SERIES

MG369XA

SYNTHESIZED SIGNAL GENERATORS

MAINTENANCE MANUAL

490 JARVIS DRIVE
MORGAN HILL, CA 95037-2809

P/N: 10370-10355
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The Anritsu product(s) listed on the title page is (are) warranted against defects in materials and workmanship for three years from the date of shipment.

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NOTICE

DECLARATION OF CONFORMITY

Manufacturer's Name: ANRITSU COMPANY

Manufacturer's Address: Microwave Measurements Division
490 Jarvis Drive
Morgan Hill, CA 95037-2809
USA

declares that the product specified below:

Product Name: Signal Generator

Model Number: MG3691A, MG3692A, MG3693A
MG3694A, MG3695A, MG3696A

conforms to the requirement of:

EMC Directive 89/336/EEC as amended by Council Directive 92/31/EEC & 93/68/EEC
Low Voltage Directive 73/23/EEC as amended by Council directive 93/68/EEC

Electromagnetic Interference:

Emissions:
CISPR 11:1990/EN55011: 1991 Group 1 Class A
EN 61000-3-2:1995 Class A
EN 61000-3-3:1995 Class A

Immunity:
EN 61000-4-2:1995/EN61326-1: 1997 - 4kV CD, 8kV AD
EN 61000-4-3:1997/ EN61326-1: 1997- 3V/m
EN 61000-4-4:1995/ EN61326-1997: 1997 - 0.5kV SL, 1kV PL
EN 61000-4-5:1995/ EN61326-1997: 1997 - 1kV L-L, 2kV L-E
EN 61000-4-6:1994/EN61326: 1998 – 3V
EN 61000-4-11:1994/EN61326: 1998 – 100% @ 20msec

Electrical Safety Requirement:

Product Safety: IEC 1010-1:1990 + A1/EN61010-1: 1993

Marcel Dubois, Corporate Quality Director

Morgan Hill, CA

13 MAR 03
Date

European Contact: For Anritsu product EMC & LVD information, contact Anritsu LTD, Rutherford Close, Stevenage Herts, SG1 2EF UK, (FAX 44-1438-740202)

Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, ANRITSU Company uses the following symbols to indicate safety-related information. For your own safety, please read this information carefully BEFORE operating the equipment.

Symbols used in manuals

DANGER Indicates a very dangerous procedure that could result in serious injury or death if not performed properly.

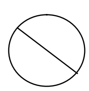
WARNING Indicates a hazardous procedure that could result in serious injury or death if not performed properly.

CAUTION Indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

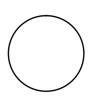
Safety Symbols Used on Equipment and in Manuals

(Some or all of the following five symbols may or may not be used on all ANRITSU equipment. In addition, there may be other labels attached to products that are not shown in the diagrams in this manual.)

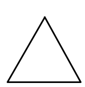
The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Ensure that you clearly understand the meanings of the symbols and take the necessary precautions BEFORE operating the equipment.



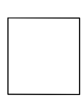
This symbol indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



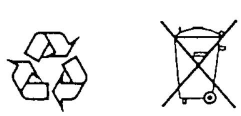
This symbol indicates a compulsory safety precaution. The required operation is indicated symbolically in or near the circle.



This symbol indicates warning or caution. The contents are indicated symbolically in or near the triangle.



This symbol indicates a note. The contents are described in the box.



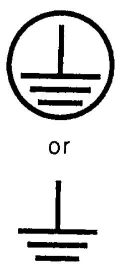
These symbols indicate that the marked part should be recycled.

For Safety

WARNING

Always refer to the operation manual when working near locations where the alert mark, shown on the left, is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.

Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.



WARNING

When supplying AC power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.

Repair

WARNING

This equipment cannot be repaired by the operator. DO NOT attempt to remove the equipment covers or to disassemble internal components. Only qualified service technicians with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision components.

