Models 3106B, 3112, 3115, 3116B, 3117, 3119

Double-Ridged Waveguide Horn

User Manual

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An ESCO Technologies Company

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Revision Record | Double-Ridged Waveguide Horn, MANUAL | Part #399318 Rev. A

Revision	Description	Date
A	Initial Release	October, 2010

Table of Contents

Notes, Cautions, and Warnings

	**Note:** Denotes helpful information intended to provide tips for better use of the product.
	**Caution: Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Included text gives proper procedures.**
	**Warning: Denotes a hazard. Failure to follow instructions could result in SEVERE personal injury and/or property damage. Included text gives proper procedures.**

See the ETS-Lindgren *Product Information Bulletin* for safety, regulatory, and other product marking information.

1.0 Introduction

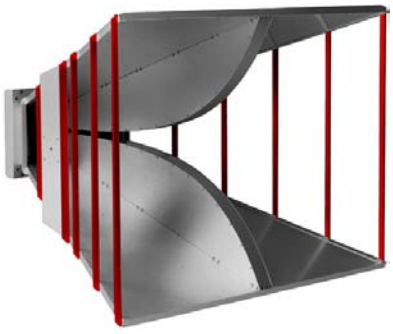
The ETS-Lindgren family of double-ridged waveguide horn antennas consists of linearly polarized broadband antennas ranging in frequency from 100 MHz to 40GHz. These antennas were designed and built specifically for EMI measurements and specifications compliance testing. However, they can also be used for antenna gain, pattern measurement, surveillance, automotive and military EMC immunity applications.

The Model 3112 Double-Ridged Waveguide Horn Antenna is a linearly-polarized antenna covering the frequency range of 100 MHz to 1 GHZ.

The Model 3112 is especially effective for generating high electromagnetic fields with relatively low power input. The antenna is also useful for receiving low-level signals where high gain characteristics are needed.

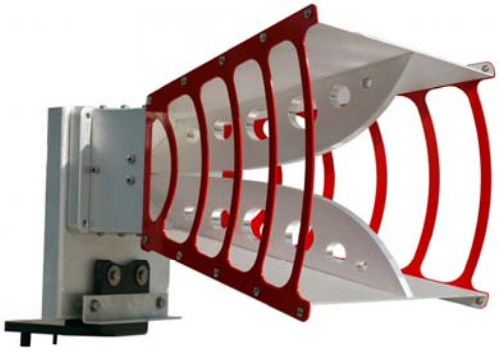
The Model 3106B Double-Ridged Waveguide Horn is a linearly polarized broadband antenna covering a frequency range of 200 MHz to 2.5 GHz. It is precision machined from aluminum, making it lightweight and durable. Two brackets are attached to the sides of the antenna so it can be polarized either horizontally or vertically.

The Model 3106B has high gain and excellent VSWR characteristics over the entire frequency range. It is especially effective for generating high electromagnetic fields with relatively lower power input. The antenna is also useful for receiving low level signals where high gain characteristics are needed.



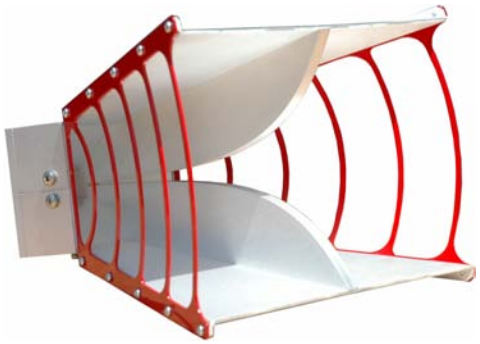
The Model 3119 Double Ridged Waveguide Horn Antenna is a linearly polarized broadband antenna covering the frequency range of 400 MHz to 6 GHz.

The Model 3119 is ideally suited for immunity over 1 GHz, and as a reference antenna for wireless testing. In addition, the 3119 is useful for antenna pattern measurement as a source antenna.



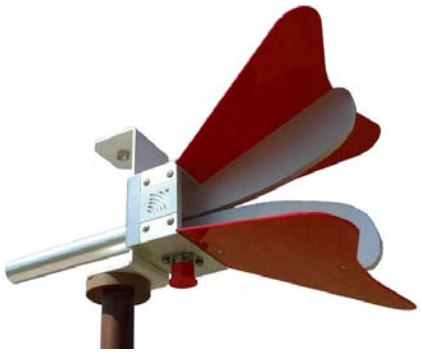
The Model 3115 Double Ridged Waveguide Horn Antenna is a linearly polarized broadband antenna covering the frequency range of 750 MHz to 18GHz.

The Model 3115 is ideally suited for IEC 61000-4-3 and MIL-STD 461E immunity tests as well as ANSI C634 and EN 55033 emissions testing. In addition, the 3115 is useful for antenna pattern measurement as a source antenna.



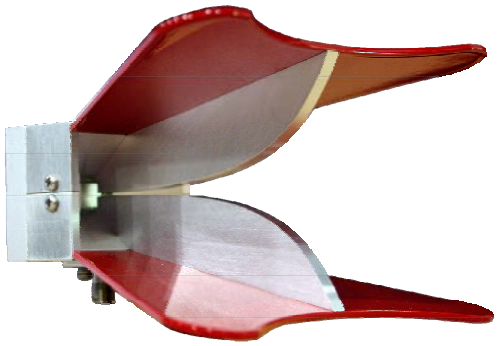
The Model 3117 Double Ridged Waveguide Horn Antenna is a linearly polarized broadband antenna covering the 1 GHz to 18 GHz frequency range.

A single well defined main lobe radiation pattern over the entire frequency range provides excellent illumination of the Equipment Under Test (EUT). The Model 3117 antenna is ideally suited for IEC61000 4 3 and MIL STD 461/462 immunity tests as well as ANSI C634 and EN 55033 emissions tests.



The ETS Lindgren Model 3116B Double Ridged Waveguide Horn is a linearly polarized broadband antenna covering the frequency range 18 GHz to 40 GHz. The Model 3116B was designed and built specifically for emissions and susceptibility testing.

The Model 3116B is precision machined from aluminum. A 50 Ω Type K (2.92mm) female connector is mounted on the base block of the antenna for increased performance at high frequencies



Models 3112 and 3117 shown with optional mounting systems.

Positioner Options

For instructions regarding mounting for each positioning system, see the user manual for each positioner or the Mounting Instruction section of this manual.

MODEL 3112 POSITIONING SYSTEM

The Model 3112 features an option for a fixed height pneumatic assisted polarization positioning system. The positioning system is ideal when using the Model 3112 for immunity testing.

Power Supply	160 mA 120 VAC Optional 220 VAC available
Pneumatic Interface	50-80 PSI
Weight	181.43 - 226.76 kg 400 -500lb
Maximum Height	355.6 cm 140 in
Maximum Weight	194.13 cm 76.43 in.

MODEL 4-TR TRIPOD

Constructed of linen phenolic and delrin, the Model 4-TR Tripod is designed with an adjustable center post for precise height adjustments.

Maximum Height	2.0m 80.0 in.
Minimum Height	94 cm 37.0
Maximum Load	11.8 kg 26.0 lb

Model 7-TR Tripod

The Model 3112 antenna is not suitable for use with the 7TR positioner

Constructed of PVC and fiberglass components, providing increased stability for physically large antennas. The unique design allows for quick assembly, disassembly, and convenient storage. The 7-TR allows several different configurations, including options for manual or pneumatic polarization. Quick height adjustment and locking wheels provide ease of use during testing.

Maximum Height	2.17m 85.8 in.
Minimum Height	0.8m 31.8 in.
Maximum Load	13.5 kg 30 lb
Straight Boom (Standard)	For general antenna mounting on a 7-TR
Offset Boom (Optional)	For general antenna mounting on a 7-TR with pneumatic or manual polarization
Centerline Rotation Boom (Optional)	When changing polarization, maintains centerline rotation, for rear-mount stinger-type antennas only
Model 3106B Boom (Optional)	For 3106B antenna only

ETS-Lindgren Product Information Bulletin

See the ETS-Lindgren *Product Information Bulletin* included with your shipment for the following:

- Warranty information
- Safety, regulatory, and other product marking information
- Steps to receive your shipment
- Steps to return a component for service
- ETS Lindgren calibration service
- ETS Lindgren contact information

2.0 Maintenance

CAUTION

Before performing any maintenance, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.

Maintenance of the double-ridged waveguide antennas is limited to external components such as cables or connectors.

If you have any questions concerning maintenance, contact ETS Lindgren Customer Service.

Annual Calibration

See the *Product Information Bulletin* included with your shipment for information on ETS-Lindgren calibration services.

Replacement and Optional Parts

ETS-Lindgren may substitute a similar part or new part number with the same functionality for another part/part number. Contact ETS-Lindgren for questions about part numbers and ordering parts.

Following are the part numbers for ordering replacement or optional parts for the double-ridged waveguide antennas.

Part Description	Part Number
User Manual	399318
Model 3112 Pneumatic Assisted Pedestal	109621
4-TR Tripod	4-TR
4-TR Mounting Bracket	101501
7-TR Tripod	7-TR
7-TR Straight Boom	109042
7-TR Offset Boom	108983
7-TR Centerline Rotation Boom	108197
7-TR Tripod, 3106B Mount, Pneumatic	7-TR/POL-3106
7-TR Boom, Model 3106B Only	108507

Service Procedures

For the steps to return a system or system component to ETS-Lindgren for service, see the *Product Information Bulletin* included with your shipment.

3.0 Specifications

Electrical Specifications

MODEL 3112

Frequency Range	100 MHz – 1 GHz
VSWR Ratio (Average)	< 1.6:1
Maximum Continuous Power	800 W
Peak Power	1.5 kW (Type N, female connector) 2.5 kW CW (EIA 1 ⅝ in. flange connector)
Impedance (nominal)	50 Ω
Connector	Type N, female EIA 1 ⅝ in. flange
Front-to-Back Ratio	20 dB
Cross Polarization	20 dB minimum

MODEL 3106B

Frequency Range	200 MHz – 2.5 GHz
VSWR Ratio (Average)	<1.6:1
Maximum Continuous Power	800 W
Peak Power	1600W
Impedance	50 Ω
Connector	Type N female
Front-to-Back Ratio	20 dB
Cross Polarization	20 dB minimum

MODEL 3119

Frequency Range	400 MHz – 6 GHz
VSWR Ratio (Average)	3.5:1
Maximum Continuous Power	800W
Peak Power	2500 W
Impedance	50 Ω
Connector	Type N, female
Front-to-Back Ratio	20 dB
Cross Polarization	20 dB minimum

MODEL 3115

Frequency Range	750 MHz – 18 GHz
VSWR Ratio (Maximum)	5:1
Maximum Continuous Power	500 Watts
Peak Power	500 Watts
Impedance	50 Ω
Connector	Type N, female
Front-to-Back Ratio	20 dB
Cross Polarization	20 dB minimum

MODEL 3117

Frequency Range	1 GHz – 18 GHz
VSWR Ratio (Average)	3.5:1 max <2:1 above 1.5 GHz
Maximum Continuous Power	300 Watts
Peak Power	400 Watts
Impedance	50 Ω
Connector	Type N
Front-to-Back Ratio	>6.42 db at 1 GHz >12.08 dB at 2 GHz >20 dB at 3 GHz – 18 GHz
Cross Polarization	20 dB at 3 GHZ – 18 GHz

MODEL 3116B

Frequency Range	18 GHz – 40 GHz
VSWR Ratio (Average)	<1.6:1
Maximum Continuous Power	25 Watts
Peak Power	70 Watts
Impedance	50 Ω
Connector	Type K (2.92mm) female
Front-to-Back Ratio	20 dB
Cross Polarization	20 dB minimum

Physical Specifications

MODEL 3112

Width	203.2 cm (80.0 in.)
Depth	182 cm (71.65 in.)
Height	139.7 cm (56.0 in.)
Approximate Weight	86.1 kg (189.81 lbs)

MODEL 3106B

Width	93.3 cm (36.7 in)
Depth	97.8 cm (38.50 in)
Height	72.90 cm (28.70 in.)
Approximate Weight	11.8 kg (26.01 lb)

MODEL 3119

Width	48.84 cm (19.23 in)
Depth	40.0 cm (15.74 in.)
Height	31.37 cm (12.35 in.)
Approximate Weight	7.4 kg (16.30 lb)

MODEL 3115

Width	24.4 cm (9.6 in)
Depth	27.9 cm (11.0 in)
Height	15.9 cm (6.2 in)
Approximate Weight	1.8 kg (4.0 lb)

