

INSTRUCTION MANUAL
for
THREE-PHASE
LINE IMPEDANCE STABILIZATION NETWORK
(LISN)
Model:
LI-3P-416 V2.0 (16 Amperes)



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LIST OF FIGURES

1.0 Introduction

This manual includes product descriptions, controls and indicators, product specifications, dimensions, safety precautions, operational instructions, warranty information, guidelines, and instructions for its proper usage.

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2.0 Products Available from Com-Power



Antennas



Antenna Kits



Absorbing Clamps



Coupling/Decoupling Networks (CDN)



Comb Generators



Current Probes & Bulk Current Injection Probes



Emissions Test Systems



Conducted Immunity Test Systems



Impedance Stabilization Networks (ISN)



Line Impedance Stabilization Networks (LISN)



Antenna Masts



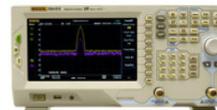
Near-Field Probe Sets



Preamplifiers



Power Amplifiers



Spectrum Analyzers



Surge Generators



Transient Limiters



Turntables



Antenna Tripods



Telecom Test Systems

www.com-power.com

3.0 Product Information

3.1 Incoming Inspection



WARNING – To avoid the possibility of electrical shock, do not apply power to the LISN or any of its accessories if there is any evidence of shipping damage. If shipping damage to the product or any of the accessories is suspected, or if the package contents are incomplete, contact Com-Power or your Com-Power distributor.

Please check the contents of the shipment against the package contents in section 3.2 to ensure that you have received all applicable items.

3.2 What is in the Package

STANDARD ITEMS:

- ✓ **LI-3P-416 V2.0 Line Impedance Stabilization Network (LISN)**
- ✓ **CONN-KIT-LI3P16A**
- ✓ **RLI v2.0 Remote LISN Interface**
- ✓ **10-Meter Fiber Optic Cable**
(Duplex Latching POF Connector at each end)
- ✓ **AC Power Adapter [6 Volts DC, 500 mA, unregulated]**
(for powering the LISN fiber optic interface circuit)
- ✓ **AC Power Adapter [6 Volts DC, 500mA, unregulated]**
(for powering the RLI V2.0 Remote LISN Interface Box)
- ✓ **AC Power Adapter [15 Volts DC, 500mA, unregulated]**
(for powering the internal LISN cooling fans)
- ✓ **Calibration Certificate and Data**

OPTIONAL ACCESSORIES:

- ✓ **LIA-COAX-E** Coaxial Adapter with plug pins for LISN EUT Port
- ✓ **LIA-COAX-M** Coaxial Adapter with plug sockets for LISN Mains Port

3.3 Product Safety Information

3.3.1 Product Hazard Symbols Definitions



The hazard symbols appearing on the product exterior are defined below.

The yellow triangle with an exclamation mark indicates the presence of important operating and/or maintenance (servicing) instructions in the literature accompanying the product.



The yellow triangle with a lightning bolt indicates an alert to the user that uninsulated **dangerous voltages** are present within the product enclosure and on output connectors. These voltages may be of sufficient magnitude to constitute a risk of electric shock to people.



The Ground symbol inside a circle indicates terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth (ground) electrode.



To indicate on the rating plate that the equipment is suitable for AC current.



To indicate on the rating plate that the equipment is suitable for direct current.

3.3.2 Product Warning/Caution Statements

The following warnings/caution statements must be adhered to ensure safe operation of the product.



WARNING: HIGH VOLTAGE!

CONNECT PROTECTIVE EARTH BEFORE APPLYING POWER!

VERIFY INPUT POWER CONFIGURATION PRIOR TO MAKING CONNECTION.



CAUTION:

TO PREVENT ELECTRIC SHOCK, DO NOT OPEN COVER. CONNECT PROTECTIVE EARTH BEFORE APPLYING POWER. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL ONLY.



TO AVOID OVERHEATING, OPERATE FANS DURING USAGE

3.3.3 General Safety Instructions

The following safety instructions have been included in compliance with safety standard regulations. Please read them carefully.

- **READ AND RETAIN INSTRUCTIONS** - Read all safety and operating instructions before operating the instrument. Retain all instructions for future reference
- **HEED WARNINGS** - Adhere to all warnings on the instrument and operating instructions.
- **FOLLOW INSTRUCTIONS** - Follow all operations and use instructions.
- **WATER AND MOISTURE** - Do not use the instrument near water.
- **VENTILATION**- The instrument should be used/installed only in locations where the flow of air through the ventilation openings is not impeded.
- **MOUNTING** - The instrument can be used in Horizontal or vertical orientation if the ventilation holes are not obstructed and the protective grounding is not defeated.
- **HEAT** - The instrument should be situated away from heat Horizontal or vertical orientation if the ventilation holes are not obstructed and the protective grounding is not defeated
- **POWER SOURCES** – Connect the instrument only to the type of power source described in the operating instructions type of power source described in the operating instructions
- **GROUNDING** - Take precautions to ensure that the grounding of the instrument is not defeated. Grounding conductor with adequate cross- section must be connected between a grounding conductor connection for the measurement area and the grounding conductor connection (grounding bolt) on the back panel of the LISN and the LISN bottom plate, before applying any power to the LISN. At shutdown or before dismantling the LISN setup, ensure that the power to LISN is discontinued before the ground conductor connection is disconnected.



CAUTION - *The specified minimum line to ground capacitance induces leakage currents more than the value permitted under EN 61010-1 standard – safety requirements for electrical equipment for measurement, control and laboratory use.*

In addition, the basic insulation required for a category I protection device cannot be assured. Therefore, it is imperative to provide additional measures safeguarding against direct or indirect contact by users.

SECTION 3 – PRODUCT INFORMATION

Before using the LISN, a secure ground connection must be made to the LISN grounding bolt and/or the bottom metal plate (The bottom surface of the LISN is left unpainted for effective ground connection). It must not be removed until after the LISN has been disconnected from the mains power supply, to avoid electric shock.

The safety notes in the accompanying operating instructions and on the outside of the device must be always followed.