WARNING ⚠

WARNING

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

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Chapter 2 Functional Description

Chapter 3 Performance Verification

Chapter 4 Calibration

Chapter 5 Troubleshooting

Chapter 6 Removal and Replacement Procedures

Chapter 1
General Information

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Figure 1-1. *Typical Series MG369XA Synthesized Signal Generator (Model MG3692A Shown)*

Chapter 1
General Information

1-1 Scope of Manual

This manual provides service information for the Model MG369XA Signal Generators. The service information includes replaceable parts information, troubleshooting, performance verification tests, calibration procedures, functional circuit descriptions and block diagrams, and assembly/subassembly removal and replacement. Throughout this manual, the terms *MG369XA* or *synthesizer* are used to refer to the instrument. Manual organization is shown in the table of contents.

1-2 Introduction

This chapter provides a general description of the MG369XA identification numbers, related manuals, and options. Information is included concerning level of maintenance, replaceable subassemblies and RF components, exchange assembly program, and preventive maintenance. Static-sensitive component handling precautions and lists of exchangeable subassemblies and recommended test equipment are also provided.

1-3 Description

The series MG369XA is a microprocessor-based, synthesized signal source with high resolution phase-lock capability. It generates both discrete CW frequencies and broad (full range) and narrow band step sweeps across the frequency range of 2 GHz to 65 GHz. Options are available to extend the low end of the frequency range to 0.1 Hz. All functions of the CW generator are fully controllable locally from the front panel or remotely (except for power on/standby) via the IEEE-488 General Purpose Interface Bus (GPIB). Table 1-1 on page 1-4 lists models, frequency ranges, and maximum leveled output power.

