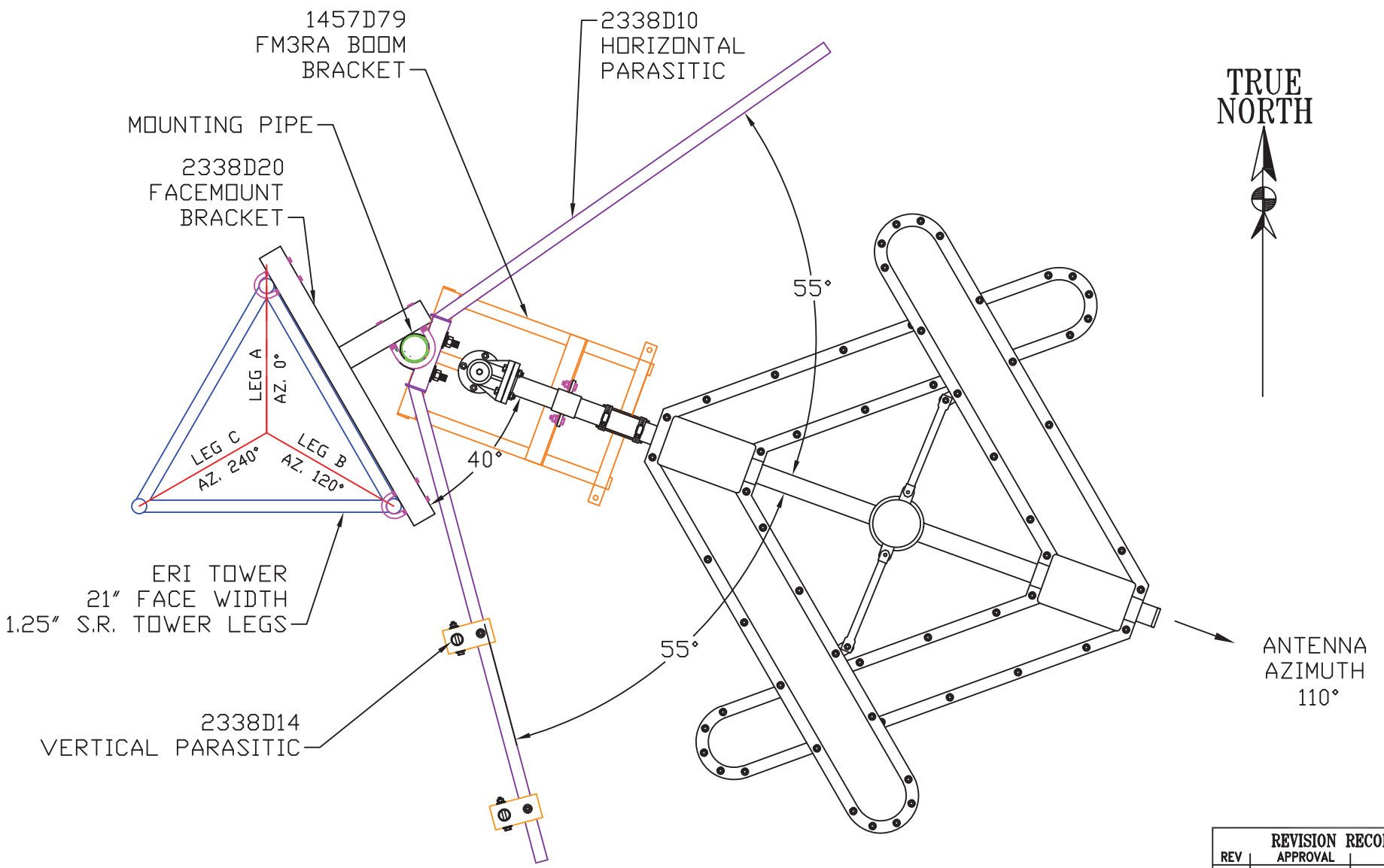
DRAWING LIST	
DWG. #	DESCRIPTION
2338D00	ANTENNA ELEVATION
2338D01	ANTENNA ORIENTATION
2338D02	BAY 1 PARASITIC PLACEMENT
2338D03	BAY 2 PARASITIC PLACEMENT



