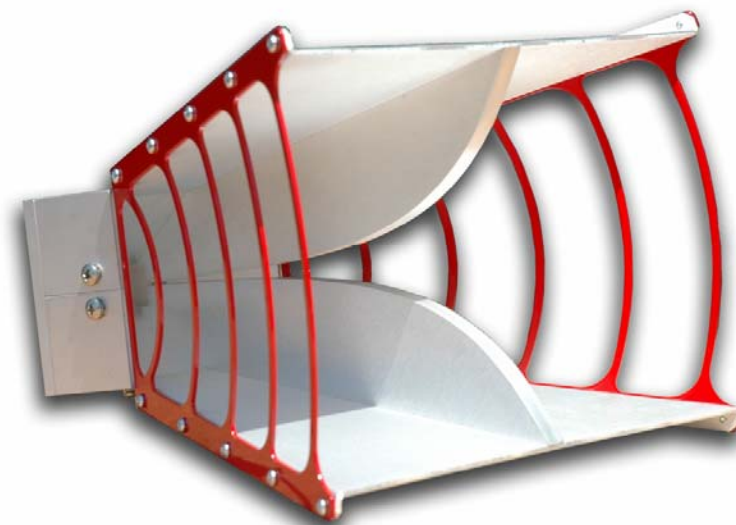


*Double-Ridged Waveguide Horn*  
**Model 3115**  
User Manual



## Model 3115 Double-Ridged Waveguide Horn

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### Model 3115 Double-Ridged Waveguide Horn, Part #399039, User Manual

Revision	Description	Date
A	Initial Release	
B		
C		
D		March, 2002
E	Revised covered frequency range and updated performance graphs.	July, 2006

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## **Table of Contents**

1. Introduction .....	1
2. Getting Started.....	3
2.1. Unpacking and Acceptance .....	3
2.2. Packing List.....	3
3. Specifications.....	5
3.1. Standard Configuration .....	5
3.2. Electrical Specifications .....	5
3.3. Physical Specifications .....	6
4. Mounting Instructions.....	7
5. Applications.....	9
5.1. Typical Data .....	10
5.2. Forward Power Calculations .....	14
6. Maintenance .....	15
7. Warranty .....	17

## **Tables**

Table 1. Model 3115 Packing List .....	3
Table 2. Model 3115 Electrical Specifications.....	5
Table 3. Model 3115 Physical Specifications.....	6
Table 4. Suitable Applications.....	9


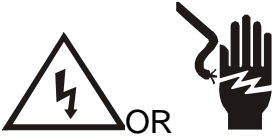

## **Figures**




Figure 1. Model 3115 Double-Ridged Waveguide Horn Antenna .....	1
Figure 2. Model 3115 Mounting Diagram.....	7
Figure 3. Model 3115 Typical Antenna Factor .....	10
Figure 4. Model 3115 Typical Antenna Gain.....	11
Figure 5. Model 3115 Typical Half Power Beamwidth.....	12
Figure 6. Model 3115 Typical VSWR .....	13

## **Model 3115 Double-Ridged Waveguide Horn**

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## Model 3115 Double-Ridged Waveguide Horn

<b>SAFETY SYMBOL DEFINITIONS</b>	
<b>NOTICE:</b> This product and related documentation must be reviewed for familiarization with safety markings and instructions prior to operation of the product.	
	<b>REFER TO MANUAL</b> —When the product is marked with this symbol refer to the instruction manual for additional information. If the instruction manual has been misplaced, go to <a href="http://www.ets-lindgren.com">www.ets-lindgren.com</a> for downloadable files or contact ETS-Lindgren customer service.
	<b>HIGH VOLTAGE</b> —Indicates the presence of hazardous voltage. Unsafe practice could result in several personal injury or death.
	<b>PROTECTIVE EARTH GROUND (SAFETY GROUND)</b> —Indicates protective earth terminal. Uninterruptible safety earth ground from the main power source to the product input wiring terminals, power cord or supplied power cord set shall be provided.
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">CAUTION</div>	<b>CAUTION</b> —Denotes a hazard. Failure to follow instructions could result in minor personal injury and/or property damage. Text that follows the symbol will provide proper procedures.
<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">WARNING</div>	<b>WARNING</b> —Denotes a hazard. Failure to follow instruction could result in SEVERE personal injury and/or property damage. Text that follows the symbol will provide proper procedures.