Table 1-1. *Series MG369XA Models*

Model Number	Configuration	Frequency Range	Max Leveled Output Power	Max Leveled Output Power w/Step Attenuator	Max Leveled Output Power w/Electronic Step Attenuator
MG3691A	w/opt 4	≥0.01 – ≤2.2 GHz	+17.0 dBm	+15.0 dBm	+13.0 dBm
	w/opt 5	≥0.01 – ≤2.0 GHz	+17.0 dBm	+15.0 dBm	+13.0 dBm
	Standard	≥2.0 – ≤8.4 GHz	+13.0 dBm	+11.0 dBm	+9.0 dBm
MG3692A	w/opt 4	≥0.01 – ≤2.2 GHz	+17.0 dBm	+15.0 dBm	+13.0 dBm
	w/opt 5	≥0.01 – ≤2.0 GHz	+17.0 dBm	+15.0 dBm	+13.0 dBm
	Standard	≥2.0 – ≤8.4 GHz	+13.0 dBm	+11.0 dBm	+9.0 dBm
	Standard	>8.4 – ≤20.0 GHz	+13.0 dBm	+11.0 dBm	+3.0 dBm
MG3693A	w/opt 4	≥0.01 – ≤2.2 GHz	+13.0 dBm	+11.0 dBm	Not Available
	w/opt 5	≥0.01 – ≤2.0 GHz	+13.0 dBm	+11.0 dBm	
	Standard	≥2.0 – ≤20.0 GHz	+9.0 dBm	+7.0 dBm	
	Standard	>20.0 – ≤30.0 GHz	+6.0 dBm	+3.0 dBm	
MG3694A	w/opt 4	≥0.01 – ≤2.2 GHz	+13.0 dBm	+11.0 dBm	Not Available
	w/opt 5	≥0.01 – ≤2.0 GHz	+13.0 dBm	+11.0 dBm	
	Standard	≥2.0 – ≤20.0 GHz	+9.0 dBm	+7.0 dBm	
	Standard	>20.0 – ≤40.0 GHz	+6.0 dBm	+3.0 dBm	
MG3695A	w/opt 4	≥0.01 – ≤2.2 GHz	+12.0 dBm	+10.0 dBm	Not Available
	w/opt 5	≥0.01 – ≤2.0 GHz	+12.0 dBm	+10.0 dBm	
	Standard	≥2.0 – ≤20.0 GHz	+10.0 dBm	+8.0 dBm	
	Standard	>20.0 – ≤50.0 GHz	+3.0 dBm	+0.0 dBm	
MG3696A	w/opt 4	≥0.01 – ≤2.2 GHz	+12.0 dBm	+10.0 dBm	Not Available
	w/opt 5	≥0.01 – ≤2.0 GHz	+12.0 dBm	+10.0 dBm	
	Standard	≥2.0 – ≤20.0 GHz	+10.0 dBm	+8.0 dBm	
	Standard	>20.0 – ≤65.0 GHz	+3.0 dBm	+0.0 dBm*	
With Option 15 (High Power) Installed					
MG3691A	w/opt 4	≥0.01 – ≤2.2 GHz	+19.0 dBm	+18.0 dBm	+15.0 dBm
	w/opt 5	≥0.01 – ≤2.0 GHz	+19.0 dBm	+18.0 dBm	+15.0 dBm
	Standard	≥2.0 – ≤8.4 GHz	+19.0 dBm	+18.0 dBm	+13.0 dBm
MG3692A	w/opt 4	≥0.01 – ≤2.2 GHz	+19.0 dBm	+18.0 dBm	+15.0 dBm
	w/opt 5	≥0.01 – ≤2.0 GHz	+19.0 dBm	+18.0 dBm	+15.0 dBm
	Standard	≥2.0 – ≤10.0 GHz	+19.0 dBm	+18.0 dBm	+13.0 dBm
	Standard	>10.0 – ≤20.0 GHz	+17.0 dBm	+15.0 dBm	+7.0 dBm
MG3693A	w/opt 4	≥0.01 – ≤2.2 GHz	+15.0 dBm	+14.0 dBm	Not Available
	w/opt 5	≥0.01 – ≤2.0 GHz	+15.0 dBm	+14.0 dBm	
	Standard	≥2.0 – ≤10.0 GHz	+15.0 dBm	+14.0 dBm	
	Standard	>10.0 – ≤20.0 GHz	+12.0 dBm	+10.0 dBm	
	Standard	>20.0 – ≤30.0 GHz	+14.0 dBm	+12.0 dBm	
MG3694A	Option 4	≥0.01 – ≤2.2 GHz	+15.0 dBm	+14.0 dBm	Not Available
	Option 5	≥0.01 – ≤2.0 GHz	+15.0 dBm	+14.0 dBm	
	Standard	≥2.0 – ≤10.0 GHz	+15.0 dBm	+14.0 dBm	
	Standard	>10.0 – ≤20.0 GHz	+12.0 dBm	+10.0 dBm	
	Standard	>20.0 – ≤40.0 GHz	+14.0 dBm	+12.0 dBm	

Note: In models with Option 22, rated output power is reduced by 2 dB.
* Typical 60 - 65 GHz.

1-4 Identification Number

All Anritsu instruments are assigned a unique six-digit ID number, such as "875012." The ID number is imprinted on a decal that is affixed to the rear panel of the unit. Special-order instrument configurations also have an additional *special* number tag attached to the rear panel of the unit, such as SM1234.

When ordering parts or corresponding with Anritsu customer service, please use the correct serial number with reference to the specific instrument's model number (i.e., Model MG3692A CW Signal Generator, Serial No. 875012, and the special's number, if appropriate).

1-5 Online Manual

This manual is available on CD ROM as an Adobe Acrobat Portable Document Format (∗.pdf) file. The file can be viewed using Acrobat Reader, a free program that is also included on the CD ROM. The file is "linked" such that the viewer can choose a topic to view from the displayed "bookmark" list and "jump" to the manual page on which the topic resides. The text can also be word-searched. Contact Anritsu customer service for price and availability.

1-6 Related Manuals

This is one of a three manual set that consists of an operation manual, a GPIB programming manual, and a maintenance manual.

