

Model 3142D

BiConiLog™ Antenna

User Manual



 **ETS·LINDGREN™**
An ESCO Technologies Company

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Revision	Description	Date
A	Initial Release	November, 2000
B	Update to new format, add Model 3142 information	January, 2001
C	Edit/update	February, 2003
D	Edit/update	June, 2003
E	Update bowtie/antenna knob information	November, 2006
F	Updated content to Model 3142D; rebrand	December, 2008
G	Updated <i>Specifications</i> ; updated <i>Additional Mounting Options</i> illustrations	May, 2009
H	Added part numbers for optional end plate kit	October, 2009
I	Added Typical Gain With and Without End Plates to <i>Typical Data</i> ; updated <i>Using the Stinger to Mount to a Model 2175 MiniMast</i>	December, 2009


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Notes, Cautions, and Warnings

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

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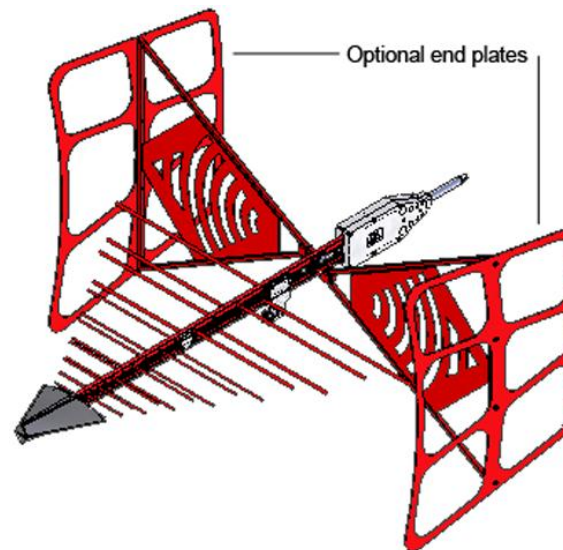
1.0 Introduction

The **ETS-Lindgren Model 3142D BiConiLog™ Antenna** is designed as a dual-purpose antenna that can be used for both immunity and emission testing. From 26 MHz to 60 MHz, the Model 3142D antenna with optional end plates exhibits an average 5.5 dB gain improvement. At some frequencies, a 10 dB gain improvement is achieved. Applications for the Model 3142D include emissions testing, immunity measurements, and medical equipment testing.

The Model 3142D includes a stinger mount; it also includes a mounting bracket and 1/4–20 thread knob to attach to an ETS-Lindgren tripod or tower adapter. For the variety of mounting options available for the Model 3142D, see *Mounting Instructions* on page 21.

Optional End Plates

Optional end plates are available to improve gain for immunity testing. This option consists of two end plates that are easily attached and detached by hand using captive screw knobs. When the end plates are attached it creates a T-shaped bow tie element.



For any dipole-type antenna to transmit or receive energy most efficiently, the length must be nearly a half-wavelength, which is about 4.6 meters long at 30 MHz, and 2.8 meters long at 50 MHz. Unfortunately, this is too unwieldy for many anechoic chambers and test sites. The optional end plates make it appear like an antenna twice as long as the 1.4 meter length. The result is approximately a 10 dB improvement in low frequency transmit gain and receive antenna factor compared to a same length regular bow tie.

With the end plates attached to the Model 3142D bow tie elements, the equivalent dipole electrical length is increased, which decreases resonant frequency and increases efficiency in the 20 MHz to 60 MHz range. Similarly, the regular bow tie has a lower resonant frequency than an equal length single wire dipole. The optional end plate has its first resonance at a frequency where its length is about 0.22λ , a regular bow tie at a length of 0.3λ , and a tuned dipole at about a length of 0.48λ . Thus, at 50 MHz the 1.4 meters-long end plate option behaves as if a 2.8 meter tuned dipole. Cross-polar radiation is minimized because current flow on one of the T end frames is almost completely cancelled by the opposite-phased current on the other T end.

Tripod Options

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



For easy horizontal and vertical polarization, the ETS-Lindgren Model 7-TR tripod is recommended.

- **Model 7-TR**—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.



- **Model 4-TR**—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.



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 3142D 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

Following are the part numbers for ordering replacement or optional parts for the Model 3142D BiConiLog™ Antenna.

Part Description	Part Number
Polarizing Mounting Adapter	100989
Thread Insert	105861B
Optional End Plate Kit (includes): <ul style="list-style-type: none">• 113031 End Plate (1)• 106364 Thumbscrew, M4x12 (4)	113032 (2 each required)



For additional/optional mounting hardware, see *Additional Mounting Options* on page 24.