- **POWER CORD PROTECTION** - Place power supply cords so that they are not likely to be walked on or pinched by items placed on them or against them.
- **CLEANING** - Clean the instrument outside surfaces of the device with soft, lint-free cloth. If necessary, a mild detergent may be used.
- **NON-USE PERIODS** - Unplug the power cords of the instrument when it is left unused for a long period of time.
- **OBJECT AND LIQUID ENTRY** - Take care that objects do not fall into instruments and that liquids are not spilled into the enclosure through openings.
- **DEFECTS AND ABNORMAL STRESS** - Whenever it is likely that the normal operation has been impaired, make the equipment inoperable and secure it against further operation.
- **SITTING OR CLIMBING** - Do not sit or climb upon the instrument or use it as a step or ladder.
- **ENVIRONMENTAL CONDITIONS** - This equipment is designed for indoor use. Ambient temperature range during operation should be between 5° C to 40° C.
- **STORAGE AND PACKAGING** - The device should only be stored at a temperature between -25 and +70 °C. During extended periods of storage, protect the device from dust accumulation. The original packaging should be used if the device is transported or shipped again. If the original packaging is no longer available, the device should be packed carefully to prevent mechanical damage.

SECTION 3 – PRODUCT INFORMATION

3.4 Product Features

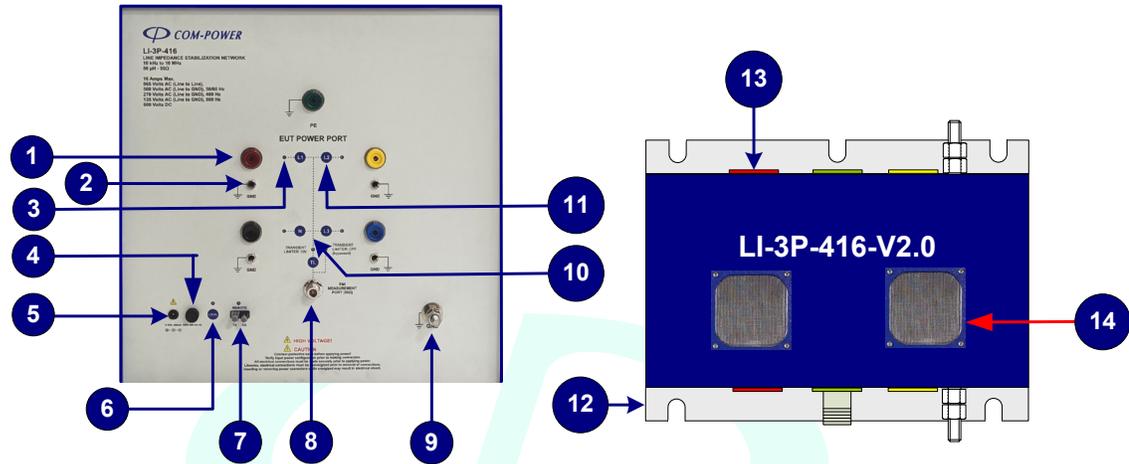


FIGURE 1 - Product Features – Front Panel and Top View

- 1 EUT Power Ports**
 Power ports to which the EUT power input wiring connects.
- 2 Ground Connection Jack**
 Reference ground connection points for coaxial adapters (sold separately).
- 3 LED Indicators of Line Under Test**
 L1, L2, L3 and N LEDs indicate which line is selected.
 Only (1) LED is illuminated at any given time.
- 4 Fuse Mounting Assembly**
 Provides access to input power fuse for fiber optic interface circuit.
 Fuse type:250V, 500mA (T).
- 5 DC Power Port for Fiber Optic Interface Circuit**
 This is the DC Power input port for the fiber optic interface circuit. The output cable of the included 6 VDC, 500 mA unregulated AC power adapter connects to this port.
- 6 Push Button LOCAL with Green Led**
 Press this button for Local Operation while LISN is in Remote Mode
- 7 Fiber Optic Port with REMOTE LED**
 Fiber optic port for connection to RLI Remote LISN Interface. When the REMOTE LED is illuminated, the LISN is in remote mode.
- 8 EMI Measurement Port**
 Coaxial, Female N-type connector intended to be connected to the 50Ω RF input of the measuring instrument.
- 9 Ground Stud**
 Provides a ground connection point at the same electrical potential as the base plate.

SECTION 3 – PRODUCT INFORMATION

- 10 **Push-Button (TL) with LED indicators for Transient Limiter**
 The TL push-button is used to toggle ON/OFF the transient limiter circuit along the measurement path. When ON, the transient limiting circuit is ENABLED. When OFF, the transient limiting circuit is BYPASSED.
- 11 **Push-Buttons for L1, L2, L3 and N**
 These buttons are used to select the line under test.
- 12 **LISN Base Plate**
 The unpainted LISN base plate is intended to be bonded to the site reference ground plane. Please refer to section 5.1 for installation information and grounding precautions.
- 13 **EUT Power Input Ports**
 Power ports for connection to EUT power source.
- 14 **Air/Heat outlets (2 Nos.)**
 Air/Heat outlets protected by steel mesh. Do not block any ventilation openings.

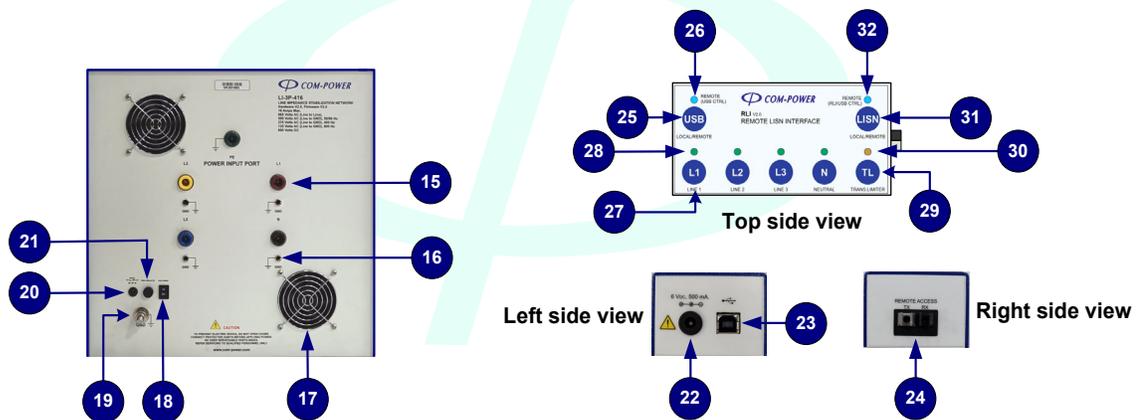


FIGURE 2 - Product Features – Rear Panel & RLI v2.0

- 15 **EUT Power Input Ports**
 Power ports for connection to EUT power source.
- 16 **Ground Connection Jack**
 Reference ground connection points for coaxial adapters (sold separately)
- 17 **Fan Intake**
 Air Intake openings.
- 18 **Power Switch for Internal Fans**
 Turns ON/OFF internal cooling fans.
- 19 **Ground Stud**
 Provides a ground connection point at the same electrical potential as the base plate.
- 20 **DC Power Port for Internal Fans**
 This is the DC power input port for the internal cooling fans. The output cable included 15 VDC, 500 mA unregulated AC power adapter connects to this port.
- 21 **Fuse Mounting Assembly**
 Provides access to input power fuse for internal fans. Fuse type: 250V, 500 mA (T).

