

HPA-272+
Rack Mounted High-Power Amplifier (100W)
700 to 2700 MHz

User's Manual



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1 INTRODUCTION

Thank you for choosing Mini-Circuits' HPA-272+ high power amplifier to meet your needs! The purpose of the this user's manual is to instruct you on basic installation and setup of your equipment, to advise you on general precautions to be taken when installing and handling the amplifier unit, and to provide basic information on the proper use of this equipment.

We're here to support you every step of the way. For technical support and assistance, please find the following points of contact for your convenience:

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2 WARNINGS

Mini-Circuits' HPA-272+ is designed with multiple levels of protection to prevent injury to the user and damage to the amplifier during operation. However, Mini-Circuits strongly recommends that you observe standard operating precautions for high-power RF amplifiers to reduce the risk of injury and damage to the amplifier and connected components.

2.1 Safety Hazards



Electrical Danger

This equipment contains live 85-265V contacts and should be used and handled only by qualified professionals. When performing any activity in and around the HPA-272+ case, please exercise extreme caution to avoid touching any parts where live voltage may be present to prevent injury or death due to electrical shock.



Heavy Object

30 lbs. (13.61 Kg)


The equipment case for your HPA-272+ unit is heavy. When handling, use caution to prevent damage to the equipment and injury. Always follow safe lifting protocols and use any necessary lifting aids to prevent muscle strain or back injury. The unit must be supported in a rack structure by securely fastened side rails or shelving.





**High Speed Fan
Blade**


The HPA-272+ contains cooling fans with rotating blades that can cause serious injury or cut. Remove any loose articles before working inside the HPA-272+ chassis to avoid getting caught in moving machinery.


2.2 Additional Precautions

 **Maximum Input Power:** The HPA-272+ has a maximum RF input power rating of +7dBm. Exceeding this maximum will likely cause permanent damage to the amplifier.

 **Power Supply:** Do not apply RF input signal to the HPA-272+ while the AC mains supply is disconnected or the amplifier is powered off from the front panel switch. Use only the supplied AC mains power supply lead for connection to a properly grounded 85-265V mains power socket.

 **Air Flow:** The equipment chassis must be mounted by the customer to maintain a minimum of 1U (1.75") free air space above and below the top and bottom panels with unobstructed access to room ambient airflow for proper operation.

 **Electrostatic Discharge:** Any person operating this unit must have Electrostatic Discharge (ESD) protection to prevent damage to any components.

 **Opening & Tampering:** This equipment is designed to be serviced only by professional electrical technicians. Case openings by any person other than qualified personnel authorized by Mini-Circuits or the customer will void any and all terms of the Limited Warranty.¹

¹ Although top and bottom panels are intended to allow accessibility, it is important to use caution when connecting or disconnecting any electrical or RF connection, or when moving, removing, or replacing any wires, cables, connections, or components within the chassis to avoid potentially damaging or dislodging any other cables or connections.

3 PHYSICAL DESCRIPTION

Mini-Circuits' HPA-272+ high power amplifier comes housed in an aluminum alloy chassis measuring 19" wide x 5.20" (3U) high x 20" deep (482 x 132 x 508mm). The front panel is fitted with an AC power on/off switch, N-Type connectors at the RF input and output ports, a standard 9-pin D-sub socket (see **section 8.2.2** Status Monitoring Via the 9-Pin D-Sub Connector), and 3 LED lights indicating AC power connection (green), temperature alarm (red), and fan malfunction alarm (red). The front panel of the unit is also equipped with two handles and marking with the name, model number, frequency range, and saturated output power of unit. Slotted holes on the outer left and right extensions of the front panel allow secure mounting to a standard 19" (483mm) rack support structure.

