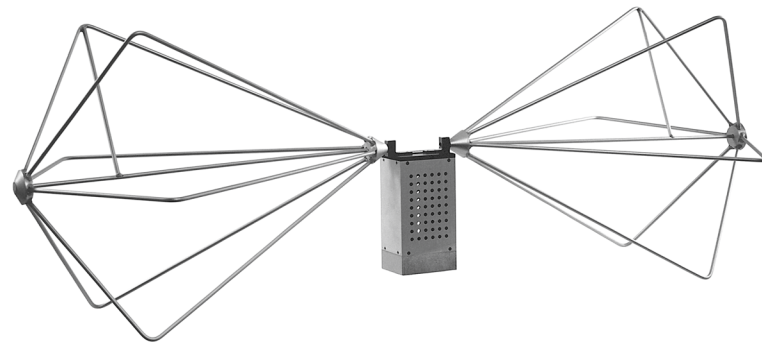


*Model 3109*

# **Biconical Antenna**

**User Manual**



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

ETS-Lindgren Inc. reserves the right to make changes to any products herein to improve functioning or design. Although the information in this document has been carefully reviewed and is believed to be reliable, ETS-Lindgren does not assume any liability arising out of the application or use of any product or circuit described herein; nor does it convey any license under its patent rights nor the rights of others. All trademarks are the property of their respective owners.

© Copyright 1989–2022 by ETS-Lindgren Inc. All Rights Reserved. No part of this document may be copied by any means without written permission from ETS-Lindgren Inc.

Trademarks used in this document: The *ETS-Lindgren* logo is a registered trademark of ETS-Lindgren Inc.; *Delrin* is a registered trademark of E. I. du Pont de Nemours and Company.

#### Revision Record

#### MANUAL,3109 | Part #399038, Rev. K

Revision	Description	Date
A—C	Initial Release; updates / edits	1989—2002
D	Added <i>PXP</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
G	Added optional 7/16 DIN connector	August, 2015
H	Added Model 3109P 7/16 and Model 3109PX 7/16	September, 2015
J	Corrected electrical specifications	May, 2016
K	Removed warranty information	February, 2022

# Table of Contents

<b>Notes, Cautions, and Warnings</b> .....	<b>v</b>
<b>1.0 Introduction</b> .....	<b>7</b>
Application .....	8
Optional Items.....	8
Portable Elements .....	8
Extended Portable Elements .....	8
DIN Connector .....	9
Carrying Cases .....	9
Tripod Options .....	10
ETS-Lindgren Product Information Bulletin .....	11
<b>2.0 Maintenance</b> .....	<b>13</b>
Model Numbers .....	13
Service Procedures .....	14
Contacting ETS-Lindgren .....	14
Sending a Component for Service.....	14
Calibration Services and Annual Calibration .....	14
<b>3.0 Specifications</b> .....	<b>15</b>
Electrical Specifications .....	15
Physical Specifications .....	16
Model 3109.....	16
Model 3109 With Portable Elements .....	17
Model 3109 With Extended Portable Elements .....	18
<b>4.0 Assembly Instructions</b> .....	<b>19</b>
<b>5.0 Mounting Instructions</b> .....	<b>21</b>
Using Included Mounting Connectors.....	21
Additional Mounting Options .....	22
4-TR Mounting Options.....	22
7-TR and Mast Mounting Options.....	23
2x2 Boom Mounting Options .....	24
<b>6.0 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

## 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.



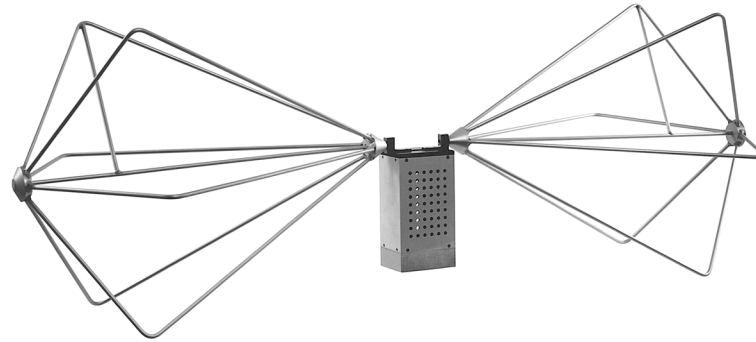
**Note:** See the ETS-Lindgren *Product Information Bulletin* for safety, regulatory, and other product marking information.

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 10. For the variety of mounting options available for the Model 3109, see *Mounting Instructions* on page 21.

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.

## Application

---

The Model 3109 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 high field strength with acceptable input power in this region of the band. The optional extended elements markedly improve performance in this region.

## Optional Items

---



**Note:** For part number and ordering information, see *Model Numbers* on page 13.

### 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.

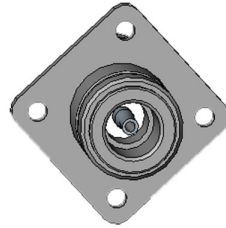
### EXTENDED PORTABLE ELEMENTS

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.

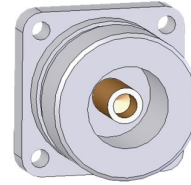


## DIN CONNECTOR

The standard connector for the Model 3109 is a Type N. As an alternative, the Model 3109 may be ordered with a 7/16 DIN connector.



*Type N Connector (Standard)*



*7/16 DIN Connector (Optional)*

## CARRYING CASES

Carrying cases for biconical antennas and portable elements are available. Contact ETS-Lindgren for ordering information.

## TRIPOD OPTIONS

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

- **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:

- 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

This page intentionally left blank.

## 2.0 Maintenance

---



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



**WARNING:** 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.

### Model Numbers

---



**Note:** 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 the different versions of the Model 3109 Biconical Antenna.

Part Description	Part Number
Model 3109	3109
Model 3109 with portable elements	3109P
Model 3109 with extended portable elements	3109PX
Model 3109 with 7/16 DIN connector	3109 7/16
Model 3109 with 7/16 DIN connector and portable elements	3109P 7/16
Model 3109 with 7/16 DIN connector and extended portable elements	3109PX 7/16

## Service Procedures

---

### CONTACTING ETS-LINDGREN



**Note:** Please see [www.ets-lindgren.com](http://www.ets-lindgren.com) for a list of ETS-Lindgren offices, including phone and email contact information.