MODEL 3117

Width	17.5 cm (6.9 in)
Depth	17.5 cm + 15.5 cm mount (6.9 in + 6.1 in mount)
Height	15.5 cm (6.1 in)
Approximate Weight	1.13 kg (2.5 lb)

MODEL 3116B

Width	10.6 cm (4.2 in.)
Depth	9.6 cm + 5.0 cm mount (3.8 in. + 2.0 in. mount)
Height	6.6 cm (2.60 in.)
Approximate Weight	0.15 kg (0.34 lb)

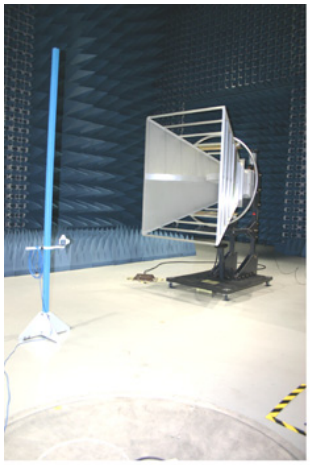
4.0 Mounting Instructions

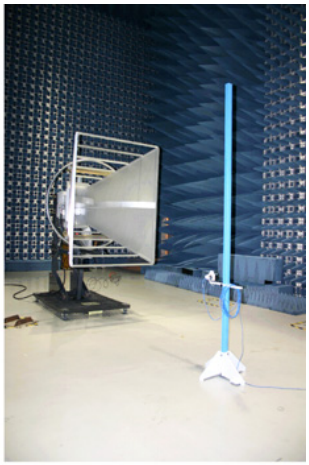
WARNING **Before connecting any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.**

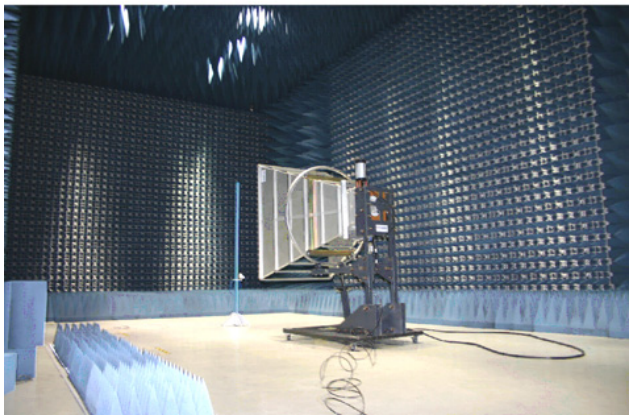
WARNING **The ETS-Lindgren Double-Ridged Waveguide Horn antennas are precision instruments, handle with care**

Model 3112 Optional Positioning System

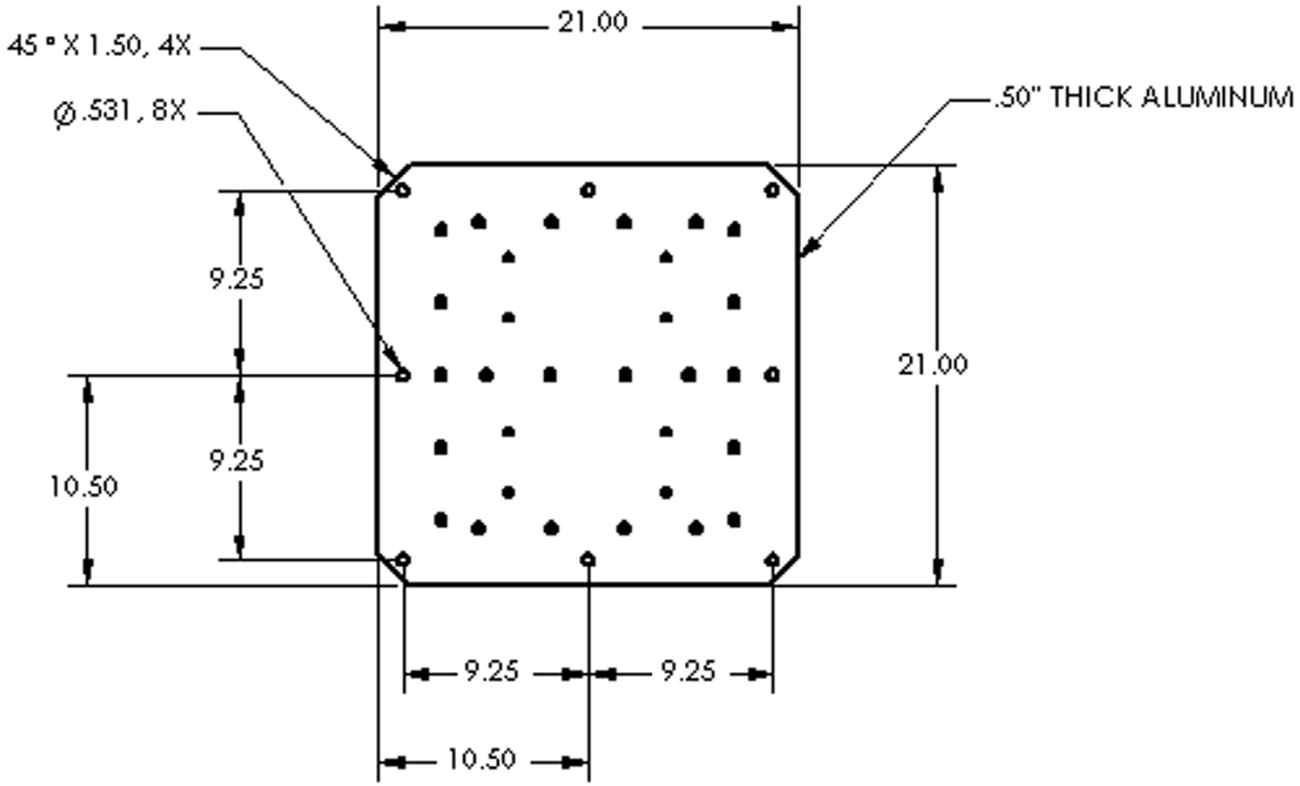
The customer is responsible for providing an adequate and safe support system for the Model 3112.





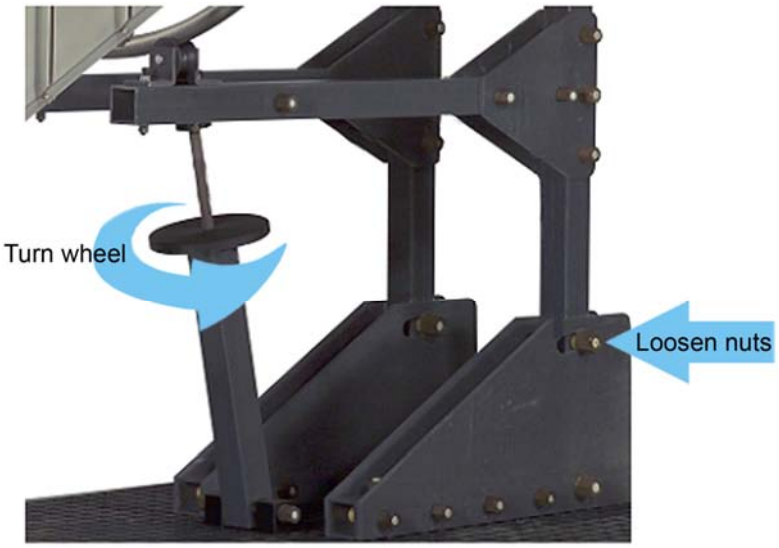


The Model 3112 includes a series of outer holes in the rear plate that is compatible with the optional positioning system. Additionally, the mounting holes can be used to meet customer-specific mounting requirements



Model 3112 Mounting Pattern
Rear plate with outer hole pattern for end mounting

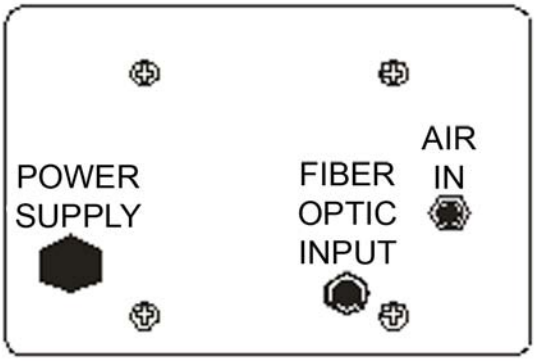
CONNECTING THE OPTIONAL POSITIONING SYSTEM



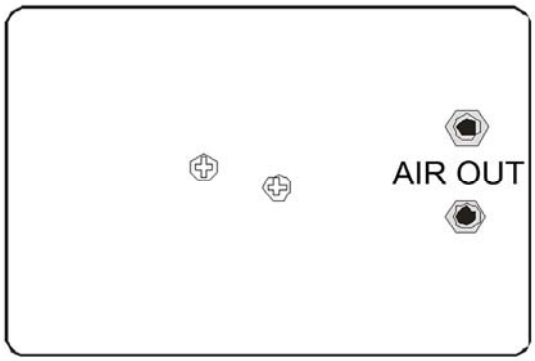
Model 3112 with optional positioner

For better field uniformity, loosen the nuts and turn the wheel at the base of the horn support. This bore sights the horn 10 degrees.

MODEL 3112 INPUT LOCATIONS



AIR POLARIZATION OPTION



1. Plug the ends of the twin air hoses into the two AIR OUT connectors located on the interface box at the base of the custom positioning system.

2. Plug the other ends of the twin hoses into the two 90 degree fittings on the air cylinder of the custom positioning system.

Attached to the air cylinder are flow control valves that allow variable speed on polarization cycling. Use a small screwdriver to adjust the airflow through the two 90-degree fittings. Because damage to the antenna may occur if the speed is set too high, adjust the flow control valves to prevent damage

3. Plug one end of the single air hose into the AIR IN connector located on the other side of the interface box at the base of the custom positioning system.

4. Plug the other end of the single air hose into the air supply.

5. Plug one end of the fiber optic cable into the FIBER OPTIC INPUT connector.

6. Plug the other end of the fiber optic cable into the remote controller; for example, the ETS Lindgren Model 2090 Multi Device Controller (or next generation ETS Lindgren controller, if applicable).

4-TR Mounting Instructions

Due to the size of Models 3112 and 3106B, do not mount these antennas onto a 4-TR tripod.

Continuously support the antenna when attaching or removing the mounting bracket or thumbscrews. Failure to provide support may result in damage to the antenna.

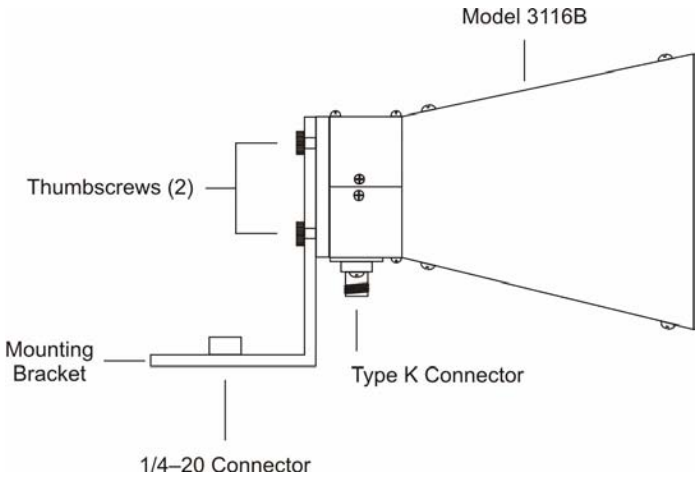
ETS-Lindgren Double Ridged Waveguide Horns ship with the following mounting hardware:

- Mounting bracket drilled to accept ETS-Lindgren or other tripod mount with 1/4–20 threads.
- Thumbscrews (2) for attaching the antenna to the mounting bracket.

VIEW OF MOUNTING BRACKET ATTACHED TO ANTENNA

For illustration purposes, the Model 3116B is shown vertically polarized. Typically for testing you will mount the antenna for horizontal polarization.

The illustration represents a typical assembly of the mounting bracket to an antenna. The Model 3116B is shown; however, the steps are similar for each ETS-Lindgren double ridged waveguide horn antenna.



