

Keysight Technologies 11867A RF Limiter

Notices

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CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Waste Electrical and Electronic Equipment (WEEE) Directive

This instrument complies with the WEEE Directive marking requirement. This affixed product label indicates that you must not discard this electrical or electronic product in domestic household waste.

Product category:

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is as shown below.



Do not dispose in domestic household waste.

To return this unwanted instrument, contact your nearest Keysight Service Center, or visit <http://about.keysight.com/en/companyinfo/environment/takeback.shtml> for more information.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

- www.keysight.com/find/mta
(product-specific information and support, software and documentation updates)
- www.keysight.com/find/assist
(worldwide contact information for repair and service)

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Table of Contents

Waste Electrical and Electronic Equipment (WEEE) Directive	3
Product category:	3
Sales and Technical Support	3
List of Figures	7
List of Tables	9
General Information	11
Introduction	11
Description	12
Installation	14
Initial inspection	14
Electrical inspection	14
Storage environment	14
Operation	15
Operating environment	15
Mating connectors	15
Instructions	15
Repair	17
Diodes	17
Connectors	17

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List of Figures

Figure 1	Typical insertion loss versus frequency	12
Figure 2	Typical return loss versus frequency	13
Figure 3	Typical output power versus input power at 25°C	13
Figure 4	Typical harmonic distortion versus input power	16
Figure 5	11867A illustrated parts breakdown	17

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List of Tables

Table 1	11867A RF limiter specifications	11
Table 2	11867A illustrated parts breakdown	18

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General Information

To obtain optimum performance from this RF limiter, observe these simple precautions:

- Make connections carefully to avoid misalignment and connector damage, which will result in inaccurate measurements.
- Keep the connectors free of dirt and any particles.
- When you clean the connectors, try using compressed air first. Do not use abrasives. With a clean foam swab, apply only isopropyl alcohol.
- For more information, refer to the *Connector Care for RF and Microwave Coaxial Connectors* document. It can be viewed online by searching for part number 08510-90064 at www.keysight.com.

Introduction

The 11867A RF limiter is an instrument accessory that can be used to protect input circuitry from transients and accidental overloads. This manual explains how to use the limiter, briefly describes tests that can be used to verify the specifications, and explains how to repair the limiter.

Instrument specifications are listed in [Table 1](#). These specifications are performance standards or limits against which the instrument may be tested.

Table 1 11867A RF limiter specifications

Parameter	Specification
Frequency range	10 Hz to 1800 MHz
Insertion loss	<1.0 dB
Frequency response ^[a]	<±0.25 dB about a 0.25 dB/GHz slope
Maximum input power levels	
– Continuous	10 watts average (+40 dBm); <1.3 V _{dc} with no RF applied; 0.0 V _{dc} with RF applied
– Pulse	100 watts peak, pulse width ≤1 μsec, 0.001 duty cycle
– Limited threshold	1 mW (0 dBm) gives approximately 1 dB compression
Impedance	50 ohm nominal
Reflection coefficient	<0.13 (1.3:1 VSWR)
RF input connector ^[b]	Type-N female
RF output connector ^[b]	Type-N male
Weight	90 grams (0.2 lb)
Dimensions	21 mm x 60 mm (0.81 in. x 2.38 in.)

[a] For operation to 2.4 GHz, see typical response shown in [Figure 1](#).

[b] Device is not suitable for bilateral operation. Input and output may not be interchanged.