### SENDING A COMPONENT FOR SERVICE

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

### CALIBRATION SERVICES AND ANNUAL CALIBRATION



**Note:** If you have the Model 3109 with portable elements or 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.

### 3.0 Specifications

---

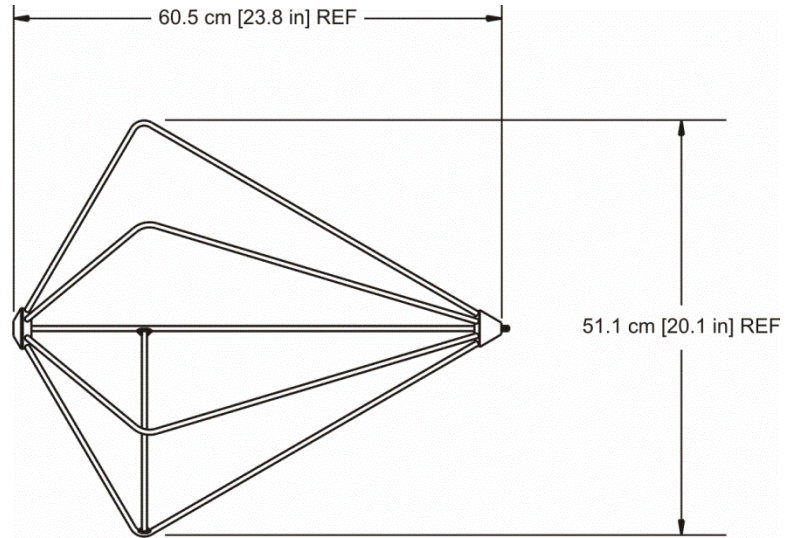
#### Electrical Specifications

---

<b>Frequency Range:</b>	20 MHz–300 MHz
<b>VSWR Ratio (Average):</b>	1.9:1
<b>Maximum Continuous Power:</b>	1 kW (N) 1.5 kW (7/16 DIN)
<b>Peak Power:</b>	2 kW
<b>Impedance (Nominal):</b>	50 $\Omega$
<b>Connector:</b>	<ul style="list-style-type: none"><li>• <b>Standard:</b> Type N female</li><li>• <b>Optional:</b> 7/16 DIN (must be specified at time of purchase)</li></ul>

## Physical Specifications

### MODEL 3109

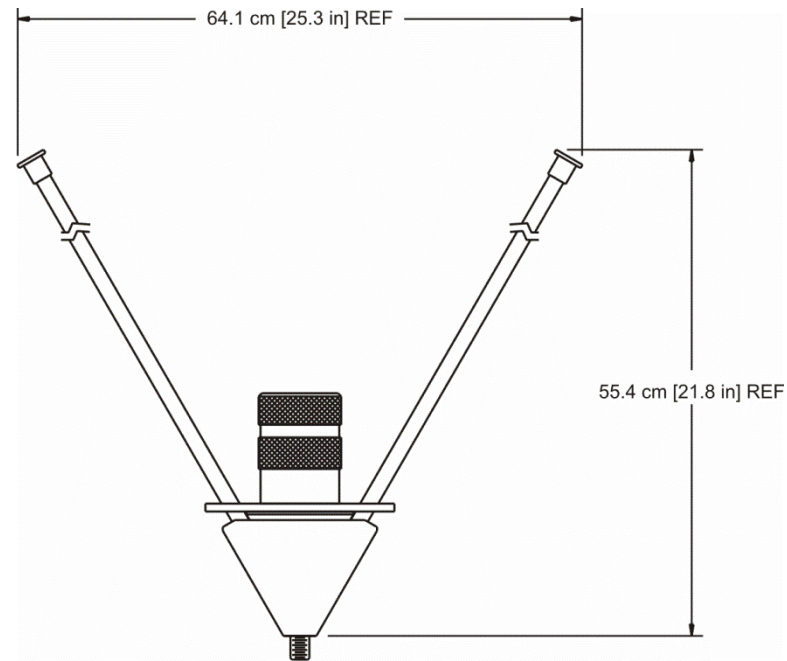


**Note:** One element is shown for illustrative purposes only; all specifications are based on the balun plus both elements.

<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)



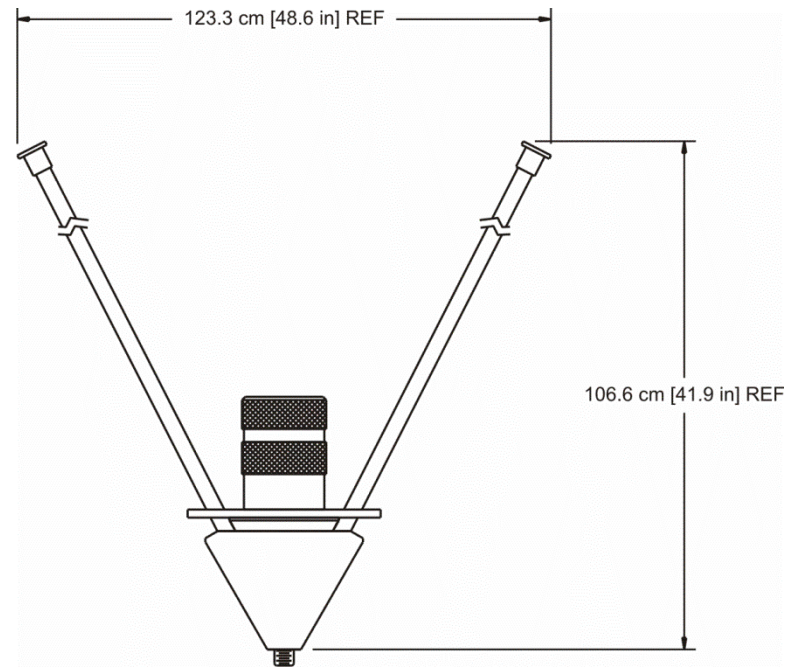
### MODEL 3109 WITH PORTABLE ELEMENTS



**Note:** 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 3109 WITH EXTENDED PORTABLE ELEMENTS



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

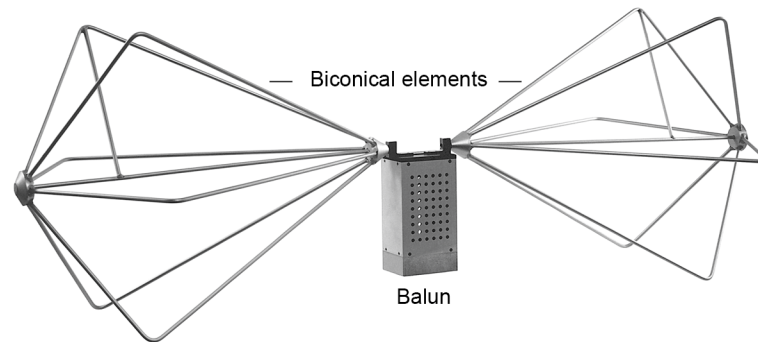
<b>Width (includes elements and balun):</b>	223.0 cm (87.8 in)
<b>Diameter:</b>	123.3 cm (48.6 in)
<b>Weight (includes elements and balun):</b>	3.1 kg (6.8 lb)

