Keysight Technologies U3070AK01

User's and Service Guide

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Gain Compression Test Set

KEYSIGHT TECHNOLOGIES

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1400 Fountaingrove Parkway
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U3070AK01

Description

The Keysight U3070AK01 Gain Compression Test Set is designed for use with the N5247A PNA-X Network Analyzer. This document guides you through the steps necessary to correctly and safely integrate the Gain Compression Test Set with the PNA-X. The Test Set is controlled by using GPIB or LAN.

- Option 050, 10 MHz to 50 GHz Gain Compression Test Set.
- Option 067, Extends the frequency range from 50 GHz to 67 GHz.

The U3070AK01 Test Set is based on the L4490A RF Switch Platform.

The N5247A PNA-X Network Analyzer will be referred to throughout this document as the PNA-X. The U3070AK01 will be referred to as the Test Set.

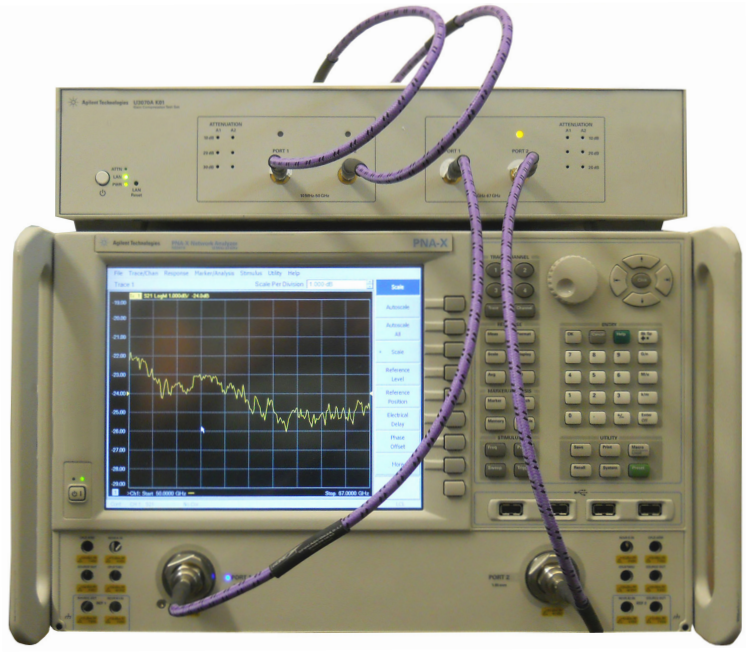
When using Keysight IO Libraries “Connection Expert Utility,” the interface identifies the Test Set as “U3070A” without Option K01. Option K01 will be listed on the serial tag on the rear panel.

Verifying the Shipment

To verify the contents shipped with your product, refer to the “Box Content List” included with the shipment.

Inspect the shipping container. If the container or packing material is damaged, it should be kept until the contents of the shipment have been checked mechanically and electrically. If there is physical damage refer to “Contacting Keysight” on page 45. Keep the damaged shipping materials (if any) for inspection by the carrier and an Keysight Technologies representative.

Figure 1 U3070AK01 with PNA-X



General Performance

The U3070AK01 Option 050 (10 MHz to 50 GHz) and Option 067 (extends to 67 GHz) are used to characterize the gain compression performance of the PNA-X. Before using the PNA-X with the Test Set,
a calibration is recommended for best measurement performance. Actual performance of the system is based on the customer's PNA-X and options that are used with the Test Set. It is not specify as an overall system performance. A functional certificate is only offered for the Test Set.

Power Requirements

Verify that the required ac power is available at all necessary locations before installing the Test Set to
the PNA.

- 100/120/220/240 V (50/60 Hz)
- The instruments can operate with mains supply voltage fluctuations up to ± 10% of the nominal voltage
- Air conditioning equipment (or other motor–operated equipment) should not be placed on the same
  ac line that powers the Test Set
- U3070AK01 maximum power is 50 W

Environmental Requirements

Refer to the PNA-X standard documentation for environmental requirements.

Environmental Tests

The U3070AK01 complies with all applicable safety and regulatory requirements for the intended location of use.

- Operating Environment (Indoor Use)
- Operating Ambient: Temperature 0 to 40 °C
- Operating Altitude: 0 to 2000 meters (~ 6,562 feet)
- The instrument can safely operate in a relative humidity of 80% for temperatures to 31 degrees C, decreasing linearly to 50% relative humidity at 40 degrees C.

Equipment Heating and Cooling

If necessary, install air conditioning and heating to maintain the ambient temperature within the appropriate range. Air conditioning capacity must be consistent with the rating listed in the PNA standard documentation.

CAUTION When installing this product in a cabinet, the convection into and out of the product must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the product by 4°C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, then forced convection must be used.

Required Conditions for Accuracy Enhanced Measurement

Accuracy–enhanced (error–corrected) measurements require the ambient temperature of the PNA-X and Test Set to be maintained within ± 1 °C of the ambient temperature at calibration.

Dimensions and Space Requirements

Standard installation of the U3070AK01 and PNA-X includes configuration and installation on a customer provided lab bench or table top of adequate size and strength.For weight, dimensions and space requirements, refer to the network analyzer documentation that is used to configure the Test Set.

Table 1 System Dimensions

Description	Dimension/Weight
Required Bench Top Dimension:	
Clearance above the bench	10 cm (3.94 in)
Width	42.5 cm (16.73 in)
Depth	58 cm (22.83 in)
Weight	9 kg (19.84 lb)

Maximum Power Levels and Performance Characteristics

Table 2 Power Levels

Option	RF Input/Output Power Damage Levels:	
050	10 MHz to 50 GHz; Port 1	+20 dBm
	10 MHz to 50 GHz; Port 2	+20 dBm
067	50 GHz to 67 GHz; Port 1	+10 dBm
	50 GHz to 67 GHz; Port 2	+10 dBm

NOTE Refer to your PNA-X standard documentation specifications to determine the maximum input power levels for the PNA-X access and test ports, or to optimize the power levels in the receivers.

NOTE Damage and maximum levels are not necessarily the optimum level.

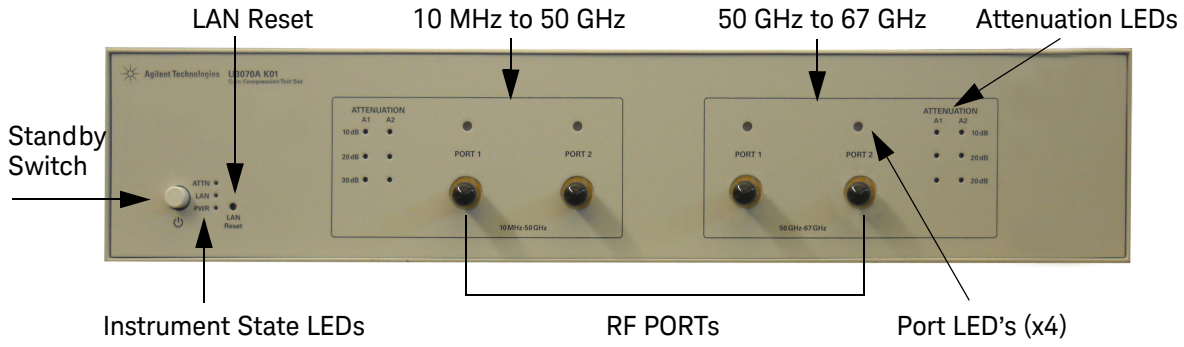
Table 3 Performance Characteristics

U3070AK01-050 (10 MHz to 50 GHz)	Frequency	Nominal (dB)
Match	10 MHz to 200 MHz > 200 MHz to 26.5 GHz > 26.5 GHz to 50 GHz	0 -6 -6
Rev Gain	10 MHz to 50 GHz	-40
Attn Error	10 MHz to 50 GHz	± 2
Fwd Gain	10 MHz to 26.5 GHz > 26.5 GHz to 50 GHz	18 15
U3070AK01-067 (50 GHz to 67 GHz)	**Frequency**	**Nominal (dB)**
Match	50 GHz to 67 GHz	-6
Rev Gain	50 GHz to 67 GHz	-40
Attn Error	50 GHz to 67 GHz	± 2
Fwd Gain	50 GHz to 67 GHz > 60 GHz to 67 GHz	7 10

Front and Rear Panel Features

CAUTION Refer to the standard instrument documentation for damage limits to the ports. Verify that your test setup will not cause those limits to be exceeded.

Figure 2 Front Panel



Standby Switch

Note that this switch is Standby only, not a line switch. The main power cord can be used as the system disconnecting device. It disconnects the mains circuits from the mains supply.

LAN Reset

The LAN reset button restores the instrument's default LAN configuration.

Attenuation LEDs

The LED's indicate the attenuation state of the programmable step attenuator.

Port LEDs

When lit the Port LEDs indicate the output port of the Test Set.

- Example 1 - To measure the forward gain (S21) of the Test Set, Port 1 LED is *off* and Port 2 LED is *on*.
- Example 2 - To measure the forward gain (S12) of the Test Set, Port 1 LED is *on* and Port 2 LED *is off*.

RF Input/Output Ports

- Option 050 (10 MHz to 50 GHz)
- Port 1 (2.4 mm female)
- Port 2 (2.4 mm female)
- Option 067 (50 GHz to 67 GHz)
- Port 1 (1.85 mm female)
- Port 2 (1.85 mm female)

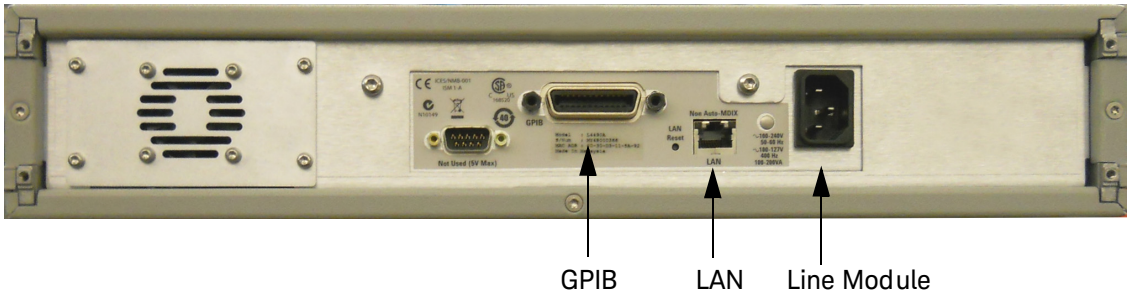
Instrument State LEDs

When the power is applied to the U3070AK01, the instrument enters its power-on sequence which requires several seconds to complete. The LEDs provide information on the state of the instrument during power-on and during upgrades of the instrument firmware. Table 4 identifies the instrument states based on the color and functioning of the LEDs.

Table 4 LED Definitions and Instrument States

LED	Color	Instrument State
ATTN LAN PWR	Off Green Green	Instrument in “ready” state LAN connection established - instrument has an IP address Firmware download complete
ATTN LAN PWR	flashing flashing Green	Power-on/boot-up. ATTN and LAN will flash red and then green during the power-on self-test.
ATTN LAN PWR	Off Red Green	No LAN connection due to: - disconnected LAN cable - failure to acquire and IP address - waiting for DHCP-assigned address
ATTN LAN PWR	Green (flashing Green Green	Instrument Busy State - firmware download (LAN LED red if download over GPIB) - lengthy instrument operation in progress
ATTN LAN PWR	Red (flashing Green Green	Instrument programming error or self-test error. Error queue is read using SYSTem:ERRor?
ATTN LAN PWR	Off Green (flashing) Green	Instrument identification. Activated from instrument Web interface: ON: Turn on Front Panel Interface Indicator OFF: Turn off Front Panel Interface Indicator

Figure 3 Rear Panel



GPIB Connector

This connector allows the Test Set to be connected directly to a controller.