SECTION 3 – PRODUCT INFORMATION

- 22 **DC Power Port**
This is the DC power input port for the RLI. The output cable of the included 6 VDC, 500 mA unregulated AC power adapter connects to this port.
- 23 **USB Port**
This USB port is for computer connection
- 24 **Fiber Optic Port**
Fiber optic port for connection to LISN.
- 25 **USB Button**
Pressing the USB button allows a connected computer to control which line is selected.
- 26 **USB LED Indicator**
It indicates that the USB button is pressed and computer control is enabled
- 27 **Line Under Test Selection Buttons (L1, L2, L3, N)**
These (4) buttons are used to select the Line Under Test.
- 28 **LED Indicators of Line Under Test (L1, L2, L3, N)**
These (4) LEDs correspond to the button immediately below each indicator. The LED which is lit indicates the current line under test.
- 29 **Transient Limiter Button (TL)**
The TL Push-button is used to toggle ON/OFF the transient limiter circuit along the measurement path. When the LED is ON, the transient limiting circuit is ENABLED. When OFF, the transient limiting circuit is BYPASSED.
- 30 **LED Indicator of Transient Limiter**
When illuminated, the transient limiter circuit is enabled.
- 31 **Local/Remote Button**
This button is used for remote control operations.
- 32 **REMOTE (RLI/USB CTRL) LED Indicator**
When the LED is illuminated, the LISN is in remote mode.

SECTION 3 – PRODUCT INFORMATION

3.5 Product Specifications

GENERAL	
Product Description	Line Impedance Stabilization Network (LISN)
Application	Power Line Conducted Emissions (Disturbance Voltages) Tests
Standards	MIL-STD-461D/E/F/G
LISN Type	50Ω, 50 μH (4) Conductor Network
Frequency Range	10 kHz to 10 MHz
Insertion Loss - 10 kHz to 150 kHz	<26 to <21 dB
Insertion Loss - 150 kHz to 10 MHz	<21 dB
INPUT POWER RATINGS FOR EQUIPMENT UNDER TEST (EUT)	
Current (maximum continuous, per line)	16 Amperes
AC Voltage (maximum)	865 Volts rms (line to line), 500 Volts rms (line to ground); 50/60Hz 270 Volts rms (line to ground); 400Hz 135 Volts rms (line to ground); 800Hz
DC Voltage (maximum)	600 Volts DC
ELECTRICAL	
Remote Interface Power Inputs	6 Volts DC (unregulated), 500 mA (LISN Front Panel and RLI-v2.0 Remote LISN Interface)
Cooling Fans Power Input	15 Volts DC (unregulated), 500 mA (LISN Rear Panel)
INPUT/OUTPUT CONNECTORS	
Power Input Port Plug (affixed to LISN chassis)	25A Receptacle Pins CONN-RP25GR [Red], CONN-RP25GY [Yellow], CONN-RP25GBL [Blue], CONN-RP25GB [Black], CONN-RP25GG [Green]
Power Input Socket (for power input cable)	25A Plug Sockets CONN-PS25GR [Red], CONN-PS25GY [Yellow], CONN-PS25GBL [Blue], CONN-PS25GB [Black], CONN-PS25GG [Green]
Power Output Port Socket (affixed to LISN chassis)	25A Receptacle Sockets CONN-RS25GR [Red], CONN-RS25GY [Yellow], CONN-RS25GBL [Blue], CONN-RS25GB [Black], CONN-RS25GG [Green]
Power Output Port Plug (for EUT power cable)	25A Plug Pins CONN-PP25GR [Red], CONN-PP25GY [Yellow], CONN-PP25GBL [Blue], CONN-PP25GB [Black], CONN-PP25GG [Green]
RF Measurement Port	50Ω - N-Type (female)
Fiber Optic Ports	Avago Duplex Latching POF Jack (LISN and RLI-v2.0 Remote LISN Interface)
Remote Interface Power Input Ports	5.5/2.1 mm Power Jack (LISN front panel and RLI-v2.0 Remote LISN Interface)
Cooling Fans Power Input Port	5.5/2.1 mm Power Jack (LISN Rear Panel)
Optional Accessories	LIA-COAX-E Coaxial Adapter with Plug Pins for LISN EUT Port LIA-COAX-M Coaxial Adapter with Plug Sockets for LISN Mains Port
ENVIRONMENTAL	
Cooling	<ul style="list-style-type: none"> • Louvered Side Panels • Forced Air by (2) user-controlled, internal fans with (2) 4.5" circular intake openings on rear panel (each opening protected by a circular metal finger guard) • (2) 4" square air outlets located on the top cover (each opening protected by metallic mesh)

SECTION 3 – PRODUCT INFORMATION

3.6 Product Dimensions

DIMENSIONS & WEIGHT	
Figure 3 - Dimension A	14.89" (37.82 cm)
Figure 3 - Dimension B	13.04" (33.12 cm)
Figure 3 - Dimension C	11.30" (28.7cm)
Figure 3 - Dimension D	17.36" (44.1 cm)
Figure 3 - Dimension E	17.79" (45.2 cm)
Figure 3 - Dimension F	0.97" (2.47 cm)
Figure 3 - Dimension G	2.84" (7.23cm)
Figure 3 - Dimension H	0.97" (2.47cm)
Figure 3 - Dimension I	2.75" (7 cm)
Weight	41.20 lbs. (18.69 kg)
Weight with Shipment Box	96.23 lbs. (43.65 kg)
Shipment Box Size	24.46" x 19.93" x 29.62"