## 4.0 Assembly Instructions

---



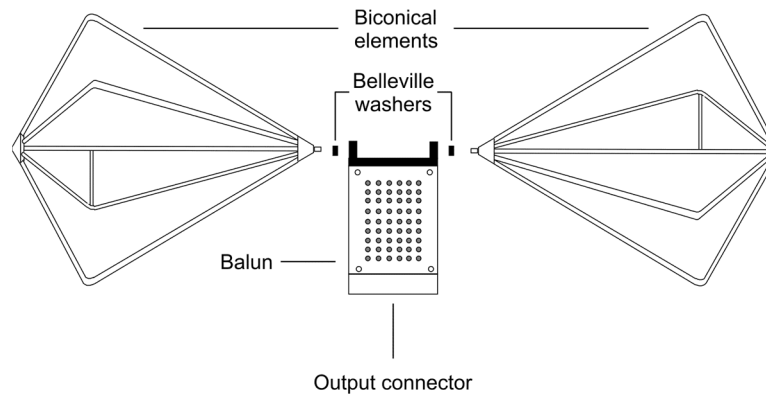
**CAUTION:** Before connecting any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.



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

---



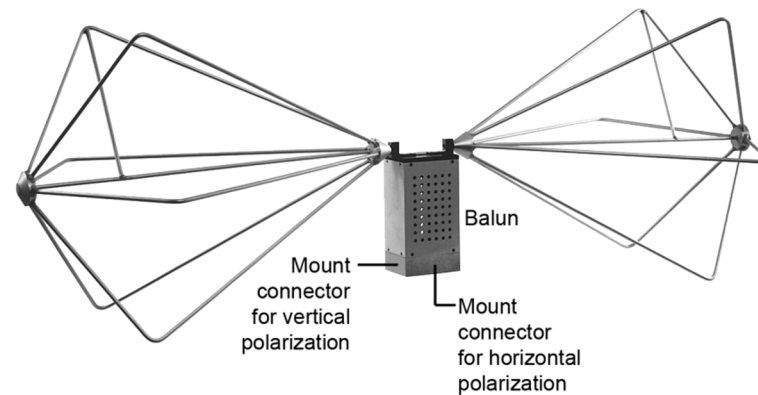
**CAUTION:** Before connecting any components, follow the safety information in the ETS-Lindgren *Product Information Bulletin* included with your shipment.



**Caution:** The Model 3109 is a precision measurement device. Handle with care.

### Using Included Mounting Connectors

---



The Model 3109 Biconical Antenna balun includes two 1/4–20 thread connectors for mounting; one each is located on two sides of the balun base. To mount the Model 3109 onto a tripod, insert a 1/4–20 thread mounting screw or knob from the tripod into the desired mounting connector.

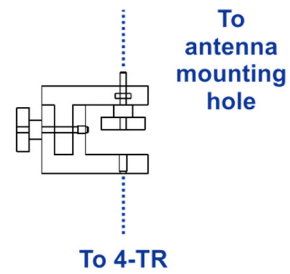
## Additional Mounting Options

---

### 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.

#### 102308 Swivel Antenna Mount



*Can mount directly to a 4-TR.  
Use of a 102308 Swivel Antenna Mount  
simplifies polarization, and is optional.*

## 7-TR AND MAST MOUNTING OPTIONS

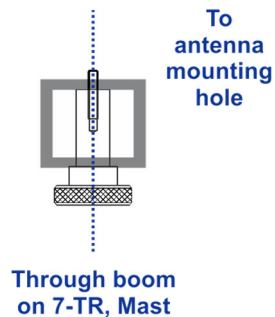
Following are options for mounting the Model 3109 onto an ETS-Lindgren 7-TR Tripod or mast. Contact the ETS-Lindgren Sales Department for information on ordering optional mounting hardware.



**Note:** *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
- *118947* – for stinger-type antennas only
- *108507 boom*—Centerline rotation boom for Model 3106 Series antennas only; when changing polarization, maintains centerline rotation