ATTACHING THE MOUNTING BRACKET TO AN ANTENNA

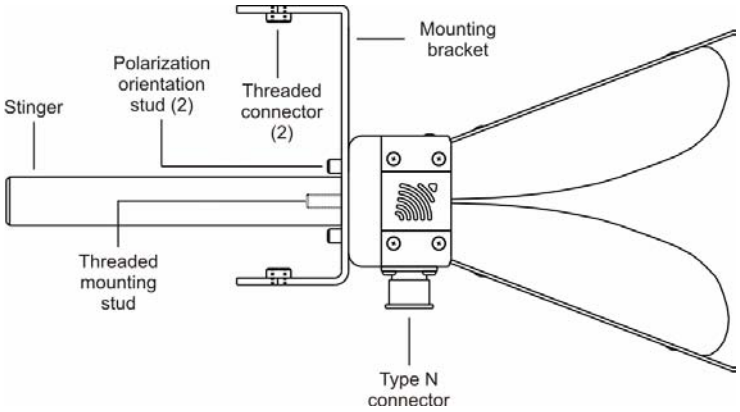
1. Hold the antenna with the connector pointing to the floor and align the holes on the back of the antenna with the holes on the bracket provided.

   Select set of holes for horizontal or vertical polarization as desired.

2. Insert both thumbscrews and tighten

VIEW OF STINGER MOUNT ATTACHED TO ANTENNA

A stinger mount may be included with the antenna for centerline rotation measurements. The illustration represents the Model 3115 antenna including the stinger mount.



MOUNTING TO A 4-TR TRIPOD

1. Attach the antenna to the mounting bracket by following the instructions in the previous section on page 21.
2. Attach the mounting bracket to the 4-TR tripod by aligning the 1/4–20 connector on the bracket with the 1/4–20 bolt on the tripod. Support the antenna securely while turning the mounting bracket to tighten the connection.
3. To change polarization, support the antenna securely and remove the thumbscrews.

   Turn the antenna to align the holes in the mounting bracket with the desired set of holes on the back of the antenna. Re-insert the thumbscrews and tighten

7-TR Mounting Instructions

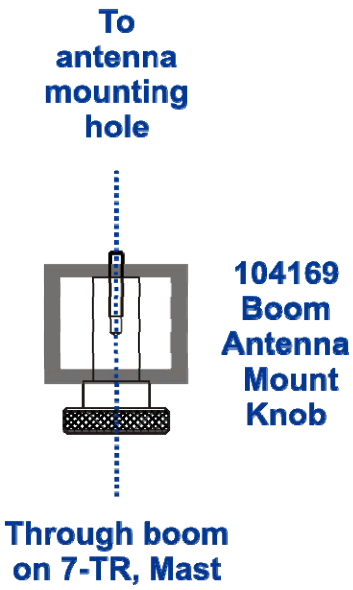
CAUTION

Due to the size of the Model 3112, do not mount the antenna onto a 7-TR tripod.

Please refer to the Model 7-TR manual for mounting instructions and options.

Mast refers to 2070 Series, 2075, and 2175 Antenna Towers.
7-TR refers to 109042, 106328, and 108197 booms:

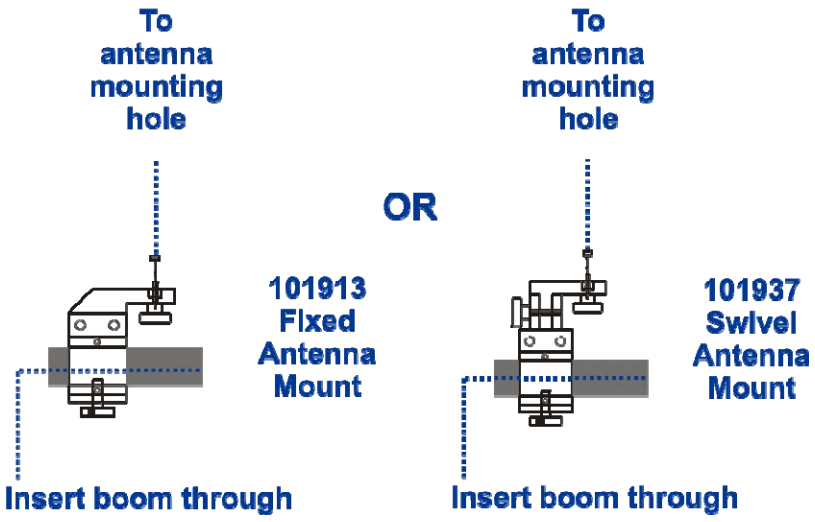
- 109042 boom—Straight boom; for general antenna mounting on a 7-TR
- 106328 boom—Offset boom; for general antenna mounting on a 7-TR with pneumatic or manual polarization
- 108197 boom—Center rotate boom; for rear mount stinger type antennas only.



2X2 BOOM MOUNTING OPTION

Following are additional options for mounting the Model 3147 onto a 2x2 boom. Contact the ETS Lindgren Sales Department for information on ordering optional mounting hardware.

2x2 boom refers to a typical 2 inch by 2 inch boom.



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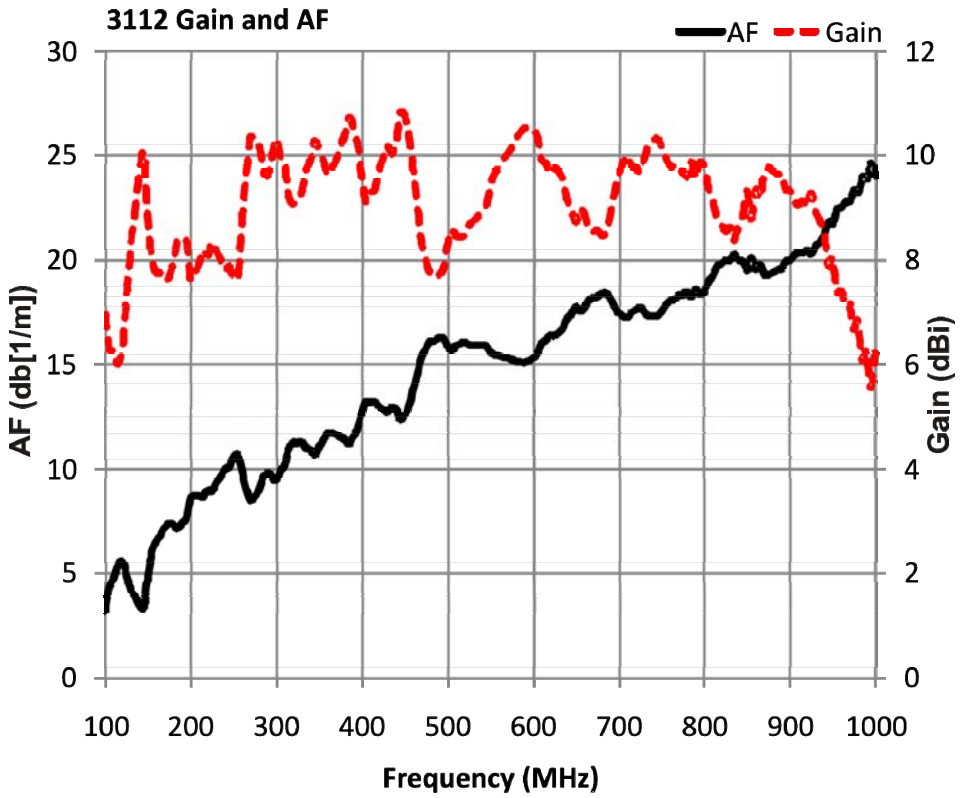
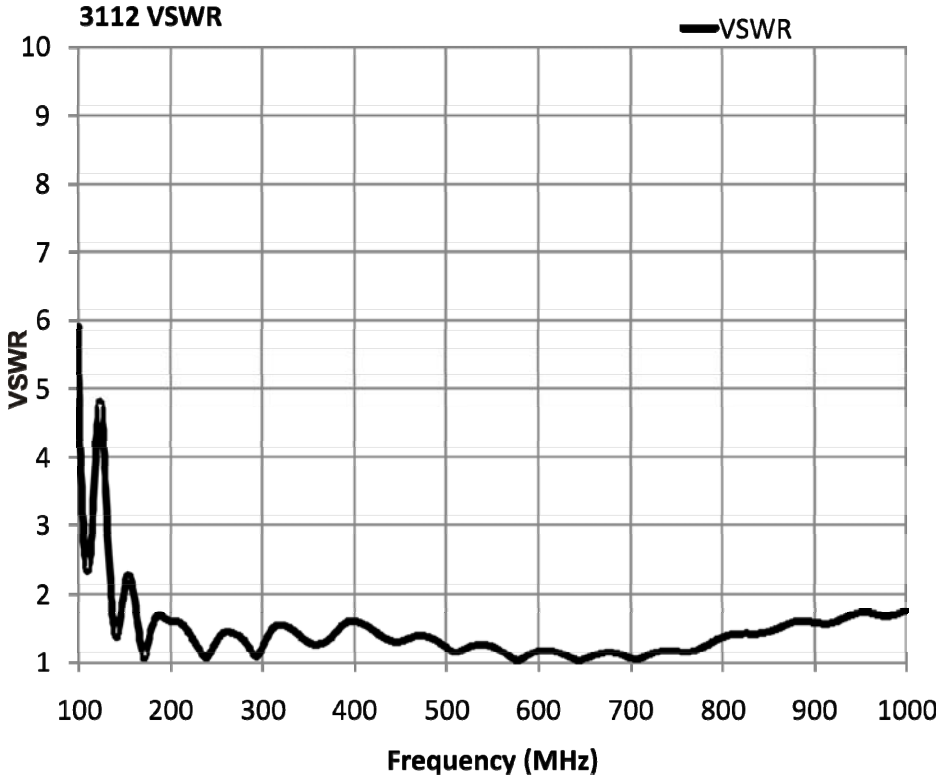
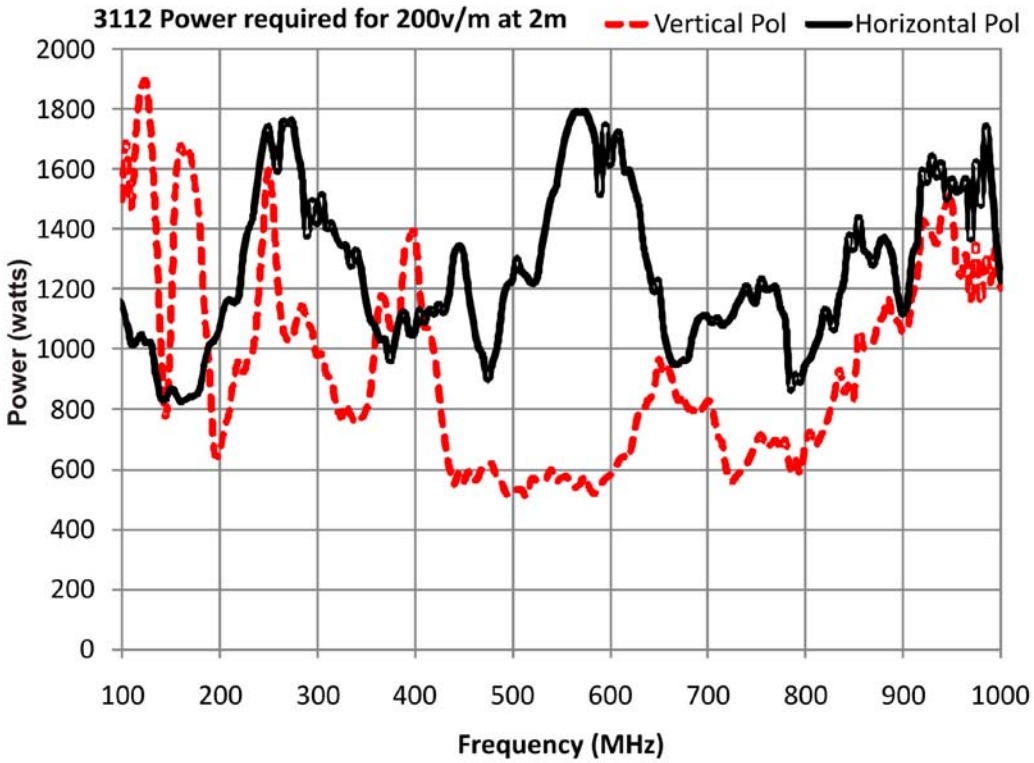
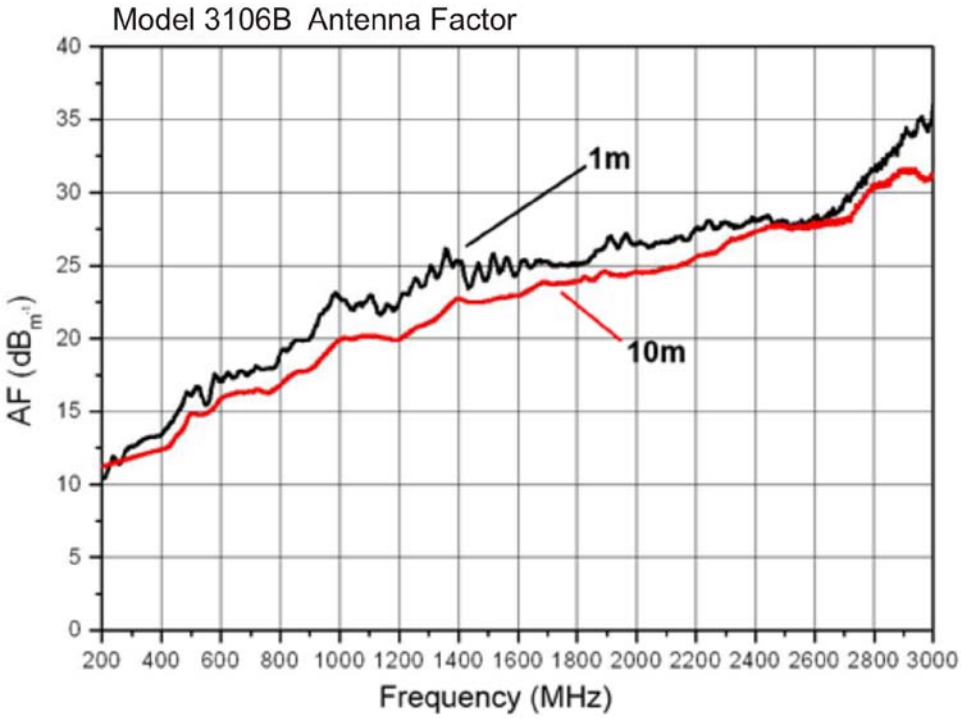
5.0 Typical Data