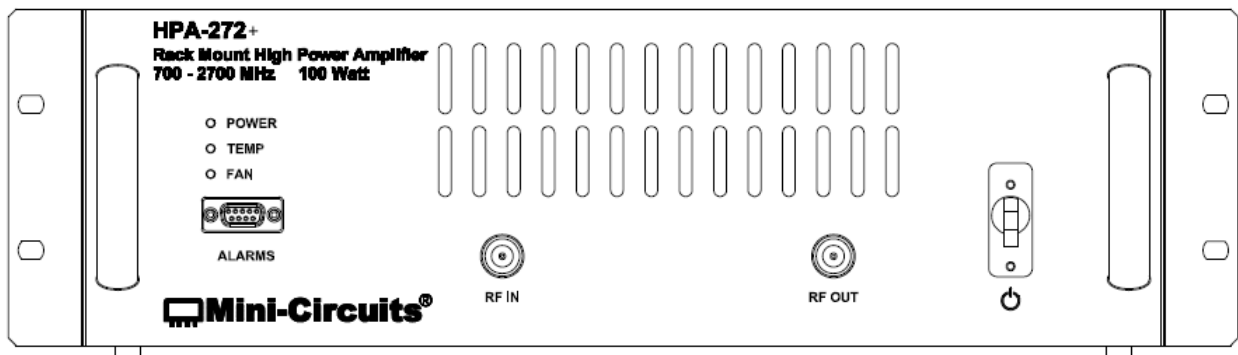


Figure 1: Front panel of HPA-272+ equipment chassis

On the rear panel of the unit is the input for a standard 85-265V AC power supply with caution label (right side). At the right of the rear panel is a clearly marked grounding terminal. It is recommended that this terminal be connected to a Common Bonding Network (CBN). On the left side of the rear panel is an identification sticker containing the model name and serial number. Two cooling fans are mounted to the center of the panel.

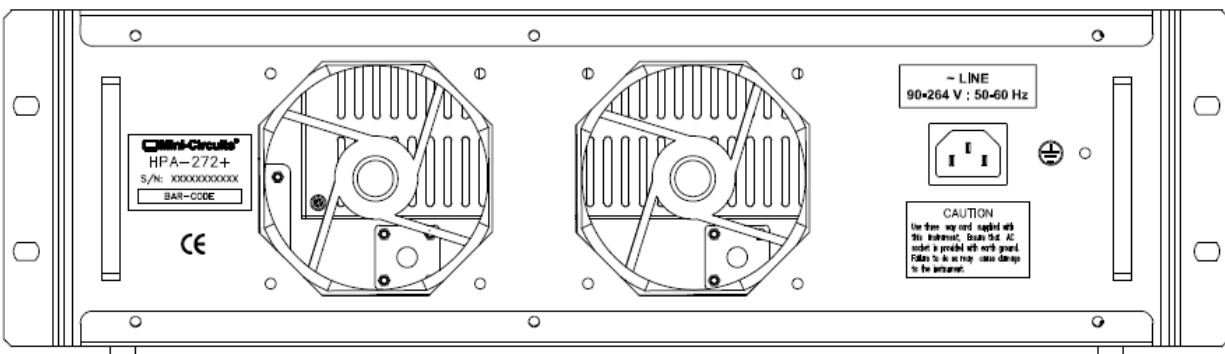


Figure 2: Rear panel of HPA-272+ equipment chassis

4 FUNCTIONAL DESCRIPTION

Mini-Circuits' HPA-272+ is a high-power rack-mountable RF amplifier capable of delivering output power up to 100W across the 700 to 2700 MHz frequency range. The amplifier provides 48 dB gain with ± 1.7 dB gain flatness, +55 dBm OIP3 and 89 dB reverse isolation. It operates on a self-contained 85 - 265V AC line power supply. This model features internal cooling and self-protection against over-temperature, and is immune to open and short loads while delivering full power from the output port.

The unit features LED indicators on the front panel which illuminate to alert the user when AC power is connected, when the unit temperature exceeds the maximum rating, and when the cooling fans are not functioning properly. The 9-Pin D-Sub socket allows remote monitoring of these conditions in layouts where the front panel is not clearly visible to the operator.