<b>GENERAL SAFETY CONSIDERATIONS</b>	
	<p><b>BEFORE POWER IS APPLIED TO THIS INSTRUMENT, GROUND IT PROPERLY</b> through the protective conductor of the AC power cable to a power source provided with protective earth contact. Any interruption of the protective (grounding) conductor, inside or outside of the instrument, or disconnection of the protective earth terminal could result in personal injury.</p>
	<p><b>BEFORE SERVICING: CONTACT ETS-LINDGREN—</b>servicing or modifying the unit without ETS-Lindgren authorization may void your warranty. If an attempt to service the unit must be made, disconnect all electrical power prior to beginning. Voltages exist at many points within the instrument that could, if contacted, cause personal injury. Only trained service personnel should perform adjustments and/or service procedures upon this instrument. <i>Capacitors inside this instrument may still be CHARGED even when the instrument is disconnected from the power source.</i></p>
	<p><b>ONLY QUALIFIED PERSONNEL</b> should operate or service this equipment.</p>

## 1. Introduction

---

The ETS-Lindgren Model 3115 Double Ridged Waveguide Antenna is a linearly polarized broadband antenna covering the frequency range of 750 MHz to 18GHz. The Model 3115 is designed specifically for EMI measurements and specifications compliance testing. However, it may also be utilized for antenna gain, pattern measurement, surveillance and other applications.

The Model 3115 is ideally suited for IEC 61000-4-3 and MIL-STD 461E immunity tests as well as ANSI C634 and EM 55033 emissions testing.



*Figure 1. Model 3115 Double-Ridged Waveguide Horn Antenna*

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## 2. Getting Started

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### 2.1. Unpacking and Acceptance

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**Step 1.** Upon delivery of your order, inspect the shipping container(s) for evidence of damage. Record any damage on the delivery receipt before signing. In the case of concealed damage or loss, retain the packing materials for inspection by the carrier.

**Step 2.** Remove the antenna from its shipping container. Save the boxes and any protective packing materials for future use.

**Step 3.** Check all material against the packing list to verify that the equipment received matches what was ordered. If you find any discrepancies, note them and call ETS-Lindgren Customer Service for further instructions.

Ensure that you are satisfied with the contents of your order and the condition of your equipment prior to placing the antenna into service.

### 2.2. Packing List

---

The Model 3115 shipping container includes:

Part Number	Quantity	Item
3115	One (1)	Double-Ridged Waveguide Horn
101501	One (1)	Mounting Bracket (including ¼-20 threads to accept tripod mount)
399039	One (1)	Manual
N/A	One (1)	Calibration Certificate

*Table 1. Model 3115 Packing List*

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### 3. Specifications

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#### 3.1. Standard Configuration

---

The Model 3115 is a dual-ridged horn antenna. The ridges act as a transmission line whose impedance changes from 50ohms at the feed point to nearly free space wave impedance at the aperture or launching point. The Model 3115 has a very broadband of more than 18 to 1 which makes it ideal for EMC use to cover wide bands without the need to stop the test and change antennas.

The antenna is precision machined from aluminum. The 50 V precision high frequency type N connector is mounted on the base block of the antenna. A bracket is provided for standard tripod mounting in multiple polarization positions.

#### 3.2. Electrical Specifications

---

<b>Frequency Range</b>	750 MHz to 18 GHz
<b>VSWR Ratio (AVG)</b>	<1.5:1
<b>Maximum Continuous Power</b>	300 Watts
<b>Peak Power</b>	500 Watts
<b>Impedance</b>	50 $\Omega$
<b>Connector</b>	Type N precision, female
<b>Front to Back Ratio</b>	20 dB
<b>Cross Polarization</b>	20 dB minimum

*Table 2. Model 3115 Electrical Specifications*

### 3.3. Physical Specifications

---

<b>Width</b>	9.6 in. (24.4 cm)
<b>Depth</b>	11.0 in. (27.9 cm)
<b>Height</b>	6.2 in. (15.9 cm)
<b>Weight</b>	4.0 lb. (1.87 kg)

*Table 3. Model 3115 Physical Specifications*

## 4. Mounting Instructions

---

The following instructions allow the user to mount the Model 3115 on an ETS-Lindgren or compatible tripod.

