

# Keysight Technologies

87405B Preamplifier 10 MHz to 4 GHz



Technical Overview

## Features

- 22 dB Gain
- 5 dB Noise Figure
- Probe-power bias connection via probe port from Keysight's spectrum analyzers
- Compact Size

## Benchtop/General Purpose Use

Used alone on the bench, the Keysight Technologies, Inc. 87405B Preamplifier can be added to any application in which additional gain and low noise are required.

The Keysight 87405B preamplifier brings reliable gain and low noise figure to measurement systems to improve overall system performance and reduce systematic errors. With its compact and portable size, this preamplifier can be powered directly from the instrument's probe-port which eliminates the need for a separate power supply and makes it an excellent choice for use in the field. The 87405B is designed for use with a variety of Keysight instruments such as the PSA, ESA, and MXA spectrum analyzers. The 87405B is the recommended preamplifier for use with the 8594E noise figure measurement solution. The rugged Type-N connectors stand up to the multiple connect and disconnects needed in field applications for reliable, repeatable measurements.

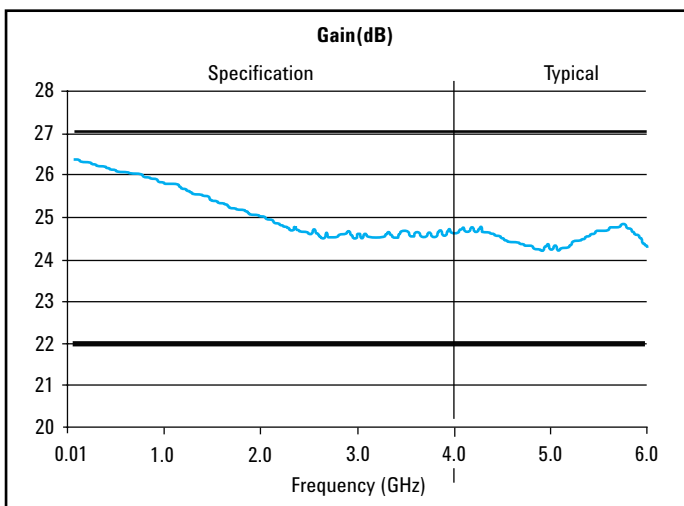
## Improve Noise Figure Measurements

Add a preamplifier to noise figure measurement systems to significantly lower system noise figure. The noise figure of the system is greatly impacted by the noise figure of the preamplifier.

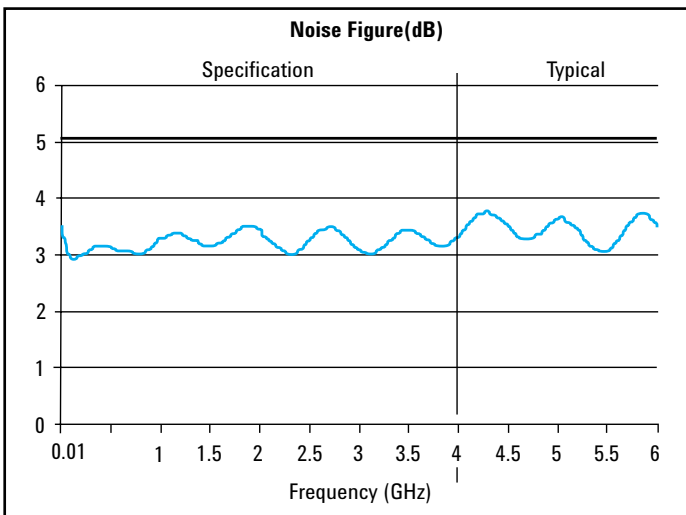
$$F_{\text{new}} = F_{\text{pa}} + \frac{F_{\text{sys}} - 1}{G_{\text{pa}}}$$

Where F and G are noise figure and preamplifier gain, both in linear terms.