### 104169 Boom Antenna Mount Knob



## 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.

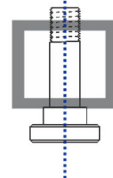


**Note:** 2x2 boom refers to a typical 2-inch by 2-inch boom.

### 106102 Universal Antenna Mount



### 104136 Boom Antenna Mount Knob



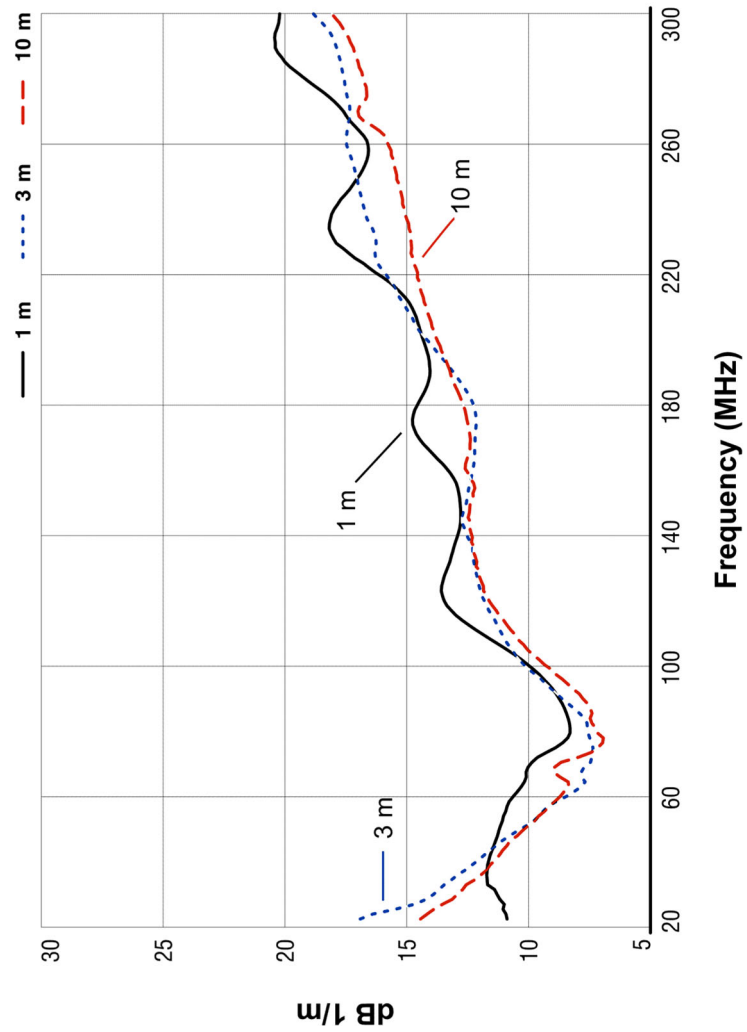