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

	With Standard Bow Tie Elements / With Optional End Plates
Frequency Range:	26 MHz–6 GHz
Input Impedance (Nominal):	50 Ω
VSWR (Average):	2:1 above 50 MHz
Maximum Continuous Power:	1 kW
Peak Power:	1.3 kW
Pattern Type:	Directional
Polarization:	Linear
Connector:	Type N female

Physical Specifications

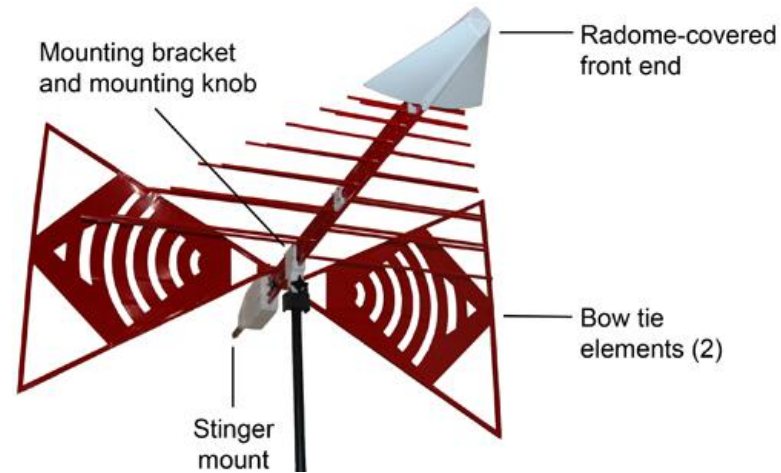
Height:	76.2 cm (30.0 in)
Length:	166.1 cm (65.39 in)
Width:	133.0 cm (52.72 in)
Weight (Without End Plates):	7.7 kg (17.0 lb)

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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 3142D BiConiLog™ Antenna consists of the following:

- Antenna
- Bow tie elements (2)
- 10–32 thumbscrew knobs to attach bow tie elements (2)
- Mounting bracket and mounting knob
- Protective end caps for bow tie elements (2)
- Screws to attach protective end caps to bow tie elements (8)

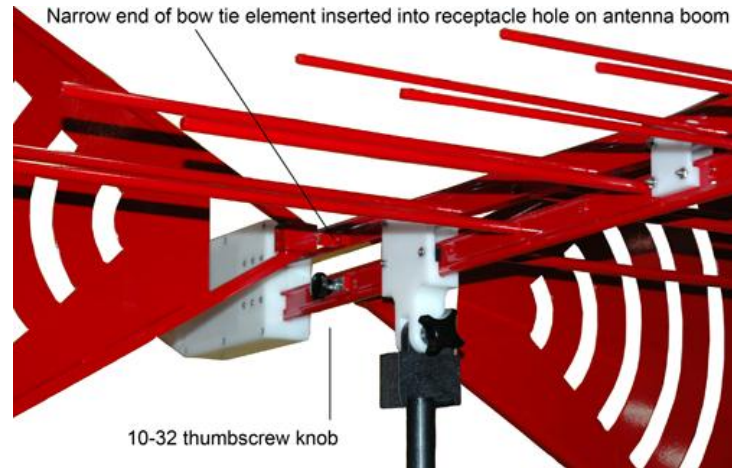
The optional end plate package consists of:

- End plates (2)
- Thumbscrew knobs to attach end plates to bow tie elements (8)

Attach Bow Tie Elements

The Model 3142D ships with the bow tie elements detached. To attach the bow tie elements:

1. For stability, mount the Model 3142D onto a tripod or tower. See *Mounting Instructions* on page 21 for the steps to mount the antenna.



2. Slide the narrow end of one of the bow tie elements into the receptacle hole on the antenna boom, and then align the bow tie with the receptacle on the boom.

