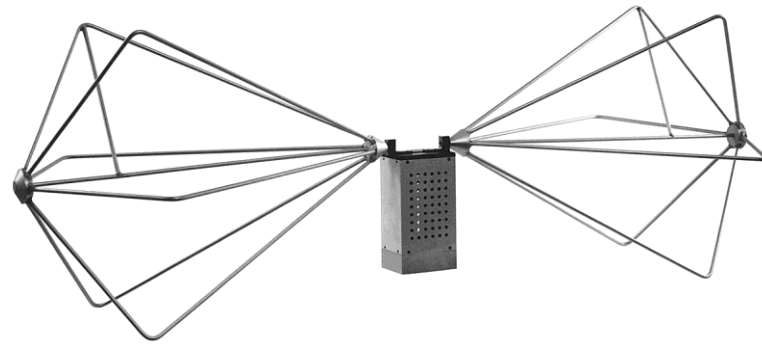


*Model 3109*

# **Biconical Antenna**

**User Manual**



 **ETS-LINDGREN**<sup>™</sup>  
An ESCO Technologies Company

ETS-Lindgren L.P. reserves the right to make changes to any product described herein in order to improve function, design, or for any other reason. Nothing contained herein shall constitute ETS-Lindgren L.P. assuming any liability whatsoever arising out of the application or use of any product or circuit described herein. ETS-Lindgren L.P. does not convey any license under its patent rights or the rights of others.

**© Copyright 1989–2011 by ETS-Lindgren L.P. All Rights Reserved. No part of this document may be copied by any means without written permission from ETS-Lindgren L.P.**

Trademarks used in this document: The *ETS-Lindgren* logo is a trademark of ETS-Lindgren L.P.

**Revision Record | MANUAL 3109 | Part #399038, Rev. F**

<b>Revision</b>	<b>Description</b>	<b>Date</b>
A—C	Initial Release; updates / edits	1989—2002
D	Added <i>P/XP</i> options	October, 2002
E	Updated <i>PX</i> branding; updated <i>Mounting Instructions</i> ; rebrand	February, 2009
F	Updated <i>Physical Specifications</i>	October, 2011


# Table of Contents

<b>Notes, Cautions, and Warnings</b> .....	<b>v</b>
<b>1.0 Introduction</b> .....	<b>7</b>
Optional Items .....	8
Model 3109P—Portable Elements .....	8
Model 3109PX—Extended Portable Elements .....	8
Carrying Cases .....	8
Tripod Options .....	9
ETS-Lindgren Product Information Bulletin .....	10
<b>2.0 Maintenance</b> .....	<b>11</b>
Annual Calibration .....	11
Replacement and Optional Parts .....	12
Service Procedures .....	12
<b>3.0 Specifications</b> .....	<b>13</b>
Electrical Specifications .....	13
Physical Specifications .....	14
Model 3109.....	14
Model 3109P (With Portable Elements).....	15
Model 3109PX (With Extended Portable Elements) .....	16
<b>4.0 Assembly Instructions</b> .....	<b>17</b>
<b>5.0 Mounting Instructions</b> .....	<b>19</b>
Additional Mounting Options .....	20
4-TR Mounting Options.....	20
7-TR and Mast Mounting Options.....	21
2x2 Boom Mounting Options .....	22
<b>6.0 Application</b> .....	<b>23</b>
<b>7.0 Typical Data</b> .....	<b>25</b>
Model 3109 Typical Data .....	25
Model 3109 Antenna Factor.....	25
Model 3109 Gain .....	26
Model 3109 VSWR .....	27
Model 3109 Half-Power Beamwidth .....	28

Model 3109 Forward Power @ 1 M—Derived from AF .....	29
Model 3109 Forward Power @ 3 M—Derived from AF .....	30
Model 3109 Forward Power @ 3 M—Measured over Conducting Ground.....	31
Model 3109 Forward Power @ 3 M—Measured over Ferrite Ground..	32
Model 3109P Typical Data.....	33
Model 3109P VSWR .....	33
Model 3109PX Typical Data.....	34
Model 3109PX Antenna Factor .....	34
Model 3109PX Gain.....	35
Model 3109PX VSWR.....	36
Model 3109PX Forward Power @ 3 M—Derived from AF .....	37
Model 3109PX Forward Power @ 3 M—Measured over Conducting Ground.....	38
<b>Appendix A: Warranty .....</b>	<b>39</b>

## Notes, Cautions, and Warnings

---

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



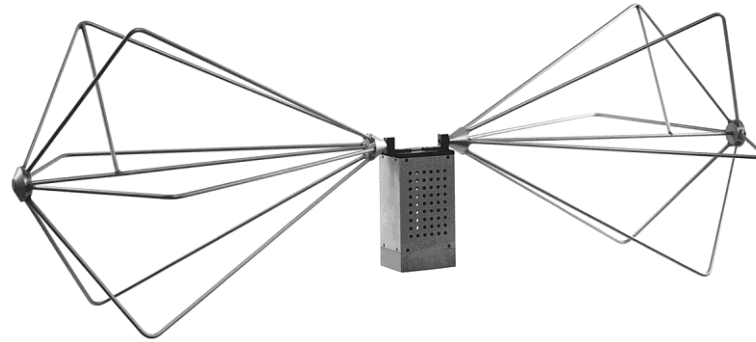
See the ETS-Lindgren *Product Information Bulletin* for safety, regulatory, and other product marking information.

This page intentionally left blank.

## 1.0 Introduction

---

The **ETS-Lindgren Model 3109 Biconical Antenna** is designed to operate over the 20 MHz to 300 MHz frequency range for generating high levels of electromagnetic (EM) fields. The ability to handle high power levels over a broadband makes the Model 3109 excellent for use in radiated susceptibility testing.



The assembly design of the Model 3109 provides for easy storage and portability. The standard biconical elements are made from welded aluminum. The 4-to-1 ratio balun network is fabricated from TFE thermoplastics and specially machined brass and aluminum support and contact parts. The bifilar inductors of the balun are wound in precision machined cuts to provide high barrier insulation between windings while simultaneously giving good coupling between bifilar windings.

The balun acts as base on the Model 3109 and is configured to accept an ETS-Lindgren tripod or most other tripods. For information on tripods, see *Tripod Options* on page 9. For the variety of mounting options available for the Model 3109, see *Mounting Instructions* on page 19.

The Model 3109 is individually calibrated at 1 m per SAE ARP 958 and 3 m and 10 m per ANSI C63.5. Actual factors and a signed *Certificate of Calibration Conformance* are included.

Because slight variations in testing environments can affect the field characteristics around an antenna, it is recommended that a field probe be used to accurately determine the field strength in the region under test.

## **Optional Items**

---

### **MODEL 3109P—PORTABLE ELEMENTS**

Collapsible folding elements are available, making the Model 3109 portable and ideal for field use. Both the standard rigid and optional folding elements attach to the balun using screw mounts. This makes changing between the two types of elements quick and easy.

### **MODEL 3109PX—EXTENDED PORTABLE ELEMENTS**

An extended version of the portable element is available. These folding elements are twice as long as the standard elements. The longer elements enable you to generate high fields at low frequencies with reduced applied power.

### **CARRYING CASES**

Carrying cases for biconical antennas and portable elements are available.