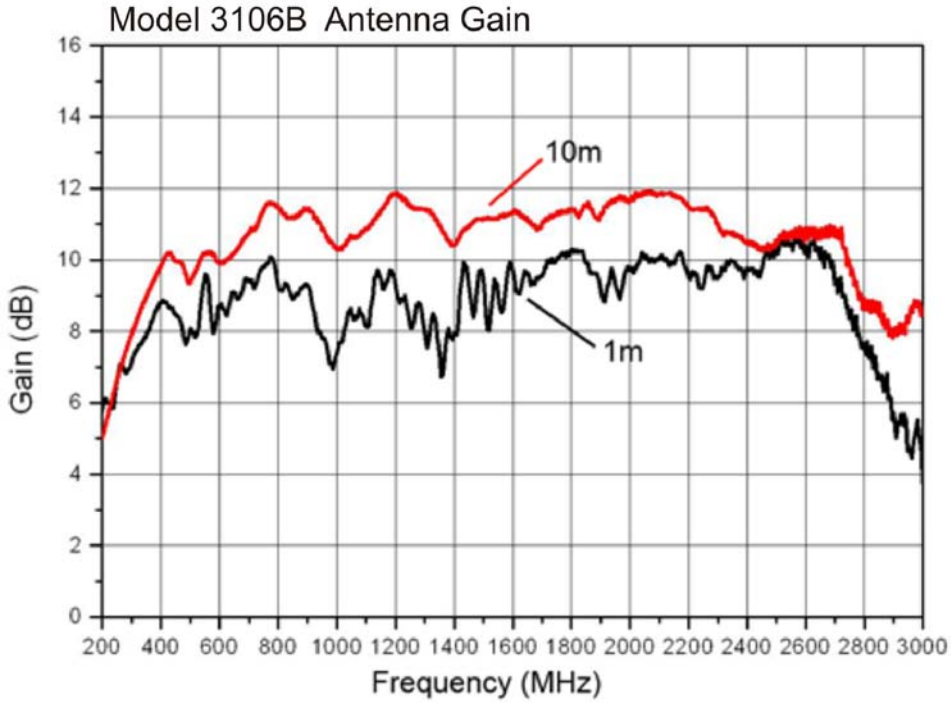
Model 3112

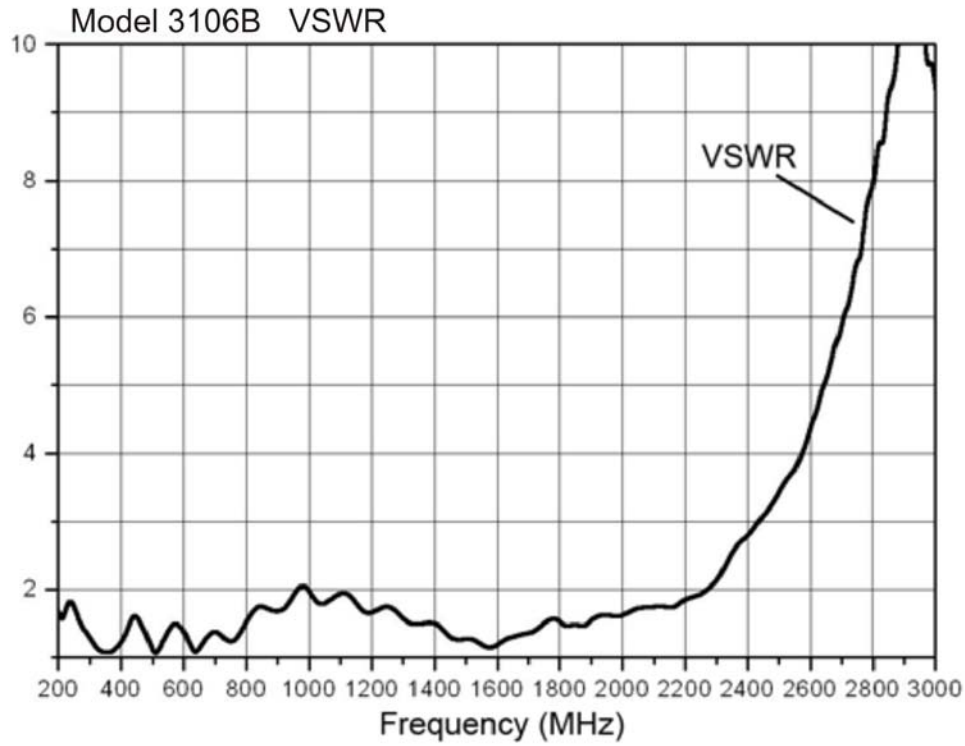


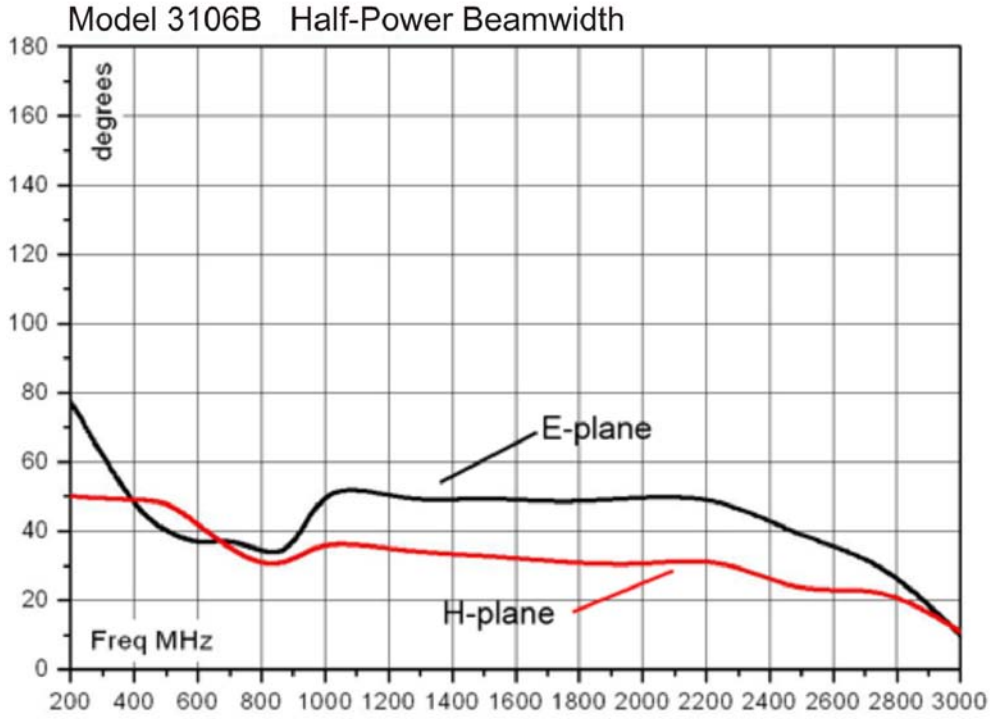


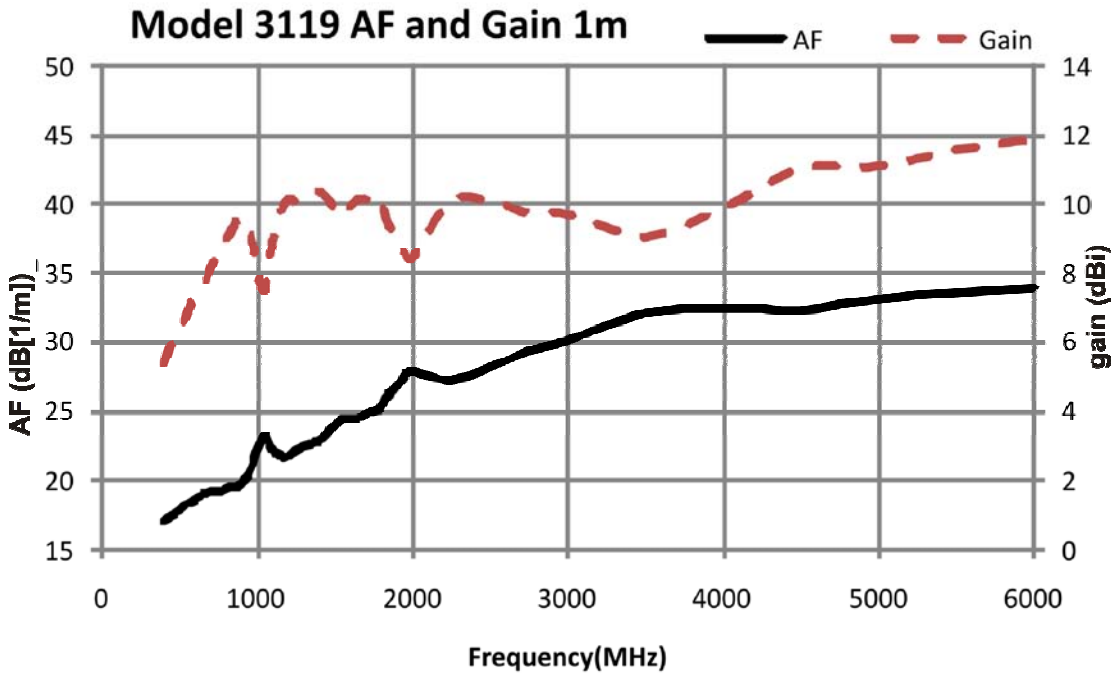

3112 Power required for 200v/m at 2m
Vertical Pol
Horizontal Pol
Power (watts)
2000
1800
1600
1400
1200
1000
800
600
400
200
0
100
200
300
400
500
600
700
800
900
1000
Frequency (MHz)

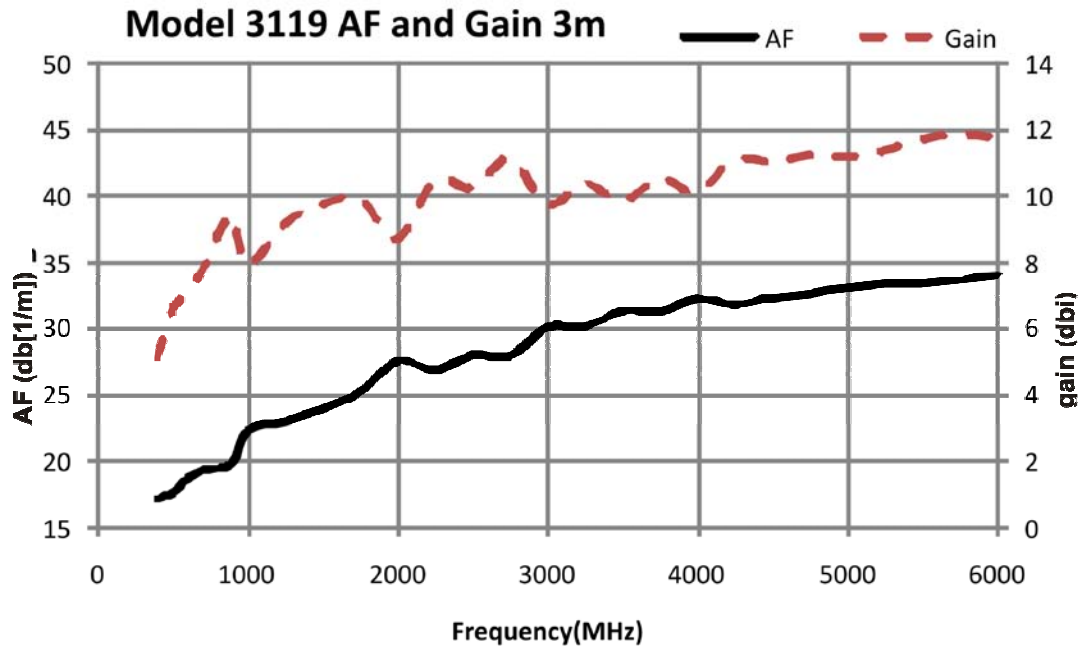

Model 3106B Antenna Factor
AF (dB$_{m^{-1}}$)
Frequency (MHz)
1m
10m
0
5
10
15
20
25
30
35
40
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000