CAUTION

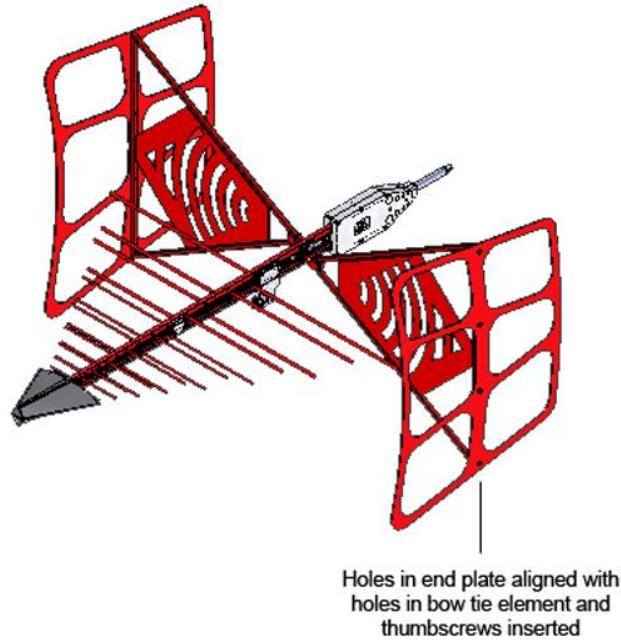
Do not cross thread this connection or permanent damage to the bow tie element could occur.

3. Insert one of the 10-32 thumbscrew knobs into the opposite side of the antenna boom from where you inserted the bow tie. Slowly tighten the knob, taking care not to cross thread the connection.
4. Repeat steps 2 and 3 for the second bow tie element.

Attach Optional End Plates

1. For protection, there is a black end cap on each of the bow tie elements. Use a Phillips screwdriver to carefully remove the four screws in each of the bow tie end caps. Remove the end caps.

The end caps should be reinstalled when you are done using the optional end plates, so store the end caps and the screws in a safe place.



CAUTION

Do not cross thread this connection or permanent damage to the bow tie element could occur.

2. Align the four holes on the wide end of the bow tie element with the four holes on the end plate. Insert each of the four thumbscrew knobs in the holes and slowly tighten, taking care not to cross thread the connection.
3. Repeat step 2 for the second end plate.

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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 3142D is a precision measurement device. Handle with care.

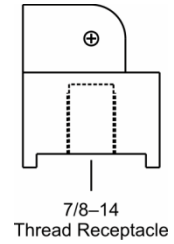
Contact with any metal or non-metallic structure can capacitively load the antenna, which may cause unrepeatable results. Therefore, make sure that no part of the dipole elements or bow ties is in contact with the tripod or tower, particularly in vertically-polarized tests. Where possible, run the feed cable straight one meter or more back from the Model 3142D BiConiLog™ Antenna before dropping vertically.

Both horizontal and vertical polarization is easily accomplished when the Model 3142D with the optional end plates is mounted onto a tower, but vertical polarization on a tripod requires special consideration. Because immunity power requirements are many dB lower for vertical polarization, the optional end plates can be removed when mounting vertically on a standard tripod. A special tripod is available from ETS-Lindgren for vertical polarization with optional end plates intact. Please contact ETS-Lindgren for the recommended mounting scheme.

Using Included Mounting Adapters

The Model 3142D ships with these mounting adapters:

- **100989 Polarizing Mounting Adapter with 7/8–14 thread receptacle**



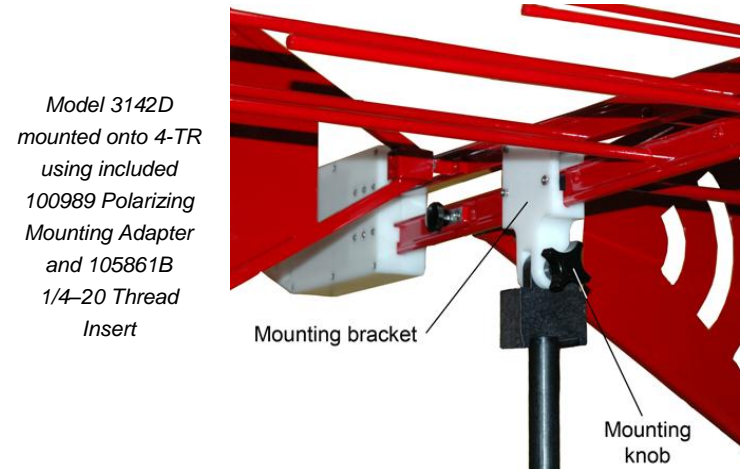
If you need to convert the polarizing adapter to a 1/4–20 receptacle, insert the 1/4–20 thread insert into the polarizing adapter



- **105861B 1/4–20 Thread Insert**



To attach the included adapters to the Model 3142D:



1. If required, insert the 1/4-20 thread insert into the polarizing adapter.
2. Remove the mounting knob from the mounting bracket on the antenna.
3. Slide the mounting bracket onto the polarizing adapter with the polarizing adapter placed between the shoulders of the mounting bracket.
4. Thread the mounting knob through the mounting bracket, then through the polarizing adapter, and finally through the hex nut.
5. Tighten the mounting knob to secure the antenna.