Operation Manual The operation manual provides instructions for operating the MG369XA using the front panel controls. It also includes general information, performance specifications, installation instructions, and operation verification procedures. The Anritsu part number for the Model MG369XA Operation Manual is 10370-10353.

GPIB Programming Manual The GPIB programming manual provides information for remotely operating the MG369XA using product specific commands sent from an external controller via the IEEE 488 General Purpose Interface Bus (GPIB). It contains a complete listing and description of all MG369XA GPIB product specific commands and several programming examples. The Anritsu part number for the Model MG369XA GPIB Programming Manual is 10370-10354.

1-7 Options

The options available for the Anritsu MG369XA series signal generators are described in the product data sheet (p/n 11410-00327). A copy of this data sheet is located in Appendix B.

1-8 Level of Maintenance

Maintenance of the MG369XA consists of:

- Troubleshooting the instrument to a replaceable subassembly or RF component
- Repair by replacing the failed subassembly or RF component.
- Calibration
- Preventive maintenance

Trouble-shooting The MG369XA firmware includes internal diagnostics that self-test most of the internal assemblies. When the MG369XA fails self-test, one or more error messages appear to aid in troubleshooting the failure to a replaceable subassembly or RF component. Chapter 5—Troubleshooting lists and describes the self-test error messages and provides procedures for isolating MG369XA failures to a replaceable subassembly or RF component.

Repair Most instrument failures are field repairable by replacing the failed subassembly or RF component. Detailed instructions for removing and replacing failed subassemblies and components are provided in Chapter 6—Removal and Replacement Procedures.

Calibration The MG369XA may require calibration after repair. Refer to Chapter 4—Calibration for a listing of requirements and procedures.

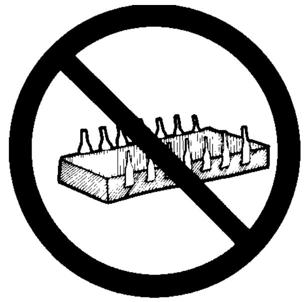
Preventive Maintenance Preventive maintenance on the MG369XA consists of cleaning the fan honeycomb filter, described in Section 1-10.

1-9 Component Handling

The MG369XA contains components that can be damaged by static electricity. Figure 1-2 illustrates the precautions that should be followed when handling static-sensitive subassemblies and components. If followed, these precautions will minimize the possibilities of static-shock damage to these items.

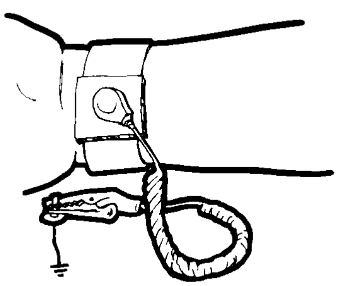
> ***NOTE***
> Use of an grounded wrist strap when handling subassemblies or components is strongly recommended.

1. Do not touch exposed contacts on any static sensitive component.



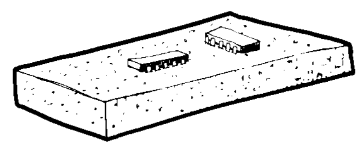
2. Do not slide static sensitive component across any surface.

3. Do not handle static sensitive components in areas where the floor or work surface covering is capable of generating a static charge.

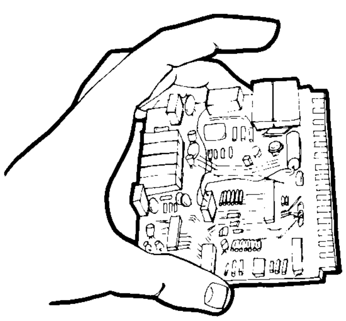


4. Wear a static-discharge wristband when working with static sensitive components.

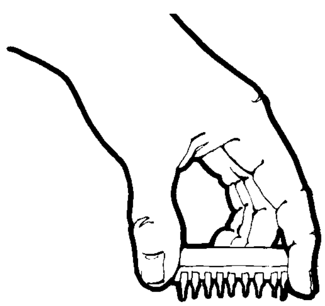
5. Label all static sensitive devices.