LAN

The instrument is controlled over Local Area Network (LAN).

Line Module

The line module contains the power cord receptacle.The line fuse, as well as a spare, reside within the line module.

Install the instrument so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

CAUTION Always use the three-prong ac power cord supplied with this product. Failure to ensure adequate grounding by not using this cord may cause damage to the product.

Power Cords

A line power cord is supplied in one of several configurations, depending on the destination of the original shipment. Keysight can supply additional certified power cords to meet region electrical supply and receptacle configurations. Please contact Keysight at: http://www.keysight.com/find for assistance in power cord selection.

WARNING **This is a Safety Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall be only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

Controlling the Test Set

Controlling the Test Set and Making Measurements

Keysight U3070A is a “slave” instruments. A controller must be used to control the Test Set. There are two methods that can be used to control the Test Set.

- Using LAN connection
- Using GPIB connection

Once the connection between the Controller and the Test Set has been established (LAN or GPIB), the Test Set can be controlled using SCPI commands.

LAN Connection using Your Companies Intranet

Connect the test set and your controlling computer to an active instrument LAN line. Open the internet browser application on the computer. Enter this default web address on your browser application: http://A-U3070A-xxxxx

The Welcome screen for the instrument should be viewable if the LAN connection is working. Select the following screen control buttons to access the SCPI command control window.

1. Browser Web Connect (control button on the left side of the screen)
2. Allow Full control
3. Commands

NOTE The last five digits in the web address (xxxxx) are the last five digits of the instruments serial number.

Once the connection between the controller and the test set has been established (LAN or GPIB), the test set can be controlled using SCPI commands.

Test Set Control Commands

This command executes the specified factory defined sequence from the non-volatile memory. If the specified sequence name not currently stored in the memory, due to corrupted program or accidentally deleted, an error will be generated.

Syntax

ROUTe:SEQuence:TRIGger <command>

Parameters

Refer to Table 5 on page 10 for commands to control the test set’s programmable attenuator.

Example:

The following executed a sequence name "ATT1_00_50G" which set’s the programmable step attenuator to 0 dB for 10 MHz to 50 GHz band.

ROUT:SEQ:TRIG ATT1_00_50G

Table 5 Programmable Attenuator Commands

Commands[1]	Description
ATT1_00_50G	10 MHz - 50 GHz band attenuator 1 setting = 0 dB (all 50 GHz Atten 1 LED="OFF")
ATT1_10_50G	10 MHz - 50 GHz band attenuator 1 setting = 10 dB (50 GHz 10 dB Atten 1 LED="On")
ATT1_20_50G	10 MHz - 50 GHz band attenuator 1 setting = 20 dB (50 GHz 20 dB Atten 1 LED="On")
ATT1_30_50G	10 MHz - 50 GHz band attenuator 1 setting = 30 dB (50 GHz 30 dB Atten 1 LED="On")
ATT1_40_50G	10 MHz - 50 GHz band attenuator 1 setting = 40 dB (50 GHz 40 dB Atten 1 LED="On")
ATT1_50_50G	10 MHz - 50 GHz band attenuator 1 setting = 50 dB (50 GHz 50 dB Atten 1 LED="On")
ATT1_60_50G	10 MHz - 50 GHz band attenuator 1 setting = 60 dB (50 GHz 60 dB Atten 1 LED="On")
ATT2_00_50G	10 MHz - 50 GHz band attenuator 2 setting = 0 dB (all 50 GHz Atten 2 LED ="OFF")
ATT2_10_50G	10 MHz - 50 GHz band attenuator 2 setting = 10 dB (50 GHz 10 dB Atten 2 LED="On")
ATT2_20_50G	10 MHz - 50 GHz band attenuator 2 setting = 20 dB (50 GHz 20 dB Atten 2 LED="On")
ATT2_30_50G	10 MHz - 50 GHz band attenuator 2 setting = 30 dB (50 GHz 30 dB Atten 2 LED="On")
ATT2_40_50G	10 MHz - 50 GHz band attenuator 2 setting = 40 dB (50 GHz 40 dB Atten 2 LED="On")
ATT2_50_50G	10 MHz - 50 GHz band attenuator 2 setting = 50 dB (50 GHz 50 dB Atten 2 LED="On")
ATT2_60_50G	10 MHz - 50 GHz band attenuator 2 setting = 60 dB (50 GHz 60 dB Atten 2 LED="On")
PORT1_50G	10 MHz - 50 GHz Port 1 = Output, Port 2= Input (Port 1 LED="ON")
PORT2_50G	10 MHz - 50 GHz Port 1 = Input, Port 2= Output (Port 2 LED="ON")
ATT1_00_67G	50 GHz - 67 GHz band attenuator 1 setting = 0 dB (all 67 GHz Atten 1 LED="OFF")
ATT1_10_67G	50 GHz - 67 GHz band attenuator 1 setting = 10 dB (67 GHz 10 dB Atten 1 LED="On")
ATT1_20_67G	50 GHz - 67 GHz band attenuator 1 setting = 20 dB (67 GHz 20 dB Atten 1 LED="On")
ATT1_30_67G	50 GHz - 67 GHz band attenuator 1 setting = 30 dB (67 GHz 30 dB Atten 1 LED ="On")
ATT1_40_67G	50 GHz - 67 GHz band attenuator 1 setting = 40 dB (67 GHz 40 dB Atten 1 LED="On")
ATT1_50_67G	50 GHz - 67 GHz band attenuator 1 setting = 50 dB (67 GHz 50 dB Atten 1 LED="On")
ATT2_00_67G	50 GHz - 67 GHz band attenuator 2 setting = 0 dB (all 67 GHz Atten 2 LED="OFF")
ATT2_10_67G	50 GHz - 67 GHz band attenuator 2 setting = 10 dB (67 GHz 10 dB Atten 2 LED="On")
ATT2_20_67G	50 GHz - 67 GHz band attenuator 2 setting = 20 dB (67 GHz 20 dB Atten 2 LED="On")
ATT2_30_67G	50 GHz - 67 GHz band attenuator 2 setting = 30 dB (67 GHz 30 dB Atten 2 LED="On")
ATT2_40_67G	50 GHz - 67 GHz band attenuator 2 setting = 40 dB (67 GHz 40 dB Atten 2 LED="On")
ATT2_50_67G	50 GHz - 67 GHz band attenuator 2 setting = 50 dB (67 GHz 50 dB Atten 2 LED="On")
PORT1_67G	50 GHz - 67 GHz Port 1 = Output, Port 2= Input (Port 1 LED="ON")
PORT2_67G	50 GHz - 67 GHz Port 1 = Input, Port 2= Output (Port 2 LED="ON")

1. The Option 067 SCPI commands will be visible in both Option 050 and 067 instruments, although Option 067 hardware is not installed. Refer to "Keysight Support, Services, and Assistance" on page 45 for upgrading to Option 067.

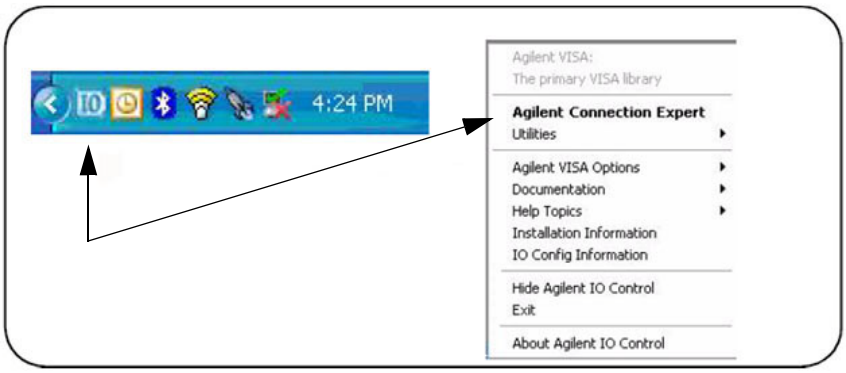
Adding Instruments to the LAN Interface

This section contains information for configuring the U3070A LAN and GPIB interfaces using Agilent/Keysight IO Libraries “Connection Expert Utility”.

Configuring the LAN Interface

1. Connect the Test Set to the PC.
2. Turn On the Test Set.
3. Select **IO Control** icon > **Agilent Connection Expert** from the application window.

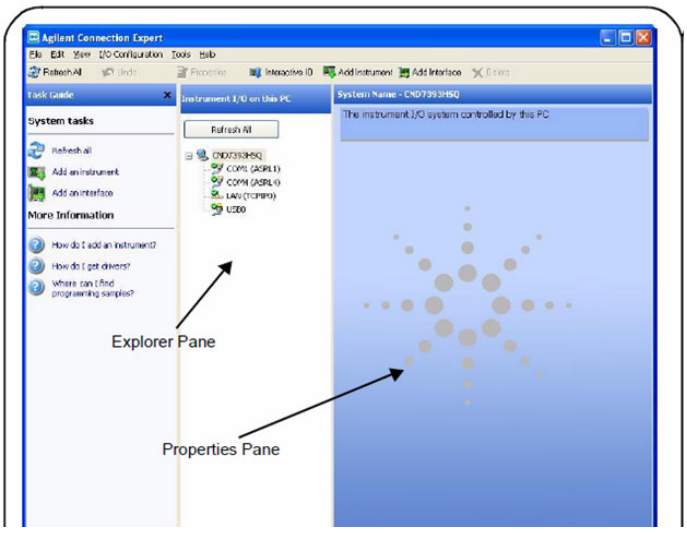
Figure 4 Agilent Connection Expert



Locating the Instrument

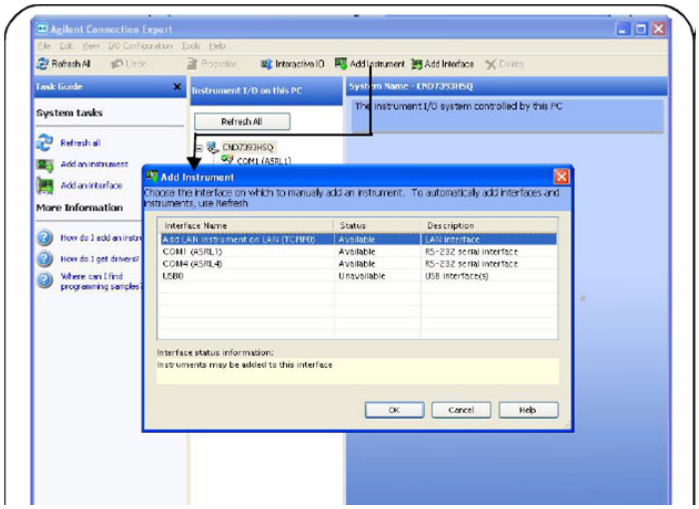
Agilent Connection Expert opens with a “Welcome Screen,” and a window similar to that shown in Figure 4. The available computer interfaces are configured during installation of the Agilent IO Libraries and are displayed in the left column (Explorer Pane). The properties of the configured interface are displayed in the right column (Propertied Pane).

Figure 5 Explorer and Properties Pane



1. Click **Add Instrument** on the tool bar to search the network for instruments.
2. Select **Add LAN Instrument on LAN (TCPIP0)** > **OK**. Agilent Connection Expert performs an automatic find of all instruments on the same subnet as the computer.
3. Select the desired instruments from the list and click **OK**. Communication paths to the instruments are verified and the instruments are added to the configured interface.