Do not cross thread or permanent damage to the adapter and thread insert could occur.

6. Attach the polarizing adapter and antenna to tripod or tower, as required.

Using the Stinger to Mount to a Model 2175 MiniMast



Do not use the stinger to mount the Model 3142D onto a 4-TR tripod.

The stinger mount provides on-axis rotation during 90° horizontal or vertical polarization. The stinger enables you to mount the antenna directly to an ETS-Lindgren 7-TR Tripod or mast.



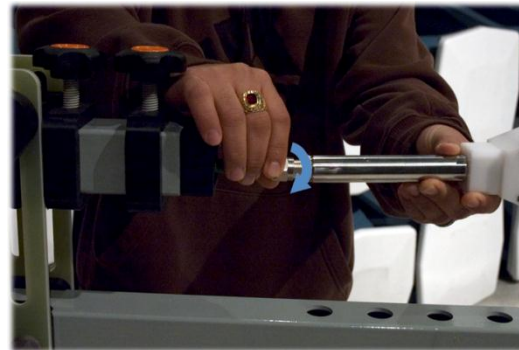
Before you begin:

- Install the center rotate boom (part# 108197) for rear-mount stinger-type antennas onto the 7-TR.
- Attach the included mounting adapter to the Model 3142D as instructed in *Using Included Mounting Adapters* on page 22.
- You will need one of the optional mounting knobs described in *7-TR and Mast Mounting Options* on page 30. To order optional mounting hardware, contact the ETS-Lindgren Sales Department

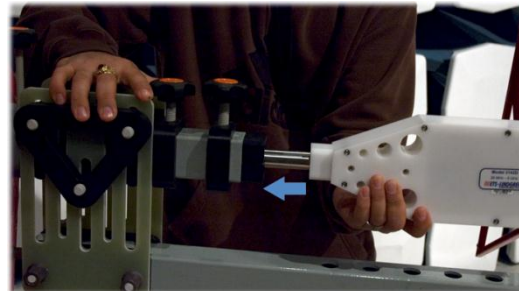
1. Thread the antenna feed or receiving cable through the center of the boom so that the antenna connector emerges a few inches out of the clamp end of the boom.



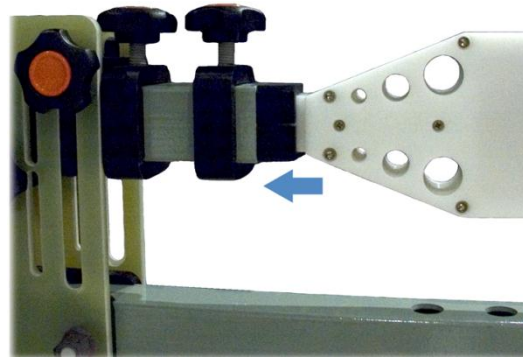
2. Attach the cable to the Type N connector at the end of the stinger.



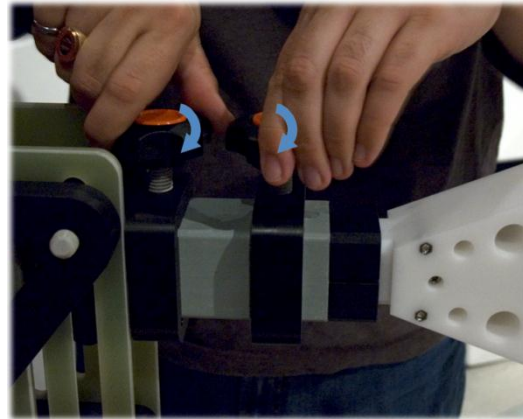
3. Slide the cable and stinger into the clamp on the boom, carefully guiding the cable out the other end.



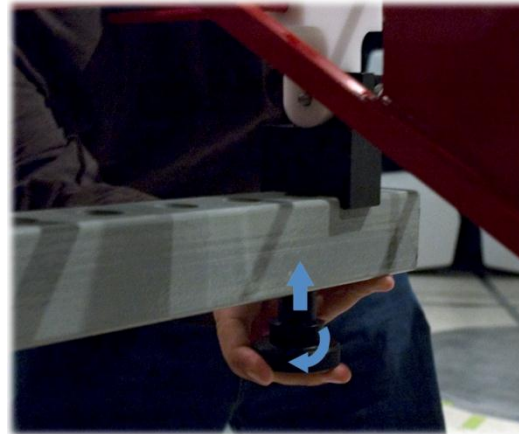
4. When you reach the back of the balun box, align it with the boom receptacle, and then slide the smaller portion of the balun box into the boom. This will prevent rotation of the antenna unless the boom is being polarized.