6. Keep component leads shorted together whenever possible.



7. Handle PCBs only by their edges. Do not handle by the edge connectors.



8. Lift & handle solid state devices by their bodies – never by their leads.

9. Transport and store PCBs and other static sensitive devices in static-shielded containers.

10. Additional Precautions:

    Keep work spaces clean and free of any objects capable of holding or storing a static charge.

    Connect soldering tools to an earth ground.

    Use only special anti-static suction or wick-type desoldering tools.

Figure 1-2. *Static-Sensitive Component Handling Precautions*

1-10 Preventive Maintenance

The MG369XA must always receive adequate ventilation. A blocked fan filter can cause the instrument to overheat and shut down. Check and clean the rear panel fan honeycomb filter periodically. Clean the fan honeycomb filter more frequently in dusty environments. Clean the filter as follows.

Step 1. Use a #3 screwdriver to remove the four screws that fasten the filter guard to the rear panel (see Figure 1-3). Retain the screws for reassembly.

Step 2. Vacuum the honeycomb filter to clean it.

Step 3. Reinstall the filter guard.

Step 4. Fasten the filter guard to the rear panel using the four screws that were removed in Step 1.

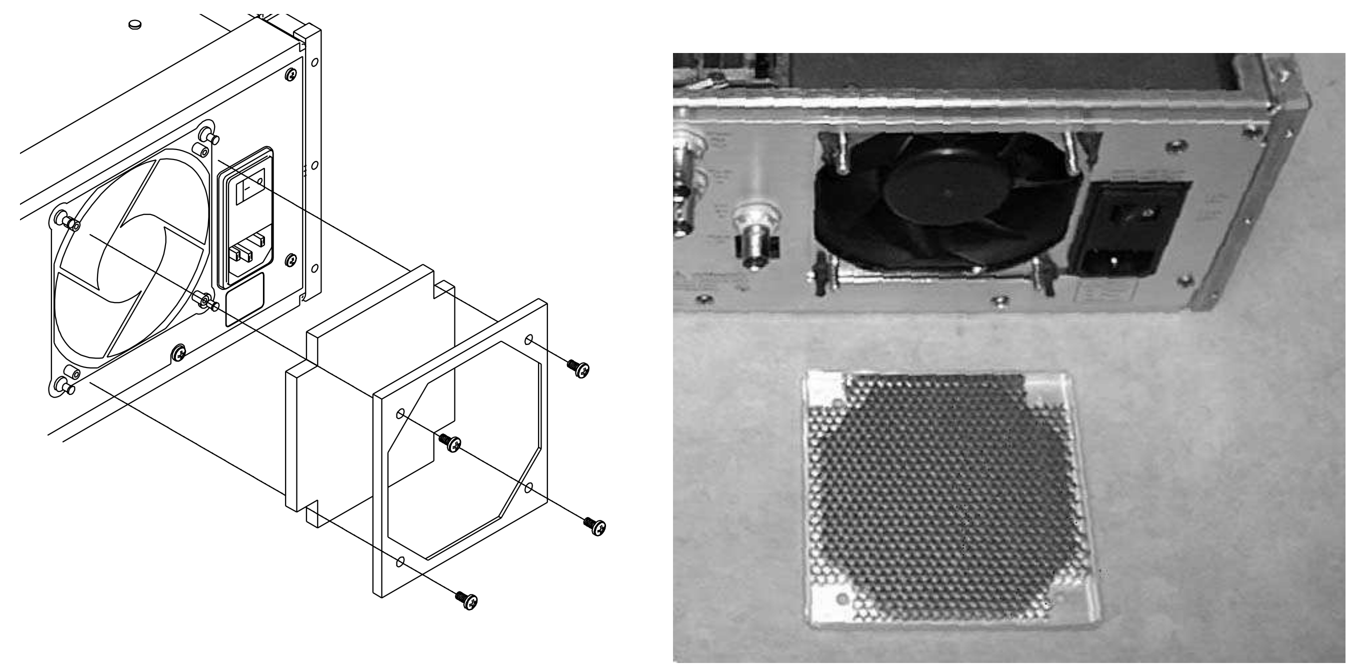


