Operating and Service Manual

Agilent 87405C
Preamplifier

Agilent Technologies

Manufacturing Part Number: 87405-90001

Printed in Malaysia

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Contents

Contents

General Information

Preamplifier Overview

The Agilent 87405C preamplifier offers reliable gain and low noise figure to measurements systems, thus improve overall system performance and reduce systematic errors. With the ability to be powered directly from the instrument probe-port, it eliminates the need for a separate power supply. The 87405C is ideal for use as the front end preamplifier for a variety of Agilent instruments such as PSA, ESA as well as the MXA series of spectrum analyzer. The rugged Type N connectors make the 87405C well suited for various field applications.

Figure 1 87405C Preamplifier

Refer to Table 1 for general information of 87405C preamplifier..

Table 1 General Information of 87405C Preamplifier

Model	Frequency Range	Small Signal Gain	Connector Type
87405C	100 MHz to 18 GHz	25 dB	Type N (m), (f)

Features

- DC bias via probe-power port on Agilent instruments eliminates the need for additional power supply
- Low noise figure of 4.5 dB and high gain of 25 dB reduces total system noise figure for better equipment dynamic range and sensitivity
- Compact design and portability allows usage in the field (Installation & Maintanence applications)
- High P1dB of 15 dBm increases available power from network analyzer and signal source

Application

Low Level Signal Measurement

In low level signal measurement, the sensitivity of the measurement system can be improved by adding a preamplifier into the system as illustrated in Figure 2.

Total noise figure of the system can also be reduced using a preamplifier as the noise figure of the system is dominated by the noise figure of the preamplifier.

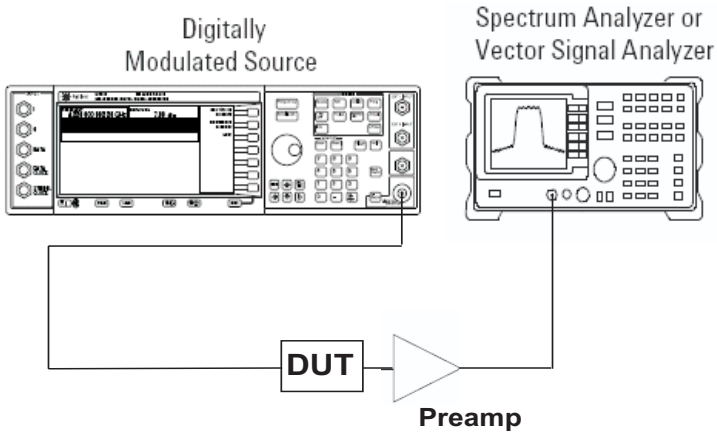

Figure 2 Low level Signal Measurement Test Setup

Specifications

Specifications refer to the performance standards or limits against which the preamplifier is tested.

Typical characteristics are included for additional information only and they are not specifications. These are denoted as "typical", "nominal" or "approximate" and are printed in italic.

Table 2 Product Specifications for 87405C Preamplifier

Agilent Model Number	87405C	
Frequency range	100 MHz to 4 GHz	4 GHz to 18 GHz
Gain, S_{21}	25 dB	
Flatness	±1.5 dB	
P_{1dB}	15 dBm	14 dBm
Noise Figure	6 dB	4.5 dB
Survival Input Power	+15 dBm	
Return Loss S_{11}	15 dB	10 dB
Return Loss S_{22}	15 dB	10 dB
Harmonics (@ +4 dBm output power)	*30 dBc typical*	
Impedance	*50 ohms nominal*	
Reverse Isolation	*50 dB typical*	
Third Order Intercept (TOI)	*+23 dBm typical*	
Power Dissipation	*2.1 W typical*	

Table 3 General Specifications for 87405C Preamplifier

Agilent Model Number	87405C
Bias Voltage	*+15V ± 6% Vdc @ 140 mA nominal*
	-15V ± 6% Vdc @ 3 mA nominal
Connectors	
RF	Type N(f) in, N(m) out
DC	Probe Power Connector (f)
Weight	0.22 kg (0.485 lb)
Dimension	
Length	98.3 mm (0.709 inch)
Height	40.3 mm (1.587 inch)

Table 4 EMC Compliance for 87405C Preamplifier

	IEC 61326:1997
	EN 61326:1997
This ISM device complies with Canadian ICES-001	
Line voltage interrupt (1 cycle, 100%)	IEC/EN 61000-4-11
Surge test (1.2 x 50µs, 0.5 kV line-line, 1 kV line-ground)	IEC/EN 61000-4-5
Electrical fast transients (0.5 kV signal lines, 1 kV power lines)	IEC/EN 61000-4-4
Radiated emissions	CISPR 11, Class A EN55011
Radiated immunity (3 V/m, 80 - 1000 MHz)	IEC/EN 61000-4-3
Conducted emissions	CISPR 11, Class A EN55011
Conducted immunity (3 V, 0.15 - 80 MHz)	IEC/EN 61000-4-6
ESD (4 kV contact discharge, 8 kV air discharge)	IEC/EN 61000-4-2

Environmental Specifications

The 87405C preamplifier is designed to fully comply with Agilent Technologies' product environmental specifications as shown in Table 5.