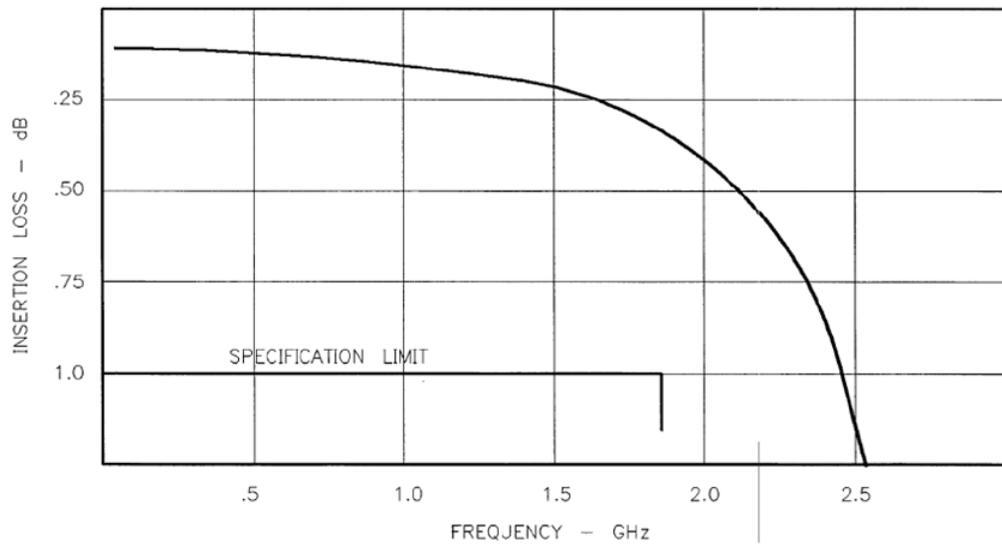


Figure 1 Typical insertion loss versus frequency

Description

The 11867A RF limiter is a unidirectional, solid state, passive device for use from 10 Hz to 1800 MHz. It consists of four oxide-passivated silicon diodes: two PIN diodes and two Schottky-Barrier diodes. These diodes are functionally integrated in a 50 ohm transmission line as part of a low pass filter with a cutoff frequency (F_c) of approximately 2.5 GHz. The limiter has no adjustments, and its diodes are not field replaceable.

For noise considerations, the limiter behaves as a thermal resistance shunted across the transmission line. The excess noise temperature is less than 20° Kelvin. This results in a noise figure that is essentially equal to the insertion loss below the limiting threshold. (Figure 1 shows typical insertion loss below the limiting threshold.)

The VSWR specification in Table 1 applies below the limiting threshold. (Typical VSWR into either port is shown in Figure 2.) VSWR above the threshold is unpredictable, since the limiter effects its limiting by reflecting some of the input power.

Limiting is non-linear and depends on input power and ambient temperature. The typical limiting curves shown in Figure 3 apply at an ambient temperature of 25°C.