## TRIPOD OPTIONS

ETS-Lindgren offers the following nonmetallic, non-reflective tripods for use at both indoor and outdoor EMC test sites.

- **4-TR Tripod**—Constructed of linen phenolic and delrin, designed with an adjustable center post for precise height adjustments. Maximum height is 2.0 m (80.0 in), and minimum height is 94 cm (37.0 in). This tripod can support up to an 11.8 kg (26.0 lb) load.



- **7-TR Tripod**—Constructed of PVC and fiberglass components, providing increased stability for physically large antennas. The unique design allows for quick assembly, disassembly, and convenient storage. 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 is 2.17 m (85.8 in), with a minimum height of 0.8 m (31.8 in). This tripod can support a 13.5 kg (30 lb) load.



## **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 Model 3109 is limited to external components such as cables or connectors.

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

### Annual Calibration

---



If you have the Model 3109P (with portable elements) or Model 3109PX (with extended portable elements), include the portable elements with the balun when sending for 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 Model 3109.

Part Description	Part Number
Model 3109	3109
Model 3109P (with portable elements)	3109P
Model 3109PX (with extended portable elements)	3109PX

## 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

---

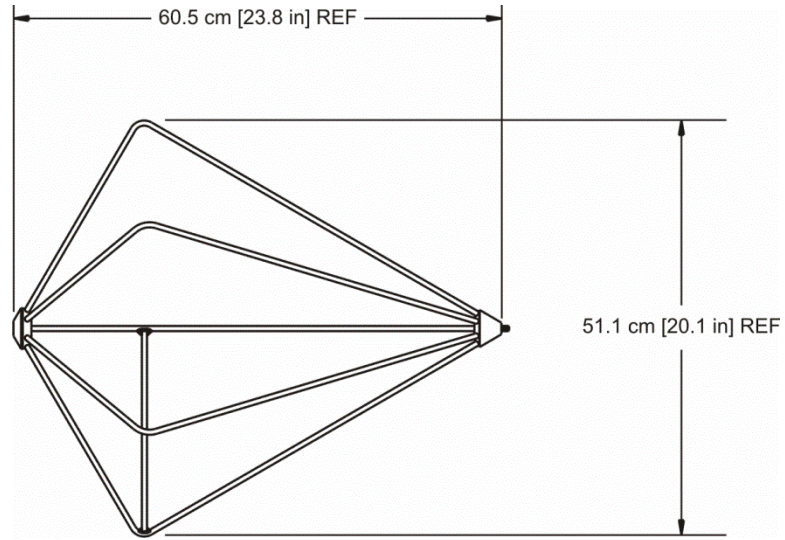
#### Electrical Specifications

---

<b>Frequency Range:</b>	20 MHz–300 MHz
<b>VSWR Ratio (Average):</b>	1.9:1
<b>Maximum Continuous Power:</b>	2 kW
<b>Peak Power:</b>	3 kW
<b>Impedance (Nominal):</b>	50 $\Omega$
<b>Connector:</b>	Type N female

## Physical Specifications

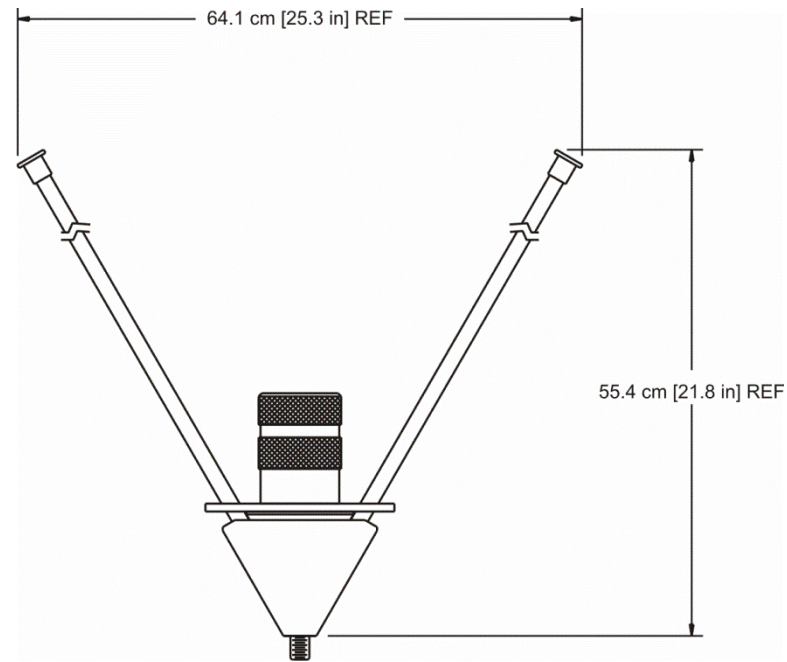
### MODEL 3109



One element is shown for illustrative purposes only; all specifications are based on the balun plus both elements.

<b>Width (includes elements and balun):</b>	131.1 cm (51.6 in)
<b>Diameter:</b>	51.1 cm (20.1 in)
<b>Weight (includes elements and balun):</b>	2.6 kg (5.8 lb)

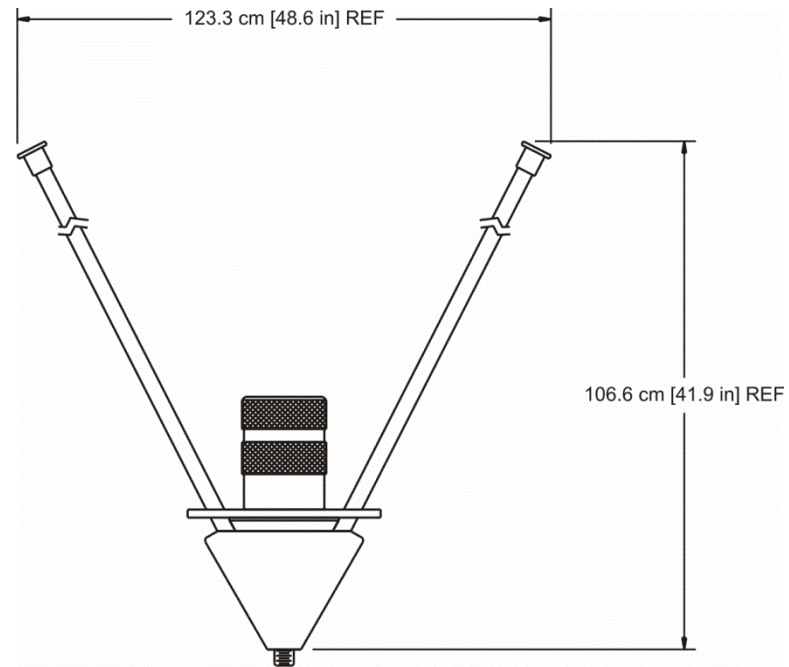
**MODEL 3109P (WITH PORTABLE ELEMENTS)**



One element is shown for illustrative purposes only; all specifications are based on the balun plus both elements.

<b>Width (includes elements and balun):</b>	120.9 cm (47.6 in)
<b>Diameter:</b>	64.1 cm (25.3 in)
<b>Weight (includes elements and balun):</b>	2.4 kg (5.4 lb)

**MODEL 3109PX (WITH EXTENDED PORTABLE ELEMENTS)**



One element is shown for illustrative purposes only; all specifications are based on the balun plus both elements.