Table 5 87405C Preamplifier Environmental Specifications

Temperature:	
Operating	-45°C to +55°C
Storage	-65°C to +85°C
Cycling	-65°C to +85°C , 10 cycles @ 20°C per minute, 20 minutes dwell time per MIL-STD-833F, Method 1010.8, Condition C (modified)
Humidity:	
Operating	50% to 95% RH at 40°C, 24 hour cycling, repeated 5 times
Storage	90% RH at 65°C, one 24 hour cycle
Shock:	
Half-sine, smoothed	1500 G @ 0.5 ms, 3 shock pulses per orientation, 18 total per MIL-STD-833F, Method 2002.4, Condition B (modified)
Vibration:	
Broadband random	50 to 2000 Hz, 7.0 G rms, 15 minutes, per MIL-STD-833F, Method 2026-1 (modified)
Altitude:	
Storage	<15,300 meters (50,000 feet)
Temperature Coefficient:	
Gain	-0.06 dB/°C

Installation

Initial Inspection

1. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked both mechanically and electrically.

- Check for mechanical damage such as scratches or dents.
- Procedures for checking electrical performance are given under “Operator’s Check” or “Performance Tests’.

2. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, contact the nearest Agilent Technologies Sales and Service office. Refer to the Service and Support information in the front matter of this manual. Agilent Technologies will arrange for repair or replacement of the damaged or defective equipment. Keep the shipping materials for the carrier’s inspection.

3. If you are returning the instrument under warranty or for service, repackaging the instrument requires original shipping containers and materials or their equivalents. Agilent Technologies can provide packaging materials identical to the original materials. Refer to Service and Support information in the front matter of this manual for the Agilent Technologies nearest you. Attach a tag indicating the type of service required, return address, model number, and serial number. Mark the container ***FRAGILE*** to insure careful handling. In any correspondence, refer to the instrument by model number and serial number.

Operating Instruction

Operator's Check

The operator's check is supplied to allow the operator to make a quick check on the preamplifier prior to use or if a failure is suspected.

Description

All four s-parameters of the preamplifier are measured using a network analyzer calibrated with the necessary settings applied.

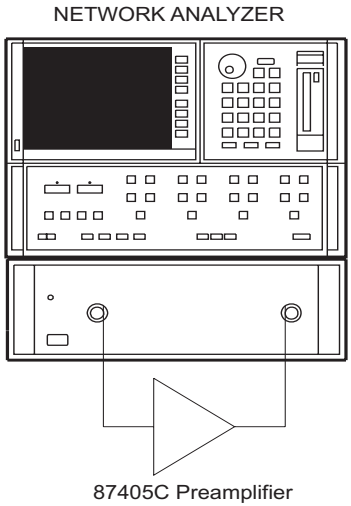

Figure 3 Equipment Setup Using Network Analyzer

Quick-Check Procedure

The equipment setup is as illustrated in Figure 3.

1. Calibrate network analyzer using an appropriate settings and setup if necessary.
2. Connect input of preamplifier to port 1 of network analyzer and output to port 2.

3. Turn on biasing to the preamplifier by connecting to power supply, ±15 V, 0.2A.
4. Measure the S11 (input return loss), S22 (output return loss) and S21 (gain). Gain flatness is the difference between maximum and minimum gain values.
5. Compare measurement results with specifications in Table 2.

Performance Tests

The preamplifier can be tested to the accuracy of the specifications with a network analyzer or equivalent equipment of suitable accuracy. If a network analyzer is available, test the instrument using the procedure in the analyzer's operating manual.

Service Instructions

Repair

In case your preamplier requires repair services, please contact your nearest Agilent Sales and Service Center.

Maintenance

The connectors, particularly the connector faces, must be kept clean.

For instruction on connecting and care of your connectors, refer to the Microwave Connector Care Quick Reference Card (08510-90360).

Replaceable Parts

Table 6 lists the replaceable parts for Agilent 87405C preamplifier.

Table 6 Replaceable Parts for 87405C Preamplifier

Description	Agilent Part Number	Qty
Cable assembly - banana plug	87405-20006	1
Cable assembly - probe power cable	87405-20007	1
Cable assembly - 15-pin	87405-20010	1

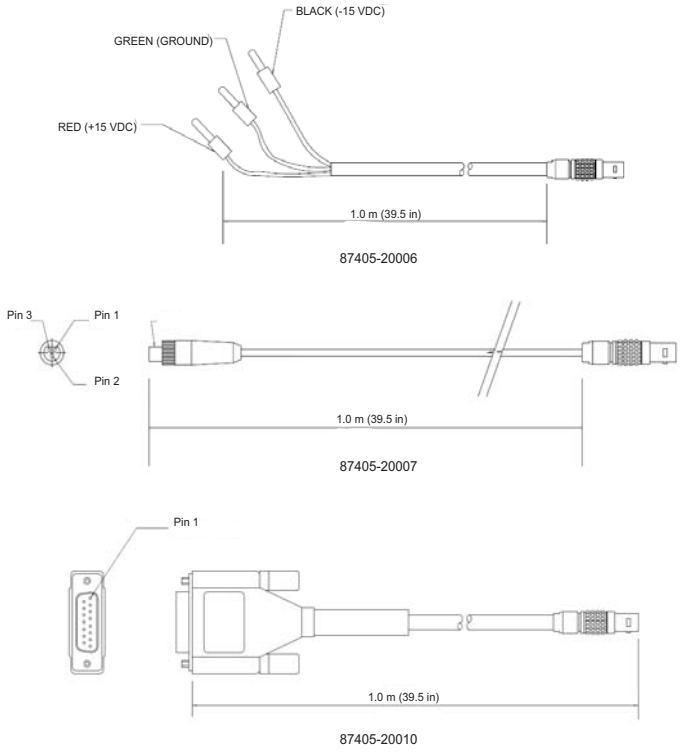

Figure 4 Drawings of Replaceable Parts for 87405C Preamplier