Through boom



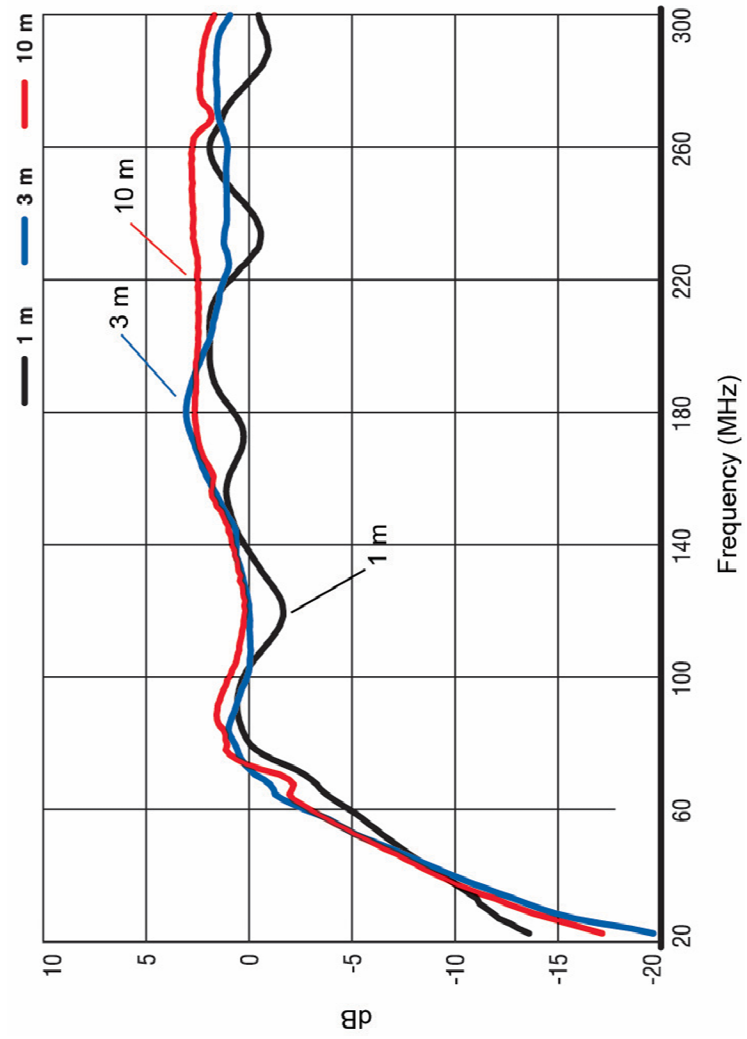
## 6.0 Typical Data

### Model 3109 Typical Data

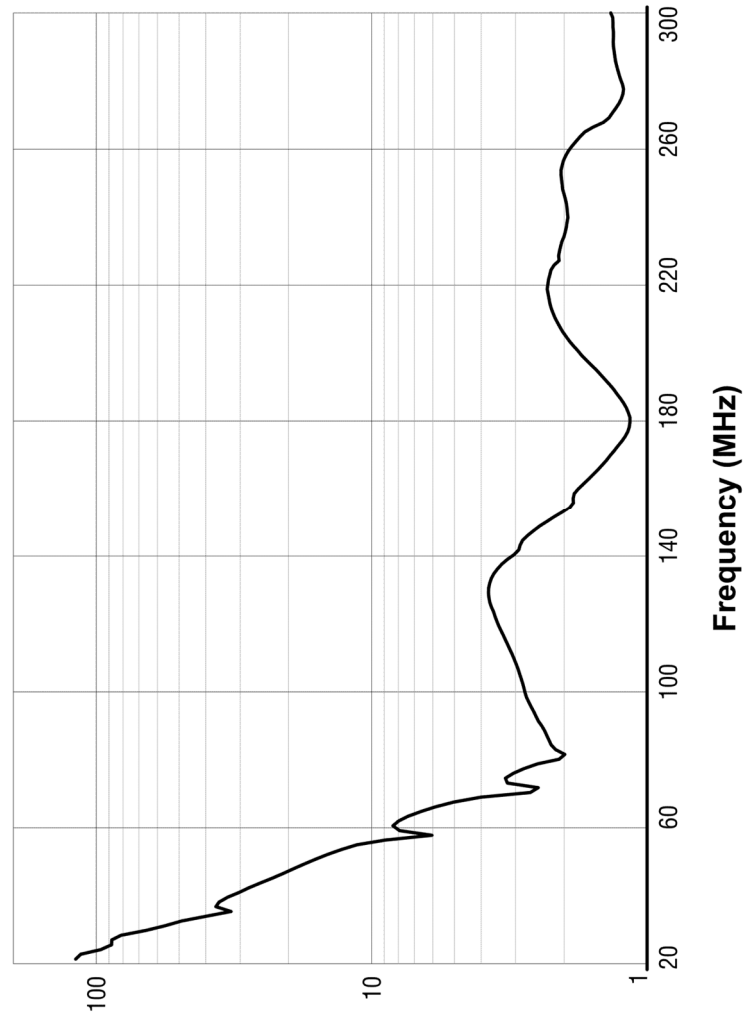
#### MODEL 3109 ANTENNA FACTOR



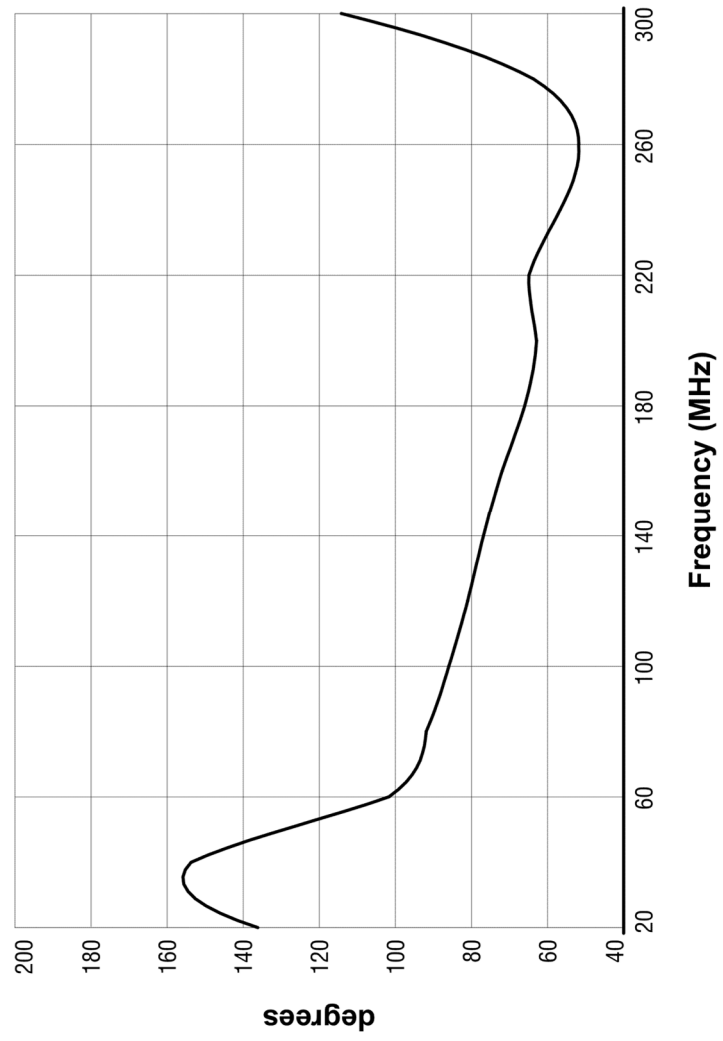
### MODEL 3109 GAIN



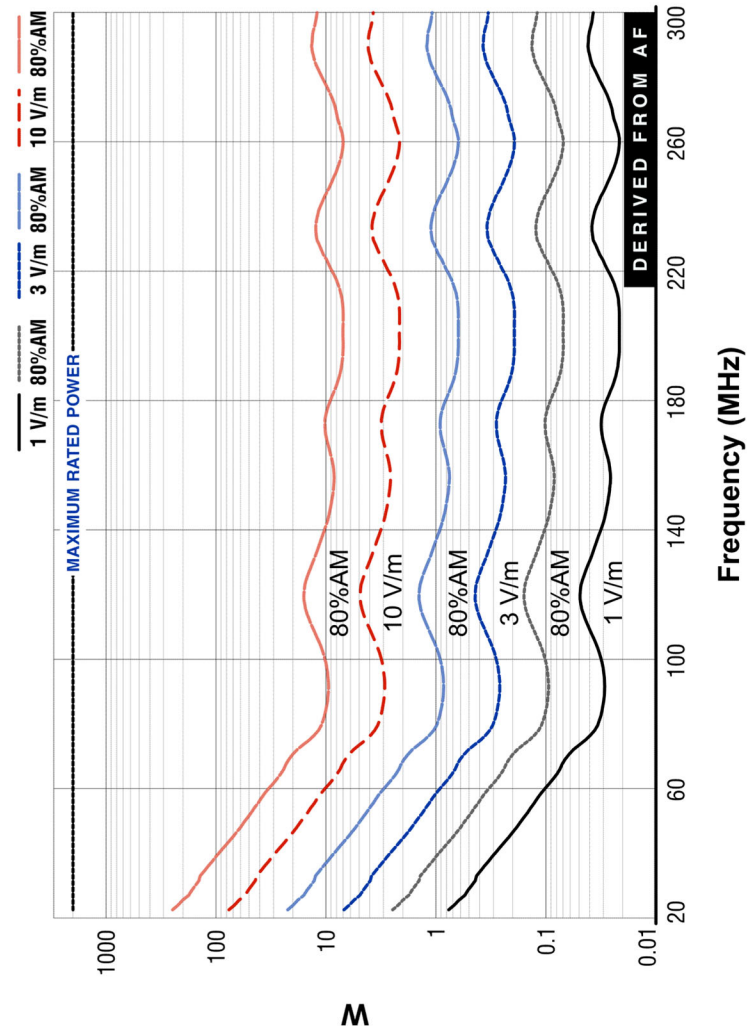