<b>Width (includes elements and balun):</b>	223.0 cm (87.8 in)
<b>Diameter:</b>	123.3 cm (48.6 in)
<b>Weight (includes elements and balun):</b>	3.1 kg (6.8 lb)

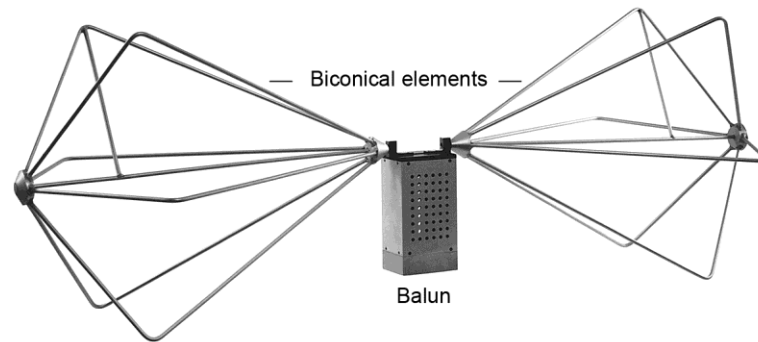


## 4.0 Assembly Instructions

---

**CAUTION**

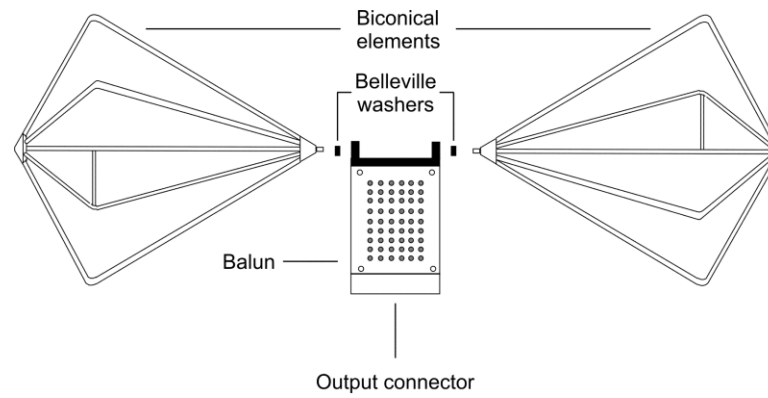
Before connecting any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.



The Model 3109 Biconical Antenna is shipped unassembled, and includes these parts:

- Balun
- Biconical element (2)
- Belleville washer (2)

To assemble the Model 3109:



1. Slide a belleville washer onto the threaded screw end of one of the biconical elements.
2. Line up the screw threads with the receptacle hole on the balun and turn the biconical element until it is firmly secured in the balun.

**CAUTION**

**Do not cross thread this connection or permanent damage to the joint could occur.**

3. Repeat step 1 and step 2 using the remaining washer and biconical element.

## 5.0 Mounting Instructions

---

**CAUTION**

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

The balun unit of the Model 3109 Biconical Antenna provides two 1/4–20 thread receptacles for mounting.

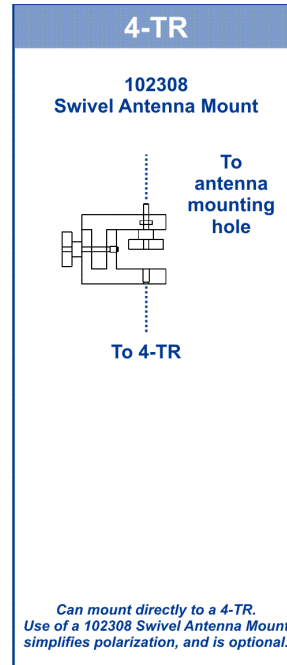
To mount the balun onto a tripod, insert a 1/4–20 thread mounting screw or knob from the tripod into the receptacle.

## Additional Mounting Options

---

### 4-TR MOUNTING OPTIONS

Following are additional options for mounting the Model 3109 onto an ETS-Lindgren 4-TR Tripod. Contact the ETS-Lindgren Sales Department for information on ordering optional mounting hardware.



## 7-TR AND MAST MOUNTING OPTIONS

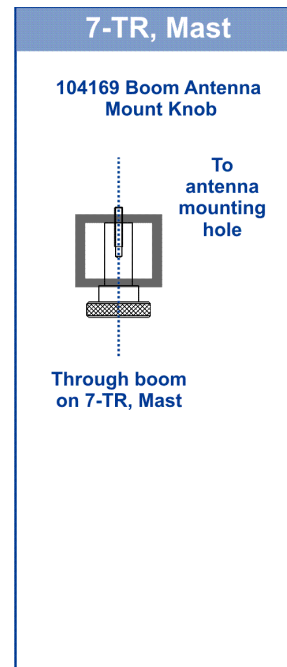
Following are options for mounting the Model 3109 onto an ETS-Lindgren 7-TR Tripod or mast. Contact the ETS-Lindgren Sales Department for information on ordering optional mounting hardware.



*Mast* refers to 2070 Series, 2075, and 2175 Antenna Towers.

*7-TR* refers to these booms:

- *109042 boom*—Straight boom; for general antenna mounting on a 7-TR
- *108983 boom*—Offset boom; for general antenna mounting on a 7-TR with pneumatic or manual polarization; can also be used to mount stinger-type antennas
- *108507 boom*—Centerline rotation boom for Model 3106 Series antennas only; when changing polarization, maintains centerline rotation

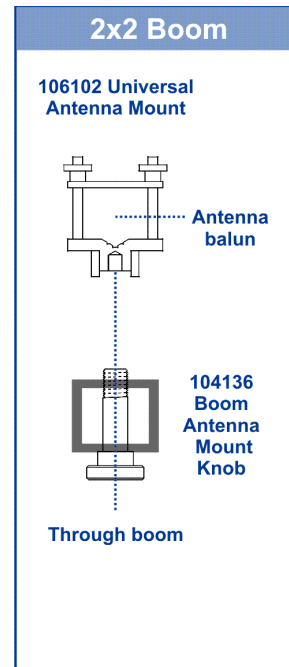


## 2x2 BOOM MOUNTING OPTIONS

Following are additional options for mounting the Model 3109 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.



## 6.0 Application

---

The Model 3109 Biconical Antenna provides a broad frequency and a high input power, making it ideal for IEC 61000-4-3 testing. The antenna uses a modified Guanella balun for impedance transformation and matching, and it is constructed of much heavier materials so that maximum continuous input power can reach 2 kW. While this antenna typically has a high VSWR at frequencies below 70 MHz, it is still capable of generating a high field strength with acceptable input power in this region of the band. The optional extended elements markedly improve performance in this region.