Figure 6 Adding Instruments

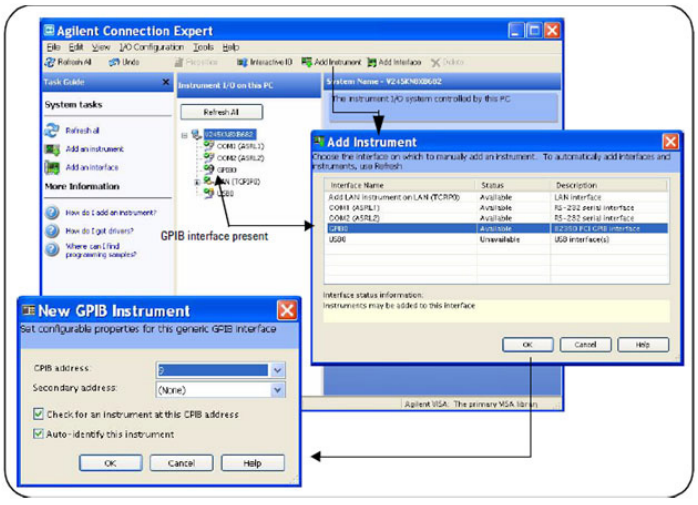


Configuring the GPIB Interface

Programming access to the Test Set is also available through the instrument's GPIB interface. The GPIB connector is located on the rear panel of the instrument.

1. Select the **Agilent Control** > **Agilent Connection Expert**. If a GPIB card is installed in your computer, the GPIB interface was configured during installation of the IO libraries and is displayed in the Explorer Pane of the “Welcome” Screen.

Figure 7 Agilent Connection Expert



Adding Instruments to the GPIB Configuration

1. Select **Add Instrument** on the tool bar.
2. Select **GPIB Interface** > **OK**.
3. Select **U3070A's Address** in the GPIB address drop-down list > **OK**.
   (Factory set address = 23)

Changing the GPIB Address

The U3070A GPIB address can only be changed programmatically. The GPIB address command is: SYSTem:COMMunicate:GPIB:ADDRess <address>

When the address is changed, the new GPIB address is *not* updated in the Keysight Connection Expert if the instrument was previously configured.

1. From the Keysight Connection Expert application window, highlight the instrument that's address was changed and click **Change Properties** in the Configurable Properties application window, change the address to the new address setting and select **OK**.

Reset Command

This command resets the instrument.

Syntax

*RST

LAN Interface Configuration Commands

IP Address Command

This command assigns a static Internet Protocol (IP) address for the U3070A. Contact your network administrator for the valid IP address to use for your instrument.

NOTE If you change the IP address, you must cycle power on the U3070A to activate the new address.

Syntax

SYSTem:COMMunicate:LAN:IPADdress <address>

SYSTem:COMMunicate:LAN:IPADdress?

You can also query the U3070A for the IP address it was assigned to.

Example

The following command sets the IP address:

SYST:COMM:IPAD 169.254.149.35

The following query returns the IP address currently being used by the instrument (quotes are also returned).

SYST:COMM:LAN:IPAD?

Typical Response: "169.254.149.35"

Auto IP Address Command

This command disable or enable the use of Auto-IP standard to automatically assign an IP address to the U3070A when on a network that does not have DHCP servers.

Syntax

SYSTem:COMMunicate:LAN:AUTOip {OFF|0|ON|1}

SYSTem:COMMunicate:LAN:AUTOip?

Example

The following command disable the Auto-IP:

SYST:COMM:LAN:AUTOIP OFF

The following query returns the current Auto-IP setting:

SYST:COMM:LAN:AUTOI P OFF

Typical Response: 0

DHCP Command

This command disables or enables the use of the Dynamic Host Configuration Protocol (DHCP).

Syntax

SYSTem:COMMunicate:LAN:DHCP {OFF|0|ON|1}

SYSTem:COMMunicate:LAN:DHCP?

When DHCP is enable (factory setting), the instrument will try to obtain an IP address from the DHCP server. If a DHCP server is found, it will assign a Dynamic IP address, Subnet Mask, and Default Gateway to the instrument.

When the DHCP is disable or unavailable, the instrument will use the Static IP address, Subnet Mask, and Default Gateway during power-on.

NOTE If you change the DHCP setting, you must cycle power on the U3070A to activate the new setting.

Example

The following command disables DHCP:

SYST:COMM:LAN:DHCP OFF

The following query returns the current DHCP setting:

SYST:COMM:LAN:DHCP?

Typical Response: 0

DNS Command

This command assigns the IP address of the Domain Name System (DNS) server. Contact your network administrator to determine if DNS is being used and for the correct address.

Syntax

SYSTem:COMMunicate:LAN:DNS <address>

SYSTem:COMMunicate:LAN:DNS?

NOTE If you change the DNS address, you must cycle power on the U3070A to activate the new address.

Example

The following command sets the DNS address:

SYST:COMM:LAN:DNS 198.105.232.4

The following query returns the DNS address currently being used by the instrument (the quotes are also returned).

SYST:COMM:LAN:DNS?

Typical Response: "198.105.232.4"

Domain Name Command

This command assigns a Domain Name to the U3070A. The Domain Name is translated into an IP address.

Syntax

SYSTem:COMMunicate:LAN:DOMain "<name>"

SYSTem:COMMunicate:LAN:DOMain?

NOTE If you change the Domain Name, you must cycle power on the U3070A to activate the new address.

Example

The following command defines the Domain Name:

SYST:COMM:LAN:DOM www.agilent.com

The following query returns the Domain Name currently being used by the instrument:

SYST:COMM:LAN:DOM?

Typical response: www.agilent.com

Gateway Address Command

This command assigns a Default Gateway for the U3070A. The specified IP Address sets the Default Gateway which allows the instrument to communicate with systems that are not on the local subnet. This is the Default Gateway where packets are sent that are destined for a device that is not on the local subnet, as determined by the Subnet Mask setting. Contact your network administrator to determine if a gateway is being used and for the correct address.

Syntax

SYSTem:COMMunicate:LAN:GATEway <address>

SYSTem:COMMunicate:LAN:GATEway?

Example

The following command sets the Default Gateway address:

SYST:COMM:LAN:GATEWAY 255.255.20.11

The following query returns the Default Gateway address currently being used by the instrument (the quotes are also returned).

SYST:COMM:LAN:GATEWAY?

Typical Response: "255.255.20.11"

Host Name Command

This command assigns a Host Name to the U3070A. The Host Name is the host portion of the domain name, which is translated into an IP address.

Syntax

SYSTem:COMMunicate:LAN:HOSTname "<name>"

SYSTem:COMMunicate:LAN:HOSTname?

NOTE If you change the Domain Name, you must cycle power on the U3070A to activate the new address.

Example

The following command defines a Host Name:

SYST:COMM:LAN:HOST "LAB1-U3070A"

The following query returns the Host Name currently being used by the instrument (the quotes are also returned):

SYST:COMM:LAN:HOST?

Typical Response: "LAB1-U3070A"

GPIB Address Command

This command assigns a GPIB address to the U3070A.

Syntax

SYSTem:COMMunicate:GPIB:ADDRess <address>

SYSTem:COMMunicate:GPIB:ADDRess?

NOTE If you change the GPIB address, you must cycle power on the U3070A to activate the new address.

Example

The following command sets the GPIB address to 10:

SYST:COMM:GPIB:ADDR 10

The following query returns the current GPIB address:

SYST:COMM:GPIB:ADDR?

Typical Response: 10

Service Information

This section contains information on the theory of operation, how to verify the performance of your Test Set, how to troubleshoot it if necessary, and a block diagram.

Electrostatic Discharge Protection

Electrostatic discharge (ESD) can damage or destroy electronic components. The module is shipped in materials which prevent damage from static, and should only be removed from the packaging in an anti-static area ensuring that the correct anti-static precautions are taken.

Two types of ESD protection are listed below. Purchase acceptable ESD accessories from your local supplier.

- Conductive table-mat and wrist-strap combination
- Conductive floor-mat and heal-strap combination

Both types, when used together, provide a significant level of ESD protection. To ensure user safety, static-safe accessories must provide at least 1 MΩ of isolation from ground.

WARNING **These techniques for a static-safe work station should not be used when working on circuitry with a voltage potential greater than 500 volts.**

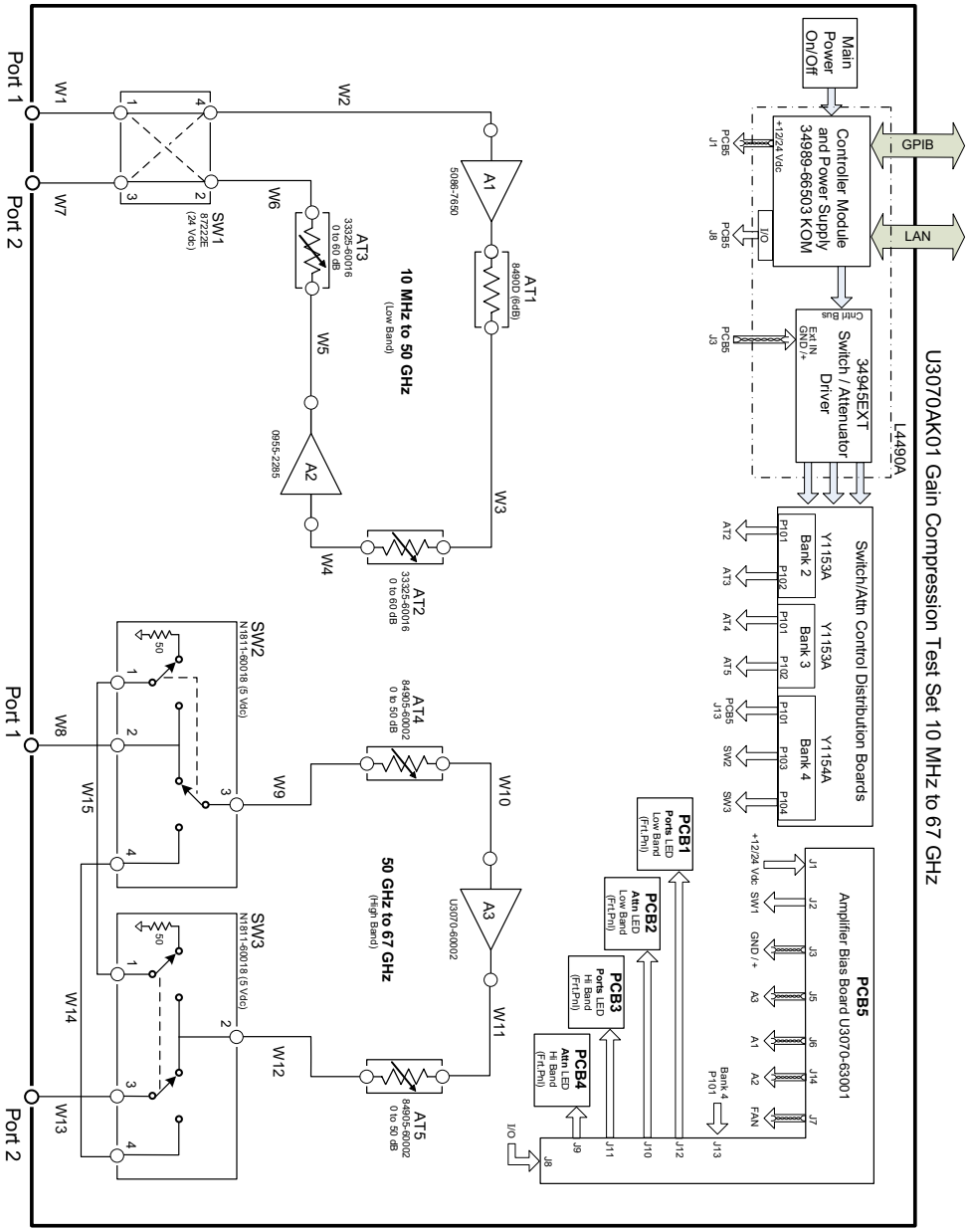
Theory of Operation

Gain Compression Test Set System Operation

Figure 8 illustrates the components and interconnects of the Test Set.