**Step 1.** For packing purposes, the Model 3115 is shipped with the mounting bracket attached in reverse. Before the antenna may be mounted on a tripod, the user must remove the wing nut and separate the antenna from the mounting bracket.

**Step 2.** To mount the antenna on a tripod, attach the mounting bracket to the tripod with the  $\frac{1}{4}$ -20 bolt provided. Next, attach the antenna to the mounting bracket by fitting the position lock (small posts on the mounting plate) into the indentation provided on the mounting bracket, then tightening the wing nut. To rotate the antenna, loosen the wing nut, reset the antenna in the desired position lock and tighten the wing nuts.

**Step 3.** After the Model 3115 antenna is mounted onto the tripod or tower, connect a type N coaxial cable from the female antenna connector to a signal generator or amplifier.

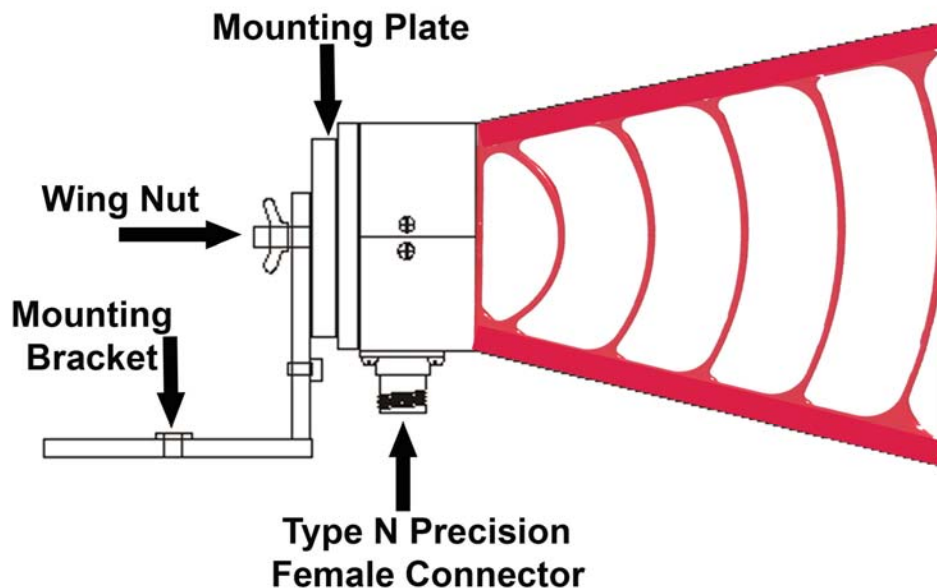


Figure 2. Model 3115 Mounting Diagram

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## 5. Applications

The Model 3115 Double-Ridged Waveguide horn antenna may be used for the following list of applications.

Radiated Emissions	FCC-15
	FCC-18
	NACSIM
Radiated Emissions, Radiated Immunity (Susceptibility)	IEC/CISPR/EN
	SAE J1113
	SAE J551
	MIL-STD-462
Transmit / Receive	MIL-STD-1541
	MIL-STD-285
Receive	IEEE STD 299

*Table 4. Suitable Applications*

Each Model 3115 is individually calibrated at 1 m per SAE ARP 958. Factors for your antenna, with apparent gain at 1.0 meter from the end of the antenna, have been determined and are included with this manual along with a signed Certificate of Calibration Conformance. This factor should be used in specification compliance testing to convert receiver reading (dBuV) to field intensity units (dBuV/M). The conversion is accomplished by adding the antenna factor in dB to the receiver reading in dB above 1 microvolt. To produce specific field strengths at one-meter spacing, see the forward power data that follows.

5.1. Typical Data

The following graphs represent data that may be expected from the Model 3115 antenna.