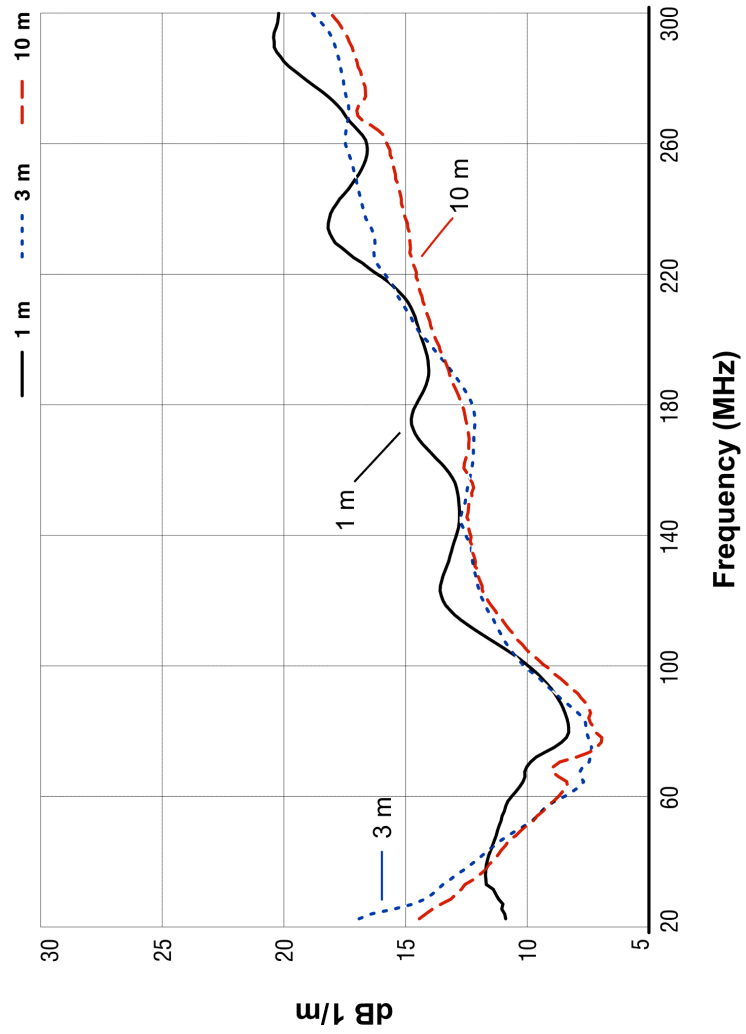
This page intentionally left blank.