SYSTEMS WITH RELIABILITY, LP 619 INDUSTRIAL PARK ROAD EBENSBURG, PENNSYLVANIA 15931	TITLE: FM3RA/2-EP-DA, FREQ. 89.5 WPMU, DUBOIS, PA MATERIAL:	SIZE C	REV	APPR.	DATE	ENGINEER:	DRAWING NUMBER: 2338D00	
			1			SCALE: NTS	NAME: BJH	DATE: 11/23/22 SHEET 1 OF 1
			2					
			3					

NOTE:

DRAWING NUMBER: 2338D01



TOP VIEW

REVISION RECORD		
REV	APPROVAL	DATE

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

TITLE: FM3RA/2-EP-DA, FREQ. 89.5
WPMU, DUBOIS, PA
ANTENNA ORIENTATION
FROM TRUE NORTH

MATERIAL:

SIZE A

PARTS MADE BY THIS DRAWING

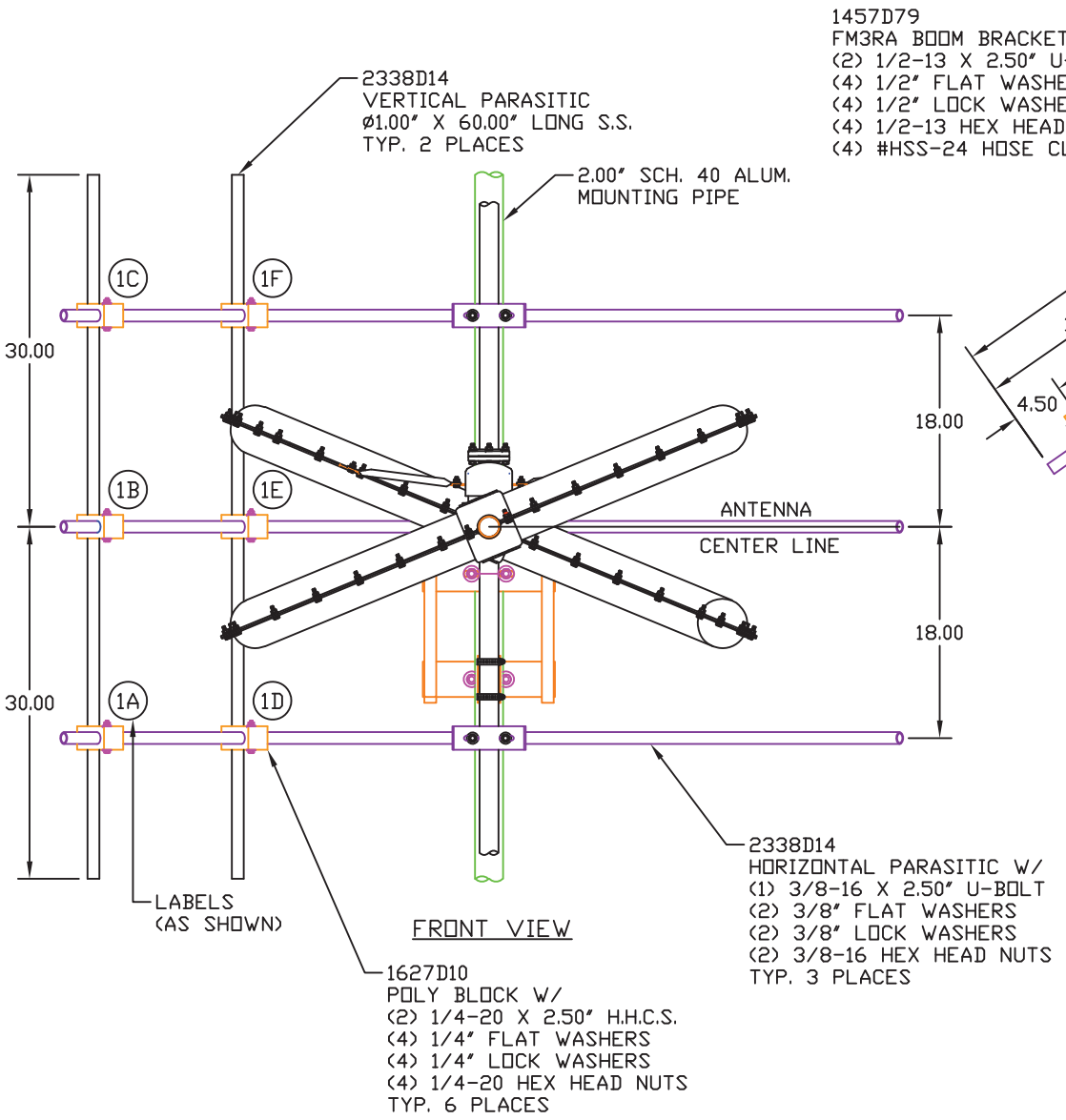
DRAWING NUMBER: 2338D01

SCALE: NTS | NAME: BJH | DATE: 11/23/22 | SHEET 1 OF 1

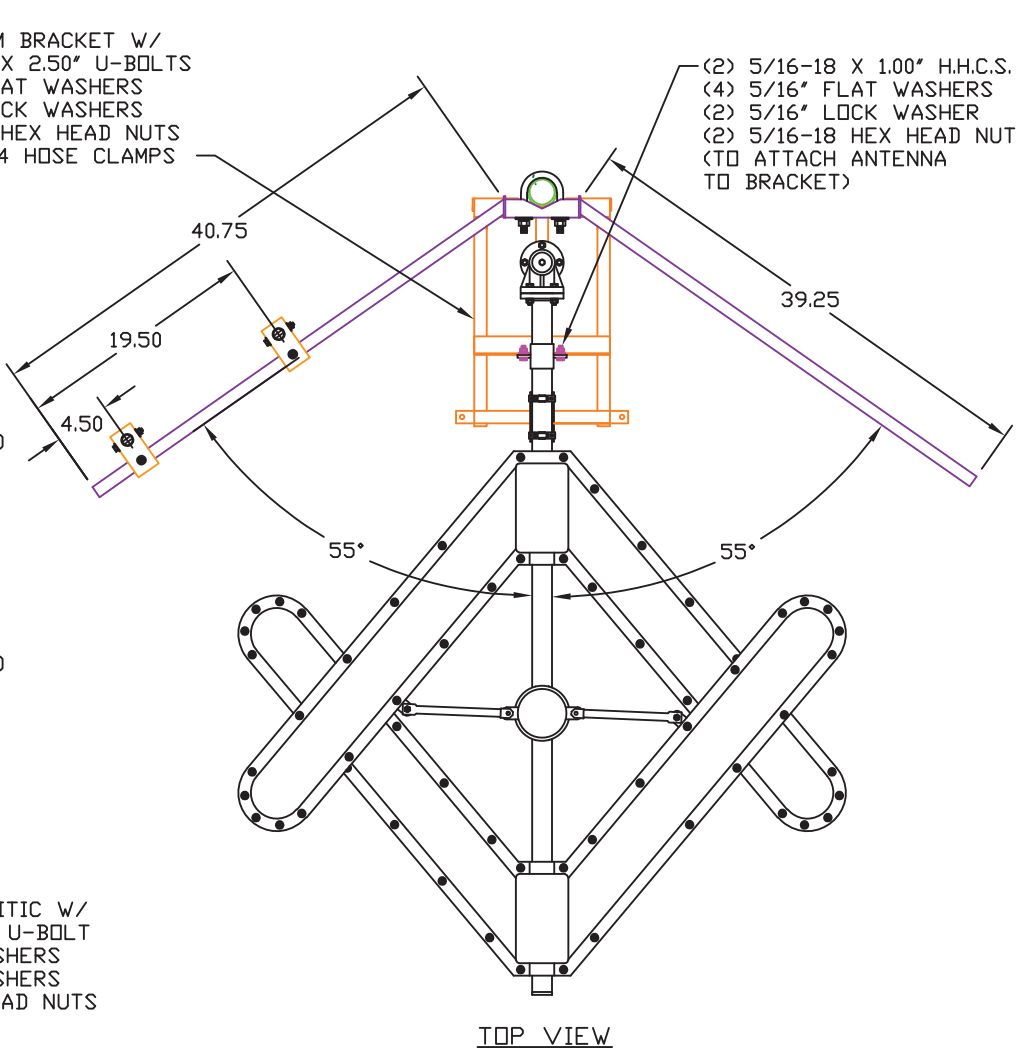
NOTE:

THE POLY BLOCKS, VERTICAL & HORIZONTAL PARASITICS ARE FACTORY DRILLED AND LABELED MATCH EACH CORRESPONDING LABELED PART DURING INSTALLATION.