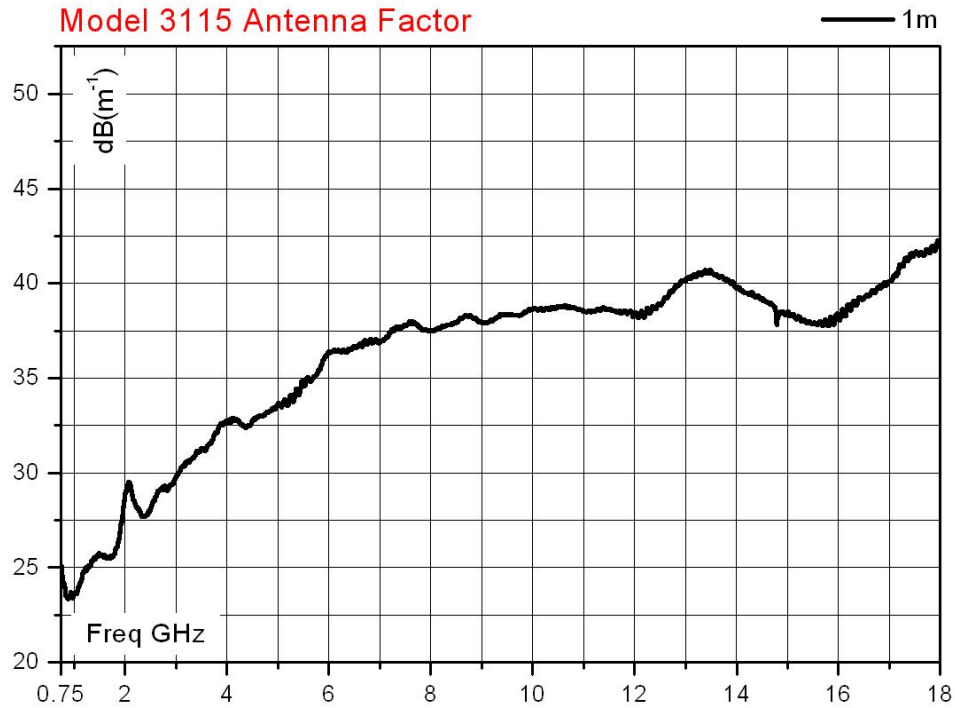


Figure 3. Model 3115 Typical Antenna Factor



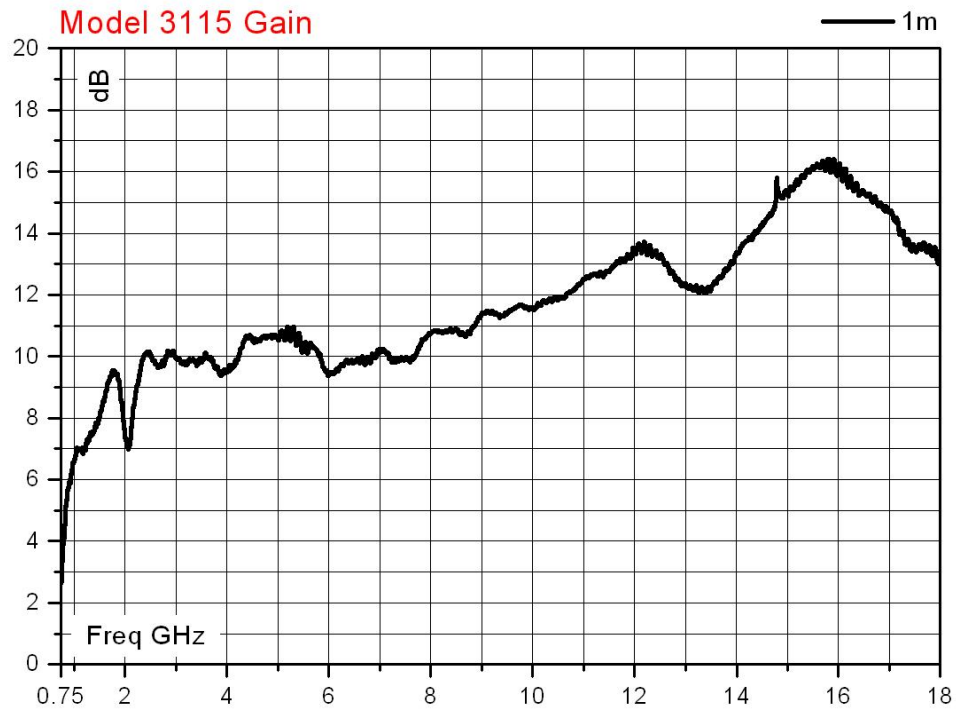


Figure 4. Model 3115 Typical Antenna Gain

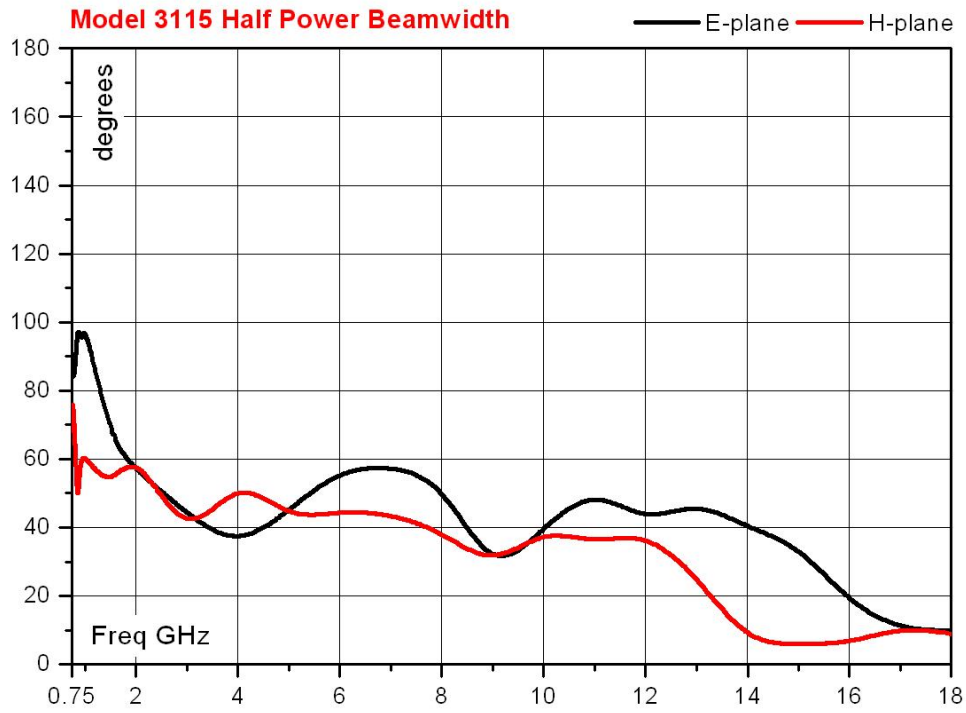


Figure 5. Model 3115 Typical Half Power Beamwidth

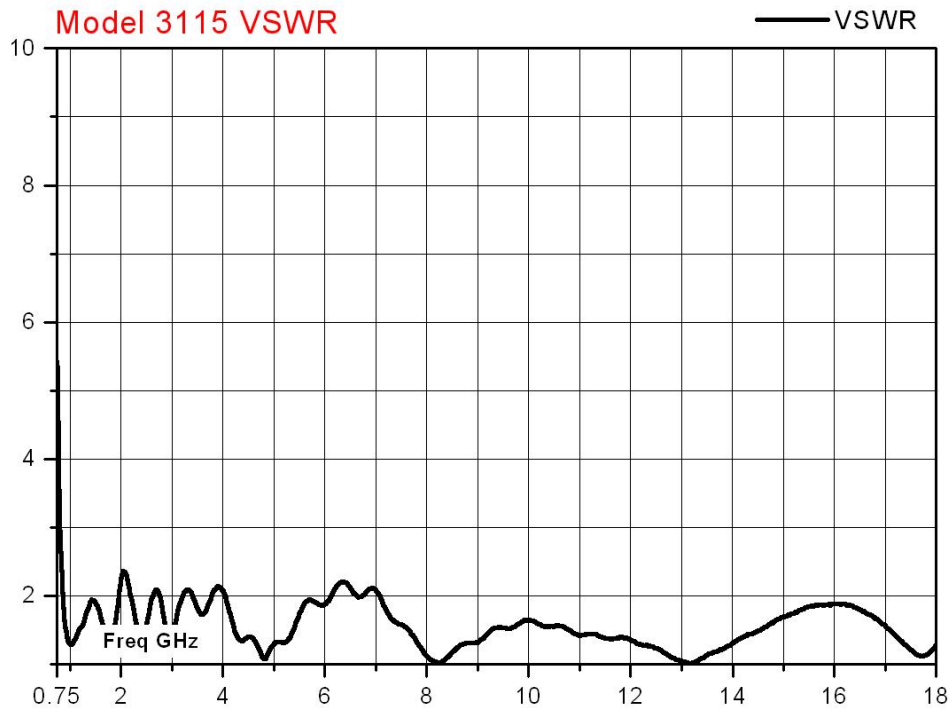


Figure 6. Model 3115 Typical VSWR

## 5.2. Forward Power Calculations

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The Field generated by an antenna for a given input power is greatly dependent on the environment where the antenna is present. Manufacturers use equations based on free space and plane wave behavior that do not apply when an antenna is inside an anechoic chamber. Consequently, these equations are to be used with care and understanding that they provide a guess of the required power to generate a field.

To estimate the required power to generate a given field at a given frequency first read the antenna gain from Figure 3 above then obtain the numeric gain through the following equation.

$$g = 10^{\left(\frac{G_{dB}}{10}\right)}$$

The required power to obtain a given peak field (i.e. not rms) is given by the following equation:

$$P = \frac{(r \cdot E)^2}{60 \cdot g}$$

Where  $P$  is the power in watts,  $E$  is the field in volts per meter and  $r$  is the distance in meters.