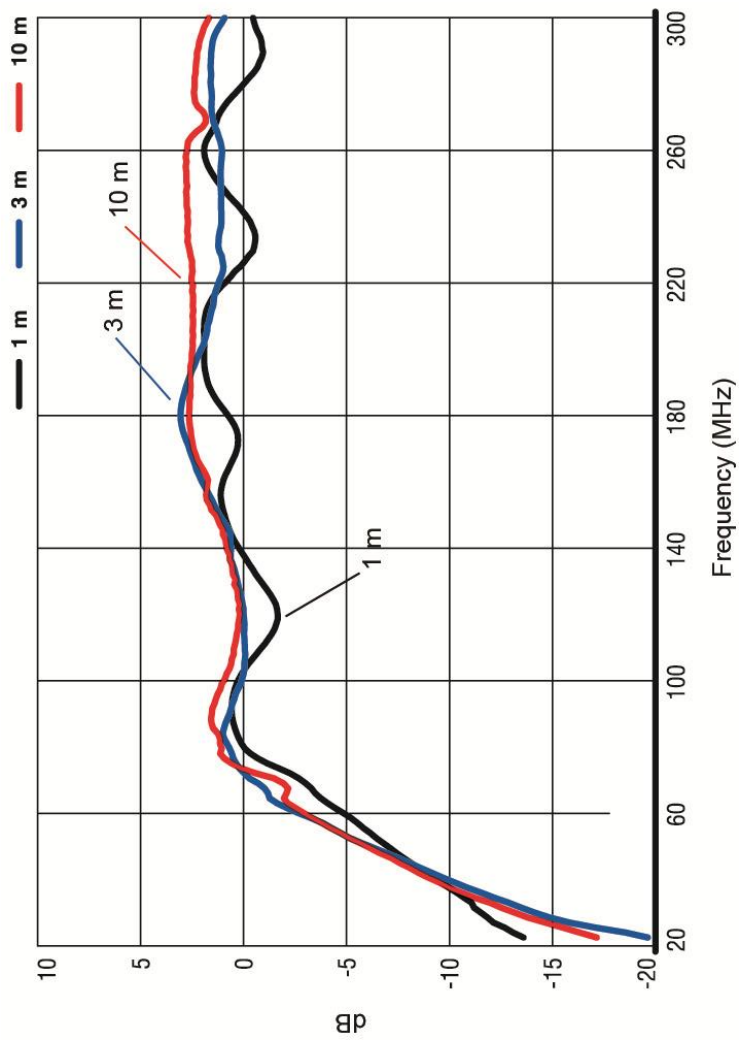
## 7.0 Typical Data

### Model 3109 Typical Data

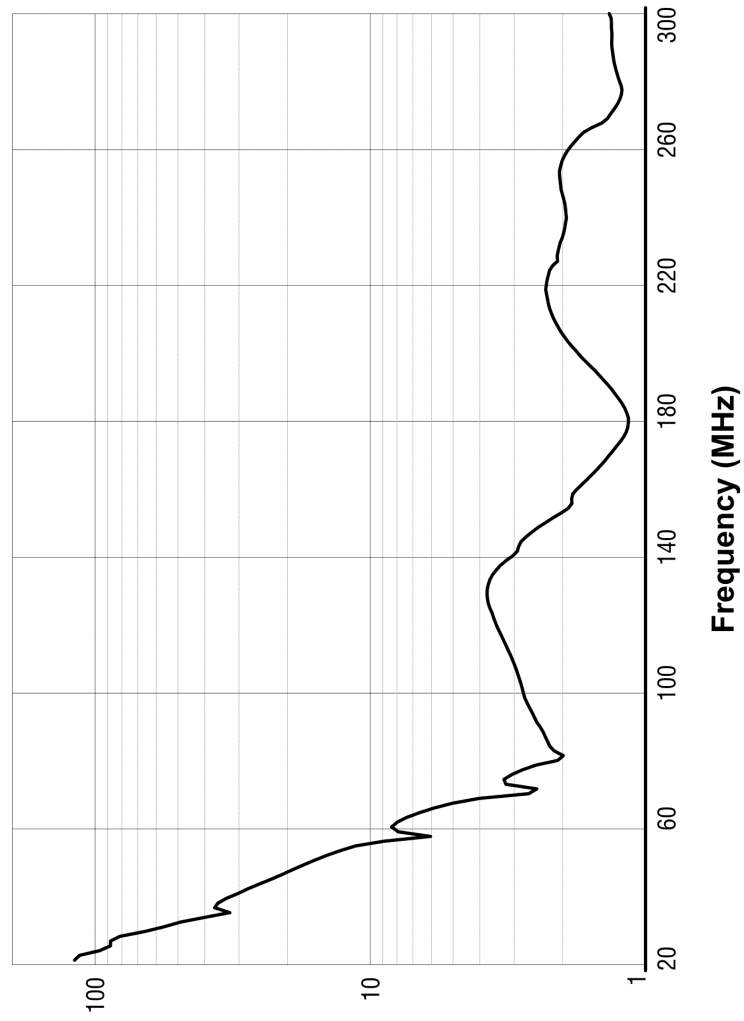
#### MODEL 3109 ANTENNA FACTOR



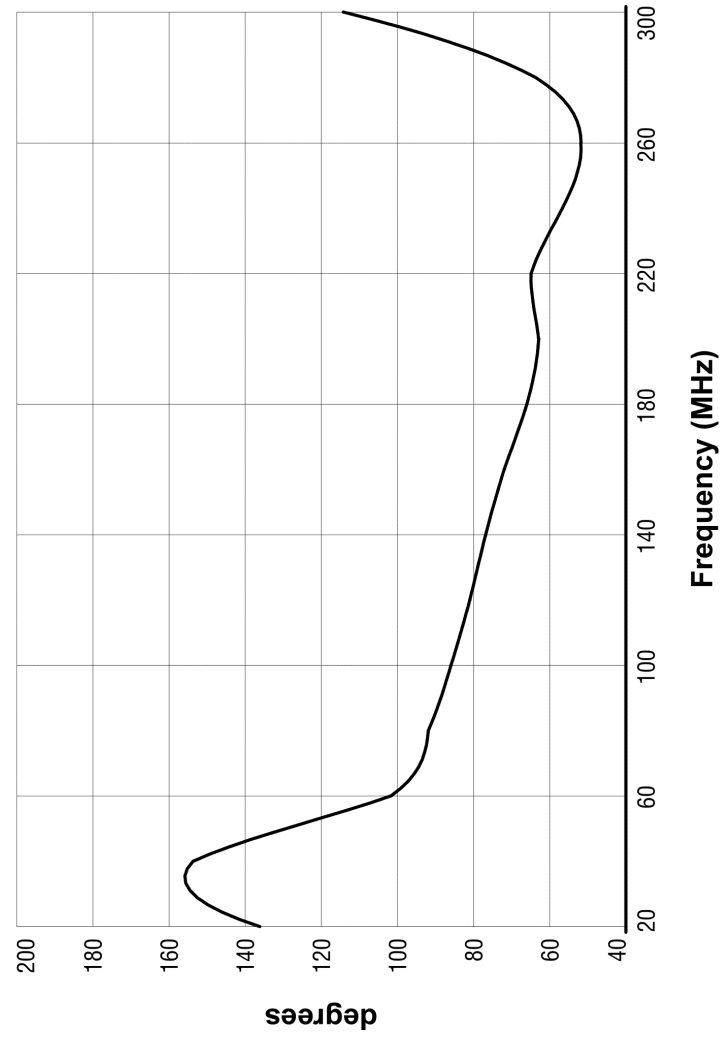
### MODEL 3109 GAIN



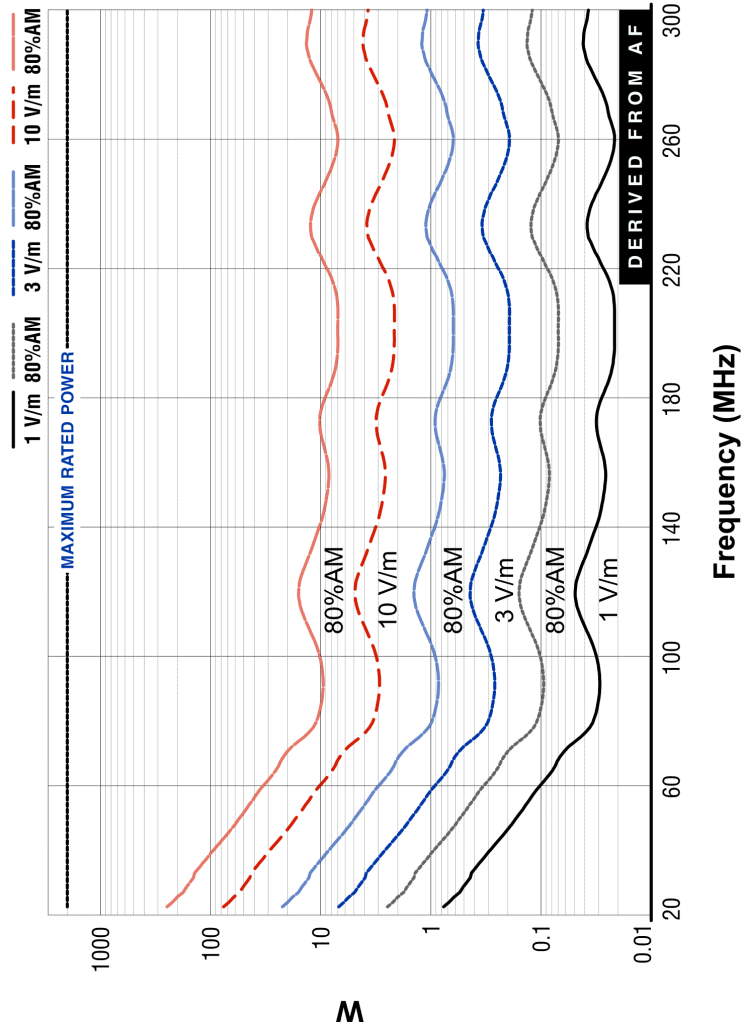
### MODEL 3109 VSWR



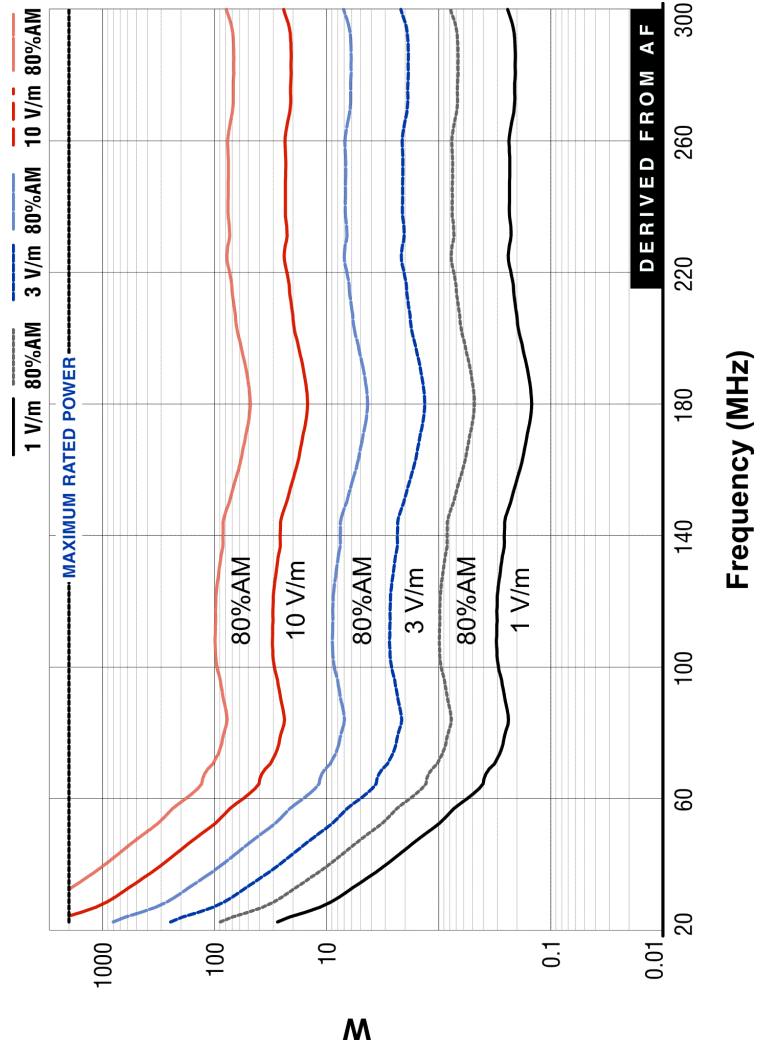
### MODEL 3109 HALF-POWER BEAMWIDTH



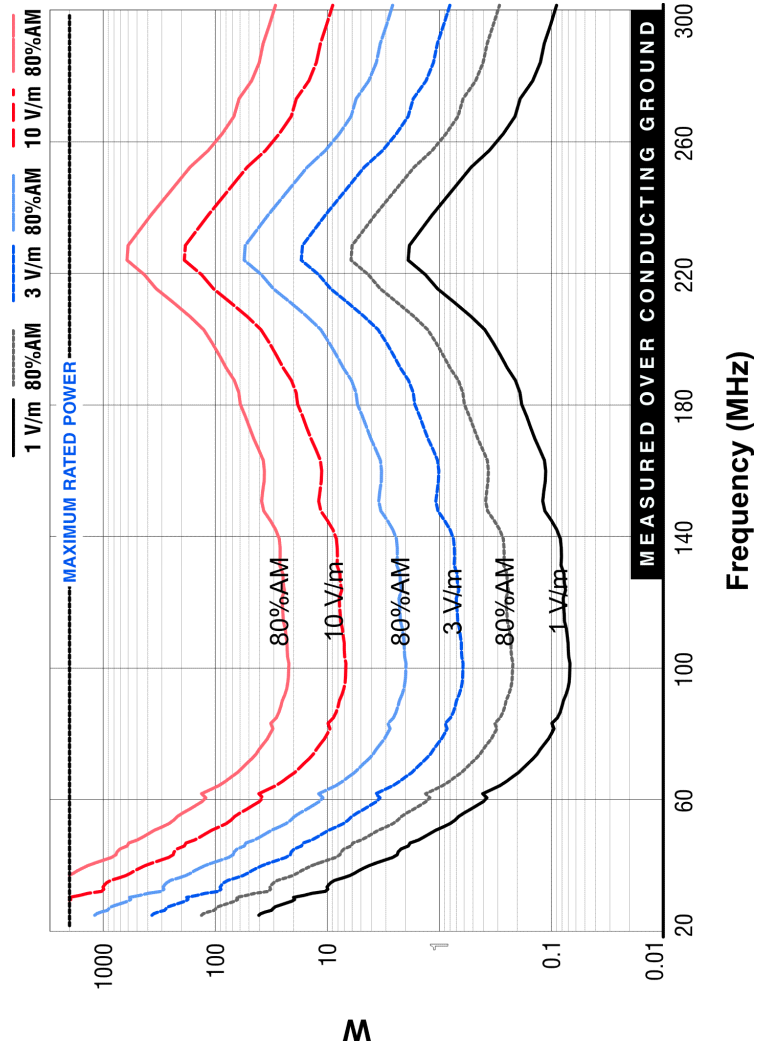