# MODEL 3109 VSWR



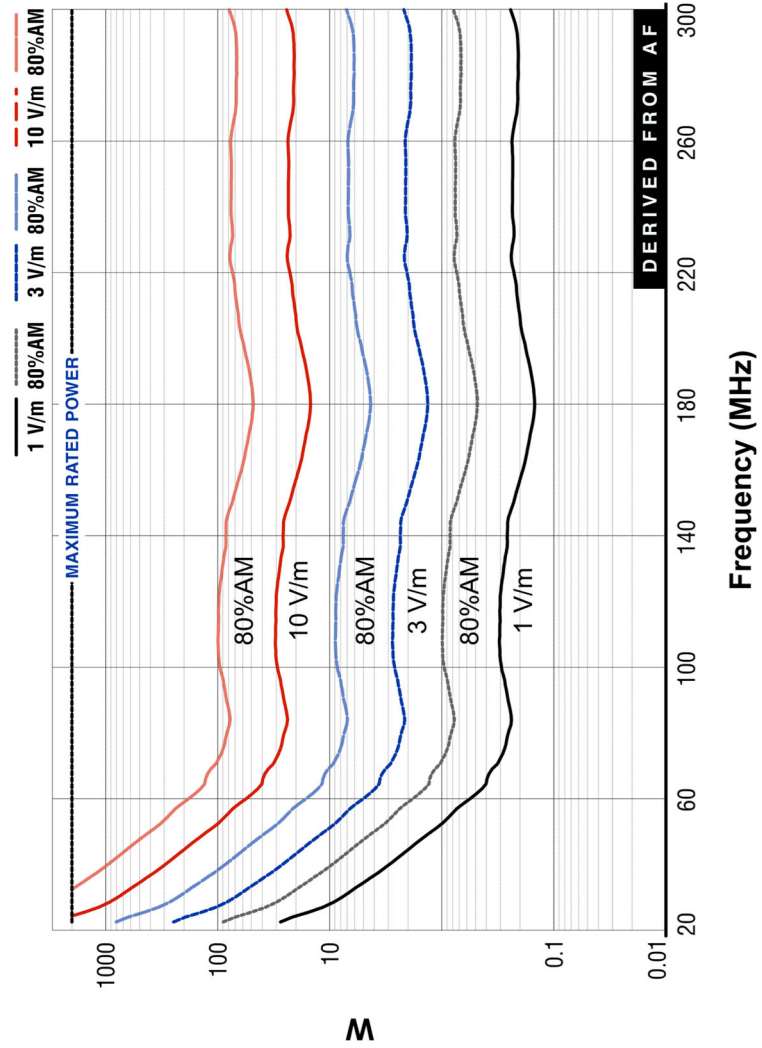
### MODEL 3109 HALF-POWER BEAMWIDTH



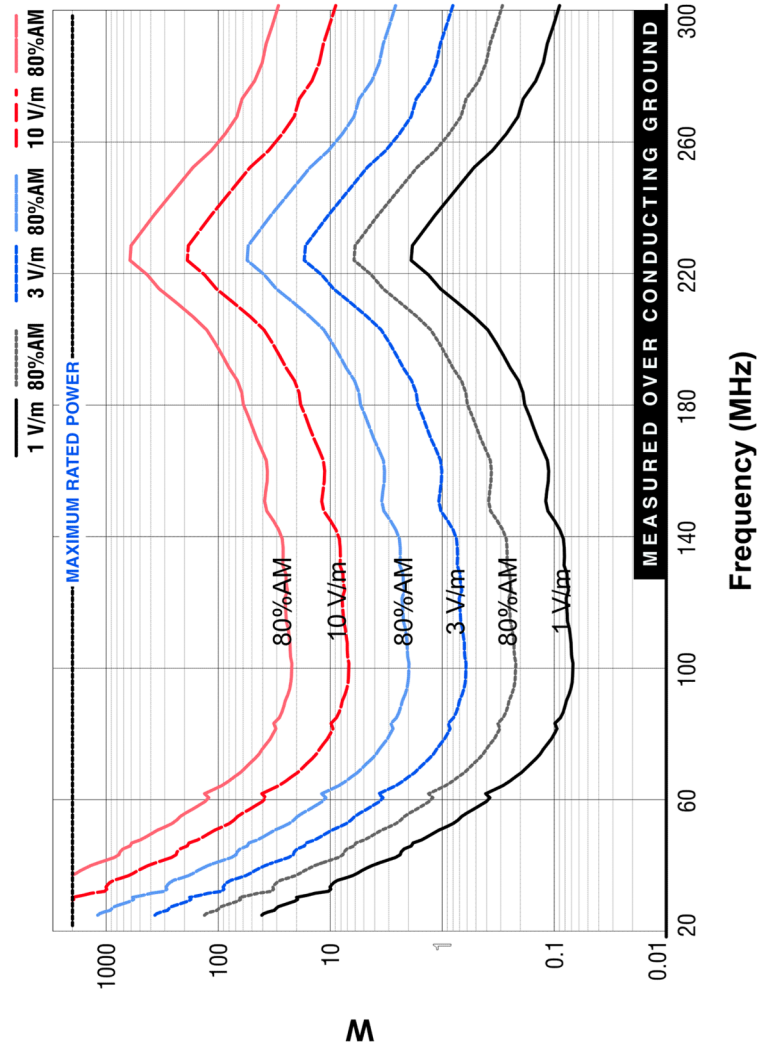
MODEL 3109 FORWARD POWER @ 1 M—DERIVED FROM AF



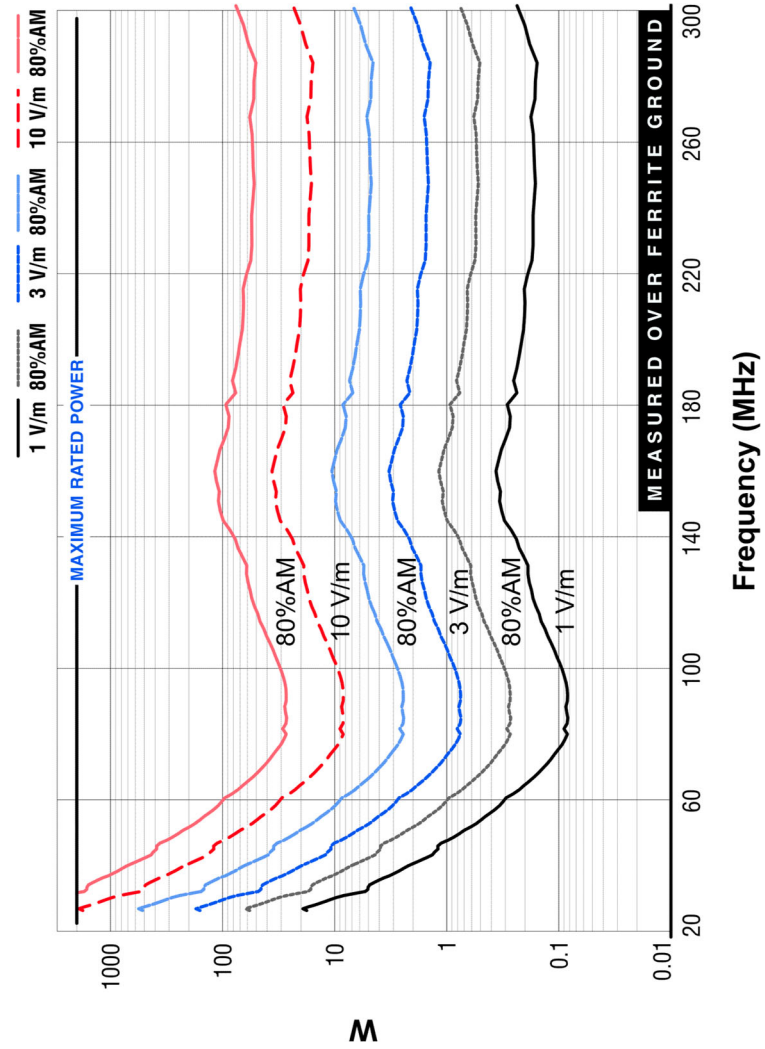
MODEL 3109 FORWARD POWER @ 3 M—DERIVED FROM AF