The HPA-272+ is an ideal solution for test applications requiring high power over a wide frequency range such as EMI and antenna testing, RF power stress testing, reliability testing and more. It is also highly useful for production test applications in which it is desirable to test many DUTs in parallel such as HTOL. The amplifier can be paired with high power splitters to distribute a test signal through up to 80 channels. See **section 9** for more information about applications of this equipment.

5 POWER SPECIFICATIONS AND MAXIMUM RATINGS

5.1 AC Power Specifications

Parameter	Specification
Supply Voltage:	~Line 85-265V : 47-63 Hz
Power Consumption	531W (typ.)

5.2 Maximum Ratings

To prevent damage to your equipment, please do not exceed any of the maximum ratings specified here and on the model data sheet.

Table 1: Maximum

Parameter	Ratings
Operating Temperature	0°C to 50°C
Storage Temperature	-20°C to 70°C (non-condensing)
Input RF Power (no damage)	+7 dBm

6 UNPACKING

6.1 Unpacking

The equipment ships in a single large cardboard carton measuring 11 x 25.125 x 23" pictured in the figure below.

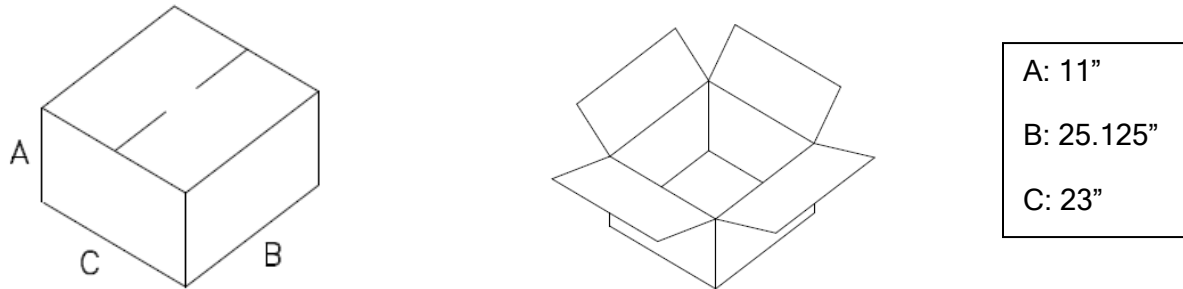


Figure 5: Shipping carton

Within the carton, the HPA-272+ unit is protected by pink foam inserts. Remove the unit from the box carefully and set on a stable surface. Be sure not to lose or misplace the power cord contained in the package with the amplifier unit.

6.2 Package Contents

Table 2: Package contents

Item Description	Quantity
HPA-272+ Unit	1
CBL-3W-XX+ Black AC Power Cord (US, EU or UK)	1



Caution: The package and its contents are heavy! Use safe lifting protocols when handling to avoid strain or injury.

7 LAYOUT AND INSTALLATION

7.1 Rack Mounting

The HPA-272+ equipment chassis should be fastened to rack support structure through the slotted rack mounting holes (4x) on the front panel shown below.