DRAWING NUMBER: 2338D02



FRONT VIEW



TOP VIEW

REVISION RECORD

REV	APPROVAL	DATE

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

TITLE: FM3RA/2-EP-DA, FREQ. 89.5
WPMU, DUBOIS, PA

MATERIAL: BAY 1
PARASITIC PLACEMENT

SIZE: A

PARTS MADE BY THIS DRAWING

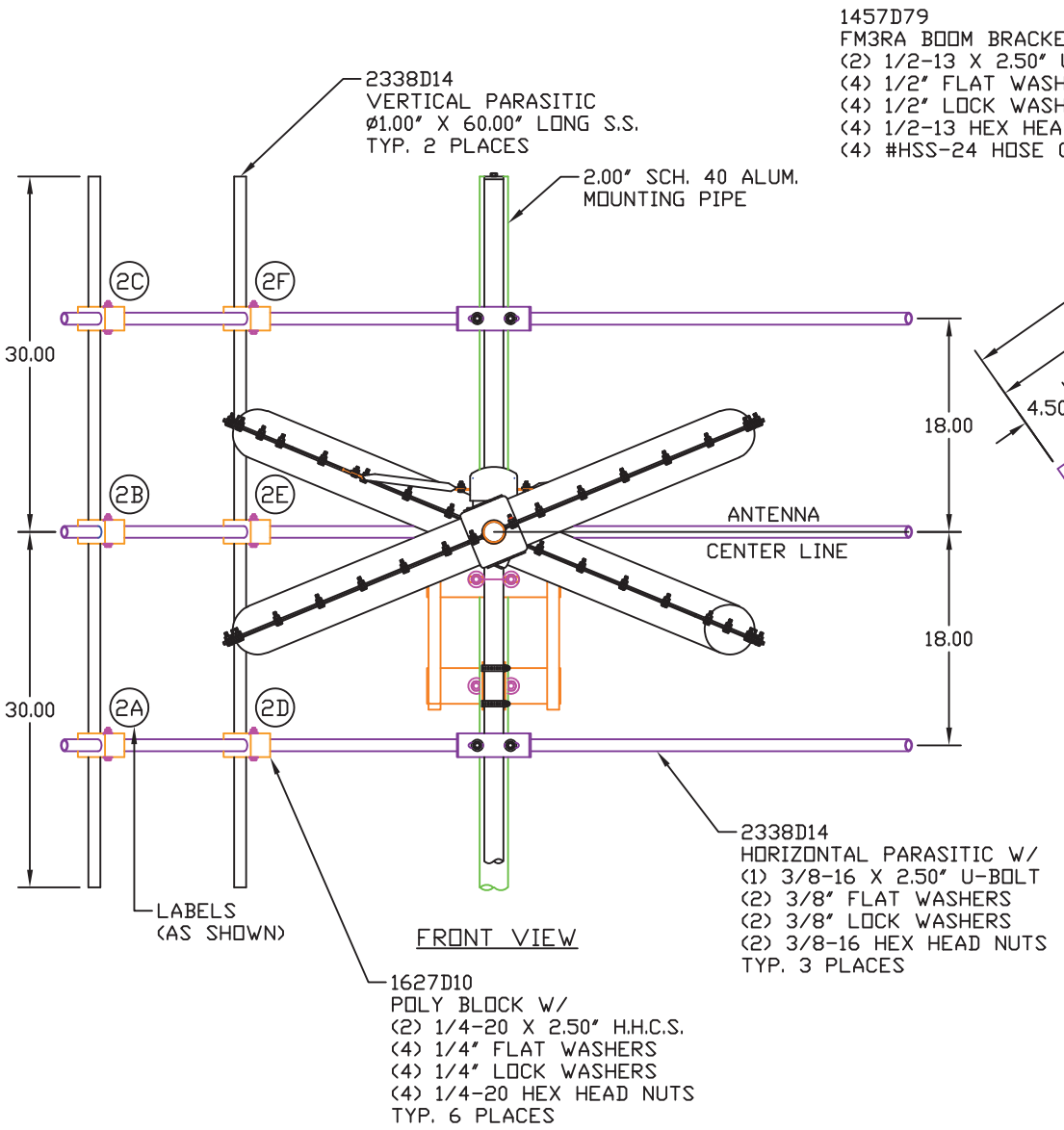