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



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

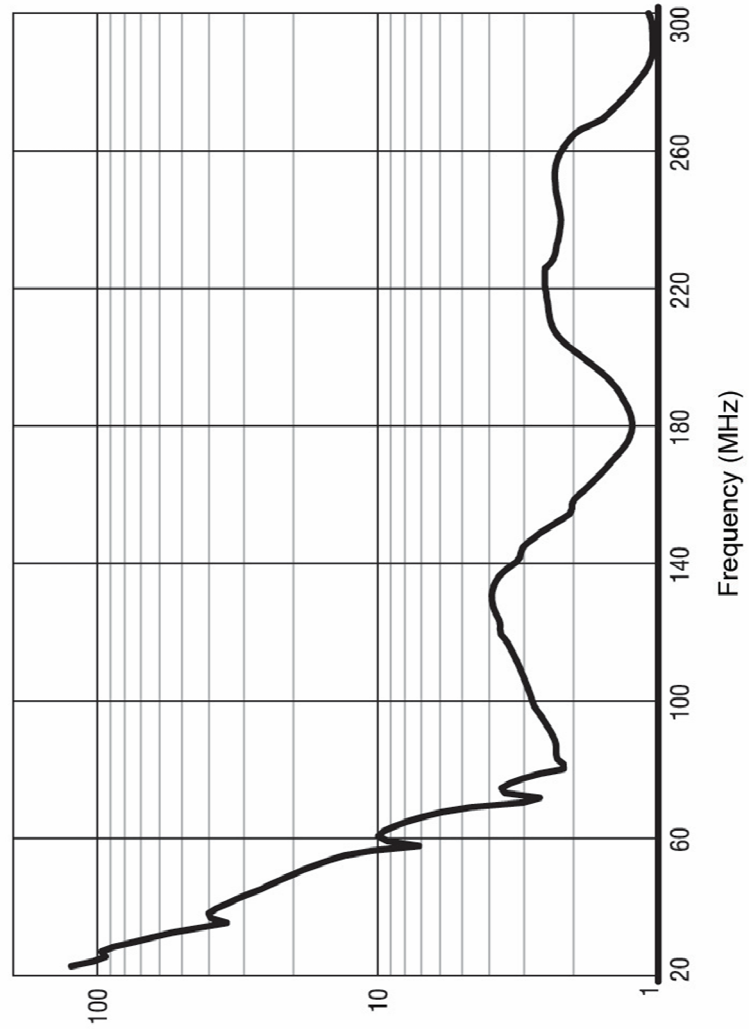




## Model 3109P Typical Data

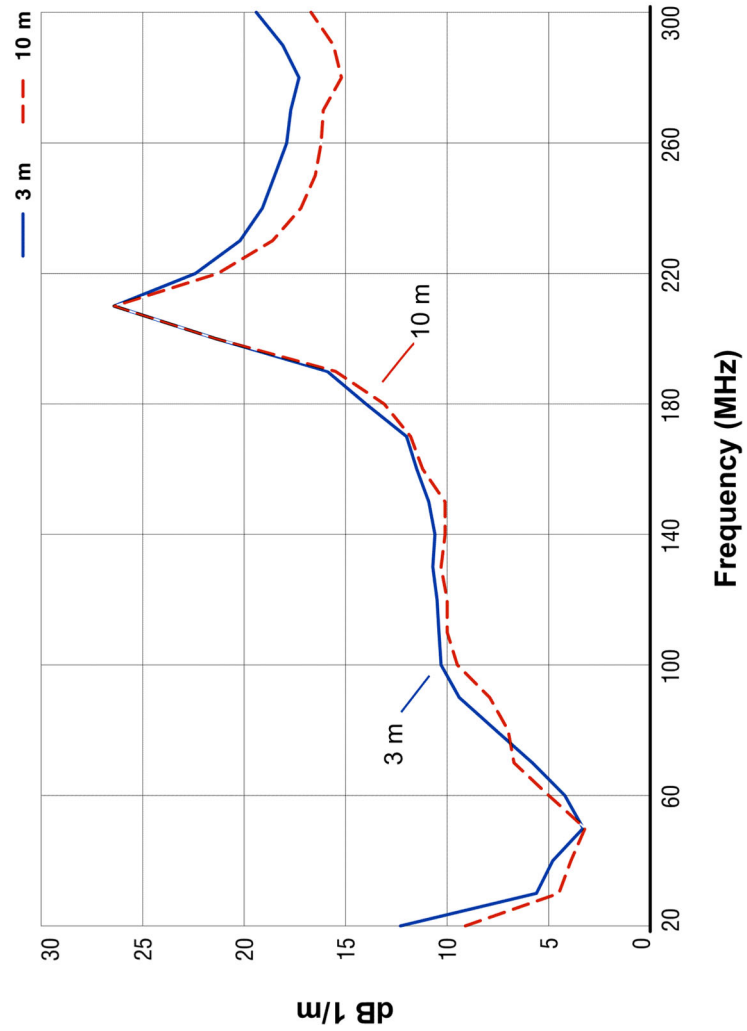
---

### MODEL 3109P VSWR

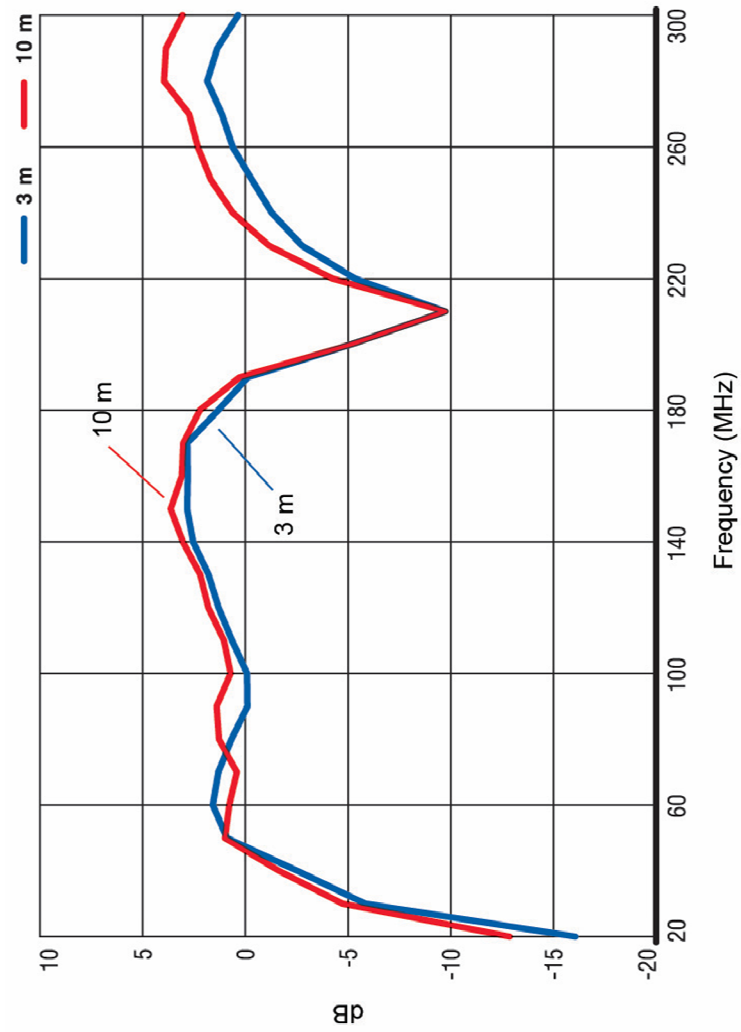