The main function of this Test Set is to characterize the gain compression performance of the network analyzer. The Test Set consists of six main components: a controller module, 39495EXT module, distribution board for programmable step attenuator, front panel LED indicator, amplifier bias board, 50 GHz and 67 GHz power amplifiers and switching network section.

Figure 8 Block Diagram for Gain Compression Test Set



Controller Module

Inside the controller module there are two main components, the AC-DC power supply and controller board. The AC-DC power supply is a 12V/65W power supply that is converted to various voltages by means of DC-DC converter inside the module. It provides regulated voltages to all assemblies in the Test Set as well as following voltages to drive programmable step attenuator in the Test Set. The internal DC voltage has the following specification:

- +24V/0.6A
- +12V/3A fuse
- +5V/1A

The controller board is the “brain” of the Test Set, it handles all the communication between the Controller and the Test Set via LAN or GPIB connectivity. Refer to “Controlling the Test Set and Making Measurements” on page 9.

39495EXT Module

This module drives the programmable step attenuators and switches. The attenuators are connected to the Test Set through the distribution boards (Y1153A and Y1154A), which is installed on the 34945EXT module.

The 34945EXT is divided into four banks, organized by channel number. Any distribution board may be installed in any bank, and multiple distribution boards of the same type may be installed on the same 34495EXT module.

Distribution Board

The Y1153A and Y1154A distribution boards provides an interface between the 34945EXT module, programmable step attenuator, switching input/output ports and between 50 GHz and 67 GHz bands with Option 067. Depending on the model number and attenuator, a suitable distribution board will be use.

LED Indicator Board

This board provides an LED indication of the attenuator setting in the Test Set. The LED indicator board is driven by the digital IO of the Test Set.

Amplifier Bias Board

The amplifier bias board provides all of the voltages to the amplifiers, fan, LED board and I/O control for the LED.

Power Amplifier and Switching Section

50 GHz and 67 GHz power amplifiers and switching network allows the user to control the IN/OUT port through a 4-way switch while maintaining the desired output power. Each section has two attenuator banks for a dynamic range from 0 to -110 dB with a 10 dB step.

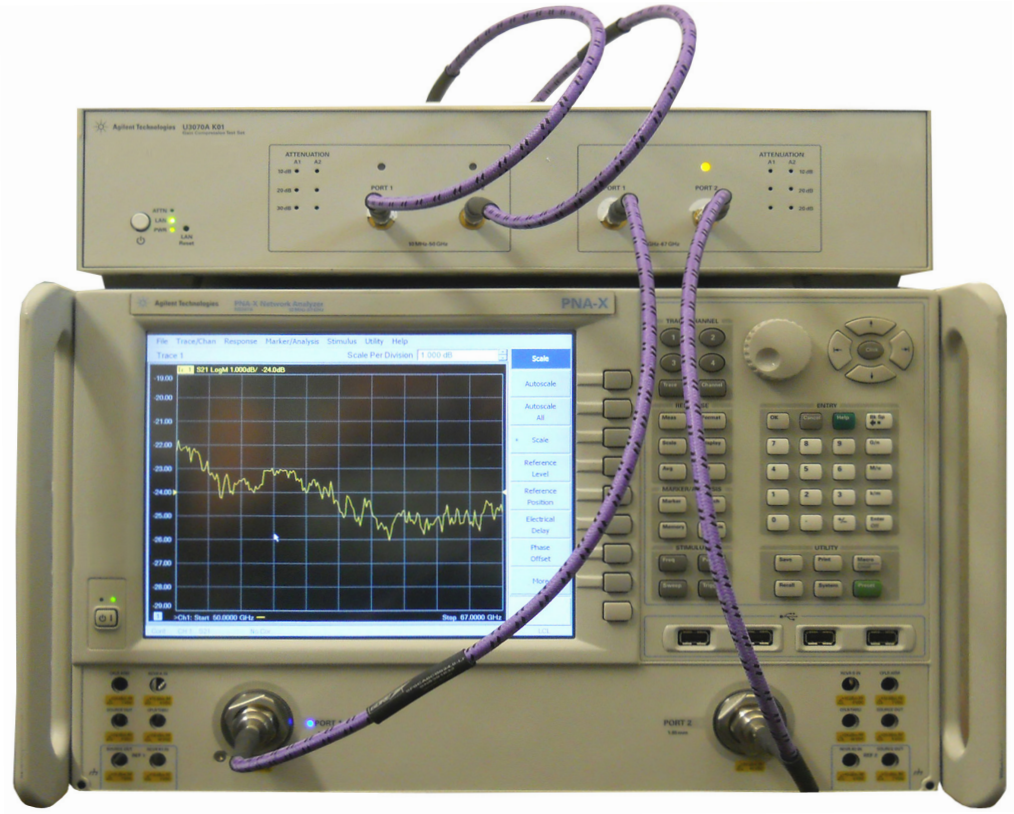
Connecting and Turning On the Test Set

The U3070AK01 is designed to be placed on top of the PNA-X.

1. Connect the Test Set to the PNA-X, using two 2.4 mm RF cables (50 Ohm) for Option 050, or two 1.85 mm RF cables for Option 067 as shown in Figure 9.
2. Connect a GPIB cable (Keysight part number 10833D) from the rear panel on the Test Set to the rear panel of the PNA-X. After the proper rear panel connections have been made, turn on the Test Set using the front panel line switch.

NOTE For accurate, repeatable measurement, allow the Test Set warm up for at least 30 minutes. For the most stable and accurate measurements leave the Test Set turned on at all times.

Figure 9 Cable Connections



Functional Tests

Functional testing consists of measuring the gain, output match and attenuator steps. For the most accurate measurements, the Keysight N5247A (67 GHz) Network Analyzer is recommended and familiarity with RF/microwave measurements is assumed. The use of adapters may be required and their effects should be accounted for within the measurements.

Equipment Required

Option 050

- N5245A Network Analyzer or equivalent
- 2.4 mm male to female test cables (x2) (8121-2065) or equivalent
- N4693A Electronic Calibration Module (10 MHz to 50 GHz), 2.4 mm, 2-Port or equivalent with one or more female ports
- Adapter (x2) (85027-60006) 2.4 mm female to female or equivalent
- N1914A EPM Series Power Meter or equivalent
- N8487A Average Power Sensor 10 MHz to 50 GHz

Option 067

- N5247A Network Analyzer or equivalent
- 1.85 mm male to female test cables (x2) (8121-2064) or equivalent
- N4694A Electronic Calibration Module (10 MHz to 67 GHz), 1.85 mm, 2-Port or equivalent with one or more female ports
- Adapter (x2) (85058-60114) 1.85 mm female to female or equivalent
- N1914A EPM Series Power Meter or equivalent
- N8488A Average Power Sensor 10 MHz to 67 GHz

There are no adjustments required for the Test Set. The instrument should be placed so that the detachable power cord is readily identifiable and is easily reached by the operator. The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch. Alternatively, an externally installed switch or circuit breaker (which is readily identifiable and is easily reached by the operator) may be used as a disconnecting device.

1. Connect a GPIB cable from the controller to the rear panel of the network analyzer.
2. After the front and rear panel connections have been made, turn on the Test Set using the front panel Standby Switch.

Calibrating the PNA-X

Set up the network analyzer for the S-parameter and attenuator testing as follows:

Option 050 (10 MHz to 50 GHz)

1. Press **[Preset]**.
2. Select **[Freq]** > **[Start Frequency]** > **[10 MHz]**.
3. Select **[Stop Frequency]** > **[50 GHz]**.
4. Select **[Sweep]** > **[Number of Points]** > **[401]**.
5. Select **[Ave]** > **[IF Band wid th]** > **[1 kHz]**.
6. Set the Output Power level > **[Power]** > **[-25 dBm]**.

Option 067 (50 GHz to 67 GHz)

1. Press **[Preset]**.
2. Select **[Start Frequency]** > **[50 GHz]**.
3. Select **[Stop Frequency]** > **[67 GHz]**.
4. Select **[Sweep]** > **[Number of Points]** > **[201]**.
5. Select **[Ave]** > **[IF Band wid th]** > **[1 kHz]**.
6. Set the Output Power level > **[Power]** > **[-10 dBm]**.

7. Perform a full 2-Port calibration at the two test ports of the network analyzer. Verify that the DUT connectors types are set to female.
   - Option 050 – APC 2.4 female
   - Option 067 – APC 1.85 female

NOTE If you are using an ECal module with female to female connectors (Option FOF) use the ECal Thru as the Unknown. If you are using an ECal module with male to female connectors (Option MOF) use a female-to-female adaptor for the Unknown Thru.