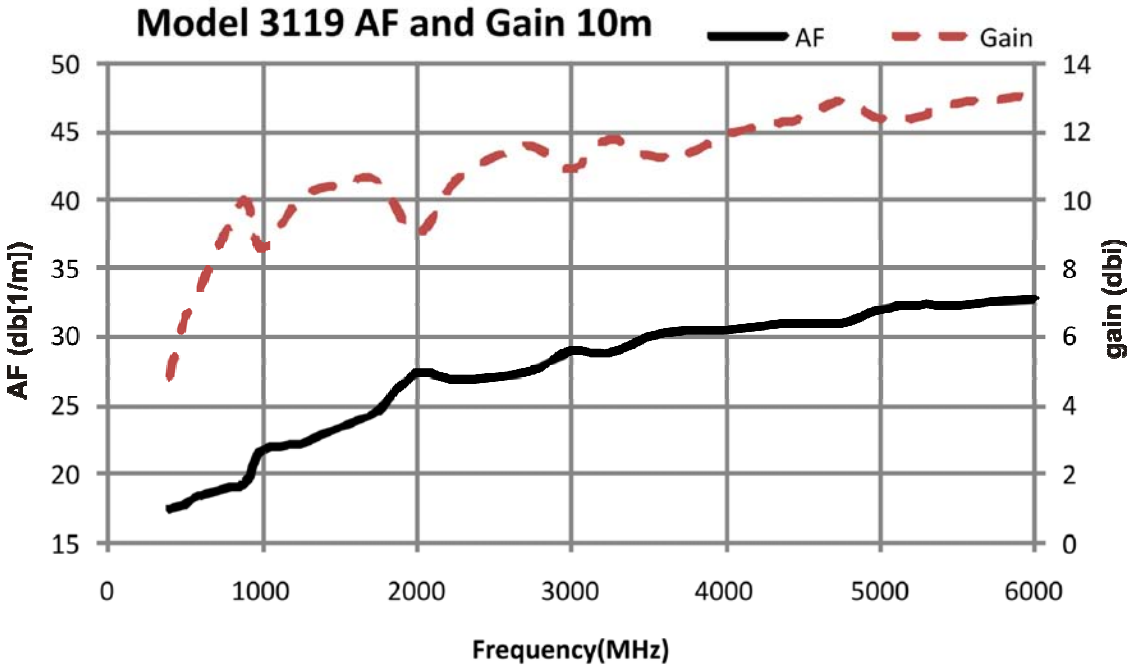

Model 3106B Antenna Gain
Gain (dB)
Frequency (MHz)
10m
1m
0
2
4
6
8
10
12
14
16
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000

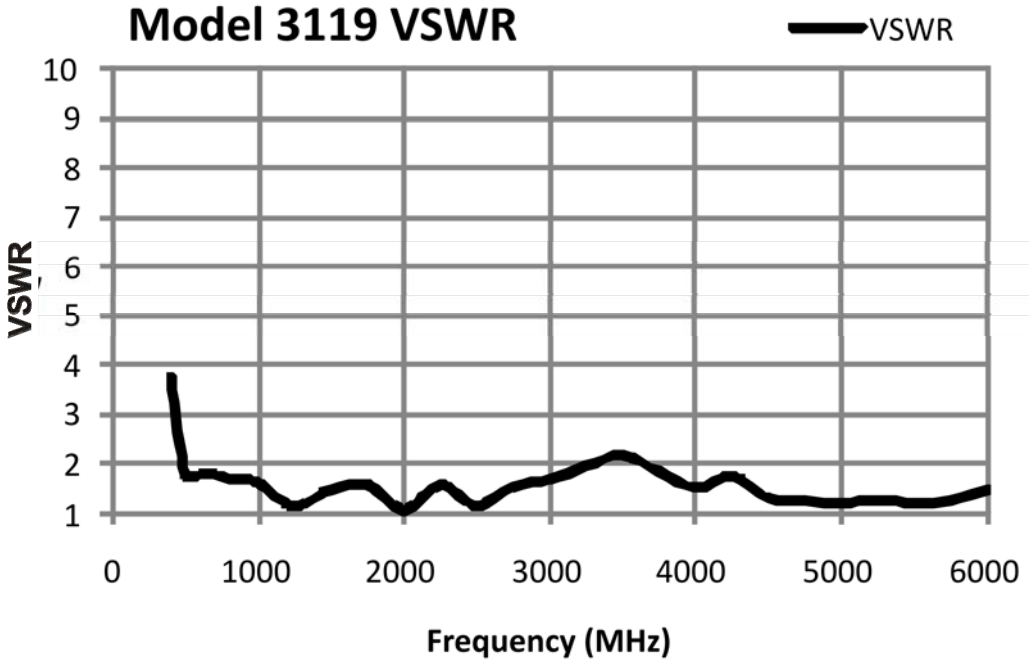

Model 3106B VSWR
10
8
6
4
2
VSWR
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000
Frequency (MHz)

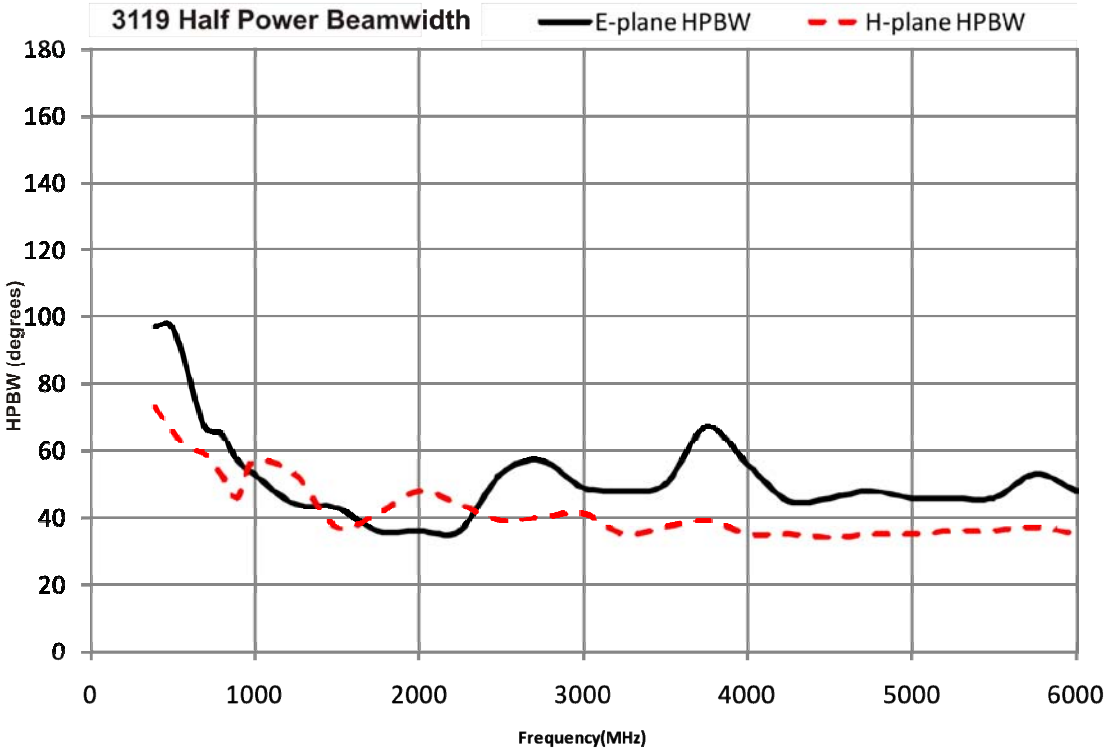

Model 3106B Half-Power Beamwidth
180
160
140
120
100
80
60
40
20
0
degrees
E-plane
H-plane
Freq MHz
200 400 600 800 1000 1200 1400 1600 1800 2000 2200 2400 2600 2800 3000

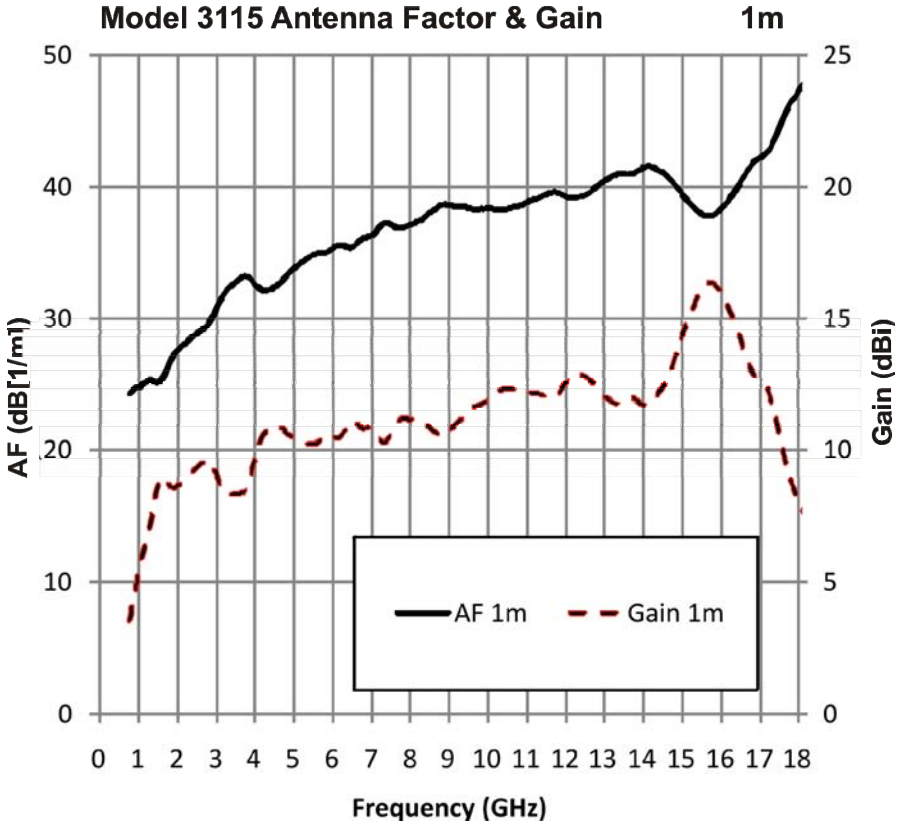

Model 3119 AF and Gain 1m
AF
Gain
AF (dB[1/m])
gain (dBi)
Frequency(MHz)
50
45
40
35
30
25
20
15
14
12
10
8
6
4
2
0
0
1000
2000
3000
4000
5000
6000