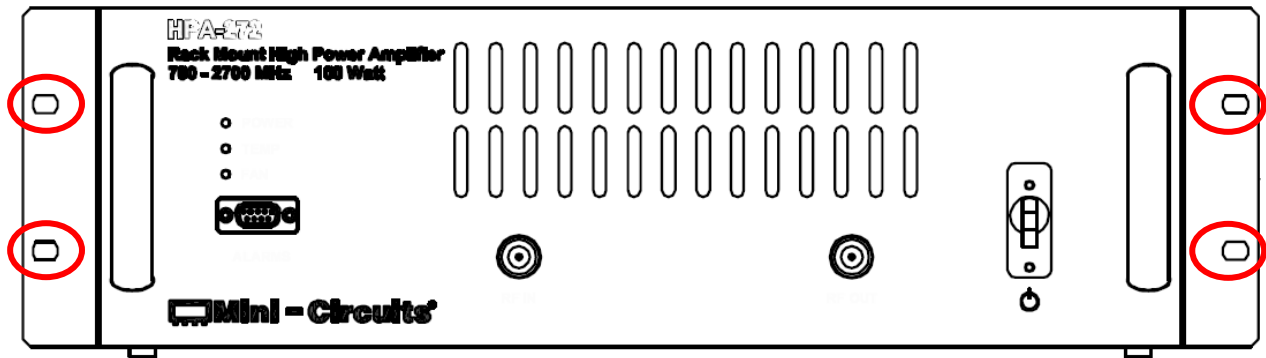


Figure 3: Slotted rack mounting holes in front panel of HPA-272+ equipment chassis

! Chassis must be mounted to maintain a minimum of 1U (1.75") clearance above top panel and below bottom panel with unobstructed access to room ambient airflow for proper operation.

! Additionally, **due to weight, the unit must be supported by means other than the front panel.** This can be facilitated by side rails or by a shelf, sufficiently secured to a standard, high grade, 19-inch equipment rack.

7.2 Rear Panel Grounding Terminal

The rear panel of the chassis is constructed with a grounding stud to ground the box. This stud should be connected to a Common Bonding Network (CBN) with 20 gauge or larger copper wire.



Figure 4: Rear panel grounding terminal

8 OPERATING INSTRUCTIONS

8.1 Connecting the Amplifier

The HPA-272+ has been designed with multiple levels of protection to prevent avoidable damage to the amplifier during operation. However, Mini-Circuits' strongly recommends that standard operating precautions for high-power RF amplifiers be observed to reduce risk of damage to the amplifier and connected components.

The recommended sequence for connecting the amplifier is as follows:

- 1) Connect AC mains power supply
- 2) Connect output load
- 3) Turn on the AC power using the switch on the front panel
- 4) Apply the RF input signal

8.2 Temperature and Fan Monitoring

8.2.1 Front Panel LED Indicators

The HPA-272+ features LED lights on the front panel which provide easy visual confirmation of the internal temperature and fan status.

- The green LED labelled "Power" indicates the unit is connected to an AC power supply and powered on.
- The red LED labeled "Temp" indicates an alarm that the temperature inside the unit exceeds the maximum rating.
- The red LED labeled "Fan" indicates a fault or mechanical blockage with the cooling fans.

Both of the red LEDs should be off during normal operation.

Table 3: LED Indicators (Front Panel)

Name	Color	LED State	
		Off	On
Power	Green	Power off	Power on
Temp	Red	Normal	Alarm Shutdown
Fan	Red	Normal	Fault

8.2.2 Status Monitoring Via the 9-Pin D-Sub Connector

In situations where the front panel of the amplifier unit is not clearly visible, the internal temperature and the “health” of the cooling fans can also be monitored remotely via the D-Sub connector on the front panel.

Connections to the 9-pin D-Sub socket on the HPA-272+ should be made as shown in table 4 below. The output at pins 1 and 2 will be TTL logic levels indicating the status of the amplifier as follows:

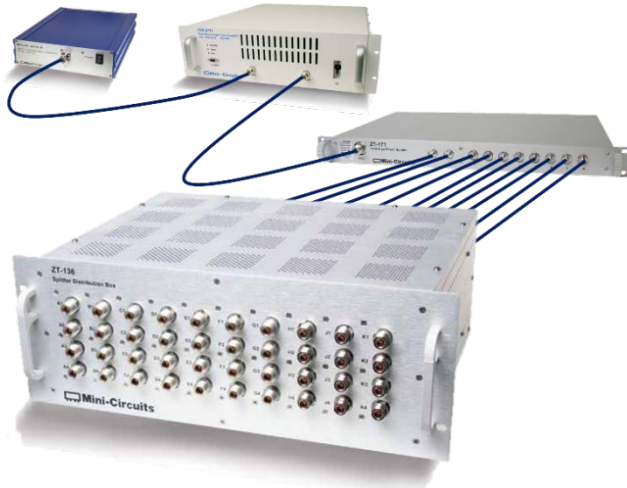
- Logic 1 (high) at pin 1 signals over temperature alarm
- Logic 1 (high) at pin 1 signals fan malfunction and potential mechanical blockage
- Logic 0 (low) at these pins indicates normal operation