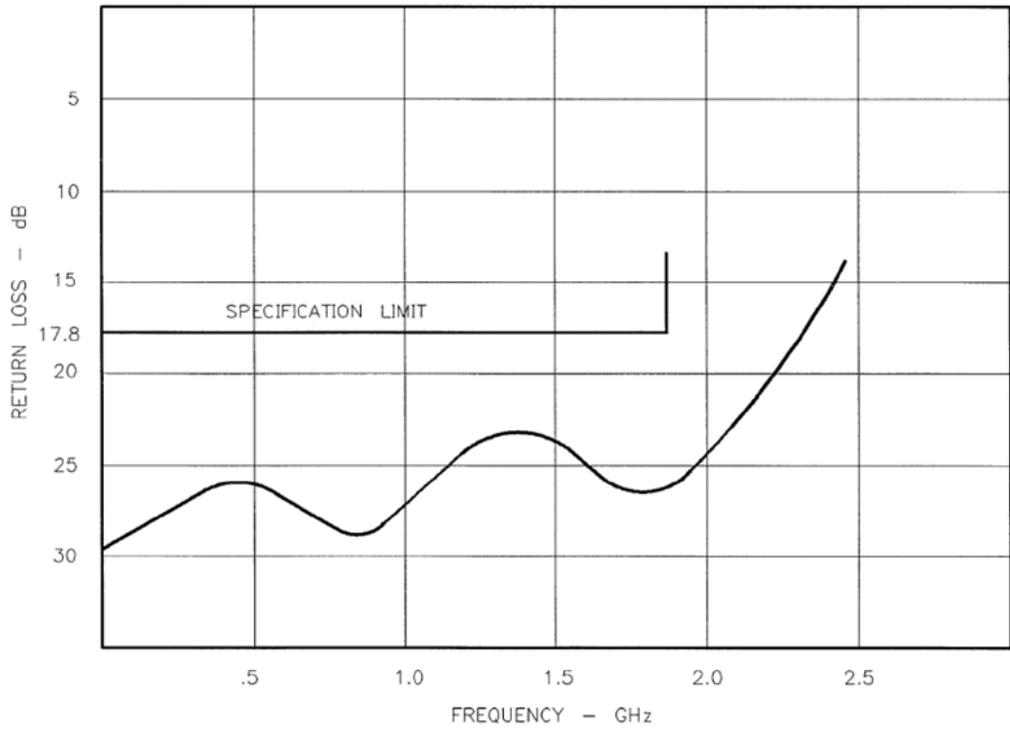


Figure 2 Typical return loss versus frequency

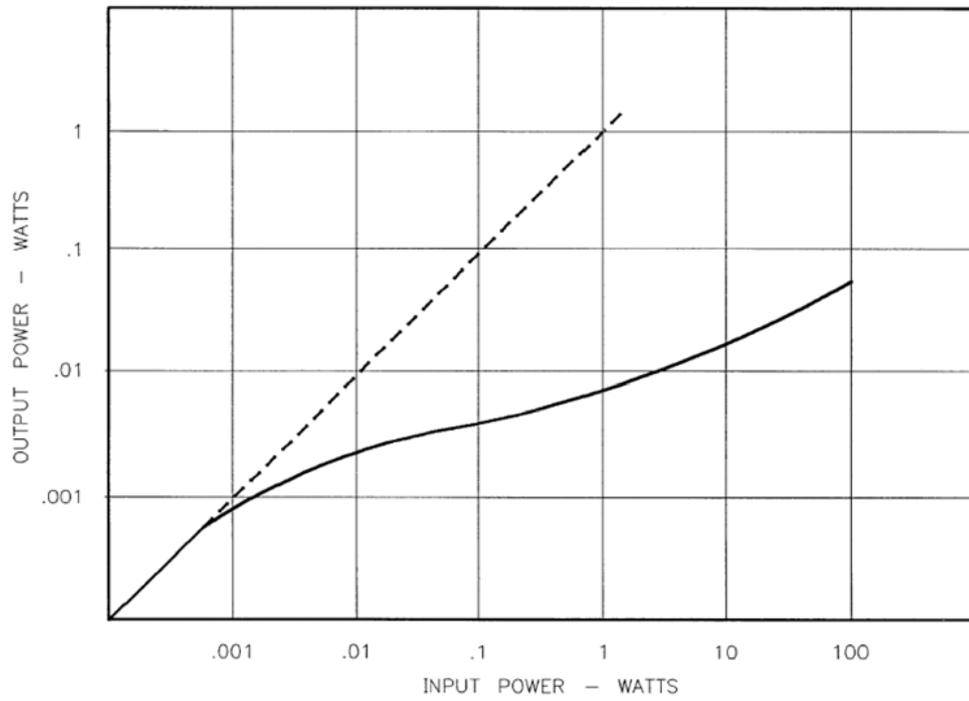


Figure 3 Typical output power versus input power at 25°C

Installation

Initial inspection

Verify that the shipment is complete by referring to the contents list in the shipping container. If the container or device appears damaged, or if the shipment is incomplete, contact Keysight Technologies – see “Sales and Technical Support” on page 3. Keysight will arrange for repair or replacement of incomplete or damaged shipments without waiting for a settlement from the transportation company.

Electrical inspection

VSWR

To check that the limiter meets the VSWR specification listed in Table 1, use any test system that can measure return loss. Terminate the unused port with an accurate 50 ohm termination. Incident power must be less than 1 mW (the limiting threshold).

Insertion loss and frequency response

To check that the limiter meets the insertion loss and frequency response specifications listed in Table 1, use any test system that can measure insertion loss. The input and output ports must be provided with a good 50 ohm match. Incident power must be less than 1 mW (the limiting threshold).