$$NF_{\text{sys}} = 10 \log (F_{\text{sys}}) \text{ in dB}$$

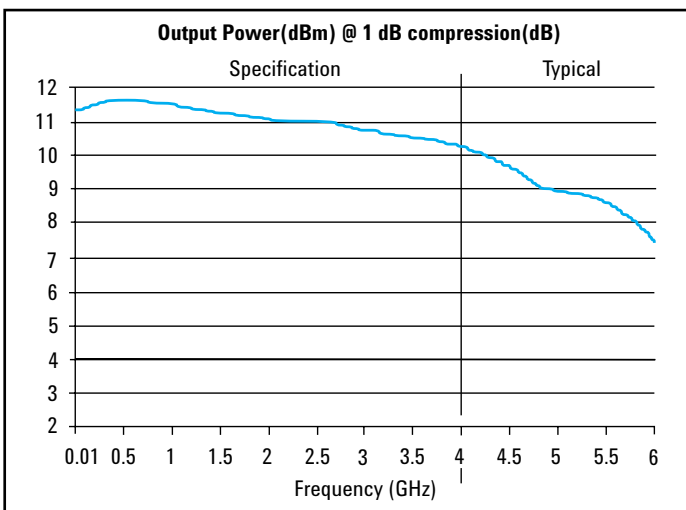


For systems having a single preamplifier, where the gain of the preamplifier is greater than or equal to the spectrum analyzer noise figure, the system noise figure approximately equals the noise figure of the pre-amplifier.



## Increase Sensitivity and Speed

Adding preamplifiers to measurement systems can improve sensitivity for measuring low-level signals. Boost the sensitivity of your Keysight spectrum analyzer 15 to 25 dB by using the 87405B preamplifier. Alternatively, better sensitivity can be traded for measurement speed. Spurious tests often require narrow resolution bandwidths to reduce the noise floor of the analyzer, allowing low-level signal detection. An analyzer with low noise figure allows you to use a wider resolution bandwidth, yet achieve the same sensitivity. Sweeptimes can improve one hundred times for each decade increase in bandwidth. The 87405B preamplifier has gain and noise figure characteristics that optimize dynamic range and sensitivity.



## 87405B Product Specifications



Frequency range	10 - 4000 MHz
Small signal gain	22 - 27 dB min-max
Gain flatness	$\pm 1.5$ dB 10 - 4000 MHz
Output power	8 dBm at 4 GHz (1 dB compression pt.)
Noise figure	5 dB 10 - 4000 MHz
Third order intercept (TOI)	15 dBm typical
Harmonics	30 dBc typical (@ +4 dBm output power)
Input VSWR	1.5:1 10 - 1000 MHz 1.7:1 1000 - 2000 MHz 2.1:1 2000 - 3000 MHz 2.2:1 3000 - 4000 MHz
Output VSWR	1.9:1 10 - 4000 MHz
Impedance	50 ohms nominal
Reverse isolation	40 dB typical
Survival input	+10 dBm typical power (max)
Power dissipation	1.6 W nominal
Temperature	(operating) 0 to +55 °C (storage) -40 to +70 °C

*Specifications describe the instrument's warranted performance over the temperature range 0 °C to +55 °C (unless otherwise noted). All specifications apply after the instrument's temperature has been stabilized after one hour continuous operation. Typical characteristics are intended to provide information useful in applying the instrument by giving typical but nonwarranted performance parameters. These are denoted as "typical" or "nominal" and apply over the temperature range 0 °C to +55 °C.*

**Caution:** Electrostatic Discharge (ESD) can damage or destroy electronic components. It is recommended that this preamplifier, like other electronic components, be installed and operated at a static-free workstation or in an environment where precautions against ESD have been implemented.