Table 4: D-Sub Male Connector Pin Functions (Front Panel)

Pin #	Function	TTL Logic Level	
		Low	High
1	Temperature Alarm	Normal	Alarm Shutdown
2	Fan Alarm	Normal	Fault
3	Ground	--	--
4-9	No Connection	--	--

9 COMPANION PRODUCTS AND APPLICATION CIRCUITS

9.1 High Power, Multi-Channel Burn-In System



The HPA-272+ may be combined with Mini-Circuits [SSG-6000RC](#) wideband synthesized signal generator, [ZT-10HPS-27+](#) high-power (100W) 10-way splitter, and [ZT-136](#) multi-splitter rack (containing 10 independent, 10W, 4-way splitters), to deliver a test tone anywhere in the 700 to 2700 MHz range into 40 test channels simultaneously at greater than 1W per channel.

This setup allows dramatic increases in burn-in production test throughput by enabling many DUTs to be tested in parallel.

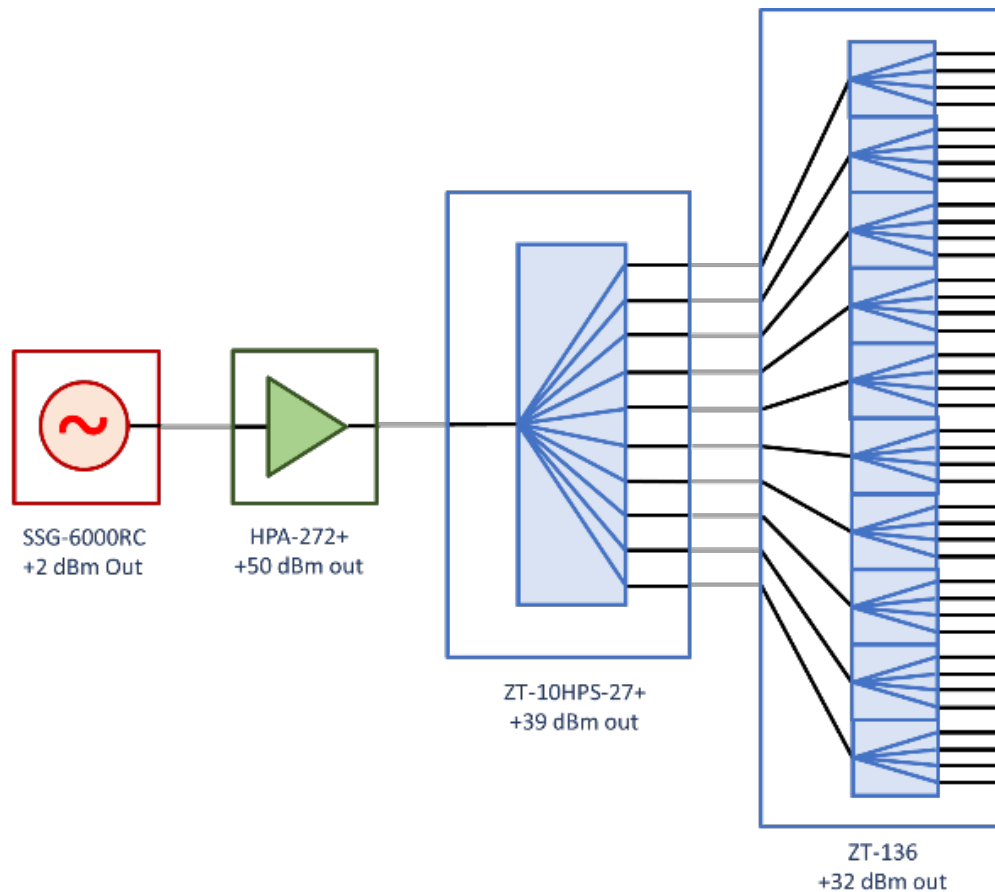
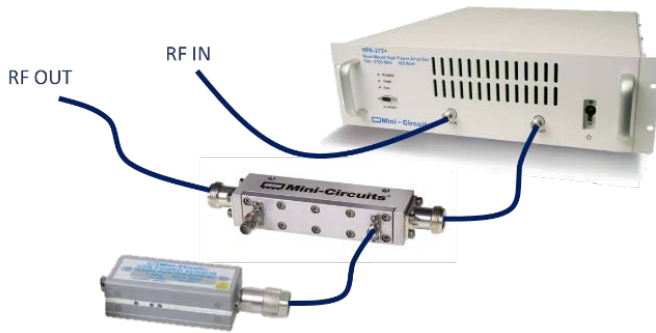