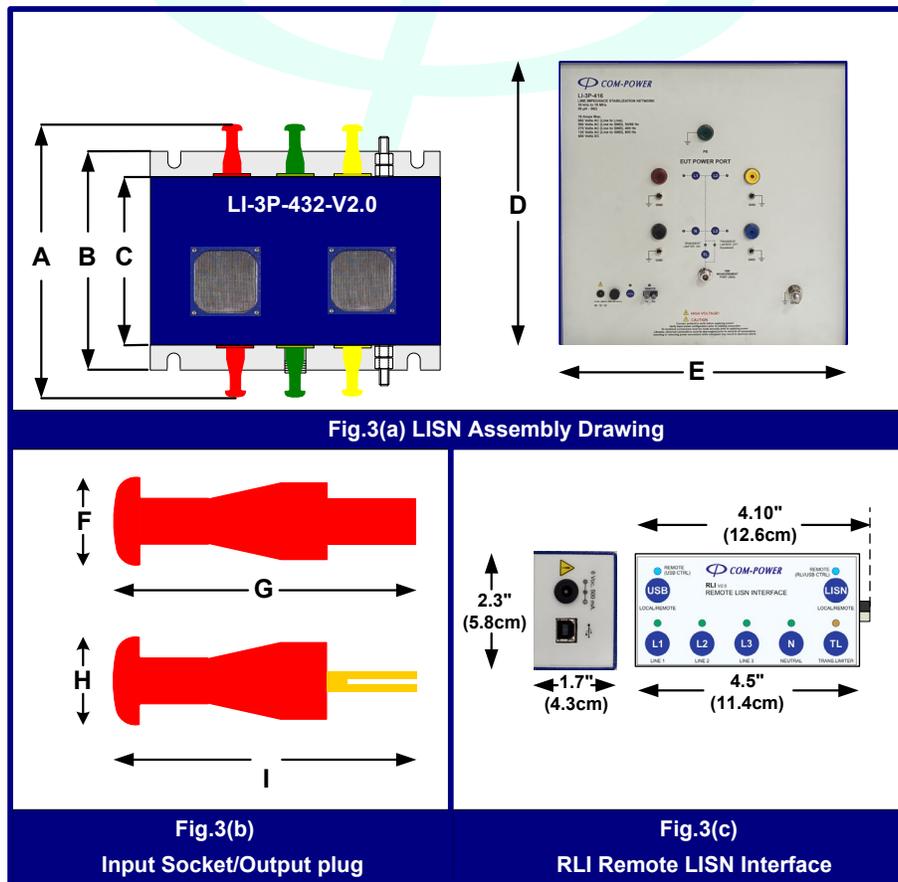


FIGURE 3 - Product Dimensions

SECTION 3 – PRODUCT INFORMATION

3.7 Product Performance Data

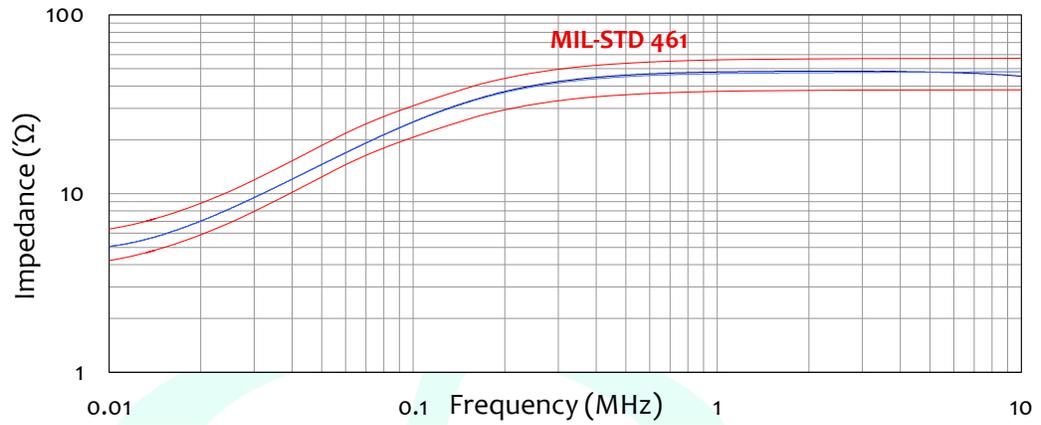


FIGURE 4 – Typical Impedance Data

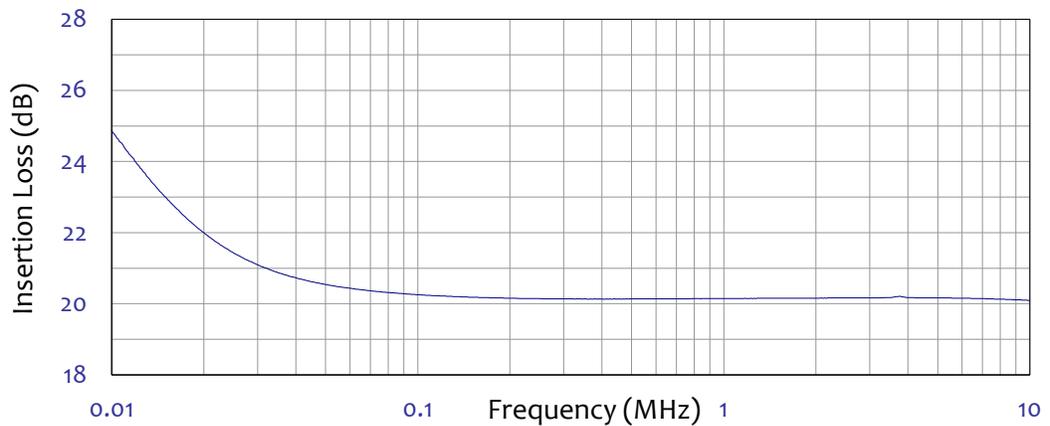


FIGURE 5 – Typical Insertion Loss Data

4.0 LISN Installation

4.1 LISN Theory

The LI-3P-416 Line Impedance Stabilization Network is specifically designed to provide a measurement platform for power line conducted emissions testing in accordance with MIL-STD-461, CE102 requirements, enabling accurate evaluation of radio-frequency conducted noise on power leads. The LISN circuitry conforms to the configuration specified in Figure 6 of MIL-STD-461, and its impedance characteristics meet the requirements outlined in Figure 7 of MIL-STD 461.

Line Impedance Stabilization Networks provide standardized line impedance to the EUT during conducted emissions testing, which is independent of the external power line impedance. The standardized impedance enables consistent readings for RF noise measurements on the power line.

In addition to providing a standardized impedance, the LISN also acts as a low-pass filter for the power to the equipment under test. The LISN provides isolation between the power source or mains network, reducing the amplitude of unwanted ambient signals/noise while allowing power to pass with minimal voltage drop. This filter comprises a single-stage low-pass LC filter. The inductor (L) used in all Com-Power LISNs is an air-core type to eliminate saturation and improve stability.

The LISN also provides a low-impedance, capacitively coupled, low-loss path for RF noise from each EUT power conductor to the measurement port. The loss incurred along each of these paths is referred to as Insertion Loss. Insertion Loss factors are individually measured and provided for each line in the network. These factors must be considered to achieve the highest measurement accuracy. The insertion loss factors (in dB) are added to the measured values (in dB μ V). A basic example schematic of the LISN is illustrated in Figure 6 below.