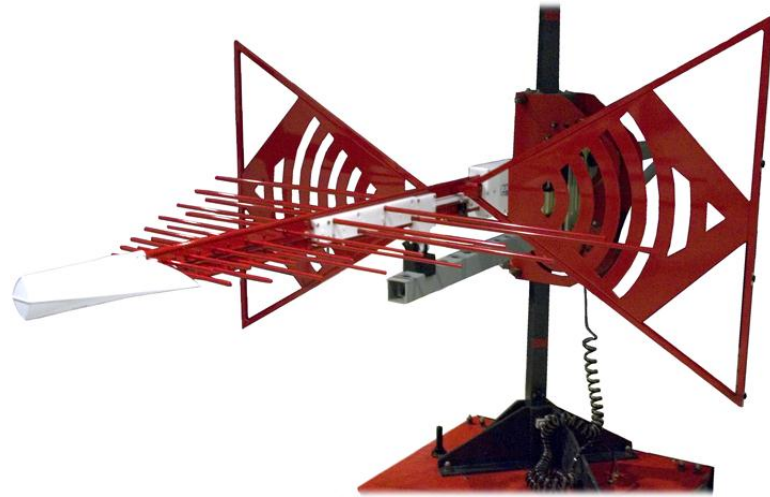


5. Tighten the clamp knobs on the boom to secure the antenna into place.



6. Secure the antenna by inserting the antenna mount knob through the boom and into the mounting adapter.





Model 3142D mounted horizontally on Model 2175

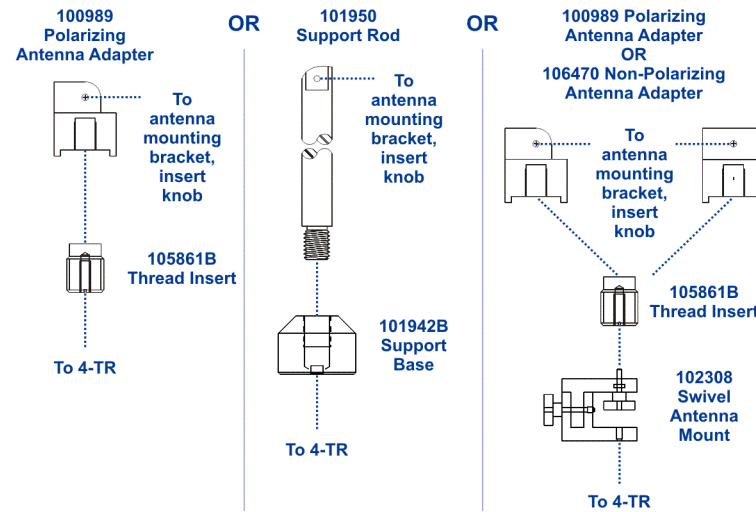


Model 3142D rotated vertically on Model 2175

Additional Mounting Options

4-TR MOUNTING OPTIONS

Following are additional options for mounting the Model 3142D onto an ETS-Lindgren 4-TR tripod. Contact the ETS-Lindgren Sales Department for information on ordering optional mounting hardware.

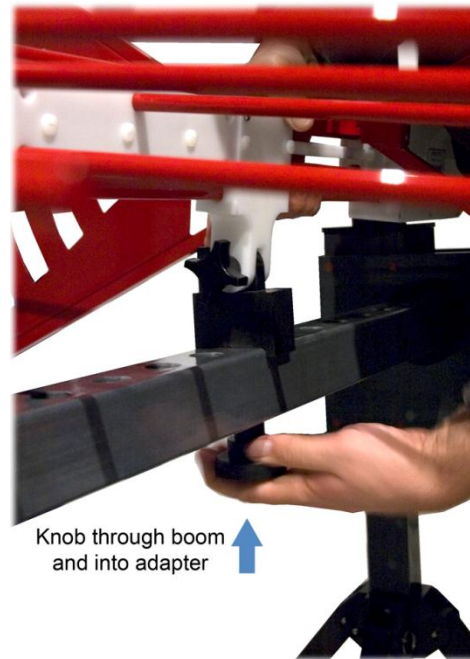


7-TR AND MAST MOUNTING OPTIONS

The stinger on the Model 3142D enables you to mount to antenna directly to an ETS-Lindgren 7-TR Tripod Positioner.

However, following are additional options for mounting the Model 3142D onto an ETS-Lindgren 7-TR Tripod Positioner.

Contact the ETS-Lindgren Sales Department for information on ordering optional mounting hardware.