Figure 5: Functional schematic of multi-channel burn-in system with HPA-272+

9.2 Output Power Monitoring



Mini-Circuits' [PWR-4RMS](#) true RMS power sensor and [ZGDC35-93HP+](#) high-power directional coupler allow a power monitoring circuit to be added to the output of the HPA-272+ amplifier. The coupler's 35 dB coupling ratio and 250W input power rating allow the power sensor to be used safely, even at fully saturated output power from the amplifier, providing a power measurement of approximately 0 to +50 dBm (1mW to 100W).

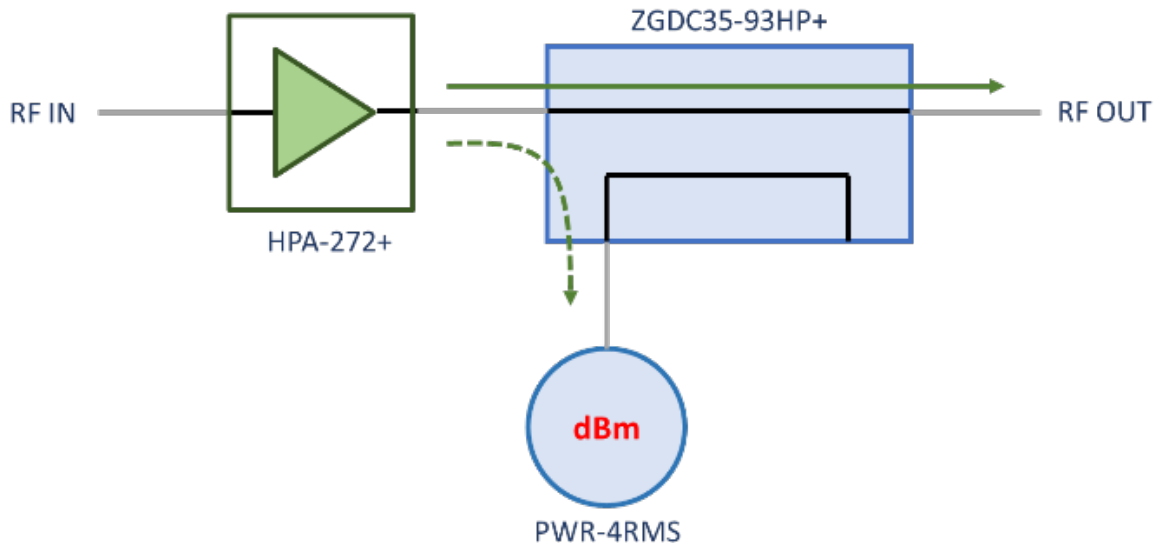


Figure 6: Functional schematic of an output power monitoring setup with HPA-272+

9.3 Output Power Monitoring with Gain Control



Combining Mini-Circuits [RUDAT-6000-60](#) programmable attenuator with the 50 dB dynamic range of the power sensor circuit presented in section 9.2 creates a high power amplifier system with typical gain control range of -2 to +48 dB.