MODEL 3109 FORWARD POWER @ 1 M—DERIVED FROM AF



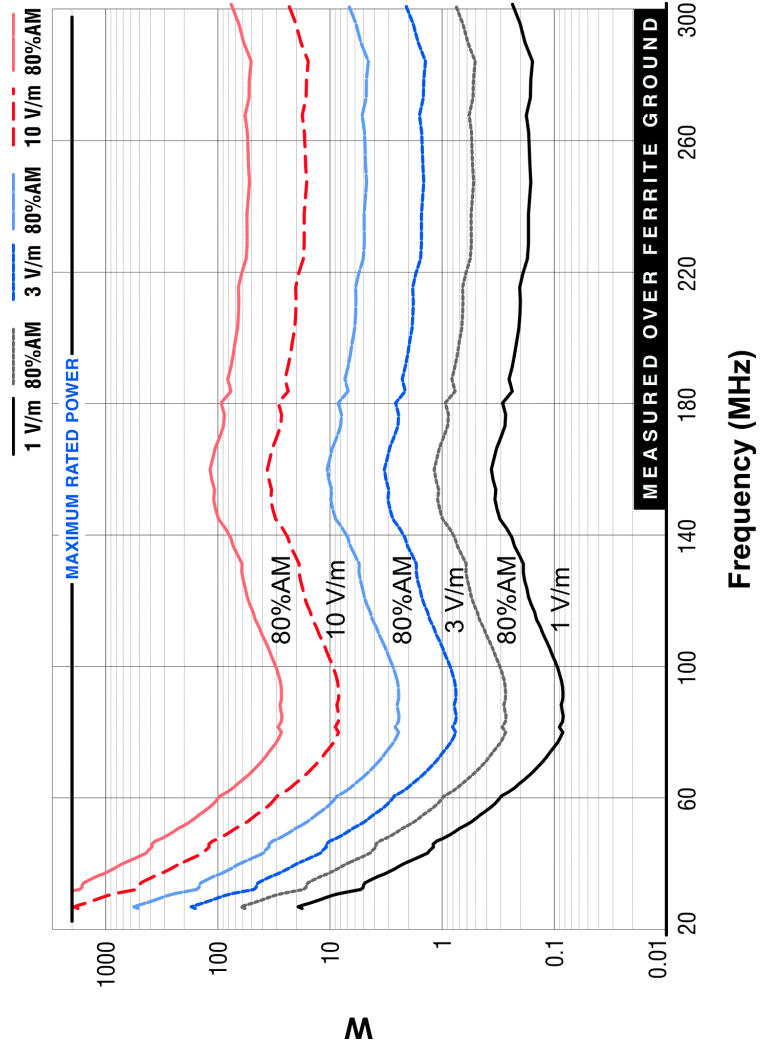
MODEL 3109 FORWARD POWER @ 3 M—DERIVED FROM AF



**MODEL 3109 FORWARD POWER @ 3 M—MEASURED OVER CONDUCTING GROUND**



**MODEL 3109 FORWARD POWER @ 3 M—MEASURED OVER FERRITE GROUND**

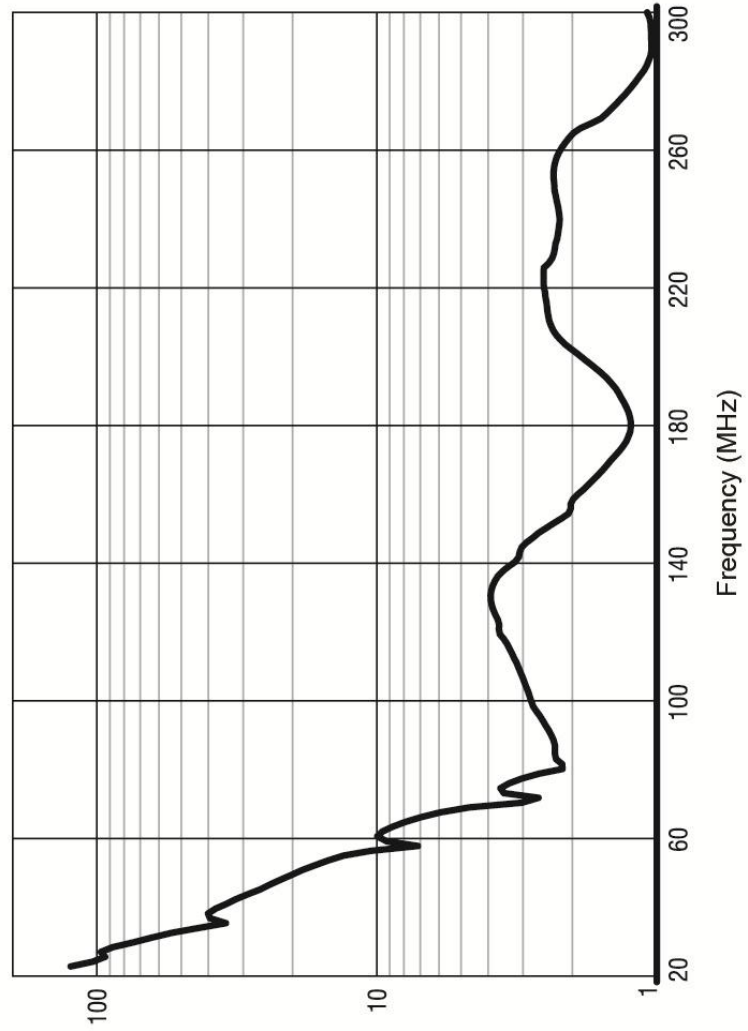




## Model 3109P Typical Data

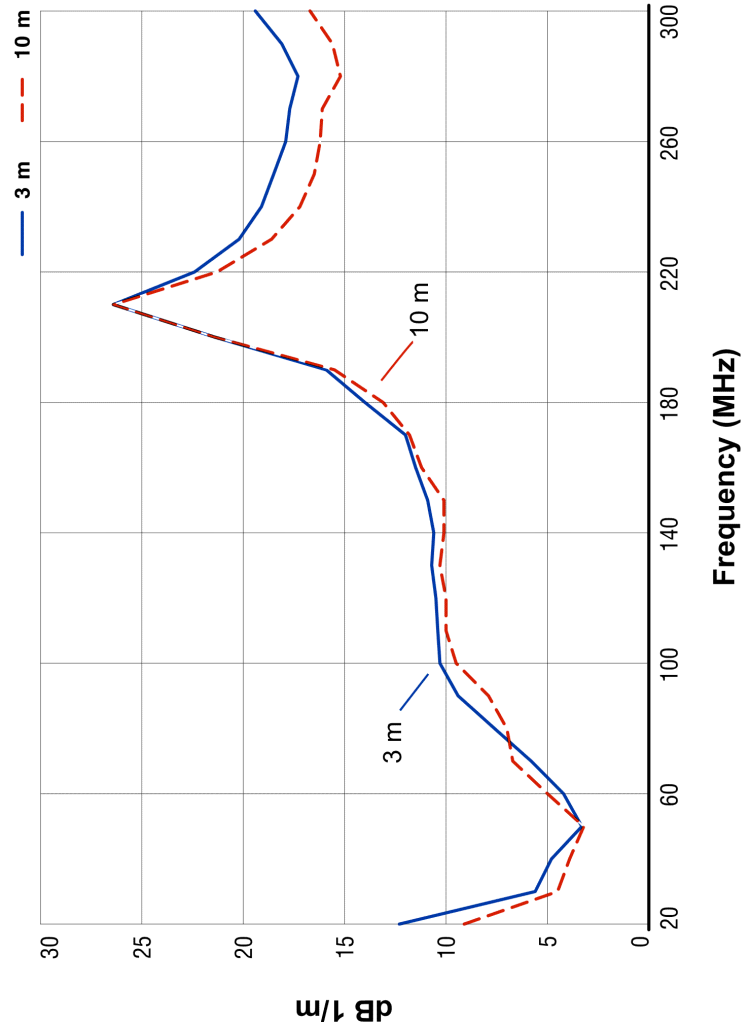