CAUTION

During the test of limiting specifications, do not apply more than 10W average power to the limiter. There should be $<1.3 V_{dc}$ with no RF applied, and $0.0 V_{dc}$ when RF is applied. Permanent damage to the diodes could result from exceeding these levels.

Limiting

The power limiting performance can be compared against the typical performance shown in Figure 3 by using the same test system that is used to check insertion loss. Incident power should be slowly increased from below 1 mW to 10 W while the output power is observed.

Storage environment

The limiter should be stored in a clean, dry environment with the following environmental limitations:

- Temperature: -40°C to $+75^{\circ}\text{C}$
- Humidity: $<95\%$ relative
- Altitude: <7620 meters (25,000 feet)

Operation

Operating environment

The operating environment should be with the following limitations:

- Temperature: 0°C to +55°C
- Humidity: <95% relative
- Altitude: <4572 meters (15,000 feet)

Mating connectors

Mating connectors used with the limiter should be Type-N connectors that are compatible with US MIL-C-39012.

Instructions

CAUTION

Do not apply more than 10 W average power or 100 W peak power to the limiter. There should be <1.3 Vdc with no RF applied, and 0.0 Vdc when RF is applied. Permanent damage to the diodes could result from exceeding these levels.

For reliable operation over its full frequency and power range, the limiter must be used as a unidirectional device. Incident power must be applied as shown on the label of the limiter. The limiter can be used to protect the input mixer of a spectrum analyzer, the sampler of a network analyzer, the power sensor (or thermistor mount) of a power meter, or the input circuitry of any other device that might be subjected to transients and accidental overloads.

The use of an attenuator between the limiter and the device it is protecting is recommended to minimize measurement uncertainty that is due to multiple mismatches. For example, set the input attenuator of a spectrum analyzer to at least 10 dB.

Harmonic distortion is generated by the limiter while it is limiting. If the incident signal exceeds the limiting threshold, use attenuation between the limiter and the source to reduce the signal below 1 mW. Typical harmonic distortion below the limiting threshold is shown in [Figure 4](#). The limiter will still prevent transients from damaging the device it is protecting.