DRAWING NUMBER: 2338D02

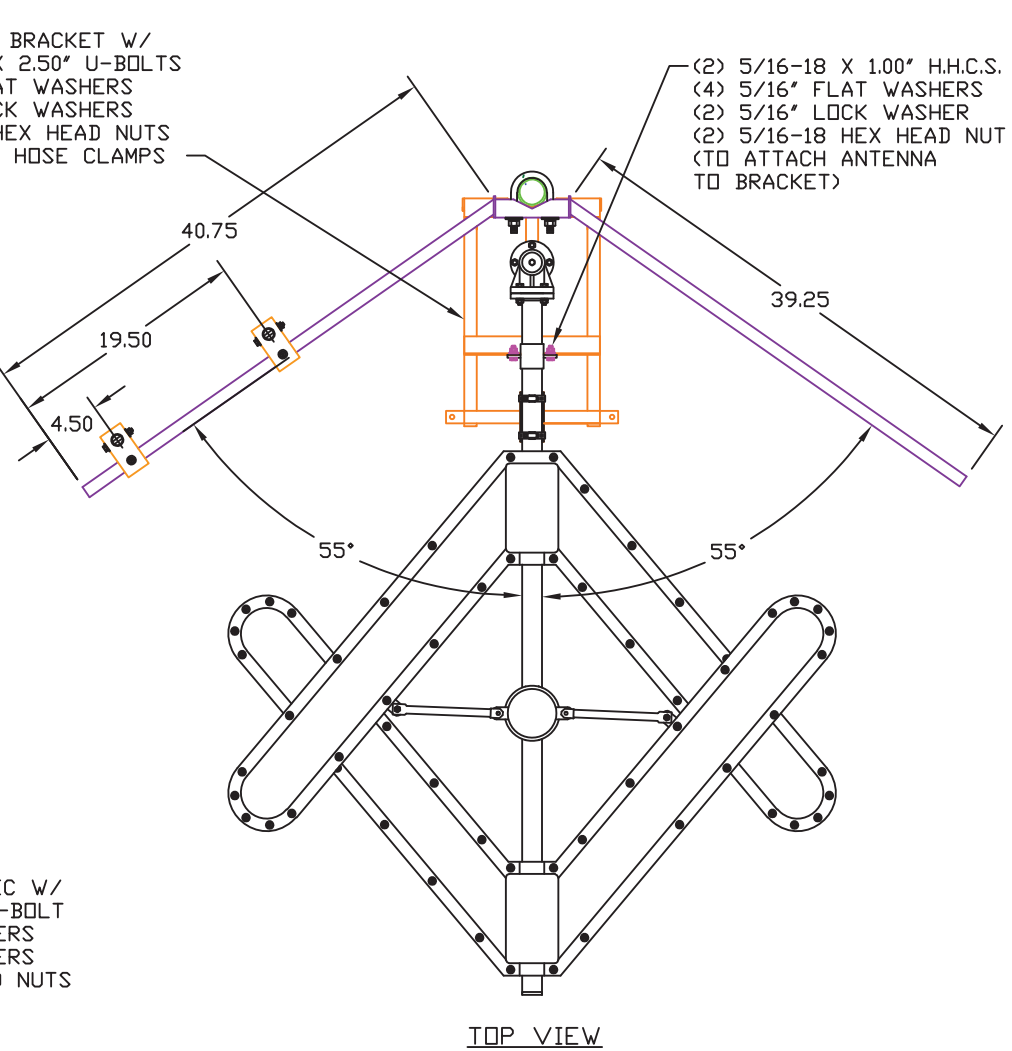
SCALE: NTS | NAME: BJH | DATE: 11/23/22 | SHEET 1 OF 1

NOTE:

THE POLY BLOCKS, VERTICAL & HORIZONTAL PARASITICS ARE FACTORY DRILLED AND LABELED MATCH EACH CORRESPONDING LABELED PART DURING INSTALLATION.