## Model 3109PX Typical Data

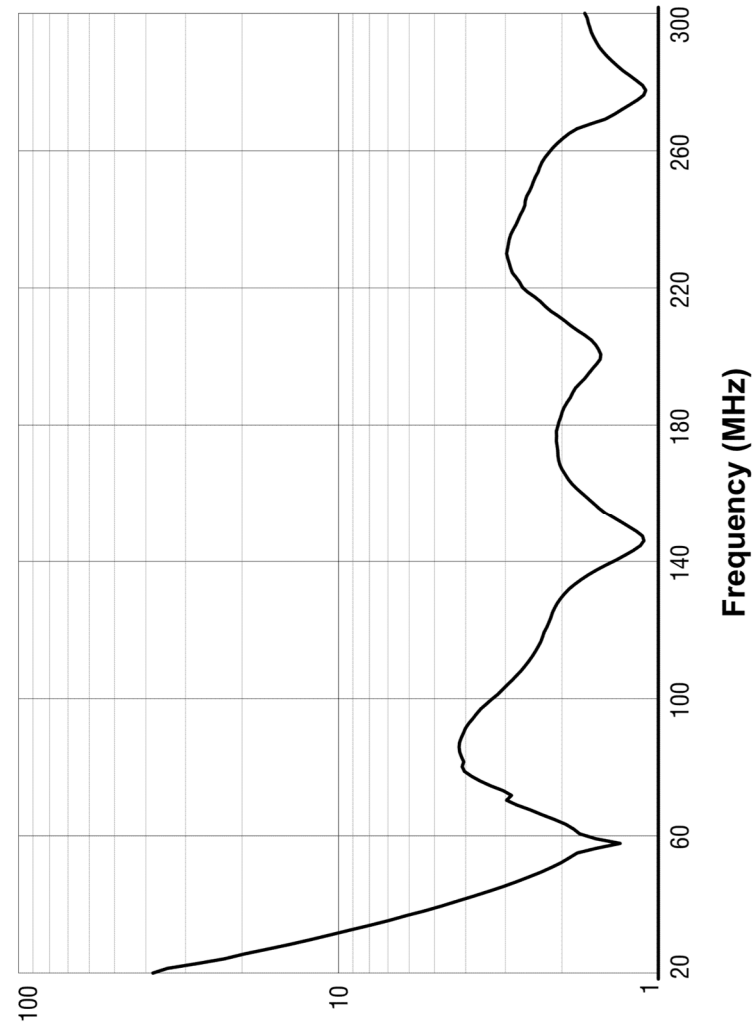
### MODEL 3109PX ANTENNA FACTOR



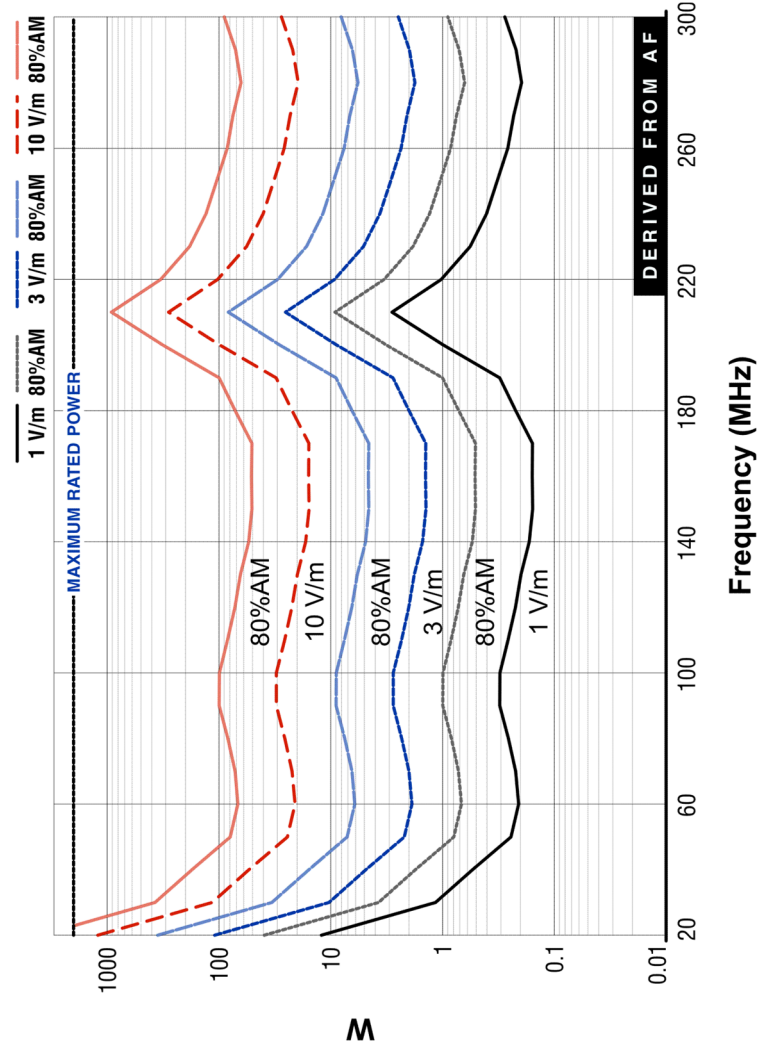
### MODEL 3109PX GAIN



### MODEL 3109PX VSWR



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



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