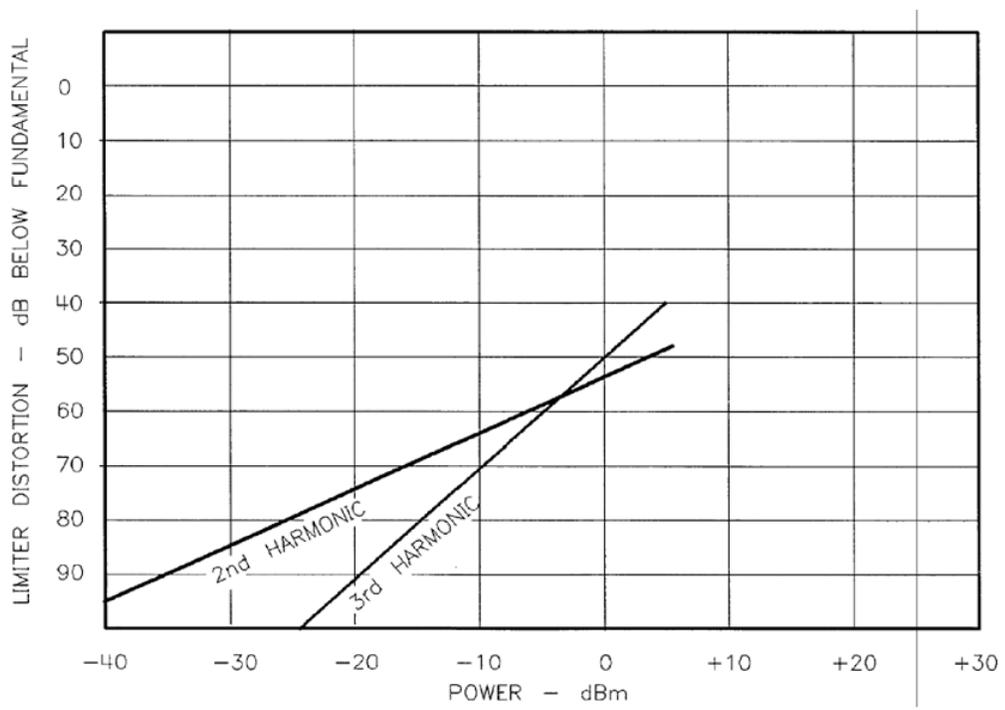


Figure 4 Typical harmonic distortion versus input power

Repair

Diodes

If the diodes of the limiter fail to function correctly or have been damaged, return the limiter to Keysight Technologies for repair – see “Sales and Technical Support” on page 3. Do NOT attempt to remove or replace the diodes.

Connectors

If a connector is damaged or worn, it can be disassembled, the worn or damaged parts replaced, and the connector reassembled. To disassemble a connector, carefully remove the label, place the limiter in a vise, and remove the connector body, which has right-hand threads. Replace the worn or damaged part (see Figure 5) and reassemble the connector.

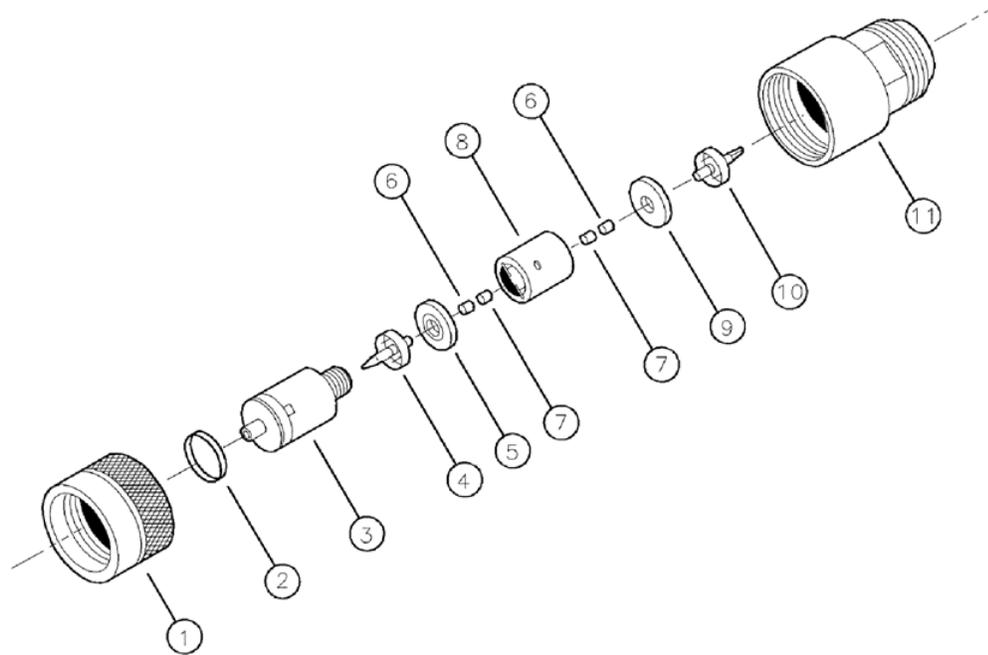


Figure 5 11867A illustrated parts breakdown

Table 2 11867A illustrated parts breakdown

Item	Description	Part number
1	Nut, RF Connector	1250-0918
2	Ring, RF Connector, Series N	1250-0016
3	Housing, Male Connector	08491-2100
4	Pin Assembly, Male	08491-4000
5	Spacer	08491-20003
6	Plug	11867-20001
7	Contact, Elastomer	8160-0729
8	Limiter Assembly (not field replaceable)	--
9	Spacer	08491-20003
10	Pin Assembly, Female	08491-4001
11	Connector, Female	08491-2101
12	Spacer, Outer Conductor (optional, not shown)	08742-0006



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