## 6. Maintenance

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To ensure reliable and repeatable long-term performance, annual recalibration of your antenna by ETS-Lindgren's experienced technicians is recommended. Our staff can recalibrate most types or brands of antenna. Please contact customer service to receive a Service Order Number prior to sending an antenna to us for calibration.

For more information about our calibration services, visit our website at <http://www.ets-lindgren.com/Calibration.cfm>.

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## 7. Warranty

### Scope and Duration of Warranties

Seller warrants to Buyer that the Standard EMCO Brand Products Excluding 5211 & 5220 be (1) free from defects in material, manufacturing workmanship, and title, and (2) conform to the Seller's applicable product descriptions and specifications, if any, contained in or attached to Seller's quotation. If no product descriptions or specifications are contained in or attached to the quotation, Seller's applicable product descriptions and specifications in effect on the date of shipment shall apply. The criteria for all testing shall be Seller's applicable product specifications utilizing factory-specified calibration and test procedures and instruments.

All product warranties, except the warranty of title, and all remedies for warranty failures are limited in time as shown in the table below.

Product Warranted	Duration of Warranty Period
Standard EMCO Brand Products Excluding 5211 & 5220	2 Years

Any product or part furnished to Buyer during the warranty period to correct a warranty failure shall be warranted to the extent of the unexpired term of the warranty applicable to the repaired or replaced product.

The warranty period shall commence on the date the product is delivered to Buyer; however, if Seller assembles the product, or provides technical direction of such assembly, the warranty period for such product shall commence on the date the assembly of the product is complete. Notwithstanding the foregoing, in the event that the assembly is delayed for a total of thirty (30) days or more from the date of delivery for any reason or reasons for which Seller is not responsible, the warranty period for such product may, at Seller's options, commence on the thirtieth (30th) day from the date such product is delivered to Buyer. Buyer shall promptly inspect all products upon delivery. No claims for shortages will be allowed unless shortages are reported to Seller in writing within ten (10) days after delivery. No other claims against Seller will be allowed unless asserted in writing within thirty (30) days after delivery (or assembly if the products are to be assembled by Seller) or, in the case of alleged breach of warranty, within the applicable warranty period.