Figure 1-3. *Removing/Replacing the Fan Filter Guard*

1-11 Startup Configurations

The MG369XA comes from the factory with a jumper across pins 2 and 3 of the A2 microprocessor PCB connector JP1 (Figure 1-4). In this configuration, connecting the instrument to line power automatically places it in operate mode (front panel OPERATE LED on).

The startup configuration can be changed so that the signal generator comes up in standby mode (front panel STANDBY LED on) when it is connected to line power. Change the startup configuration as follows:

Step 1. Disconnect the instrument from line power.

Step 2. Remove the top cover from the MG369XA and A2 PCB. Refer to Section 6-5 for instructions.

Step 3. Locate the connector JP1 and remove the jumper from across pins 2 and 3. Refer to Figure 1-4 below.

Step 4. Install the jumper across pins 1 and 2 of the connector JP1.

Step 5. Install the top covers and connect the signal generator to line power. The instrument should come up in standby mode.

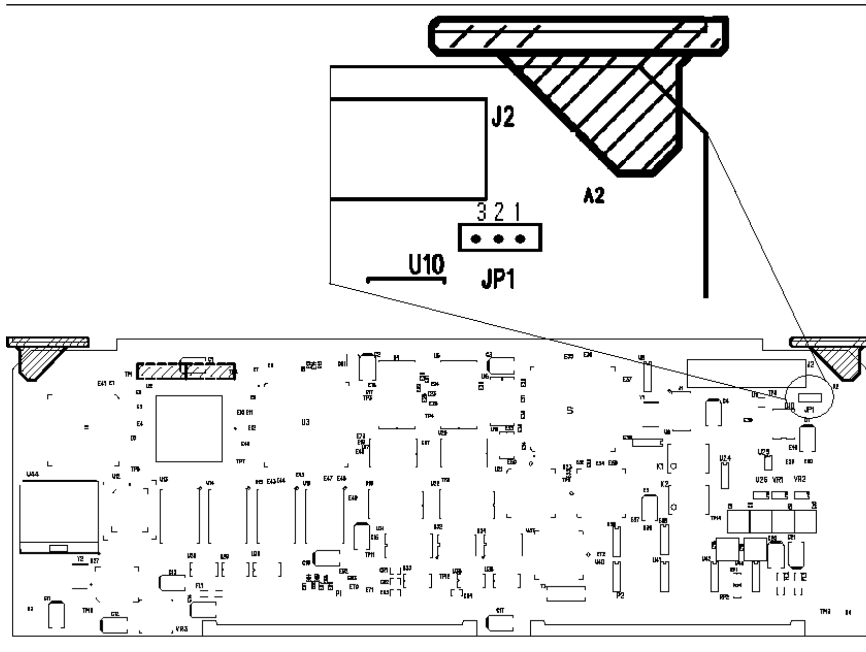


Figure 1-4. *Startup Configuration of A2 Connector JP1*

1-12 Recommended Test Equipment

Table 1-2 provides a list of recommended test equipment needed for the performance verification, calibration, and troubleshooting procedures presented in this manual.