---

### MODEL 3109P VSWR

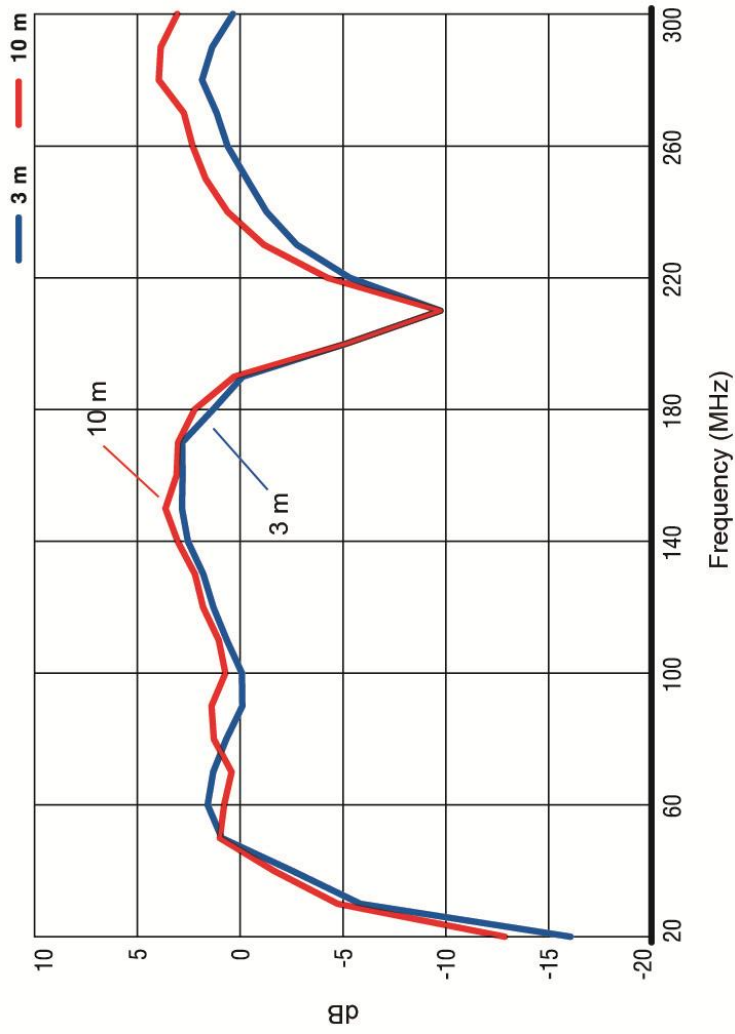


## Model 3109PX Typical Data

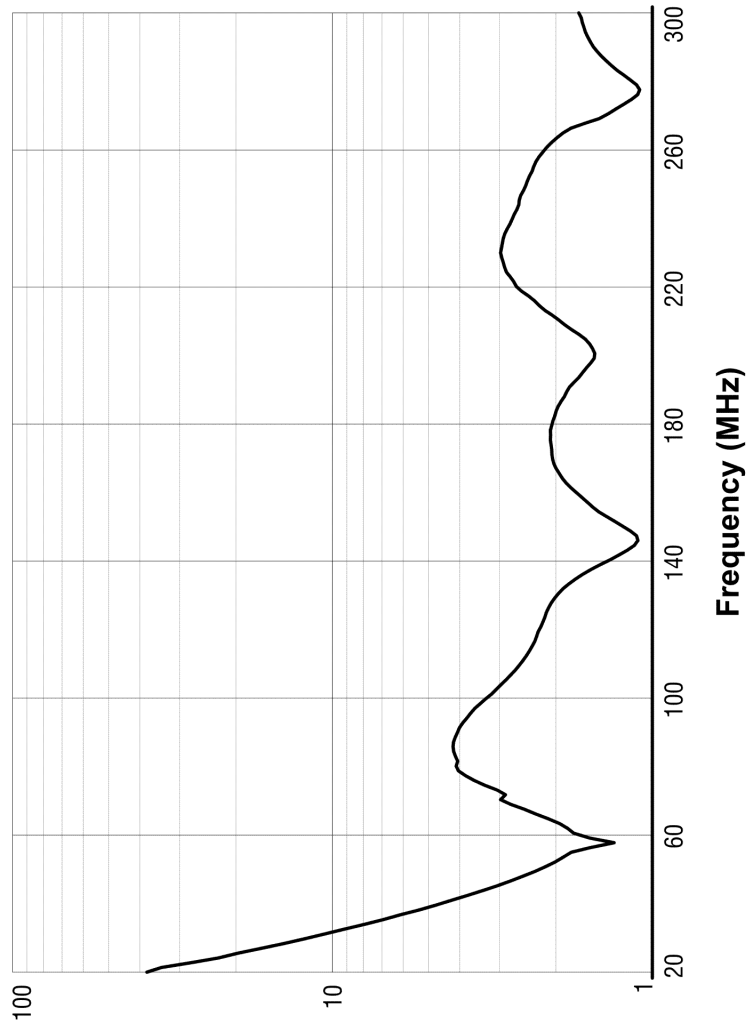
### MODEL 3109PX ANTENNA FACTOR



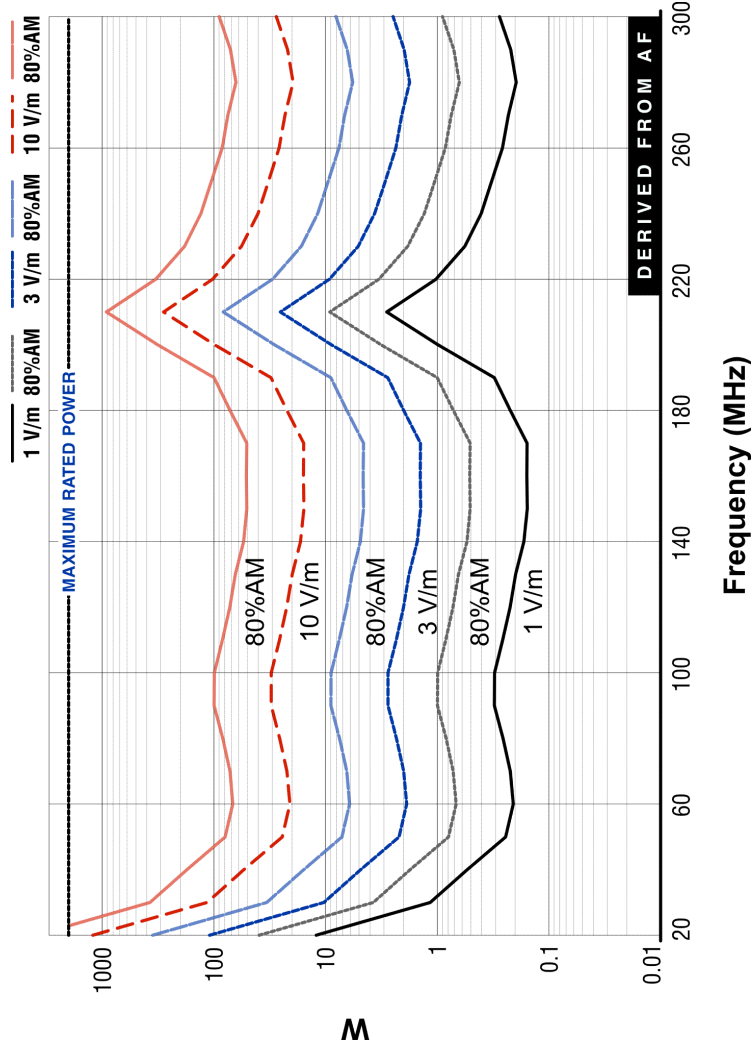
### MODEL 3109PX GAIN



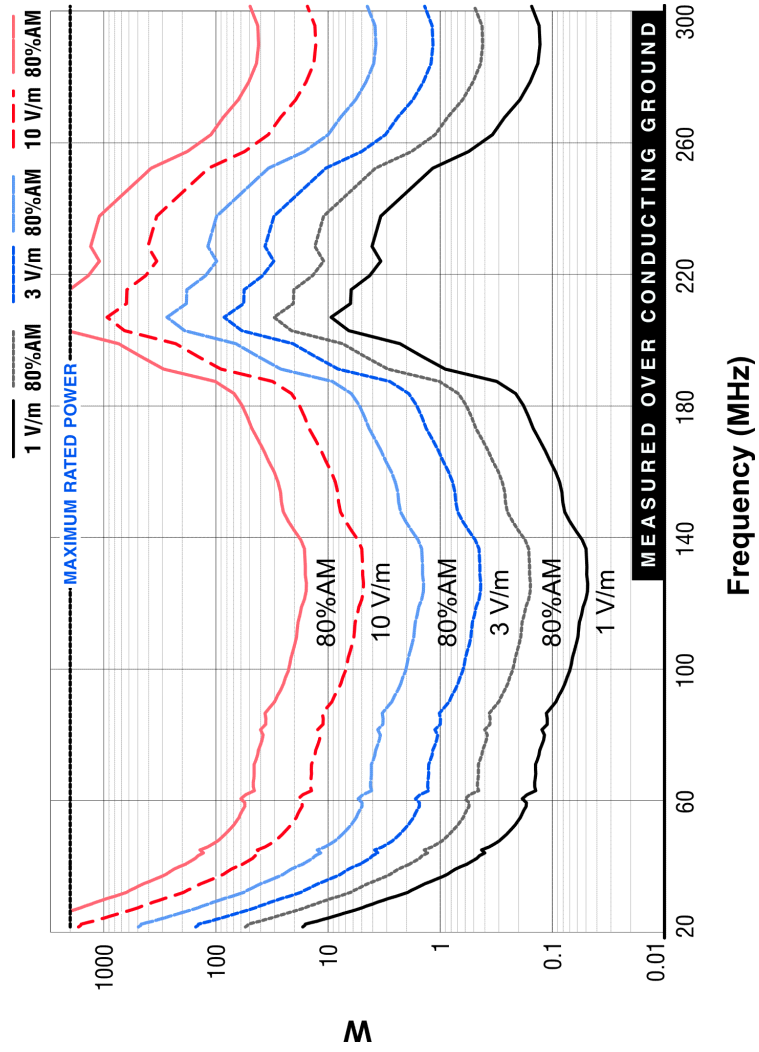
**MODEL 3109PX VSWR**



MODEL 3109PX FORWARD POWER @ 3 M—DERIVED FROM AF



**MODEL 3109PX FORWARD POWER @ 3 M—MEASURED OVER CONDUCTING GROUND**



## Appendix A: Warranty

---



See the *Product Information Bulletin* included with your shipment for the complete ETS-Lindgren warranty for your Model 3109.

### DURATION OF WARRANTIES FOR MODEL 3109

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 3109 Biconical Antenna Model 3109P Biconical Antenna Model 3109PX Biconical Antenna	2 Years