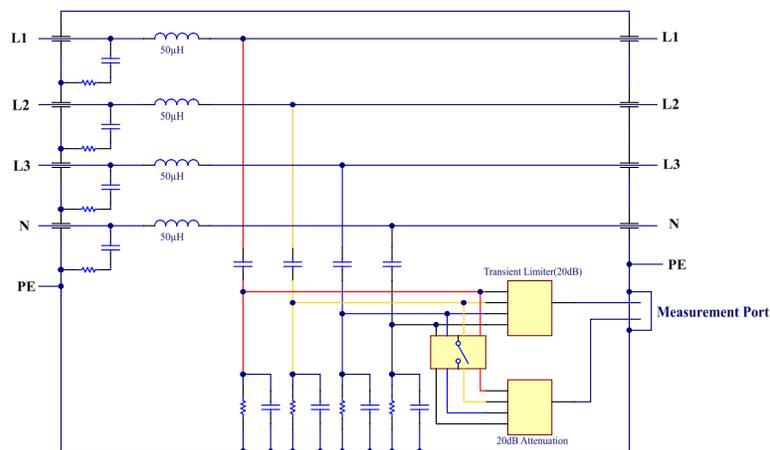


FIGURE 6 – Schematic Diagram of LI-3P-416

SECTION 4 – LISN INSTALLATION

4.2 Safety Considerations

It is critical that the LISN be installed in a manner which ensures that each of following conditions is satisfied:



- The metal enclosure of the LISN must be connected to the reference ground plane of the site. The recommended connection method is via a direct, surface-to-surface connection between the LISN base plate and an exposed, conductive surface of the floor or wall of a shielded enclosure. The LISN base plate should be bolted to the surface using the mounting holes on the front and back of the LISN base plate.



Where installation as described in the previous paragraph is not possible, the LISN may be connected to earth ground via the ground lug located on the rear panel of the LISN. Thick metallic braid or heavy gauge wiring is recommended, and the length shall be kept as short as possible.

In cases where no ground plane is available, a Mains isolating transformer shall be used.

Please refer to the safety instructions in section 3.3 for more information on the importance of grounding. The grounding instructions should always be followed.

- The ventilation openings in the LISN enclosure must be unobstructed.
- No signal or operating voltages/currents shall exceed those specified in the product specifications listed in section 3.5.
- The LISN power input port must connect to an appropriate power source protected by a circuit breaker with a current rating that is greater than or equal to the rating of the LISN.
- Due to the high level of earth leakage current, the device cannot be connected to any power source protected by a Ground Fault Circuit Interrupter (GFCI), also called Ground Fault Interrupter (GFI) or Residual Current Device (RCD).

Failure to comply with any of these points may damage the equipment and/or pose an electrical hazard.

4.3 Test Equipment Setup & Connections

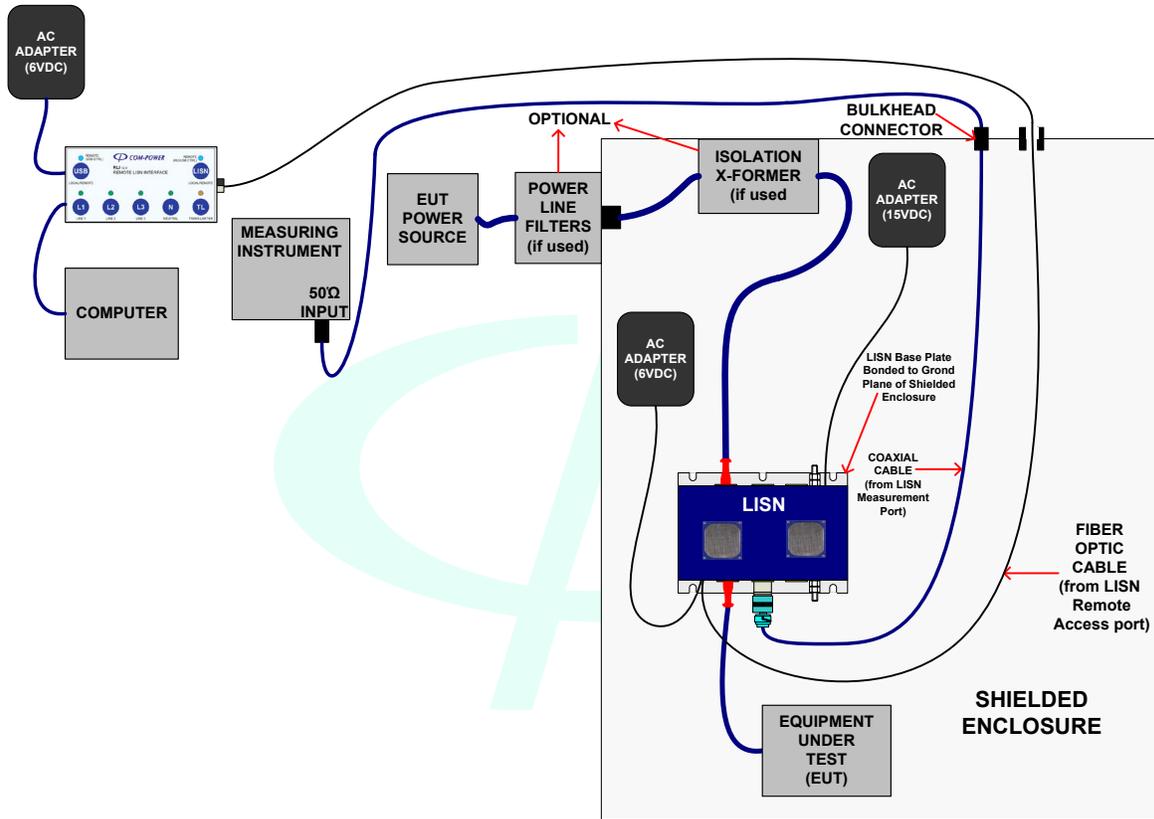


FIGURE 7 – Typical Test Setup

Depending on the electromagnetic environment, the use of a shielded enclosure, power line filters and/or isolation transformers may or may not be necessary. The LISN will act as a filter, providing some isolation between the Mains Port and EUT Port. However, this may not be sufficient for some installations, and additional power line filtration may prove to be necessary.

MIL-STD-461 requires the use of a 20 dB attenuator in order to protect the measuring instrument. The LI-3P-4-series LISNs incorporate the 20 dB attenuation internally, so no external attenuator is needed.

Using the transient limiter protects the RF input of your EMI receiver or spectrum analyzer, which is extremely sensitive and easily damaged by high voltage transients. In addition, Com-Power Transient Limiters incorporate both a low-pass and a high-pass filter to further attenuate out-of-band signals, thereby reducing the risk of RF overload.