Figure 10 Cal Wizard

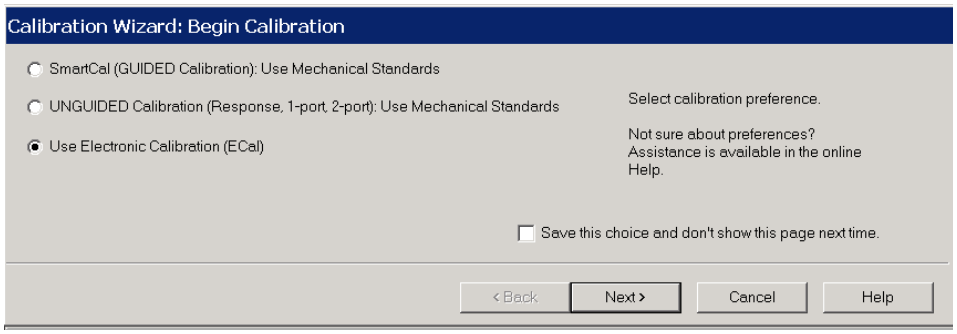


Figure 11 Connector Type

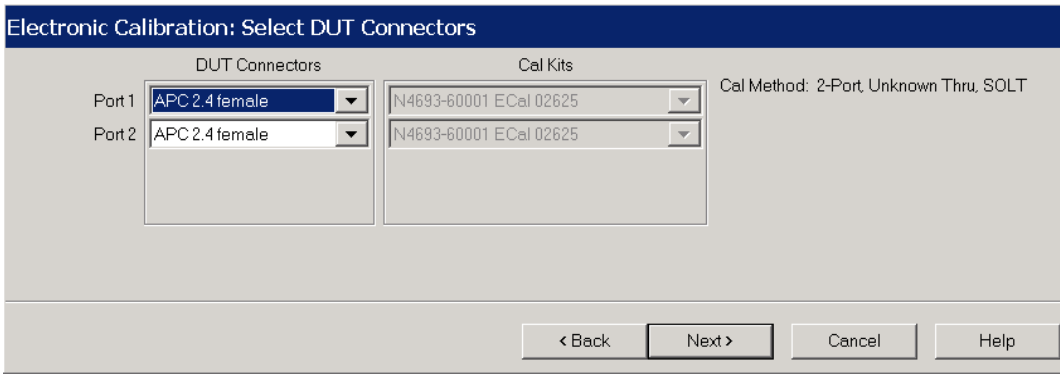
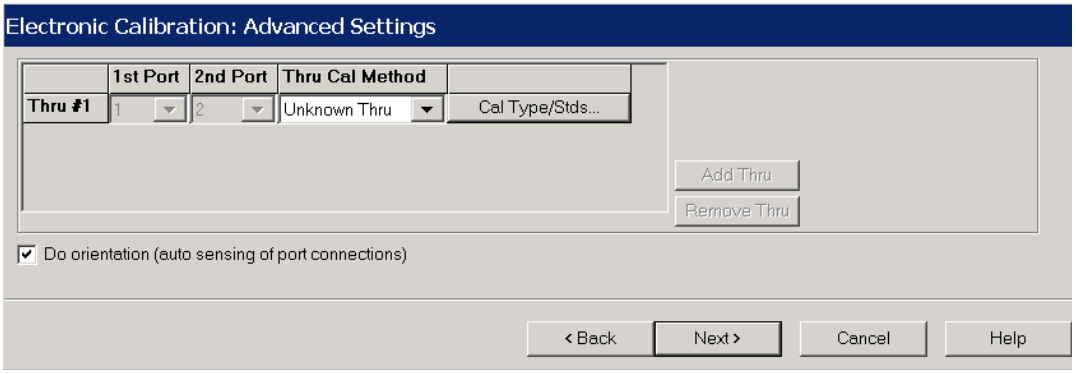
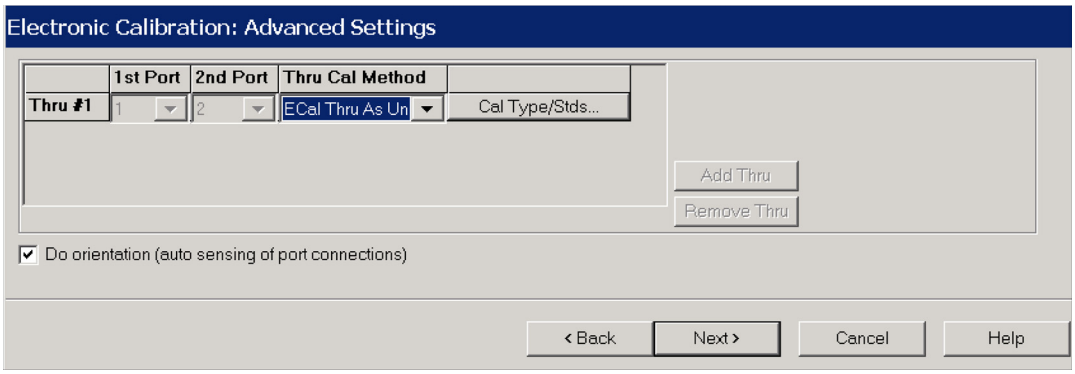


Figure 12 Thru Types (Option MOF Top, FOF Bottom)

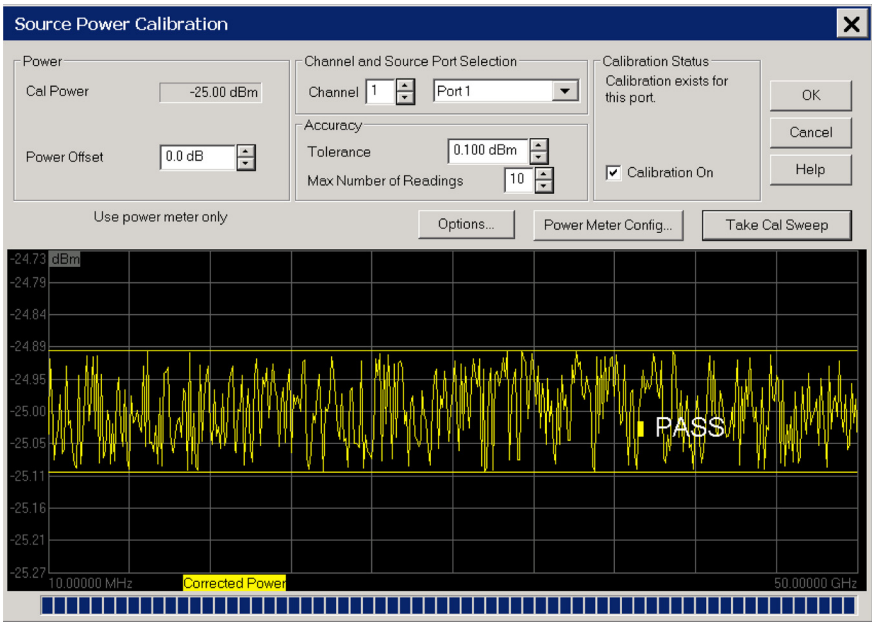




Source Power Cal on Port 1

1. Zero and calibrate the power sensor on the power meter.
2. Set the power accuracy as indicated in Figure 13.

Figure 13 Source Power Cal



S Parameter Verification

This procedure tests the S-parameters of the Test Set for the forward and reverse setups. It is assumed that a calibration was performed as outlined in “Functional Tests” on page 22.

1. Connect the two 2.4 mm RF cables from the PNA-X to the Test Set Option 050 (10 MHz to 50 GHz).
   For Option 067 use two 1.85 mm RF cables.
   a. Port 1 to Port 1
   b. Port 2 to Port 2
2. Set up the Test Set’s RF Output to PORT 2 and the internal attenuators to 0 dB. Execute the following commands over GPIB:

   Option 050

   - ROUT:SEQ:TRIG PORT2_50G
   - ROUT:SEQ:TRIG ATT1_00_50G
   - ROUT:SEQ:TRIG ATT2_00_50G

   Option 067

   - ROUT:SEQ:TRIG PORT2_67G
   - ROUT:SEQ:TRIG ATT1_00_67G
   - ROUT:SEQ:TRIG ATT2_00_67G
3. Measure the S11, S22, S21 and S12 responses.
4. Save the trace data file as a PortS21.CSV for future data analysis and performance comparison for Match (S11 & S22), Forward Gain (S21), and Reverse Gain (S12) in Table 6 on page 34.
5. Set up the Test Set’s RF Output to PORT 1. Execute the following commands over GPIB:

   Option 050

   - ROUT:SEQ:TRIG PORT1_50G

   Option 067

   - ROUT:SEQ:TRIG PORT1_67G
6. Save the trace data file as a PortS12.CSV for future data analysis and performance comparison for Match (S11 & S22), Forward Gain (S12), and Reverse Gain (S21) on Table 6 on page 34.

Step Attenuator Verification

This section tests the internal attenuators of the Test Set. This procedure verifies the attenuator attenuation cards for functionality only, and does not check each individual attenuator setting. It is assumed that a calibration has been performed as outlined in “Functional Tests” on page 22.

1. Set up the Test Set’s RF Output to PORT 2. Execute the following commands over GPIB:

   Option 050

   - ROUT:SEQ:TRIG PORT2_50G
   - ROUT:SEQ:TRIG ATT1_00_50G
   - ROUT:SEQ:TRIG ATT2_00_50G

   Option 067

   - ROUT:SEQ:TRIG PORT2_67G
   - ROUT:SEQ:TRIG ATT1_00_67G
   - ROUT:SEQ:TRIG ATT2_00_67G
2. Measure the S21 response.
3. Normalize the trace, select **[Math/Memory]** > **[Data>>Mem]** > **[Data/Mem]**. The display trace should be at 0 dB.
4. Set up the Test Set using a different attenuator setting. Execute the following command over the GPIB:

   Option 050

   - ROUT:SEQ:TRIG ATT1_10_50G

   Option 067

   - ROUT:SEQ:TRIG ATT1_10_67G
5. Use the **[Marker Search]** function to determine the **max and min magnitudes** for the trace.
6. Verify the performance and record the data on Table 6 on page 34.
7. Repeat step 3 through step 5 for attenuator settings 20 and 30. Execute the following commands over GPIB:

   Option 050

   - ROUT:SEQ:TRIG ATT1_20_50G
   - ROUT:SEQ:TRIG ATT1_30_50G

   Option 067

   - ROUT:SEQ:TRIG ATT1_20_67G
   - ROUT:SEQ:TRIG ATT1_30_67G

8. Reset the Test Set so that the attenuator is set to zero. Execute the following commands over GPIB:

   Option 050

   - ROUT:SEQ:TRIG ATT1_20_50G
   - ROUT:SEQ:TRIG ATT1_30_50G

   Option 067

   - ROUT:SEQ:TRIG ATT1_20_67G
   - ROUT:SEQ:TRIG ATT1_30_67G

9. Repeat step 4 through step 8 for attenuator 2 settings.Changing the ATT1 to ATT2.

   - ROUT:SEQ:TRIG ATT2_XX_ZZG, Where XX=0,10,20,30 and ZZ= 50 or 67

For further information on controlling the Test Set, refer to “Controlling the Test Set and Making Measurements” on page 9.

Minimum Power Verification

This procedure measures the Test Set's Port 2 power. It is assumed that a calibration was performed as outlined in "Functional Tests" on page 22.

CAUTION Do not exceed the maximum power rating of the Power Sensor.

1. Connect the Port 1, 2.4 mm RF cable from the PNA-X to Port 1 on the Test Set (Option 050), or the 1.85 mm RF cable for Option 067.
2. Set up the Test Set's RF Output to PORT 2. Execute the following commands over GPIB:

   Option 050

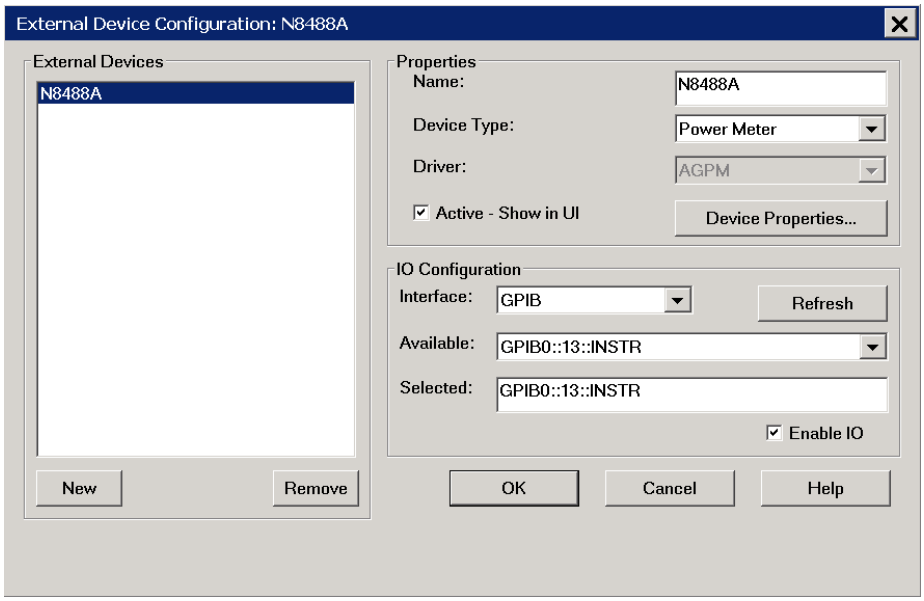
   - ROUT:SEQ:TRIG PORT2_50G

   Option 067

   - ROUT:SEQ:TRIG PORT2_67G
3. Measure the S21 response.
4. Select **[Utilities] > Configure >External Device Config...** configure your power sensor as indicated in Figure 14.

NOTE The power sensor in the procedure is N8488A, but it could be named whatever you choose.