DRAWING NUMBER: 2338D03





REVISION RECORD

REV	APPROVAL	DATE

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

TITLE: FM3RA/2-EP-DA, FREQ. 89.5
WPMU, DUBOIS, PA

MATERIAL: BAY 2
PARASITIC PLACEMENT

SIZE: A

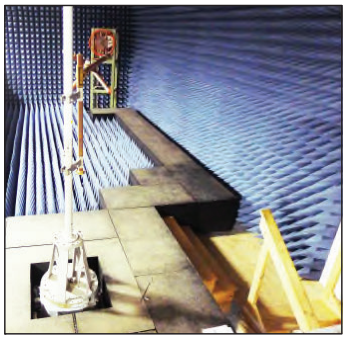
PARTS MADE BY THIS DRAWING

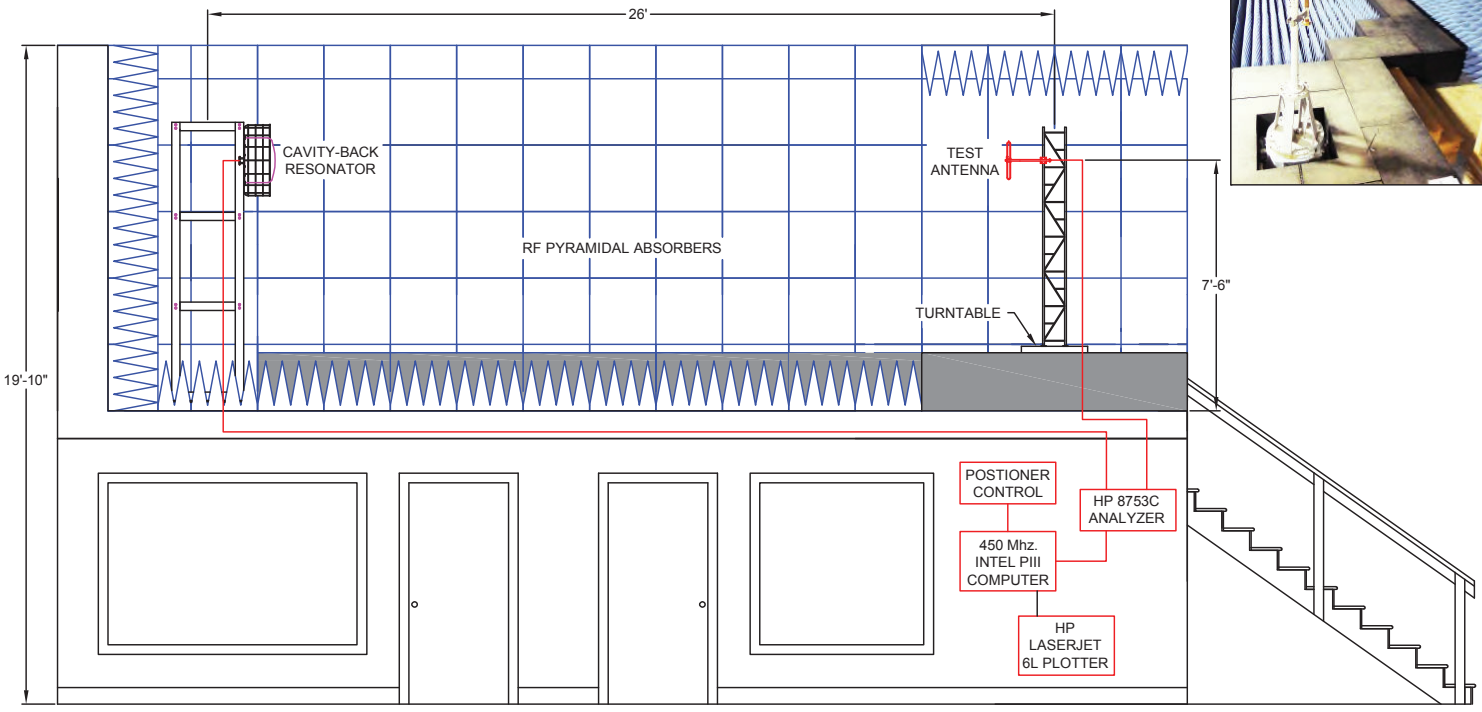
DRAWING NUMBER: 2338D03

SCALE: NTS | NAME: BJH | DATE: 11/23/22 | SHEET 1 OF 1

NOTE:

DRAWING NUMBER: 2105A15