Table 1-2. *Recommended Test Equipment (1 of 2)*

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USAGE*
Spectrum Analyzer	Frequency: 0.01 to 50 GHz Resolution Bandwidth: 10 Hz	HP8565E	C, P
Phase Noise Measurement System	Frequency Range: 5 MHz to 26.5 GHz See Table 3-2 on page 3-11	Aeroflex/Comstron PN9000 with: PN9060-00 Status Module PN9470-00 Noise Output Module PN9450-00 Lock Control Module PN9342-00 Phase Detector Module PN9530-00 Crystal Oscillator Module	P
Modulation Analyzer	AM and FM Measurement Capability to >500 MHz and –20 dBm	HP8901A	P
Frequency Counter	Frequency Range: 0.01 to 40 GHz Input Impedance: 50Ω Resolution: 1 Hz Other: External Time Base Input	Anritsu Model MF2414B	C, P
Power Meter with Power Sensor	Frequency: 0.01 to 65 GHz Power Range: –70 to +20 dBm	Anritsu Model ML2437A/38A with Power Sensor: MA2421A (100 kHz to 18 GHz) MA2474A (0.01 to 40 GHz) SC6230 (0.01 to 65 GHz)	C, P
Power Supply	Output: +1V DC	Agilent E3631A	P
Digital Multimeter	Minimum 1% RMS ACV Accuracy at 100 kHz	Fluke 8840A	C, P
Function Generator	DDS, 0.01 to 10 MHz	Agilent 33120A	C, P
Digital Sampling Oscilloscope	Frequency: 50 GHz	Agilent 86100A with: 83484A 50 GHz Module	P
Measuring Receiver	Noise Floor: <–140 dBm @ 500 MHz	Anritsu Model ML2530A	C, P
Frequency Reference	Frequency: 10 MHz Accuracy: 5×10^{-12} parts/day	Absolute Time Corp., Model 300	C, P
Local Oscillator	Frequency: 0.01 to 40 GHz	Anritsu Model MG3694A with: Options 3, 4 and 15	P
Local Oscillator (Level Calibration)	Frequency: 0.01 to 40 GHz	Anritsu Model 69067B with: Option 14 and SM5709	C
Scalar Network Analyzer with RF Detector	Frequency: 0.01 to 60 GHz	Anritsu Model 56100A with RF Detector: 560-7K50 (0.01 to 40 GHz) 560-7VA50 (0.01 to 50 GHz) SC5198 (0.01 to 60 GHz)	C, T
Diplex Switch Assembly	Frequency Range: 0.1 Hz to 10 MHz Frequency Range: 0.01 to 40 GHz	Anritsu P/N: 46504 Anritsu P/N: 29850	C
Mixer	Frequency Range: 500 MHz to 40 GHz Conversion Loss: 10 dB (typical)	Anritsu P/N: 60-114	C, P

* P = Performance Verification Tests; C = Calibration; T = Troubleshooting

Table 1-2. Recommended Test Equipment (2 of 2)

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	USAGE*
Attenuator	Frequency Range: DC to 40 GHz Max Input Power: >+20 dBm Attenuation: 3, 6, 10, and 20 dB	Anritsu, Model 41KC-3 Anritsu, Model 41KC-6 Anritsu, Model 41KC-10 Anritsu, Model 41KC-20	C, P
Attenuator	Frequency Range: DC to 60 GHz Max Input Power: >+20 dBm Attenuation: 10 dB	Anritsu, Model 41V-10	C
Adapter 2.4 mm (m) to K (f)	Frequency Range: 0.01 to 40 GHz	Any common source (Agilent P/N: 11904-60003)	P
Adapter 3.5 mm (m) to BNC (f)	50Ω	Any common source	P
Feed Through Termination	50Ω BNC	Any common source	P
Tee	Connectors: 50Ω BNC	Any common source	P
Cables	Connectors: 50Ω BNC RF Connections: K-Cables	Any common source	C, P
AUX I/O Interface Cable	Provides interface between the MG369XA and the 56100A Scalar Network Analyzer	Anritsu P/N:806-7	C
Special AUX I/O Cable Assembly	Provides interface between the MG369XA and the Power Meter	Anritsu P/N: 806-97	P
Serial Interface Assembly	Provides serial interface between the PC and the MG369XA	Anritsu P/N: T1678	C
Personal Computer	IBM AT or compatible with GPIB interface	PC: Any common source GPIB Interface: National Instruments P/N: PCI-GPIB (Desktop) PCMCIA-GPIB (Notebook)	C
Level Calibration Software	Provides automated power level calibration of the MG369XA	Anritsu P/N: 2300-497	C