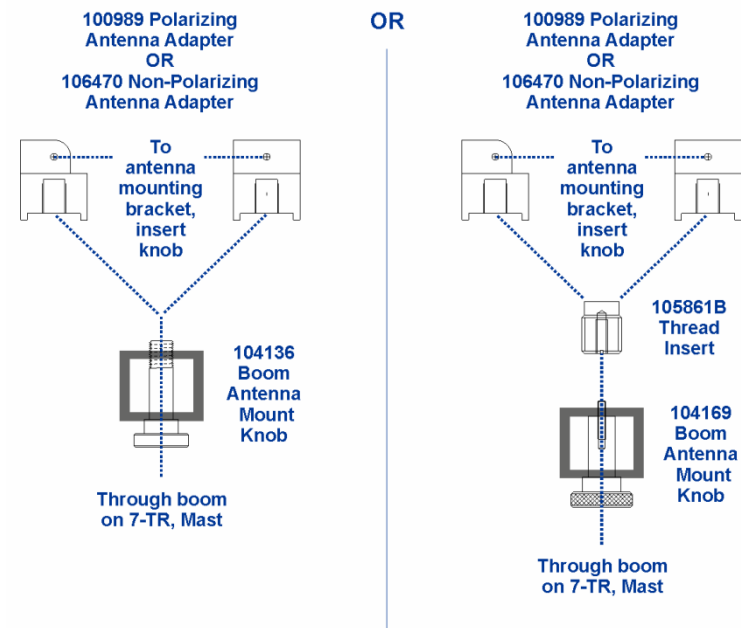
Non-stinger method to mount Model 3142D to 7-TR



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





*Model 3142D mounted horizontally
on 7-TR*



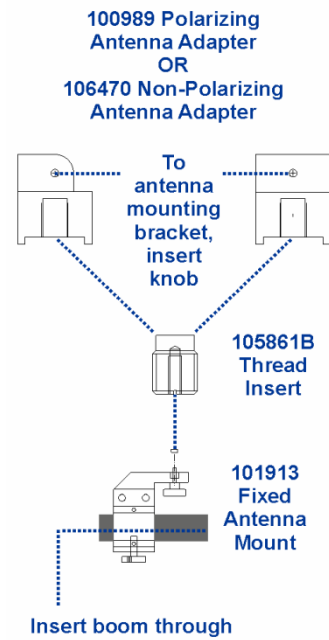
*Model 3142D mounted vertically
on 7-TR*

2x2 BOOM MOUNTING OPTIONS

Following are additional options for mounting the Model 3142D 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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6.0 Application

Without Optional End Plates

For emissions measurements, electric field strength in $db[V/m]$ is obtained from:

$$E(\text{dBV/m}) = V(\text{dBV}) + AF(\text{dB1/m}) + \alpha(\text{dB})$$

V = the receiver or spectrum analyzer voltage reading

AF = antenna factor

α = cable loss in dB, if cable losses are non-negligible

For immunity testing, the electric field strength generated at a distance d can be approximated by:

$$E(\text{V / m}) = \frac{\sqrt{30Pg}}{d}$$

d = distance, in meters

g = numeric gain ($10^{G[\text{dB}]/10}$)

P = antenna net input power, in watts

An estimate of the power required for any field strength E can be obtained from the forward power graphs in *Typical Data* beginning on page 39, which shows power required in watts to generate 1 V/m. For any other field strength not shown, multiply the power in watts by the desired E-field squared, or:

$$P(E \text{ V/m}) = E^2 P(1 \text{ V/m})$$

Actual transmitted field strength should be verified using an ETS-Lindgren electric field probe, or equivalent.

An estimate of the power required, taking VSWR into account, is obtained from:

$$P_f = P_n / \{1 - [(VSWR-1)/(VSWR+1)]^2\}$$

P_f = forward (amplifier output) power

P_n = new power, as discussed

For IEC/EN 31000-4-3 type testing, the antenna tip can be placed at any distance between one and three meters from the EUT as long as the front face plane is illuminated according to the -0, +6 dB uniform field specifications.

It is usually necessary to place RF absorbing material between the EUT and antenna to suppress ground plane reflection to ensure the field uniformly, or to conduct the immunity test in a fully-lined anechoic room. In general, closer distances require less power to create a given field strength.

With Optional End Plates

For emissions testing it is recommended that the Model 3142D BiConiLog™ Antenna be used without the optional end plates. The coupling of the endplates to ground will create higher uncertainty values, particularly in the vertical polarization.