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

UNLESS OTHERWISE SPECIFIED

REVISION RECORD

REV	APPROVAL	DATE

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

TITLE: TEST RANGE SCHEMATIC

MATERIAL:

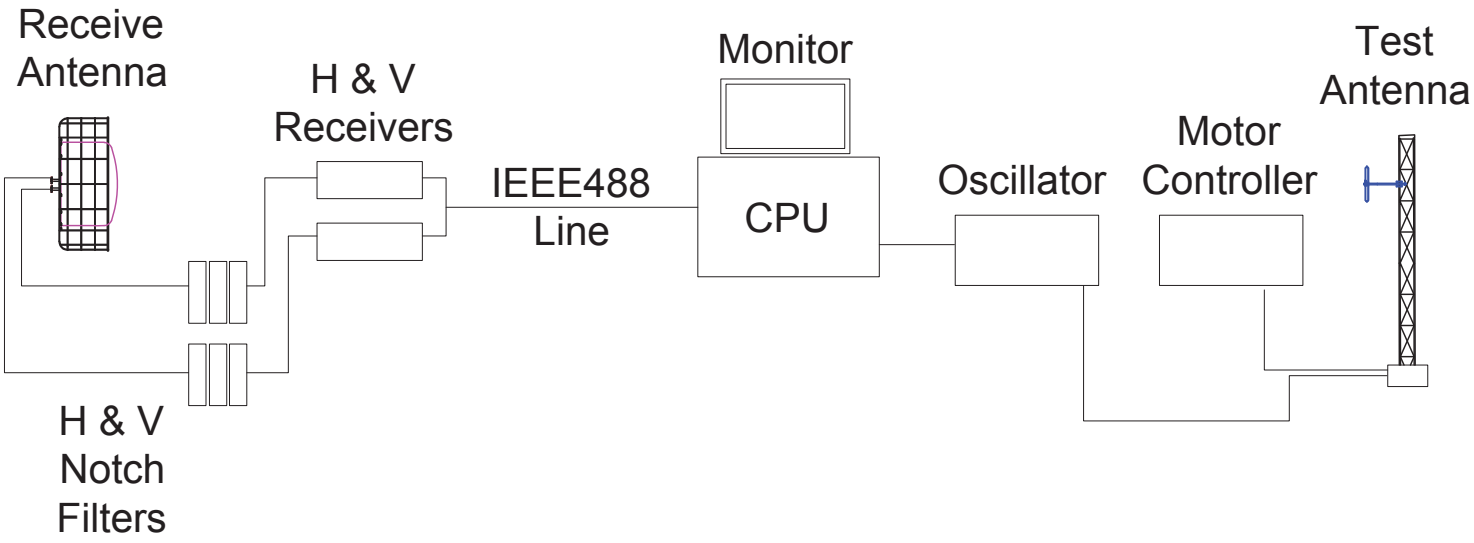
SIZE A

PARTS MADE BY THIS DRAWING

DRAWING NUMBER: 2105A15

SCALE: NTS | NAME: BJH | DATE: 10/21/20 | SHEET 1 OF 1

SYSTEM BLOCK DIAGRAM



1/3 SCALE TEST RANGE

Anechoic Chamber