## EMC

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

## General Specifications

Bias voltage and current	15 ±6% Vdc @ 105 mA nominal
Connectors	RF Type N(f) in, N(m) out DC Probe Power Connector (f)
Weight	Net 233 g, shipping 546 g

## Environmental Information

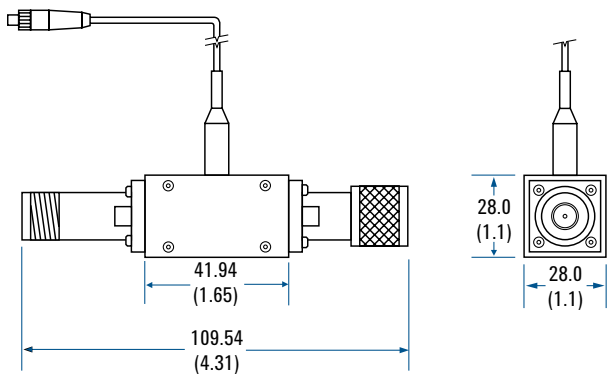
Moisture resistance	65 °C at 95% RH for 10 days per Mil-Std-883C method 1004.5
Altitude, non-operating	15,000 meters per Mil-Std-883C method 1001-C

## Reliability

Random vibration 5.2 G (rms) to 2000 Hz	per Mil-Std-883C method 2026-11A
Shock 1500 G (peak), 0.5 ms per	Mil-Std-883C method 2002.3-B
Operating temperature (0 to +55 °C)	Class B2/B1 HPETM 757
Storage temperature (-40 to +70 °C)	Class B HPETM 757
5 Day Op. humidity cycle (40C/95% RH)	Class A2, B1, B2 HPETM 758, 4.6
Product safety evaluation	CSA 61010-1

# Mechanical Dimensions

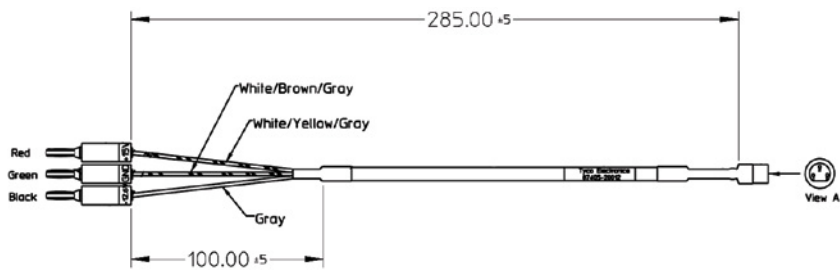
## 87405B Preamplifier 10 MHz to 4 GHz



### General specifications

Weight: Net 233 g, shipping 546 g.  
Cable nominal length is 460 mm (18.11 inches). Note: Dimensions are in mm (inches) nominal, unless otherwise specified.

## Option 001 Cable-Power Probe Connector to Banana Plugs



View A	Pin	Wire Colour	Voltage	Current	Plug Jacket Color
Ground	3	Gray	-12.6V±20%	75mA	Black
+15V	2	White/Brown/Gray	GND		Green
-12.6V	1	White/Yellow/Gray	+15V±20%	150mA	Red

## Powering Up Your Preamplifier

### Preamplifier biasing connection with Keysight E3620A



Set V1 to +15V

Set V2 to -12.6V

Connects to Red  
banana plug of the  
biasing cable.

Connects to Green  
banana plug of the  
biasing cable.

Connects to Black  
banana plug of the  
biasing cable.

Connect V1-, GND and V2+ together as shown in above green wires.

## Ordering Information

87405B Preamplifier 10 MHz to 4 GHz

87405B Option 001 Cable

## Recommended Power Supply

E3620A 50W Dual Output Power Supply  
E3630A 35W Triple Output Power Supply  
E3631A 80W Triple Output Power Supply  
E3646A 60W Dual Output Power Supply  
E3647A 60W Dual Output Power Supply  
E3648A 100W Dual Output Power Supply  
E3649A 100W Dual Output Power Supply

## Related Literature

*Noise Figure Measurement Accuracy*, Application Note, literature number 5952-3706E

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