For immunity testing, the electric field strength generated at a distance *d* can be approximated by:

$$E(\text{V / m}) = \frac{\sqrt{30Pg}}{d}$$

d = distance, in meters

g = numeric gain ($10^{G[\text{dB}]/10}$)

P = antenna net input power, in watts

Actual transmitted field strength should be verified using an ETS-Lindgren electric field probe, or equivalent.

An estimate of the power required, taking VSWR into account, is obtained from:

$$P_f = P_n / \{1 - [(VSWR-1)/(VSWR+1)]^2\}$$

P_f = forward (amplifier output) power

P_n = new power, as discussed

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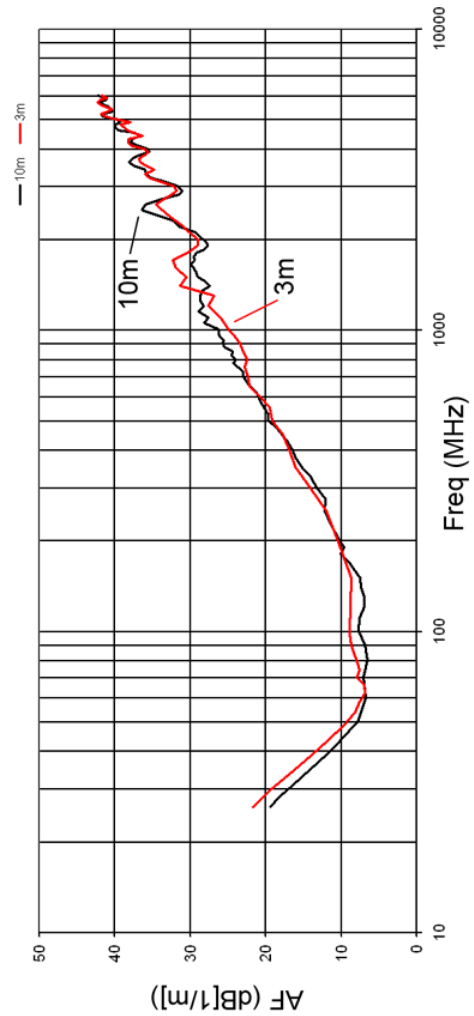
It is usually necessary to place RF absorbing material between the EUT and antenna to suppress ground plane reflection to ensure the field uniformly, or to conduct the immunity test in a fully-lined anechoic room. In general, closer distances require less power to create a given field strength.

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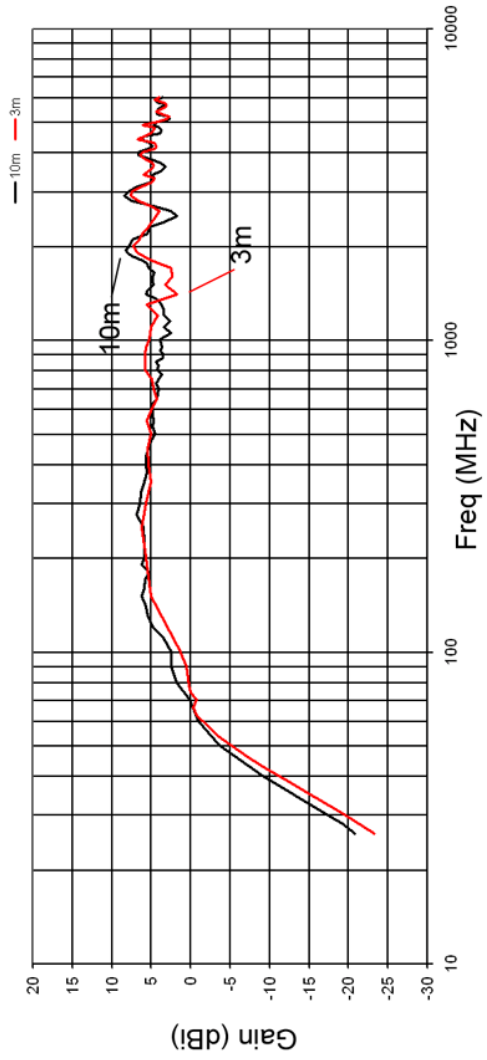
7.0 Typical Data

Typical Antenna Factor

Distance for the ANSI 3-meter and 10-meter calibrations is measured from the antenna midpoint, and for SAE 1-meter calibrations the distance is measured from the antenna tip. Midpoint is defined as half the distance between the small elements and the bow ties, which is about 45 cm from the small end tip.