### Warranty Exclusions

Except as set forth in any applicable patent indemnity, the foregoing warranties are exclusive and in lieu of all other warranties, whether written, oral, express, implied, or statutory. EXCEPT AS EXPRESSLY STATED ABOVE, SELLER MAKES NO WARRANTY, EXPRESS OR IMPLIED, BY STATUTE OR OTHERWISE, WHETHER OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE OR USE OR OTHERWISE ON THE PRODUCTS, OR ON ANY PARTS OR LABOR FURNISHED DURING THE SALE, DELIVERY OR SERVICING OF THE PRODUCTS. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

Warranty coverage does not include any defect or performance deficiency (including failure to conform to product descriptions or specifications) which results, in whole or in part, from (1) negligent storage or handling of the product by Buyer, its employees, agents, or contractors, (2) failure of Buyer to prepare the site or provide an operating environmental condition in compliance with any applicable instructions or recommendations of Seller, (3) absence of any product, component, or accessory recommended by Seller but omitted at Buyer's direction, (4) any design, specification, or instruction furnished by Buyer, its employees, agents or contractors, (5) any alteration of the product by persons other than Seller, (6) combining Seller's product with any product furnished by others, (7) combining incompatible products of Seller, (8) interference with the radio frequency fields due to conditions or causes outside the product as furnished by Seller, (9) improper or extraordinary use of the product, or failure to comply with any applicable instructions or recommendations of Seller, or (10) acts of God, acts of civil or military authority, fires, floods, strikes or other labor disturbances, war, riot, or any other causes beyond the reasonable control of Seller. This warranty does not cover (1) contact fingers or replacements unless loss is caused by a defect in material or manufacturing workmanship within the scope of this warranty (2) items designed to be consumable and (3) removal and reconstruction of walls, partitions, ceilings and other facility costs arising from repair or replacement of the product or parts thereof by Seller under the warranty. Seller does not warranty products of others which are not included in Seller's published price lists for shielding products and systems supplies and accessories.

**Buyer's Remedies**

If Seller determines that any product fails to meet any warranty during the applicable warranty period, Seller shall correct any such failure by either, at its option, repairing, adjusting, or replacing without charge to Buyer any defective or nonconforming product, or part or parts of the product. Seller shall have the option to furnish either new or exchange replacement parts or assemblies.

Warranty service during the applicable warranty period will be performed without charge to Buyer within the contiguous 48 United States during Seller's normal business hours. After the warranty period, service will be performed at Seller's prevailing service rates. Subject to the availability of personnel, after-hours service is available upon request at an additional charge. For service outside the contiguous 48 United States, travel and per diem expenses, when required, shall be the responsibility of the Buyer, or End User, whichever is applicable.

The remedies set forth herein are conditioned upon Buyer promptly notifying Seller within the applicable warranty period of any defect or nonconformance and making the product available for correction.

The preceding paragraphs set forth Buyer's exclusive remedies and Seller's sole liability for claims based on failure of the products to meet any warranty, whether the claim is in contract, warranty, tort (including negligence and strict liability) or otherwise, and however instituted, and, upon the expiration of the applicable warranty period, all such liability shall terminate. IN NO EVENT SHALL SELLER BE LIABLE TO BUYER FOR ANY SPECIAL INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND ARISING OUT OF, OR AS A RESULT OF, THE SALE, DELIVERY, NON-DELIVERY, SERVICING, ASSEMBLING, USE OR LOSS OF USE OF THE PRODUCTS OR ANY PART THEREOF, OR FOR ANY CHARGES OR EXPENSES OF ANY NATURE INCURRED WITHOUT SELLER'S WRITTEN CONSENT DESPITE ANY NEGLIGENCE ON BEHALF OF THE SELLER. IN NO EVENT SHALL SELLER'S LIABILITIES UNDER ANY CLAIM MADE BY BUYER EXCEED THE PURCHASE PRICE OF THE PRODUCT IN RESPECT OF WHICH DAMAGES ARE CLAIMED. This agreement shall be construed in accordance with laws of the State of Illinois. In the event that any provision hereof shall violate any applicable statute, ordinance, or rule of law, such provision shall be ineffective to the extent of such violation without invalidating any other provision hereof.

Any controversy or claim arising out of or relating to the sale, delivery, nondelivery, servicing, assembling, use or loss of use of the products or any part thereof or for any charges or expenses in connection therewith shall be settled in Austin, Texas by arbitration in accordance with the Rules of the American Arbitration Association, and judgment upon the award rendered by the Arbitrator may be entered in either the Federal District Court for the Western District of Texas or the State District Court in Austin, Texas, all of the parties hereto consenting to personal jurisdiction of the venue of such court and hereby waive the right to demand a jury trial under any of these actions.