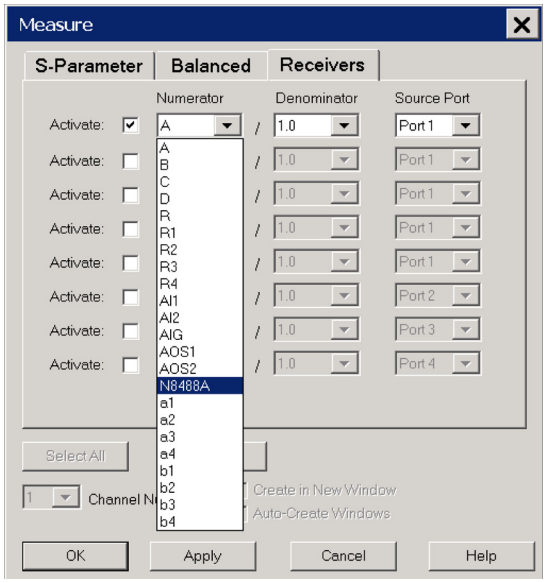
Figure 14 External Device Configuration: Power Sensor



5. Press **OK** and close the dialog box.

6. Connect the power sensor to Port 2, 2.4 mm connector if measuring Option 050 or the 1.85 mm connector if measuring Option 067.
7. Select **[Response]** > **Measure** > **Measure...** select the **Receivers** tab. Activate the power sensor as the receiver as shown in Figure 15.

Figure 15 Power Sensor as Receiver



8. Select N8488A and press **Apply**, close the dialog box.
9. Use the **[Marker Search]** function to determine the minimum power for the trace. Verify the performance and record the data in Figure 7 on page 12.
10. Not recorded, but the power should be verified at the Test Set port with the Test Set RF cable attached and should meet the minimum band power levels in step 13. This can be accomplished by increasing the power. Measure the power at the frequency point or band of interest. Increase the power in 1 dBm steps until power exceeds Minimum Band Power Level.
11. Same setup, but attach the Test Set 2.4 mm RF cable to Port 2 of the 2.4 mm connector for Option 050. For Option 067 connect the 1.85 mm connector.
12. Connect the N8488A Power Sensor to the end of the cable.
13. Minimum Band Power Levels:

Option 050

- 10 MHz to 26.5 GHz Power Out > 13 dBm
- > 26.5 GHz to 50 GHz Power Out > 8 dBm

Option 067

- 50 GHz to 67 GHz Power Out > 5 dBm

CAUTION Do Not exceed the maximum power rating of the Power Sensor.

NOTE This test does not take into account the test cable supplied with the Test Set.