The Transient Limiter (TL ON) circuit includes 20 dB attenuation. When set for (TL OFF), the Transient Limiter is bypassed, and the signal is routed through a separate 20 dB attenuation pad.

SECTION 4 – LISN INSTALLATION

4.3.1 LISN Input Power Connections

Your LI-3P-416 LISN is provided with five (5) 25A Plug Sockets: red, yellow, blue, black, green (with female contacts), which are used to connect the LISN to the Power Source of Equipment Under Test (EUT). The colors of these connectors match the input receptacles on the rear of the LISN. Figure 8 shows these connectors.

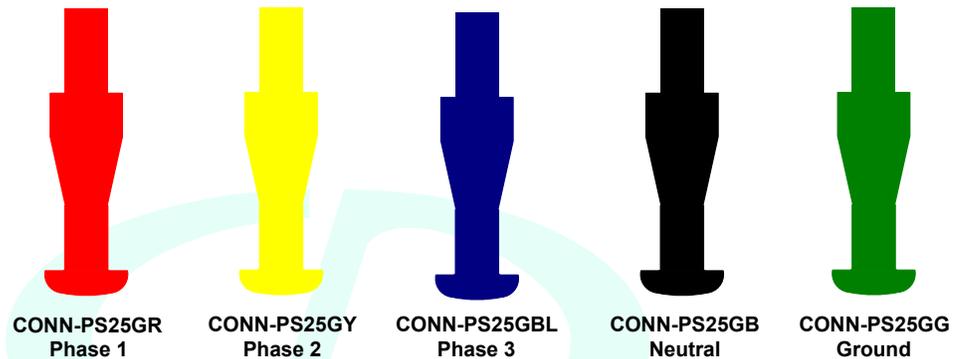


FIGURE 8 – Power Input Port Plug Socket Connectors (16 Amps)

4.3.2 LISN Output Power Connections

Your LI-3P-416 LISN includes five (5) 25A Plug Pins: red, yellow, blue, black, and green (with male contacts), used to connect the LISN to the input power cable for the Equipment Under Test (EUT). The colors of these connectors match the output receptacles on the front of the LISN. Figure 9 shows these connectors.

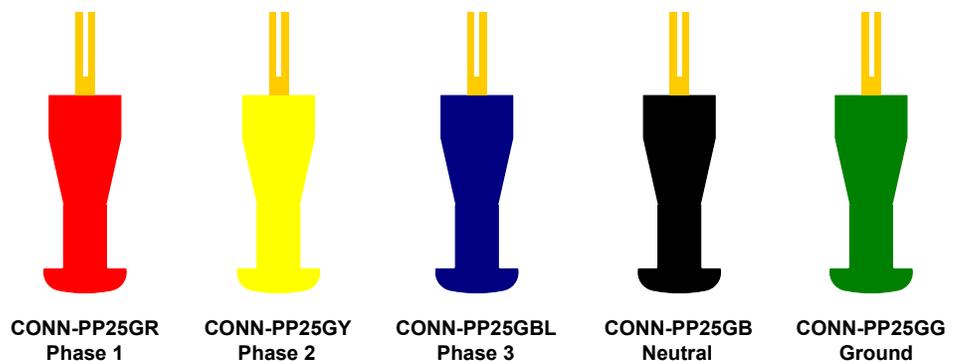


FIGURE 9 – EUT Power Port Plug Pin Connectors (16 Amps)

5.0 LISN Operation

The LI-3P-416 model can be operated locally via the front-panel interface and remotely via the RLI interface or an attached computer.

5.1 Local (Front panel) Operation

To operate LISN locally, one of the supplied 6 VDC power adapters must be plugged into the power input port on the front panel. The push buttons on the LISN front panel are used to select L1, L2, L3, or N as the line under test and to enable/bypass the transient limiter.



TEST LINE SELECTION DC input, Local Operation, Fiber Optic

NOTE: The LISN can be operated from the front panel when the REMOTE LED is NOT lit, indicating there is no remote connection to the RLI V2.0 Remote LISN Interface. When operating from the front panel, 6 VDC input power is required.

5.2 Remote Operation

To enable remote operation, the 6 VDC power adapters must be plugged in and connected to the appropriate input power port on the RLI V2.0 Remote LISN Interface and on the front panel of the LISN.



Then, connect one end of the fiber optic cable to the fiber optic port on the RLI V2.0, and connect the other end to the fiber optic port on the front panel of the LISN.

SECTION 5 – LISN OPERATION

Once the fiber optic cable is connected and both sides are powered, the link is established automatically. When linked, the REMOTE and L1 LEDs on the LISN front panel should illuminate, as well as the L1 LED on the RLI V2.0.

Once linked, you are now able to select the Line using the L1, L2, L3, and N push-buttons on the top surface of the RLI V2.0. The active (illuminated) line-under-test indicator LED on both the RLI V2.0 and the LISN front panel will correctly reflect the selected line.

The LISN can also be controlled via a computer. Simply connect RLI to the computer using a USB Type B to Type A cable. The command codes for the RLI V2.0 are given in Figure 10.

No.	Commands	Description	Return Value	Condition For Return Value
1	@CTS	To begin communication between PC & RLI.	@Access Granted\$	If RLI is in Remote Mode.
			@Access Denied\$	If RLI is in Manual Mode.
2	@DTS	To end communication between PC & RLI.	@Disconnected\$	If RLI is in Remote Mode.
			@Access Denied\$	If RLI is in Manual Mode.
3	@CSS	Query the connection status between RLI & LI-3P.	@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.
			@Connected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
4	@CHS	Query the Selected Channel on RLI.	@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@Access Denied\$	If RLI is in Manual Mode.
			@L1\$	If L1 is Selected.
			@L2\$	If L2 is Selected.
			@L3\$	If L3 is Selected.
5	@L1\$	Set the Channel Selection to L1 on RLI.	@Access Denied\$	If RLI is in Manual Mode.
			@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@L1-Selected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
6	@L2\$	Set the Channel Selection to L2 on RLI.	@Access Denied\$	If RLI is in Manual Mode.
			@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@L2-Selected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
7	@L3\$	Set the Channel Selection to L3 on RLI.	@Access Denied\$	If RLI is in Manual Mode.
			@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@L3-Selected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
8	@NES	Set the Channel Selection to N on RLI.	@Access Denied\$	If RLI is in Manual Mode.
			@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@NE-Selected\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
9	@TTS	Set Transient Limiter ON	@Access Denied\$	If RLI is in Manual Mode.
			@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@TL-ONS\$	If RLI & LI-3P are Linked via Fiber Optic Communication.
10	@TBS	Set Transient Limiter OFF	@Access Denied\$	If RLI is in Manual Mode.
			@Disconnected\$	If RLI & LI-3P are Not Linked via Fiber Optic Communication.
			@TL-OFF\$	If RLI & LI-3P are Linked via Fiber Optic Communication.