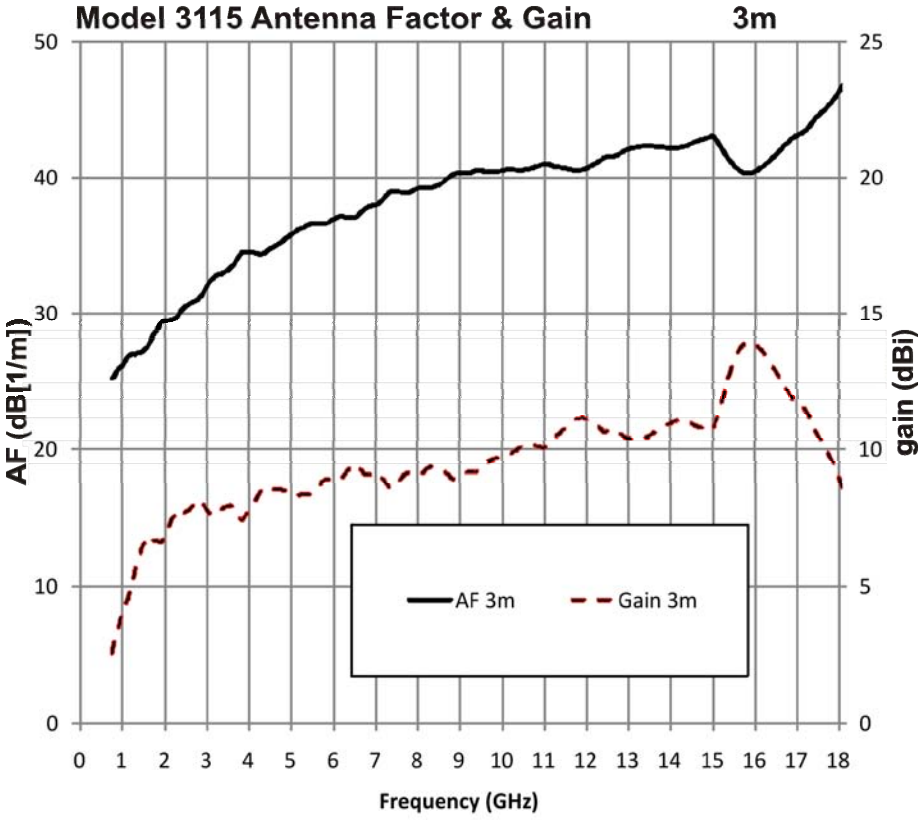

Model 3119 AF and Gain 3m
AF
Gain
AF (db[1/m])
gain (dbi)
Frequency(MHz)
50
45
40
35
30
25
20
15
14
12
10
8
6
4
2
0
0
1000
2000
3000
4000
5000
6000

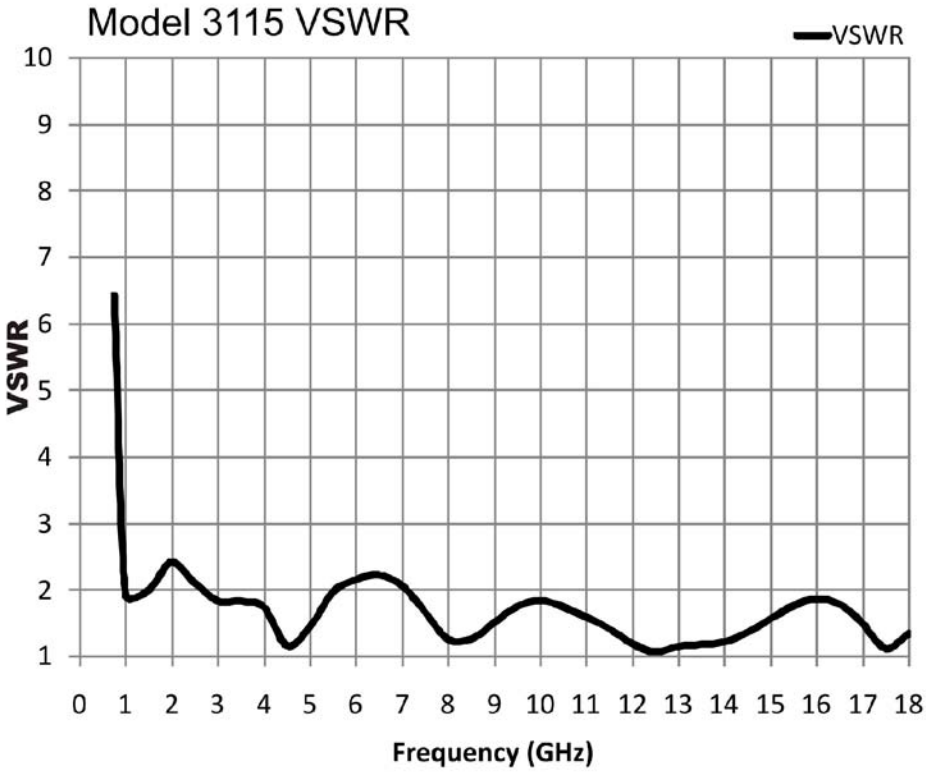

Model 3119 AF and Gain 10m
AF
Gain
AF (db[1/m])
gain (dbi)
50
45
40
35
30
25
20
15
14
12
10
8
6
4
2
0
0
1000
2000
3000
4000
5000
6000
Frequency(MHz)


Model 3119 VSWR
VSWR
VSWR
10
9
8
7
6
5
4
3
2
1
0
1000
2000
3000
4000
5000
6000
Frequency (MHz)

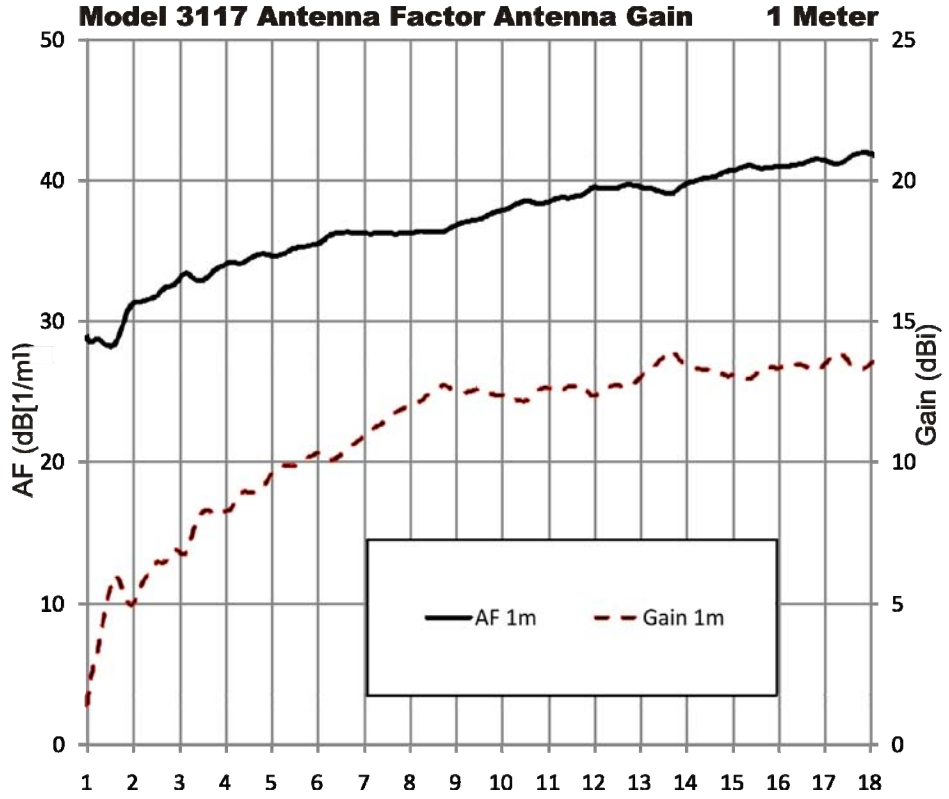

3119 Half Power Beamwidth
E-plane HPBW
H-plane HPBW
HPBW (degrees)
180
160
140
120
100
80
60
40
20
0
0
1000
2000
3000
4000
5000
6000
Frequency(MHz)

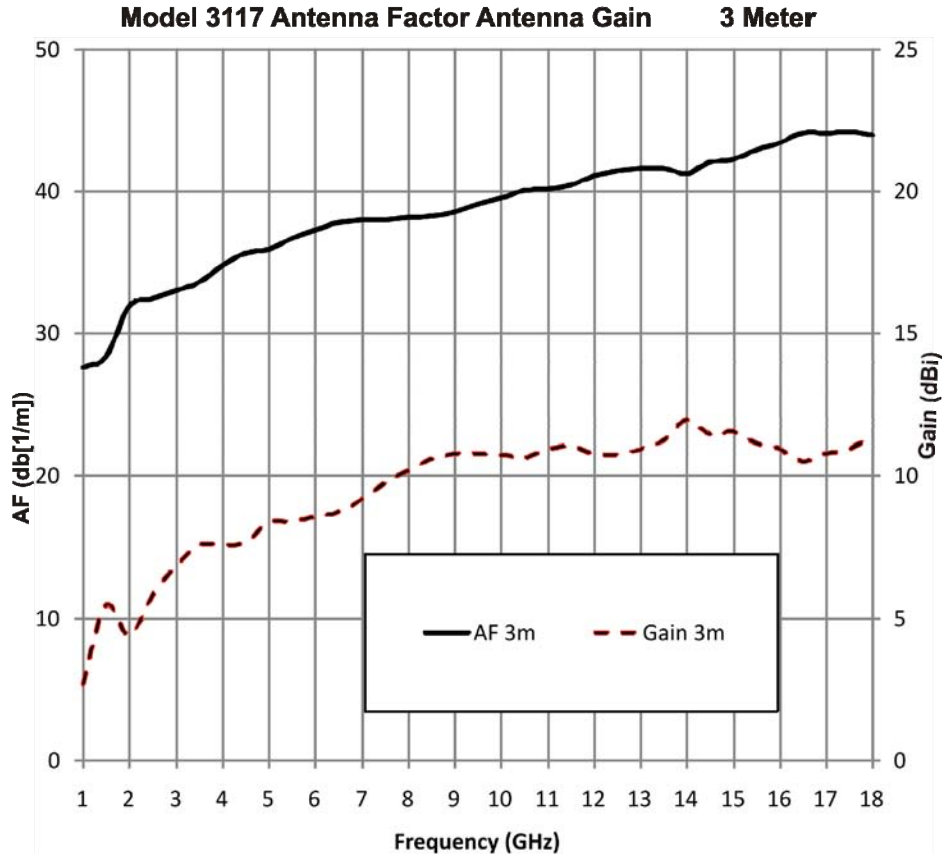

Model 3115 Antenna Factor & Gain 1m
AF (dB[1/m])
Gain (dBi)
Frequency (GHz)
AF 1m
Gain 1m

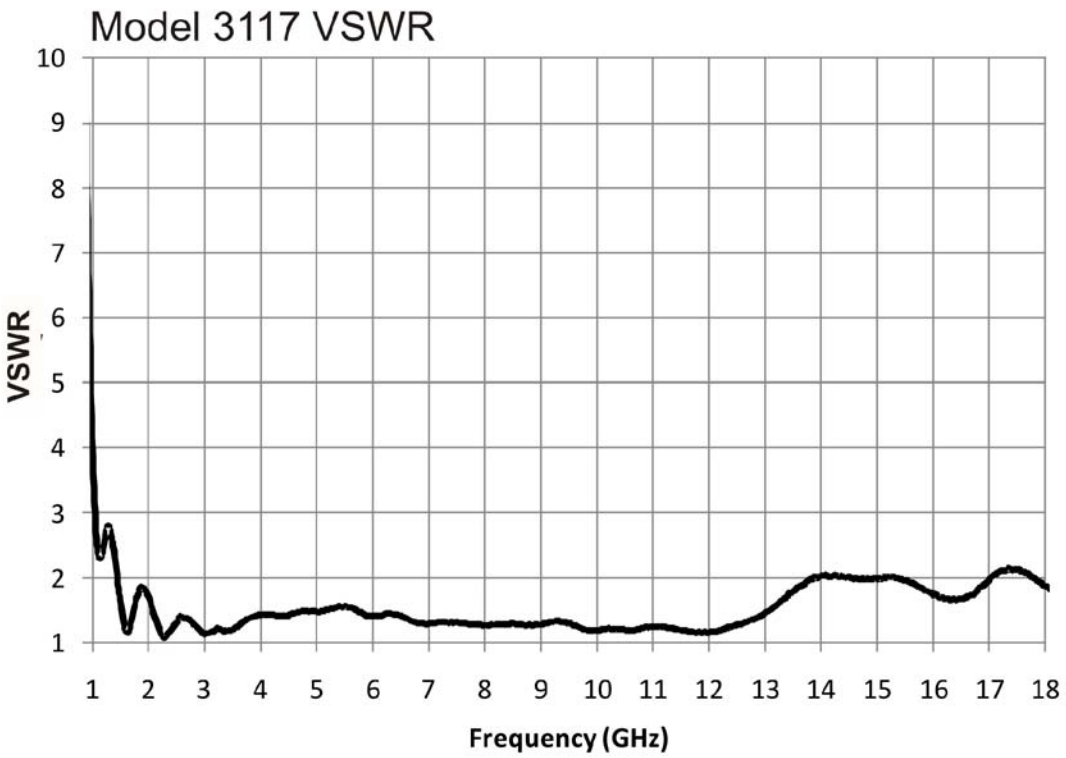

Model 3115 Antenna Factor & Gain 3m
AF (dB[1/m])
gain (dBi)
Frequency (GHz)
AF 3m
Gain 3m