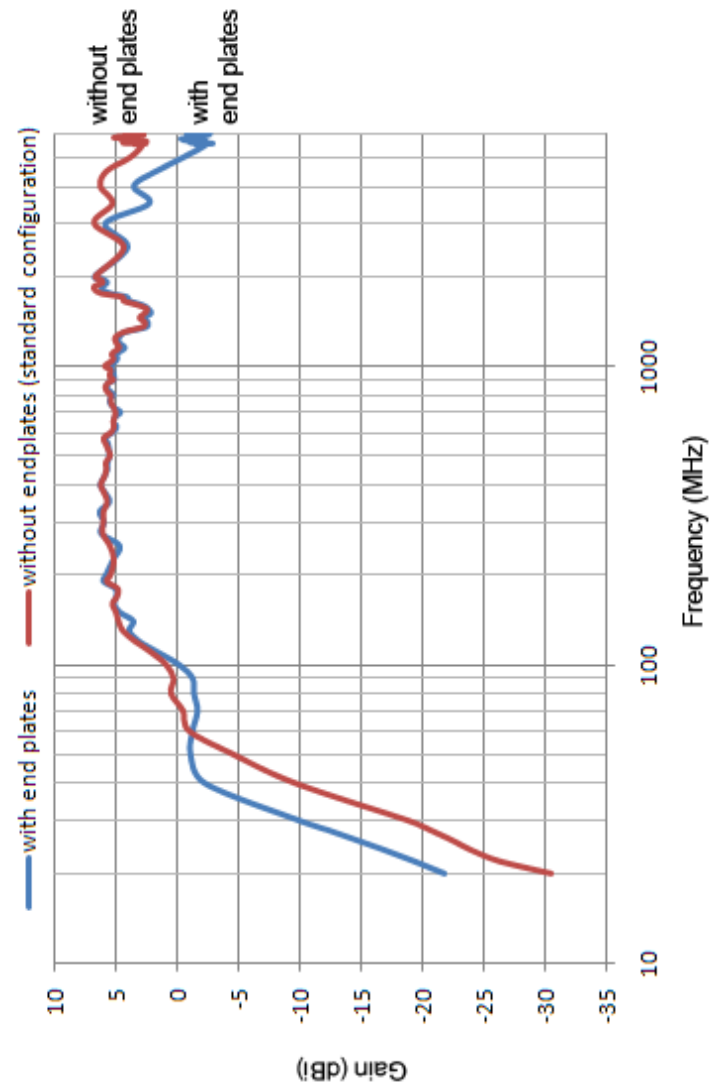
Typical Gain



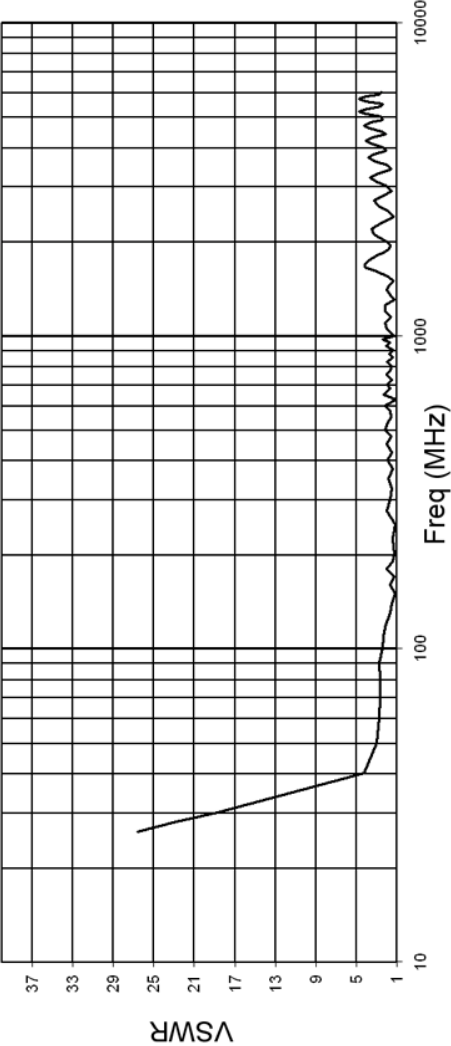
Typical Gain With and Without End Plates



For frequencies above 60 MHz, use the Model 3142D BiConiLog™ Antenna without the end plates; additional gain is provided only when using end plates for frequencies below 60 MHz.



Typical VSWR



Appendix A: Warranty



See the *Product Information Bulletin* included with your shipment for the complete ETS-Lindgren warranty for your Model 3142D BiConiLog™ Antenna.

DURATION OF WARRANTIES FOR MODEL 3142D

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 3142D BiConiLog Antenna	2 Years