FIGURE 10 – Commands for Controlling RLI/LISN

SECTION 5 – LISN OPERATION

5.3 Fan Operation

To operate the fan, connect the 15VDC AC adapter to the DC power input for internal fans, located on the rear panel of the LISN.

Once power is applied, the fans can be toggled ON/OFF using the fan power switch located on the rear panel of the LISN.

It is recommended that the fans remain ON whenever current is flowing through the LISN conductors.



SECTION 5 – LISN OPERATION

6.0 LISN Measurements

Measurements of conducted emissions, sometimes referred to as disturbance voltages, using LI-3P-416 LISN are made individually on each current-carrying conductor with reference to ground.

Measured values must be corrected to account for any losses incurred along the measurement path. These corrections usually include the insertion loss values for the LISN (with respect to the line being measured), coaxial measurement cables, attenuation pads or transient limiters, connecting adapters, etc.

6.1 LISN Insertion Loss Factors

The Insertion Loss for a LISN is essentially the difference, in dB, between a signal's amplitude present on the EUT power conductors at the entry point of the EUT power port into the LISN, and the amplitude of the same signal at the measurement port of the LISN.

All Com-Power LISNs are individually calibrated, and the insertion loss values are provided. There are eight (8) total sets of Insertion Loss Factors for the LI-3P-416; two (2) for each line; one set with the Transient Limiter ON (Enabled), and the other set with the Transient Limiter OFF (bypassed).

Typical Insertion Loss factors for the LI-3P-416 LISN are shown in the Figure 11 table.

Equipment:		Three-Phase Line Impedance Stabilization Network (LISN)						
Model:		LI-3P-416						
Frequency (MHz)	LISN Insertion Loss Factors (TL OFF & TL ON Modes)							
	LINE 1		LINE 2		LINE 3		NEUTRAL	
	TL OFF (dB)	TL ON (dB)	TL OFF (dB)	TL ON (dB)	TL OFF (dB)	TL ON (dB)	TL OFF (dB)	TL ON (dB)
0.01	24.91	25.74	24.87	25.73	24.93	25.78	24.92	25.82
0.011	24.45	25.08	24.42	25.10	24.47	25.14	24.48	25.18
0.012	24.02	24.52	24.00	24.55	24.06	24.60	24.07	24.63
0.013	23.66	24.06	23.65	24.07	23.69	24.12	23.71	24.16
0.014	23.35	23.65	23.34	23.68	23.37	23.72	23.41	23.77
0.015	23.08	23.33	23.08	23.33	23.10	23.38	23.15	23.43
0.016	22.80	22.99	22.81	23.02	22.84	23.05	22.87	23.10
0.017	22.60	22.72	22.60	22.76	22.63	22.79	22.67	22.84
0.018	22.40	22.49	22.42	22.53	22.44	22.56	22.47	22.60
0.02	22.05	22.07	22.06	22.10	22.08	22.13	22.11	22.17
0.025	21.48	21.41	21.49	21.44	21.51	21.46	21.55	21.49
0.03	21.14	21.02	21.16	21.04	21.16	21.06	21.19	21.09
0.035	20.92	20.76	20.93	20.78	20.94	20.80	20.96	20.82
0.04	20.78	20.60	20.78	20.62	20.79	20.63	20.81	20.65
0.045	20.67	20.48	20.68	20.50	20.68	20.50	20.70	20.53
0.05	20.59	20.39	20.60	20.41	20.60	20.42	20.62	20.43
0.1	20.35	20.12	20.36	20.14	20.36	20.14	20.37	20.15
0.3	20.26	20.05	20.30	20.07	20.30	20.07	20.30	20.08
0.5	20.26	20.05	20.29	20.06	20.29	20.06	20.30	20.07
1	20.28	20.06	20.30	20.07	20.30	20.07	20.30	20.08
2	20.28	20.06	20.29	20.07	20.30	20.07	20.30	20.08
3	20.27	20.06	20.29	20.07	20.29	20.07	20.30	20.08
5	20.22	20.02	20.24	20.03	20.24	20.03	20.25	20.04
7.5	20.12	19.93	20.14	19.94	20.15	19.95	20.16	19.97
10	19.97	19.80	19.99	19.81	20.01	19.82	20.02	19.85

FIGURE 11 – Typical Insertion Loss Factors for LI-3P-416 LISN

SECTION 6 – LISN MEASUREMENTS

6.1.1 Example Calculation

An LI-3P-416 LISN was used to measure the conducted emissions of an EUT. The measurement port of the LISN was connected to the RF input of the measuring instrument via a coaxial cable. A signal is observed on LINE 2, with the Transient Limiter ON. The frequency of the signal is 10 MHz, and the measured amplitude is 40 dB μ V. What is the actual amplitude of this signal on the LINE 2 conductor of the EUT input power?

For the system shown above, there will be only two factors to consider: the insertion loss of the coaxial cable and the LISN insertion loss factor @ 10 MHz for Line 2 with TL ON.

We'll assume that the insertion loss of the coaxial cable at 10 MHz is 1.5 dB, and by referring to the typical insertion loss table shown in Figure 11, the LISN insertion loss factor for LINE 2 with TL ON is 19.81 dB

Measured amplitude @ 10 MHz =	40.0 dB μ V
LISN Insertion Loss Factor @10 MHz for LINE 2 with TL ON =	19.81 dB
Insertion Loss of Coaxial Cable @10 MHz =	1.5 dB
Measured Amplitude + LISN Insertion Loss + Cable Insertion Loss = Corrected Reading =	61.31 dBμV

6.1.2 LISN Insertion Loss Calibration

The test setup for normalization and LISN Insertion Loss measurements are illustrated in Figure 11. The insertion loss factor is the difference (in dB) between the normalization measurements and the LISN insertion loss measurements.