Figure 16 Typical Option 050 Port21 S-Par Plot

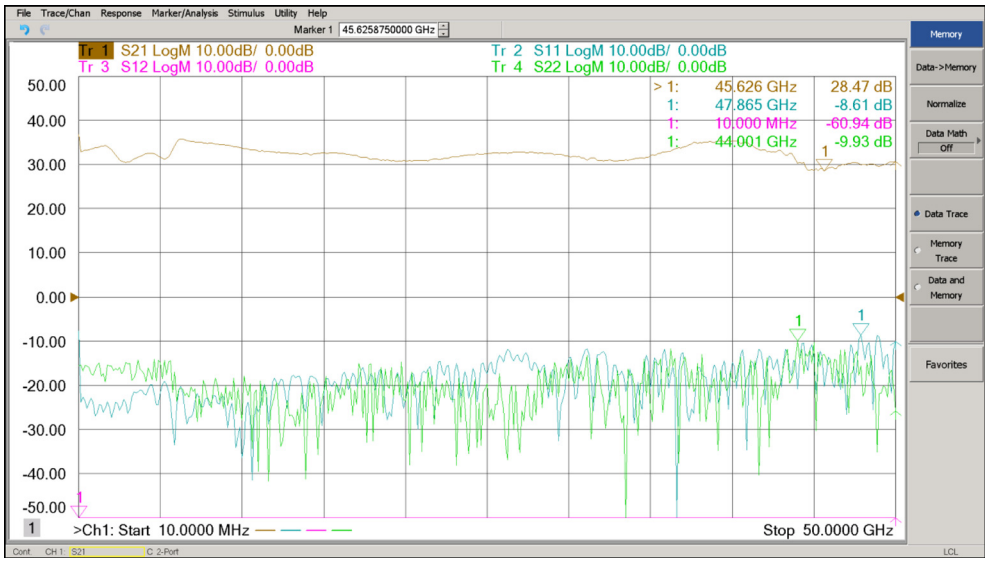


Figure 17 Typical Option 050 Port12 S-Par Plot

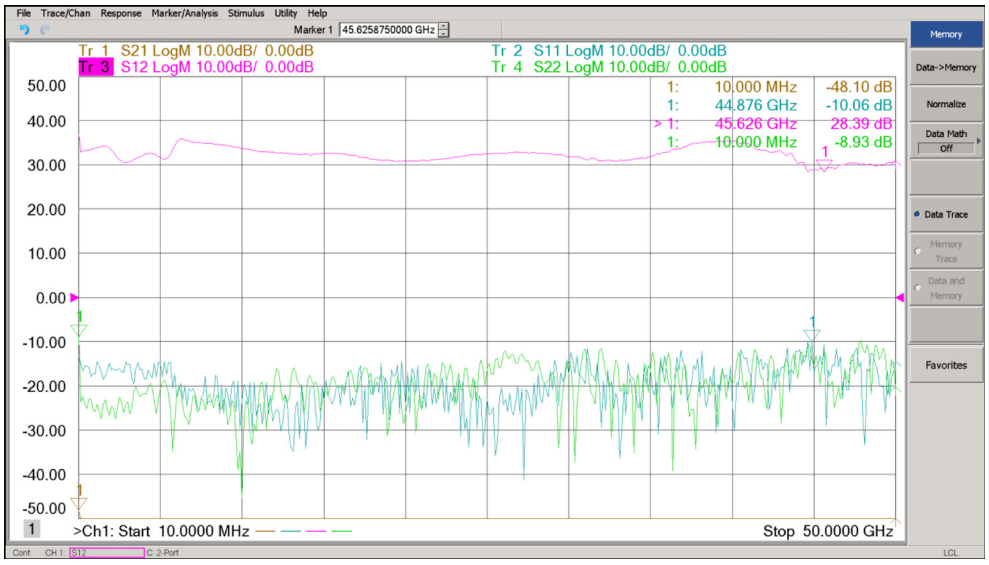


Figure 18 Typical Option 050 Min Power Plot

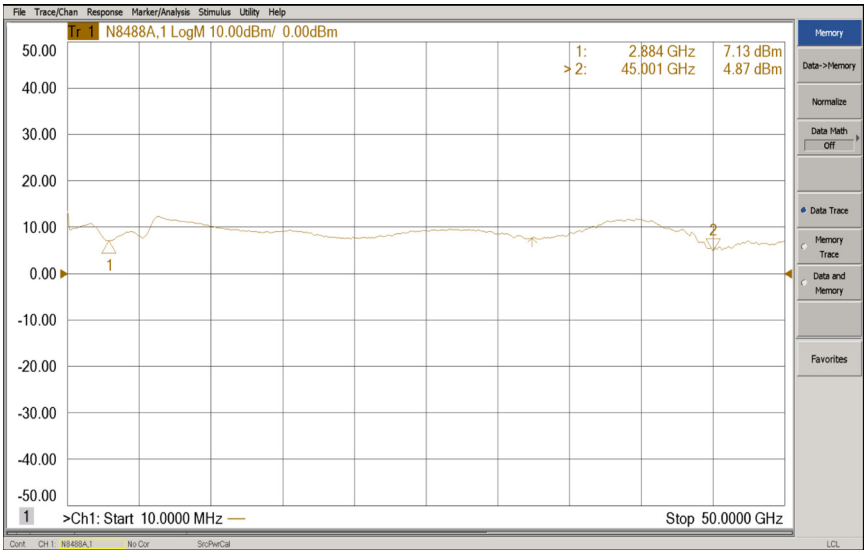


Figure 19 Typical Option 067 Port21 S-Parameter Plot

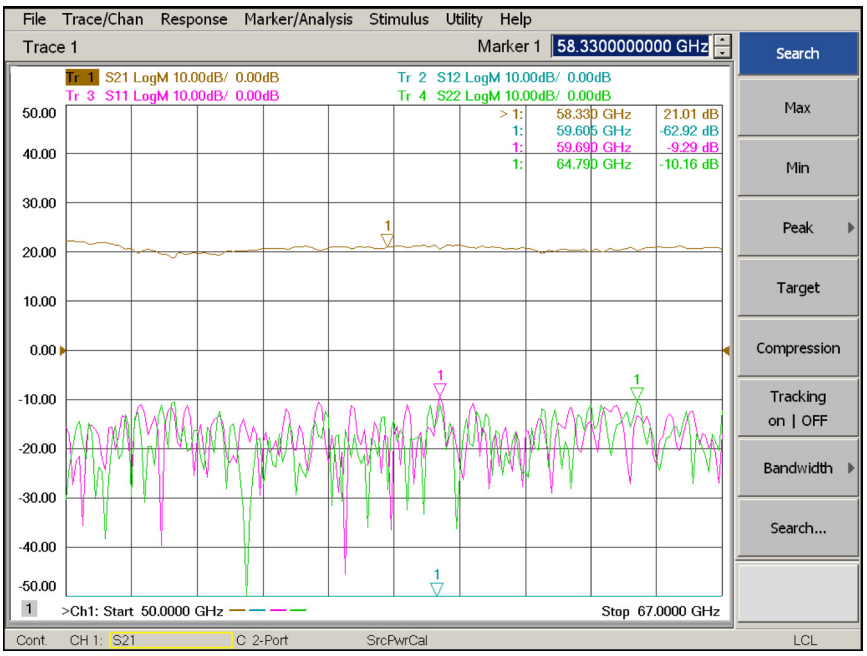


Figure 20 Typical Option 067 Port12 S-Parameter Plot

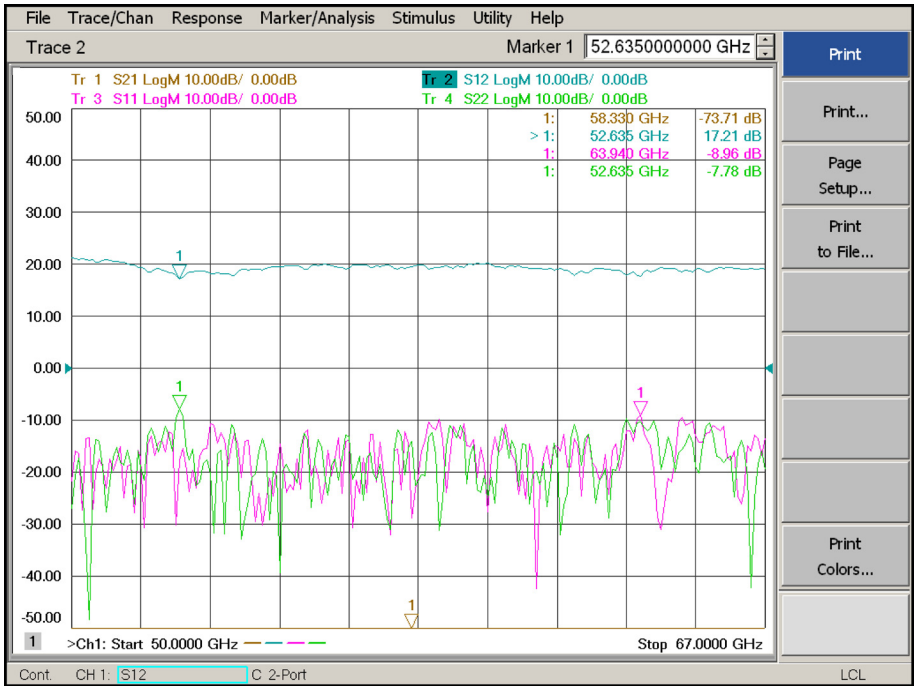


Figure 21 Typical Option 067 Min Power Plot

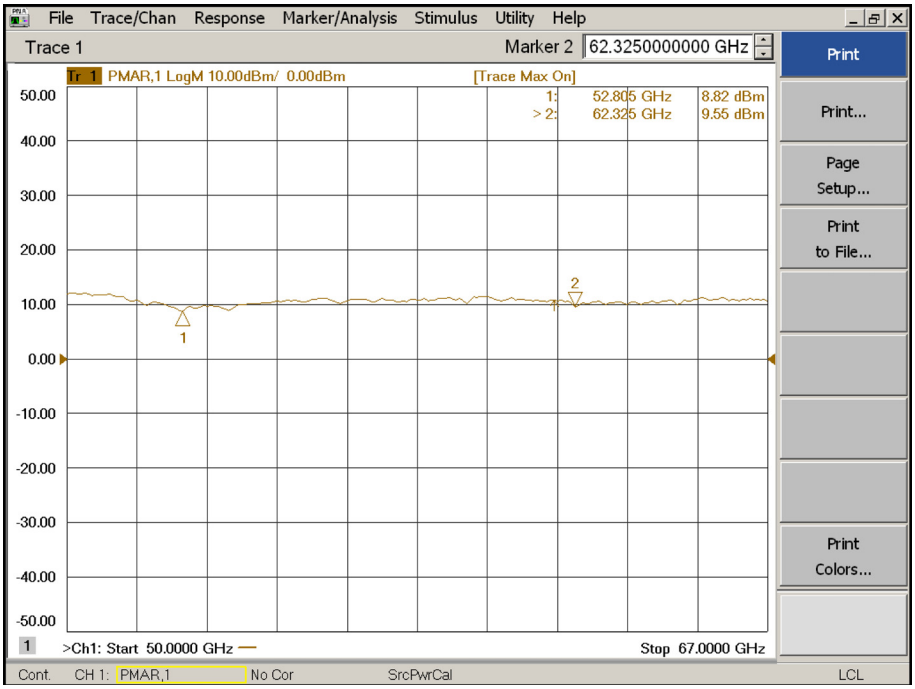


Table 6 U3070AK01 Test Record

U3070AK01 Option 050			
S-Parameter Verification			
PortS21 “Port 2 LED ON”	**Frequency**	**Nominal (dB)**	**Measured Results**
Match (S11 & S22)	10 MHz to 200 MHz > 200 MHz to 26.5 GHz > 26.5 GHz to 50 GHz	0 -6 -6	
Forward Gain (S21)	10 MHz to 26.5 GHz > 26.5 GHz to 50 GHz	> 18 > 15	
Reverse Gain (S12)	10 MHz to 50 GHz	< -40	
PortS12 “Port 1 LED ON”	**Frequency**	**Nominal (dB)**	**Measured Results**
Match (S11 & S22)	10 MHz to 200 MHz > 200 MHz to 26.5 GHz > 26.5 GHz to 50 GHz	0 -6 -6	
Forward Gain (S12)	10 MHz to 26.5 GHz > 26.5 GHz to 50 GHz	> 18 > 15	
Reverse Gain (S21)	10 MHz to 50 GHz	< -40	
Attenuator Verification	**Frequency**	**Nominal (dB)**	**Measured Results**
Attenuator 1 10 dB 20 dB 30 dB	10 MHz to 50 GHz	 10 (±2) 20 (±2) 30 (±2)	
Attenuator 2 10 dB 20 dB 30 dB	10 MHz to 50 GHz	 10 (±2) 20 (±2) 30 (±2)	
Minimum Power Verification	**Frequency**	**Nominal (dB)**	
Min Power @ -25 dBm	10 MHz to 26.5 GHz > 26.5 GHz to 50 GHz	> -7 dBm > -10 dBm	

Table 6 U3070AK01 Test Record

U3070AK01 Option 067			
S-Parameter Verification			
PortS21 “Port 2 LED ON”	**Frequency**	**Nominal (dB)**	**Measured Results**
Match (S11 & S22)	10 MHz to 200 MHz	-6	
Forward Gain (S21)	50 GHz to 60 GHz > 60 GHz to 67 GHz	> 7 > 10	
Reverse Gain (S21)	10 GHz to 50 GHz	< -40	
PortS12 “Port 1 LED ON”	**Frequency**	**Nominal (dB)**	**Measured Results**
Match (S11 & S22)	50 GHz to 60 GHz	-6	
Forward Gain (S12)	50 GHz to 60 GHz > 60 GHz to 67 GHz	> 7 > 10	
Reverse Gain (S21)	50 GHz to 60 GHz	< -40	
Attenuator Verification	**Frequency**	**Nominal (dB)**	**Measured Results**
Attenuator 1 10 dB 20 dB 30 dB	50 GHz to 60 GHz	 10 (±2) 20 (±2) 30 (±2)	
Attenuator 2 10 dB 20 dB 30 dB	50 GHz to 60 GHz	 10 (±2) 20 (±2) 30 (±2)	
Minimum Power Verification	**Frequency**	**Nominal (dB)**	
Min Power @ -10 dBm	50 GHz to 60 GHz > 60 GHz to 67 GHz	> -3 dBm > 0 dBm	

Replaceable Parts

The following table contains the list of replaceable parts for the Test Set. If any of these parts or assemblies are replaced, you must run the test(s) indicated in the column “Required Tests” to verify the performance.

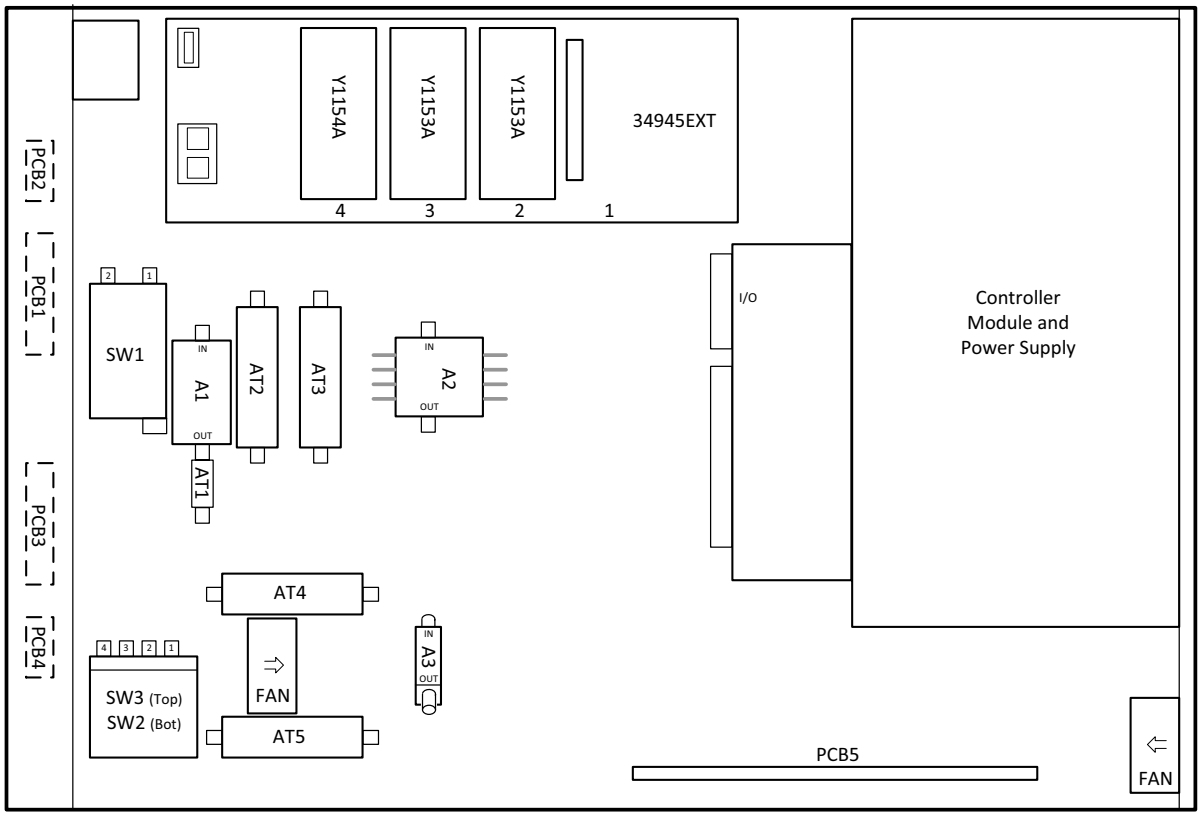
NOTE Special options are built to order, long lead times may be encountered when ordering replacement parts.

Description	Required Tests	Keysight Part Number	Qty
U3070AK01:			
LED Assembly Board	50 & 67 GHz Bands	08720-60182	2
2U RF Switch Platform with Integrated Switch Driver, includes 64 Switch Drive lines with Option 004	50 & 67 GHz Bands	L4490A-CFG002	1
10 LED Board	n/a	N5261-63005	2
Fan Assembly	n/a	U3070-60007	1
PCA, Amplifier Biasing Board	50 & 67 GHz Bands	U3070-63001	1
Distribution Card, UW	50 & 67 GHz Bands	Y1153-66501	2
Distribution Card, UW	50 & 67 GHz Bands	Y1154-66501	1
U3070AK01-050:			
Microwave Broadband Amplifier Module, 65 GHz max 2.7 Watt	50 GHz Band	0955-2285	1
Attenuator, 60 dB, 3SCN (PB Free)	50 GHz Band	33325-60016	2
Input Amplifier	50 GHz Band	5086-7650	1
Cable, Assembly Coaxial 50W, 2.4 mm Jack, 2.4 mm plug (24 inch)	50 GHz Band	8121-2065	2
Coaxial Fixed Attenuator, DC-50 GHz with Option 006	50 GHz Band	8490D-CFG007	1
Switch Transfer, 4-Port, DC 50 GHz, 24 Vdc, isolation 26.5 GHz to 50 GHz at -70 dB	50 GHz Band	87222-60027	1

Description	Required Tests	Keysight Part Number	Qty
U3070AK01-067:			
Bulkhead Connector, 1.85 mm female	67 GHz Band	5065-4673	2
Cable, Assembly Coaxial 50 Ohm, 1.85 mm-Jack, 1.85 mm plug (24 inch)	67 GHz Band	8121-2064	2
Attenuator 50 dB, 3 section, 5 volt (PB Free)	67 GHz Band	84905-60002	2
Coaxial Switch, 67 GHz, 4-Port, Terminated Latching, Option 105-201-401 (PB Free)	67 GHz Band	N1811-60018	2
Amplifier 50 GHz to 67 GHz	67 GHz Band	U3070-60002	1

NOTE Before replacing an assembly or board inspect for obvious, easily repaired defects such as bent pins on ICs or cold solder joints.

Figure 22 Component Layout



Troubleshooting

This section contains information on troubleshooting the Test Set to the assembly level only. By following these procedures you should be able to determine whether the power supply, front panel, or main switch board need replacing. Refer to “Theory of Operation” on page 19 and “U3070AK01 Block Diagram” on page 39.

NOTE If you disassemble the instrument, be sure to work at an antistatic workstation and use a grounded wrist strap to prevent damage from electrostatic discharge (ESD). See “Electrostatic Discharge Protection” on page 18.