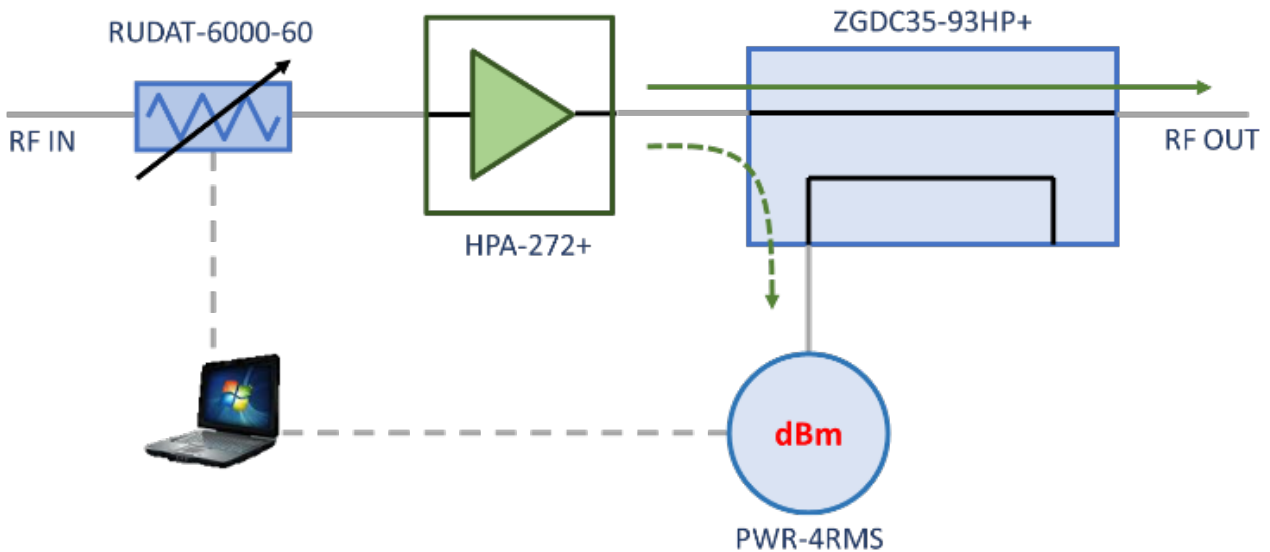


Figure 7: Amplifier system with output power monitoring and gain control using HPA-272+ and RUDAT-6000-60

9.4 High Reliability Test Cables



Mini-Circuits' [CBL series](#) of triple-shielded, high-reliability test cables are ideal for lab and production test requirements requiring superior quality and high performance from DC to 18 GHz. We have a wide selection of models in stock from 1.64 to 50 feet with SMA and N-Type connectors. Custom assemblies are also available on request.

9.5 HandFlex[®] Interconnect Cables



Mini-Circuits 141-series of HandFlex interconnect cables are ideal for fixed interconnections between components in test systems from DC to 18 GHz. Available from stock in a wide variety of lengths and many combinations of SMA, SMA right-angle, SMA bulkhead, and N-type connectors, they provide a low cost replacement to semi-rigid cables which often require special bending tools. With a minimum bend radius of just 8mm, 141-series HandFlex interconnect cables are ideal for enabling repeatable measurements in tight system layouts.

RETURN MATERIAL AUTHORIZATION (RMA)

If you have received this unit by mistake or wish to return it for evaluation, please contact Test Solutions support using the information on page 4. You may also contact our Sales Department at +1 718 934-4500 / sales@minicircuits.com or your local Mini-Circuits sales representative. They will discuss your RMA request, and per Mini-Circuits RMA policy, issue an identification number to ensure proper handling. **All returns must be accompanied by appropriate Mini-Circuits identification and documentation to ensure proper handling.**

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