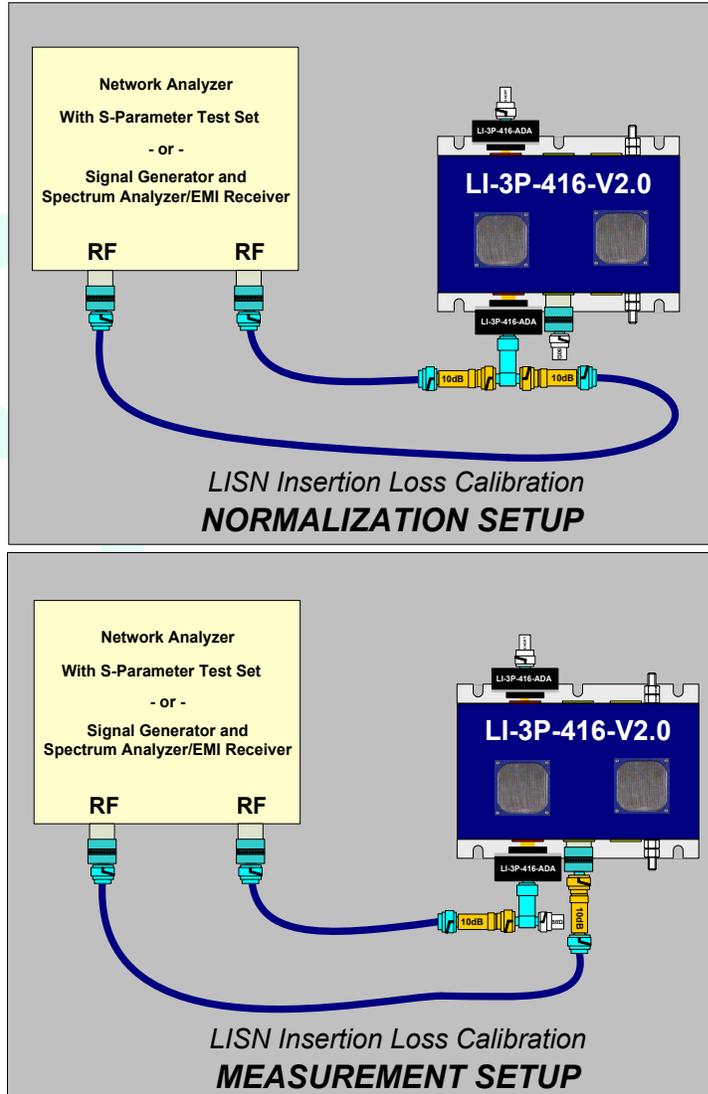


FIGURE 12 – Setup Diagrams for LISN Insertion Loss Calibration

6.1.3 Non-LISN Insertion Loss Calibration

Insertion Loss values for coaxial cables and most measurement system components having a single coaxial input and output, such as attenuators, filters, dc blocks, etc., can be easily determined through a simple calibration process.

The test setup for normalization and insertion loss measurements is illustrated in Figure 13. The insertion loss factor is the difference (in dB) between the normalization measurements and the insertion loss measurements.

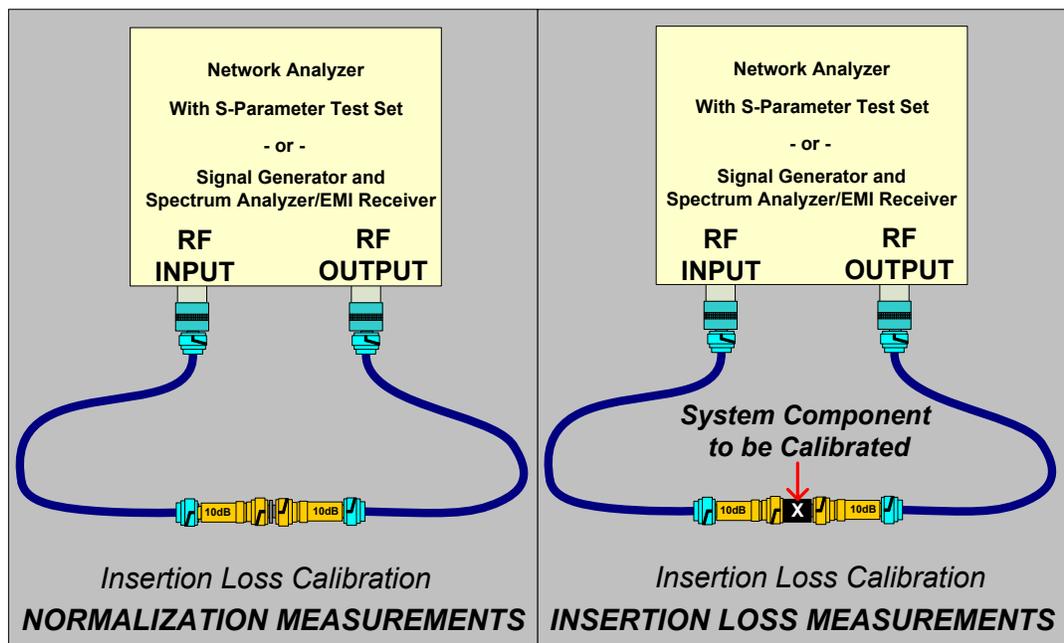


FIGURE 13 – Setup Diagrams for Non-LISN Insertion Loss Calibration

7.0 Warranty

Com-Power warrants to its customers that the products it manufactures will be free from defects in materials and workmanship for a period of three (3) years. This warranty shall not apply to:

- Transport damage during shipment from your plant.
- Damages due to poor packaging.
- Products operated outside their specifications.
- Products Improperly maintained or modified.
- Consumable items such as fuses, power cords, cables, etc.
- Normal wear
- Calibration
- Products shipped outside the United States without the prior knowledge of Com-Power.

In addition, Com-Power shall not be obliged to provide service under this warranty to repair damage resulting from attempts to install, repair, service or modify the instrument by personnel other than Com-Power service representatives.

Under no circumstances does Com-Power recognize or assume liability for any loss, damage or expense arising, either directly or indirectly, from the use or handling of this product, or any inability to use this product separately or in combination with any other equipment.

When requesting warranty services, it is recommended that the original packaging material be used for shipping. Damage due to improper packaging will be avoided in the warranty.

If you feel that the product is not working as intended, or is malfunctioning, please contact Com-Power for assistance. In the case of repairs or complaints, please visit our website at www.com-power.com and fill out an RMA form (<http://com-power.com/repairservicereq.asp>). The RMA number should be displayed in a prominent location on the packaging and on the product, along with a description of the problem and your contact information

SECTION 7 – WARRANTY

8.0 Product Maintenance

This product contains no user-serviceable parts. If the unit is not operating or requires calibration, please contact Com-Power Corporation. Any modifications or repairs performed on the unit by someone other than an authorized factory-trained technician will void the warranty.

The exterior surface may be cleaned with mild detergent and then wiped with a dry, clean, lint-free cloth. Use care to avoid liquids or other foreign objects entering the chassis.