Power Supply

Turn the instrument on. Check the condition of the LED on the front panel:

1. LED is off: Check the main fuse located in the power supply filter at the rear of the instrument.
2. If the fuse is in working order and the LED is still off, check the cable and connections between the main board and front panel board.
3. If the cable and connections are good and the LED is still off, the power supply may not be supplying the necessary +24 V, +12 V, and +5 V to the main board.
4. Disconnect the dc power cable from the power supply to the main switch board and measure the voltages. They should be +24 V, +12 V, and +5 V. If not, replace the power supply.

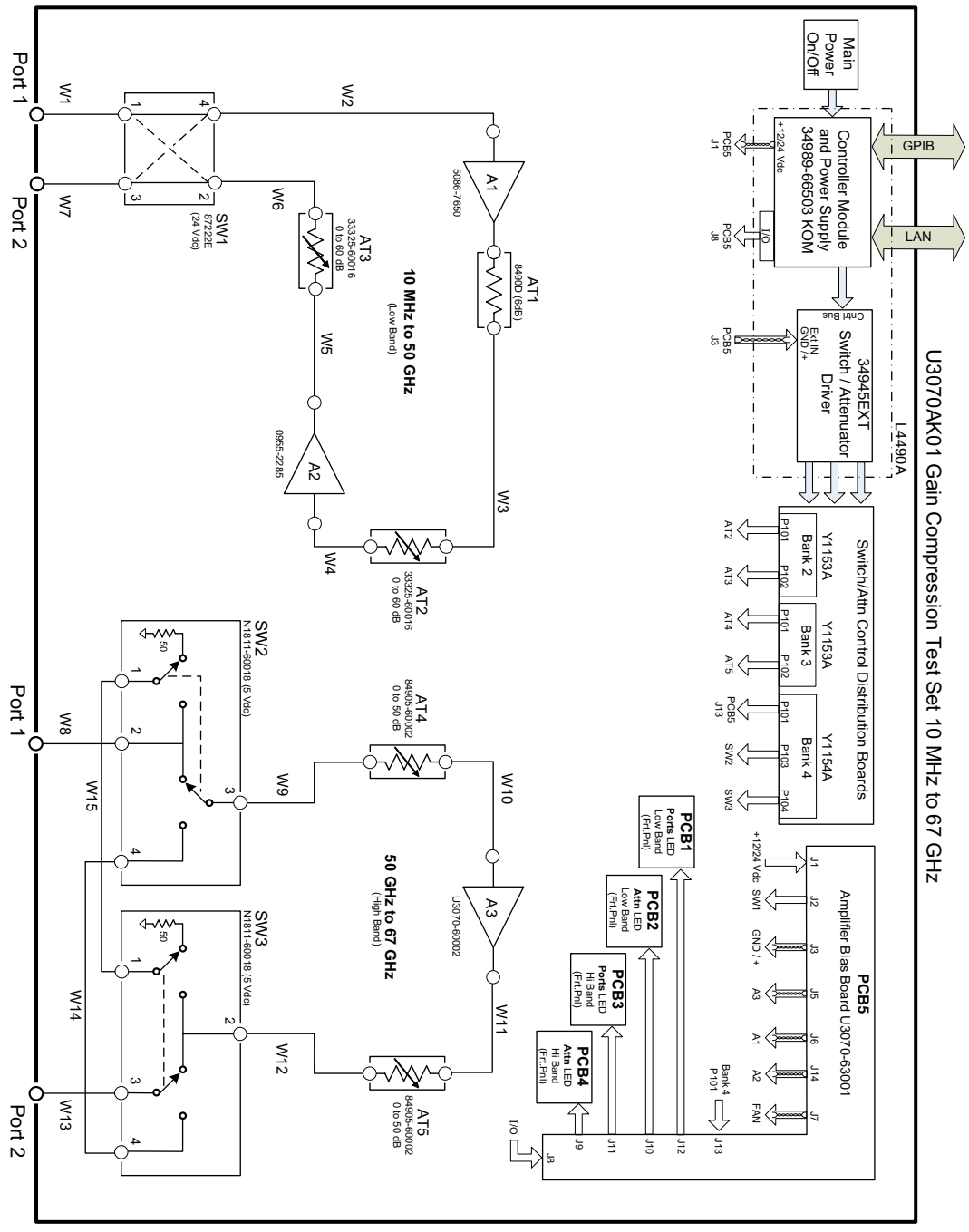
Front Panel Board Problems

Turn the instrument On and check the following:

1. Check for power supply problems.
2. If the LED has no backlight replace the LED assembly.
3. If the LED has backlight but no data is displayed, adjust R48 on the bottom side of the controller board. If there is still no data displayed, the problem is with the LED assembly or the controller board, replace.

Refer to Figure 23 for the major components and the U3070AK01 switching paths.

Figure 23 U3070AK01 Block Diagram



Safety and Information

Introduction

Review this product and related documentation to familiarize yourself with safety markings and instructions before you operate the instrument.

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Safety Earth Ground

WARNING	**This is a Safety Class I Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

CAUTION	Always use the three prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage and the risk of electrical shock.

Declaration of Conformity

A copy of the Declaration of Conformity is available upon request, or a copy is available on the Keysight Technologies web site at http://regulations.corporate.keysight.com/DoC/search.htm

Statement of Compliance

This product has been designed and tested in accordance with accepted industry standards, and has been supplied in a safe condition. The documentation contains information and warnings that must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

Before Applying Power

Verify that the premises electrical supply is within the range of the instrument. The instrument has an autoranging power supply.

WARNING	**If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

CAUTION	The Mains wiring and connectors shall be compatible with the connector used in the premise electrical system. Failure, to ensure adequate earth grounding by not using the correct components may cause product damage, and serious injury.

CAUTION	Always use the three prong AC power cord supplied with this product. Failure to ensure adequate earth grounding by not using this cord may cause product damage and the risk of electrical shock.

CAUTION	This product is designed for use in Installation Category II and Pollution Degree.

CAUTION	Before switching on this instrument, make sure the supply voltage is in the specified range.

CAUTION	Verify that the premise electrical voltage supply is within the range specified on the instrument.

CAUTION	Ventilation Requirements: When installing the instrument in a cabinet, the convection into and out of the instrument must not be restricted. The ambient temperature (outside the cabinet) must be less than the maximum operating temperature of the instrument by 4 °C for every 100 watts dissipated in the cabinet. If the total power dissipated in the cabinet is greater than 800 watts, forced convection must be used.

WARNING	**Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended. Discard used batteries according to manufacturer's instructions.**

WARNING	**For continued protection against fire hazard replace line fuse only with same type and rating. The use of other fuses or material is prohibited.**

WARNING	**These servicing instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**

WARNING	**The opening of covers or removal of parts is likely to expose the user to dangerous voltages. Disconnect the instrument from all voltage sources before opening.**

WARNING	**No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.**

WARNING	**The detachable power cord is the instrument disconnecting device. It disconnects the mains circuits from the mains supply before other parts of the instrument. The front panel switch is only a standby switch and is not a LINE switch (disconnecting device).**

Connector Care and Cleaning Precautions

Remove the power cord to the instrument. To clean the connectors use alcohol in a well ventilated area. Allow all residual alcohol moisture to evaporate, and fumes to dissipate prior to energizing the instrument.

WARNING	**To prevent electrical shock, disconnect the Keysight U3070AK01 from mains electrical supply before cleaning. Use a dry cloth or one slightly dampened with water to clean the external case parts. Do not attempt to clean internally.**

WARNING	**If flammable cleaning materials are used, the material shall not be stored, or left open in the area of the equipment. Adequate ventilation shall be assured to prevent the combustion of fumes, or vapors.**

Regulatory Information

This section contains information that is required by various government regulatory agencies.

Instrument Markings

The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

The AC symbol indicates the required nature of the line module input power.

This symbol indicates separate collection for electrical and electronic equipment, mandated under EU law as of August 13, 2005. All electric and electronic equipment are required to be separated from normal waste for disposal (Reference WEEE Directive, 2002/96/EC).

This symbol indicates that the power line switch is ON.

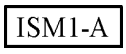
This symbol indicates that the power line switch is in the STANDBY position.

This symbol indicates that the power line switch is in the OFF position.

This symbol is used to identify a terminal which is internally connected to the product frame or chassis.

The CE mark is a registered trademark of the European Community. (If accompanied by a year, it is when the design was proven.)

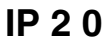
The CSA mark is a registered trademark of the CSA International.



This mark designates the product is an Industrial Scientific and Medical Group 1 Class A product (reference CISPR 11, Clause 5)

This is a marking to indicate product compliance with the Canadian Interference-Causing Equipment Standard (ICES-001).

Direct Current.



The instrument has been designed to meet the requirements of IP 2 0 for egress and operational environment.

The RCM mark is a registered trademark of the Australian Communications and Media Authority

Indicates the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of the product.

This symbol on all primary and secondary packaging indicates compliance to China standard GB 18455-2001.

South Korean Certification (KC) mark; includes the marking's identifier code which follows the format: MSIP-REM-YYY-ZZZZZZZZZZZZZZ.

Battery Collection

Do not throw batteries away but collect as small chemical waste, or in accordance with your country's requirements. You may return the battery to Keysight Technologies for disposal. Refer to "Contacting Keysight" on page 45 for assistance.

Electrical Safety Compliance

SAFETY

Complies with European Low Voltage Directive 2014/35/EU

- IEC/EN 61010-1:2010, 3rd Edition
- Canada: CSA C22.2 No. 61010-1-12
- USA: UL std no. 61010-1, 3rd Edition
- Acoustic statement (European Machinery Directive 2022/42/EC, 1.7.4.2U)
  Accoustical noise emission
  LpA<70 dB
  Operator position
  Normal operation mode
  Per ISO 7779

EMI and EMC Compliance

EMC

Complies with European EMC Directive 2014/30/EU

- IIEC 61326-1:2012/EN 61326-1:2013
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11:2011
- ICES/NMB-001
  This ISM device complies with Canadian ICES-001.
  Cet appareil ISM est conforme a la norme NMB du Canada.
- South Korean Class A EMC declaration: This equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

A 급 기기 (업무용 방송통신기자재)이 기기는 업무용 (A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주 의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으 로 합니다 .

Keysight Support, Services, and Assistance

Service and Support Options

There are many other repair and calibration options available from the Keysight Technologies support organization. These options cover a range of service agreements with varying response times. Contact Keysight for additional information on available service agreements for this product.

Contacting Keysight

Assistance with test and measurement needs, and information on finding a local Keysight office are available on the Internet at:
http://www.keysight.com/find/assist

You can also purchase accessories or documentation items on the Internet at:
http://www.keysight.com/find

If you do not have access to the Internet, contact your field engineer.

NOTE	In any correspondence or telephone conversation, refer to the Keysight product by its model number and full serial number. With this information, the Keysight representative can determine the warranty status of your unit.

Shipping Your Product to Keysight for Service or Repair

IMPORTANT	Keysight Technologies reserves the right to reformat or replace the internal hard disk drive in your analyzer as part of its repair. This will erase all user information stored on the hard disk. It is imperative, therefore, that you make a backup copy of your critical test data located on the analyzer's hard disk before shipping it to Keysight for repair.

If you wish to send your instrument to Keysight Technologies for service or repair:

- Include a complete description of the service requested or of the failure and a description of any failed test and any error message.
- Remove and retain the front handles and all rack mount hardware. The analyzer should be sent to Keysight in the same configuration as it was originally shipped.
- Remove and retain the front handles and all rack mount hardware. The analyzer should be sent to Keysight in the same configuration as it was originally shipped.
- Contact Keysight for instructions on where to ship your analyzer.