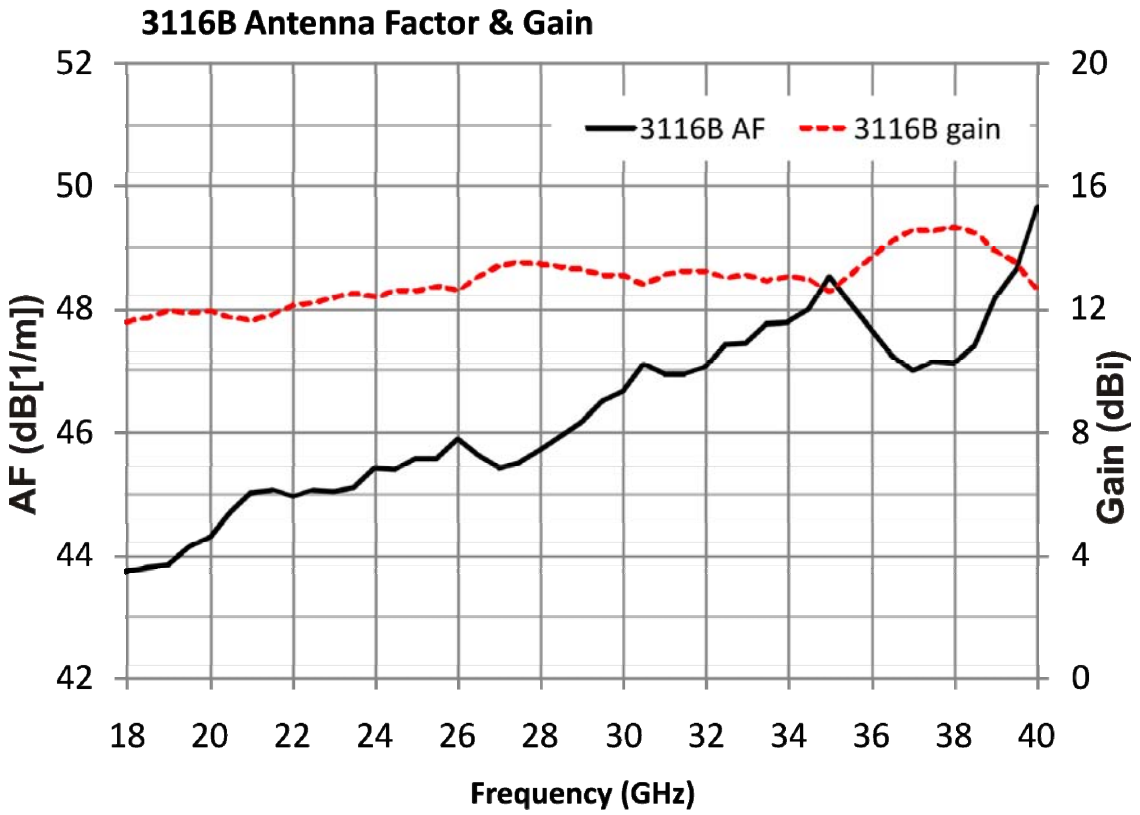

Model 3115 VSWR
VSWR
VSWR
Frequency (GHz)
10
9
8
7
6
5
4
3
2
1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

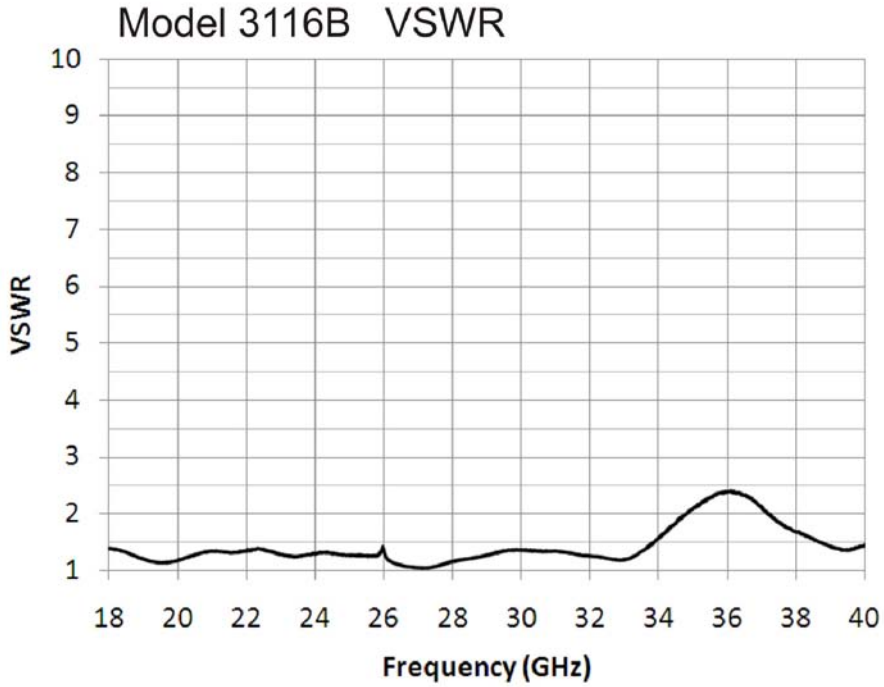
Model 3117


Model 3117 Antenna Factor Antenna Gain 1 Meter
AF (dB[1/m])
Gain (dBi)
AF 1m
Gain 1m
50
40
30
20
10
0
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18


Model 3117 Antenna Factor Antenna Gain 3 Meter
AF (db[1/m])
Gain (dBi)
Frequency (GHz)
AF 3m
Gain 3m
50
40
30
20
10
0
25
20
15
10
5
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18


Model 3117 VSWR
VSWR
Frequency (GHz)
10
9
8
7
6
5
4
3
2
1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18


3116B Antenna Factor & Gain
3116B AF
3116B gain
AF (dB[1/m])
Gain (dBi)
Frequency (GHz)
52
50
48
46
44
42
20
16
12
8
4
0
18
20
22
24
26
28
30
32
34
36
38
40


Model 3116B VSWR
VSWR
Frequency (GHz)
10
9
8
7
6
5
4
3
2
1
18
20
22
24
26
28
30
32
34
36
38
40

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Appendix A: Warranty

See the *Product Information Bulletin* included with your shipment for the complete ETS-Lindgren warranty for your Double-Ridged Waveguide Horn antenna.

DURATION OF WARRANTIES FOR DOUBLE-RIDGED WAVEGUIDE HORN ANTENNAS

All product warranties, except the warranty of title, and all remedies for warranty failures are limited to two years.

Product Warranted	Duration of Warranty Period
Model 3112	2 Years
Model 3106B	2 Years
Model 3119	2 Years
Model 3115	2 Years
Model 3117	2 Years
Model 3116B	2 Years

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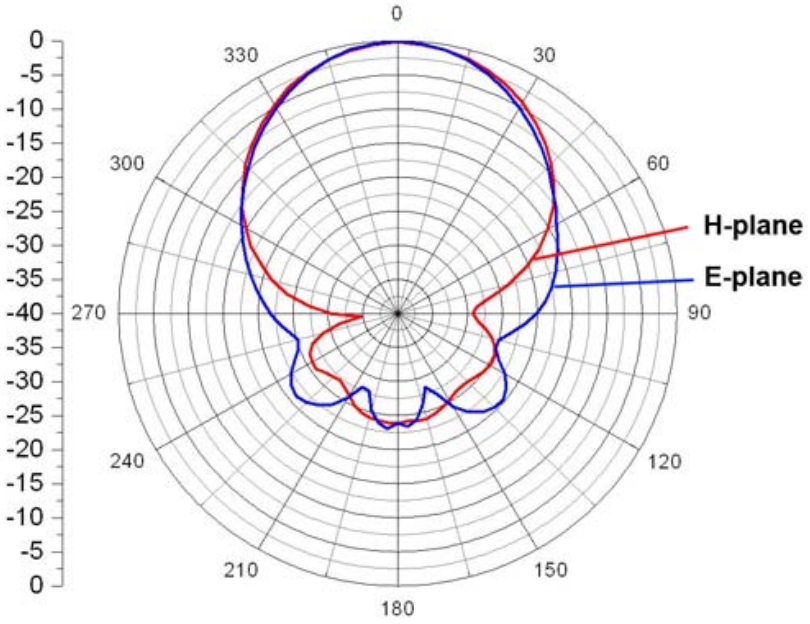
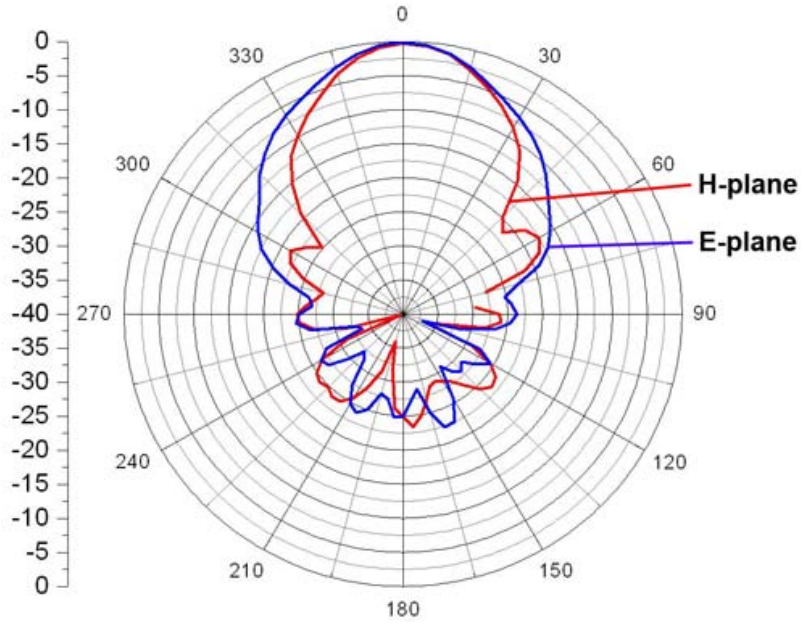
Appendix B: Typical Measured Radiated Patterns

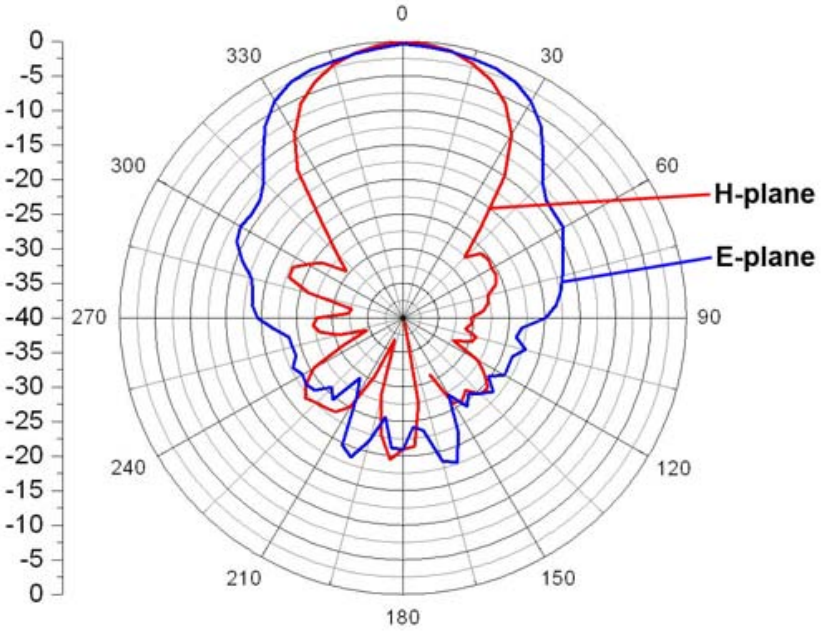
MODEL 3106B



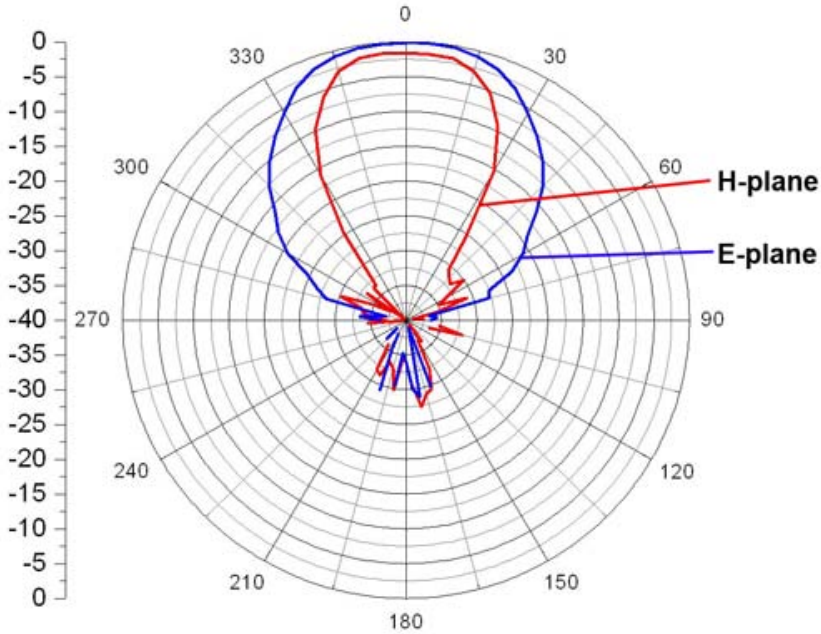
400 MHz



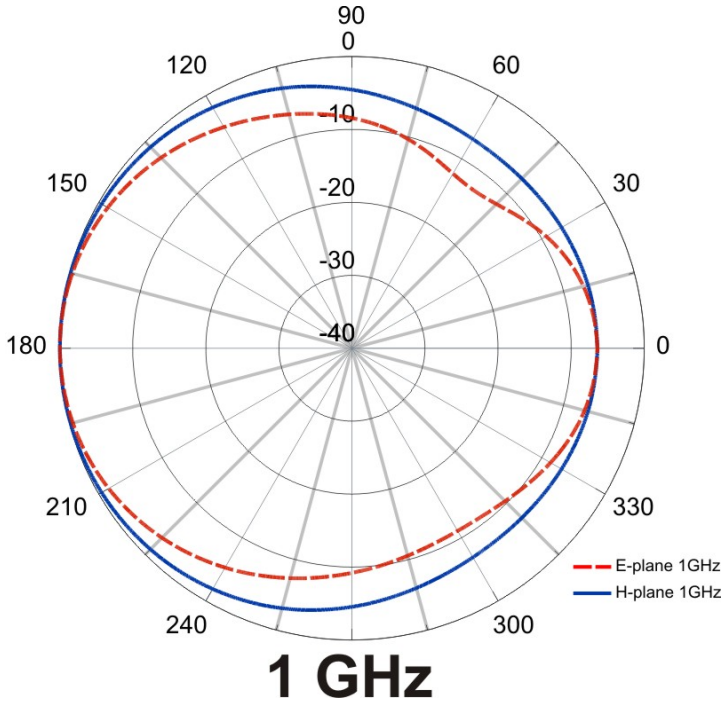
800 MHz



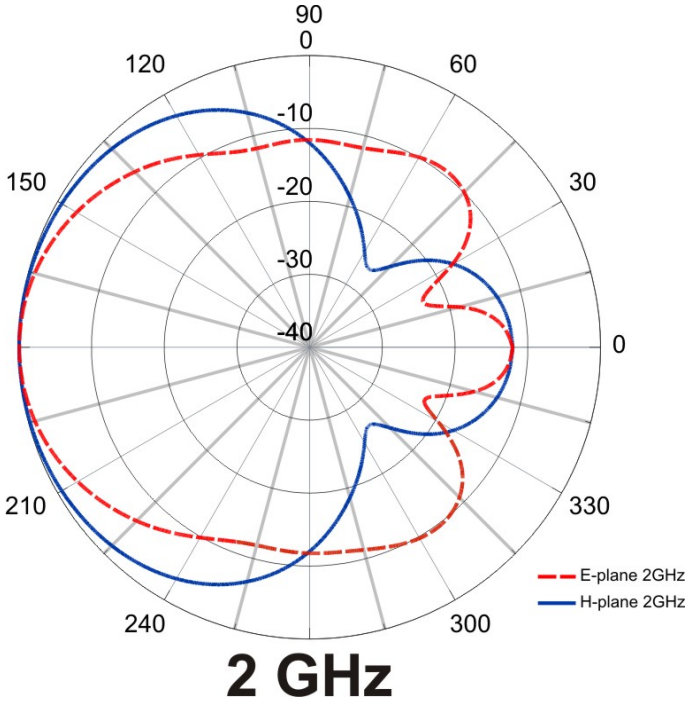
1000 MHz



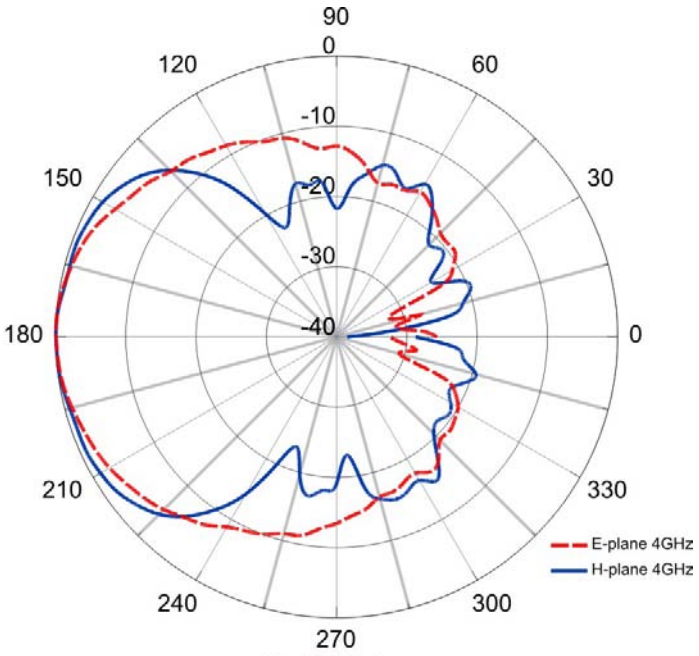
2000 MHz


90
0
120
60
-10
150
-20
30
-30
-40
180
0
210
330
E-plane 1GHz
H-plane 1GHz
240
300

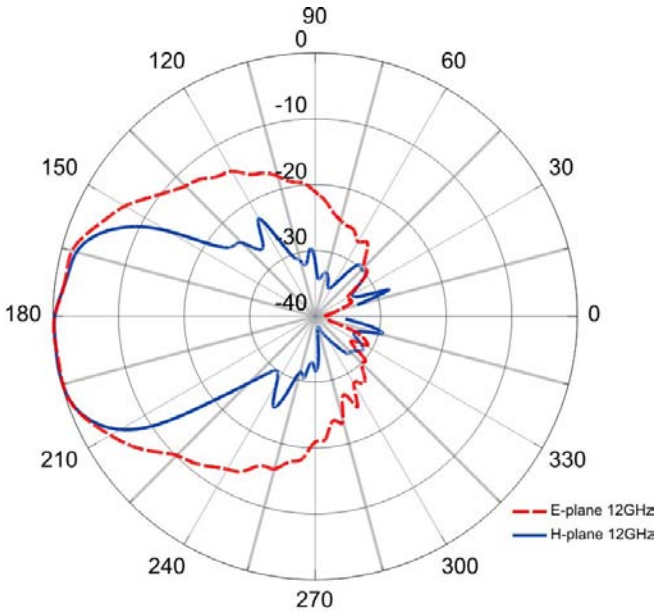
1 GHz


90
0
120
60
-10
150
-20
30
-30
-40
0
210
330
E-plane 2GHz
H-plane 2GHz
240
300

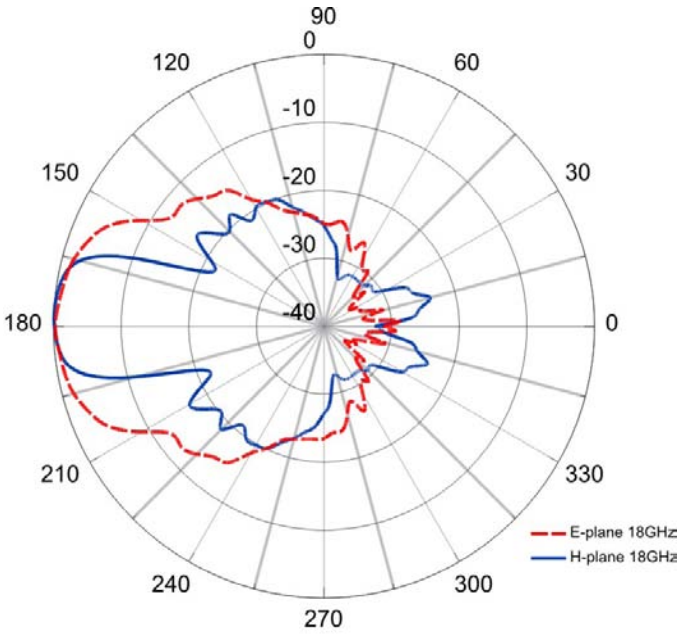
2 GHz


90
0
120
60
-10
150
-20
30
-30
180
-40
0
210
330
E-plane 4GHz
H-plane 4GHz
240
300
270

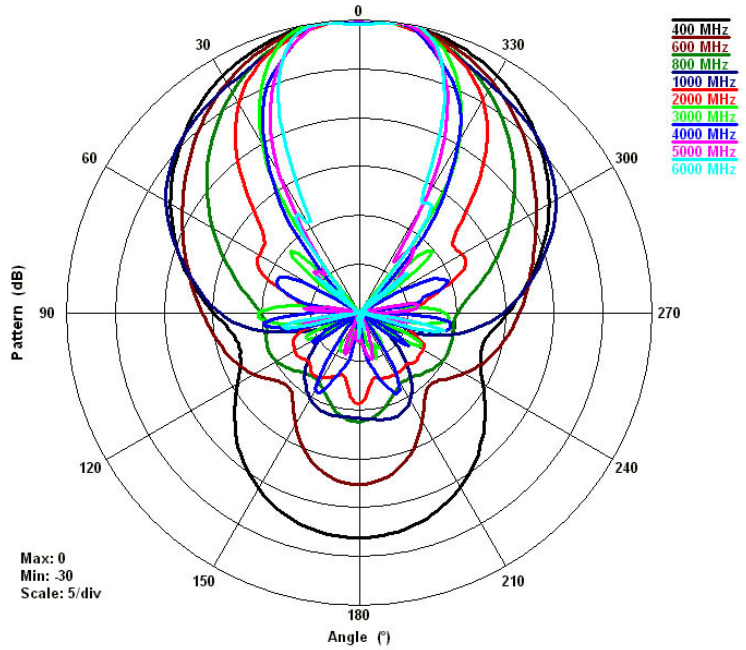
4 GHz


90
0
120
60
-10
150
-20
30
-30
180
-40
0
210
330
E-plane 12GHz
H-plane 12GHz
240
300
270

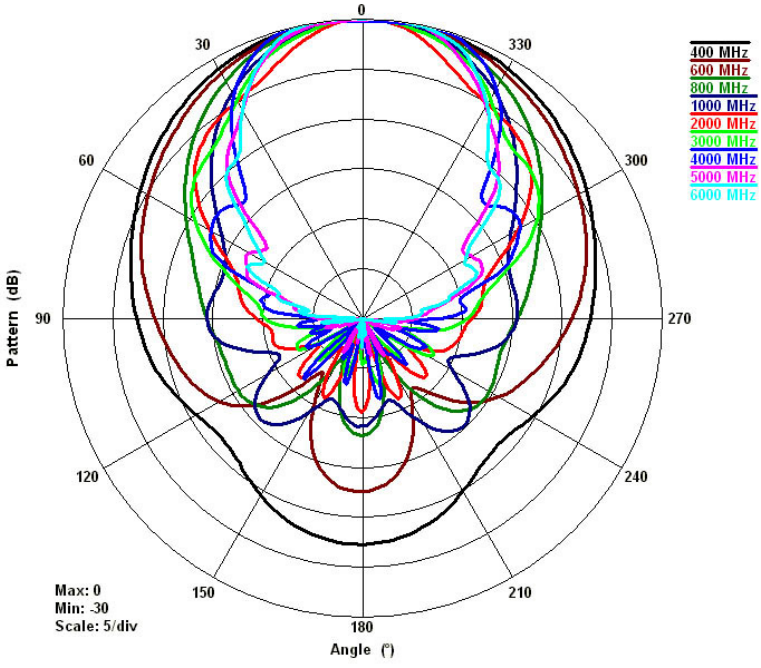
12 GHz


90
0
120
60
-10
150
-20
30
-30
-40
180
0
210
330
E-plane 18GHz
H-plane 18GHz
240
300
270

18 GHz



H-Plane



E-Plane