* P = Performance Verification Tests; C = Calibration; T = Troubleshooting

Chapter 2
Functional Description

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Chapter 2 Functional Description

2-1 Introduction

This chapter provides brief functional descriptions of the major subsystems that are contained in each model of the MG369XA. In addition, the operation of the frequency synthesis, automatic level control (ALC), and RF deck subsystems is described so that the reader may better understand the overall operation of the instrument. Block diagrams are included to supplement the written descriptions.

2-2 Major Subsystems

The MG369XA circuitry consists of various distinct subsystems that are contained on one or more printed circuit board (PCB) assemblies or in microwave components located on the RF deck. The following paragraphs identify the subsystems that make up the instrument and provide a brief description of each. Figure 2-1 (page 2-7) is an overall block diagram of a typical MG369XA.

Digital Control

This circuit subsystem consists of the A2 Microprocessor PCB. The central processor unit (CPU) located on this PCB is the main controller for the MG369XA. This controller directly or indirectly controls all functions of the instrument. The CPU contains memory that stores the main operating system components and instrument firmware, instrument calibration data, and front panel setup data during the power-off condition. It has a GPIB interface that allows it to communicate with external devices over the GPIB and a serial interface to a serial terminal port on the rear panel. The CPU is directly linked via a dedicated data and address bus to the front panel assembly, the A5 Auxiliary/Analog Instruction PCB, the A6 ALC PCB, the A7 Yig-lock PCB, the A9 YIG assembly, the optional A8 DDS PCB of the CW Generator or Function Generator of the Signal Generator, and the A13 Pulse Generator PCB.

Interface circuits on the A2 PCB indirectly link the CPU to the A3 reference/fine loop PCB, and the A4 coarse loop PCB. The A2 PCB contains circuits that perform parallel-to-serial and serial-to-parallel data conversion. The A2 also contains circuitry for many of the rear panel signals and a 13-bit resolution digital volt meter (DVM).

Front Panel Assembly

This circuit subsystem consists of the front panel, the front panel rotary data knob, the front panel control PCB, and the liquid crystal display (LCD). The subsystem interfaces the front panel LCD, light emitting diodes (LEDs), and keys to the CPU via the dedicated data and address bus. The front panel rotary data knob is also linked to the CPU via the data and address bus.

The front panel PCB contains the keyboard matrix conductive rubber switches. It has circuits to control the LCD dot-matrix display, turn the front panel LEDs on and off, and convert keyboard switch matrix signals to parallel key code. It also contains the standby/operate line switch and the optical encoder for the rotary data knob.

Frequency Synthesis

The frequency synthesis subsystem consists of the A3 reference/fine loop PCB, the A4 coarse loop PCB, the A7 YIG lock PCB, and the A9 YIG assembly. It provides the reference frequencies and phase lock circuits for precise control of the YIG-tuned oscillator frequencies, as follows:

- The reference loop circuitry located on the A3 PCB supplies the stable 10 MHz and 500 MHz reference frequency signals for the rest of the frequency synthesis system
- The A4 coarse loop PCB generates coarse tuning frequencies of 219.5 to 245 MHz for use by the YIG lock PCB
- The fine loop circuitry located on the A3 PCB provides fine tuning frequencies of 21.5 to 40 MHz for use by the YIG lock PCB
- The A7 YIG lock PCB performs phase detection of the YIG-tuned oscillator's output frequency and provides a YIG loop error voltage signal. This error signal is further conditioned, producing a correction signal that is used to fine tune and phase lock the YIG-tuned oscillator

The CPU sends control data to the A3 reference/ fine loop PCB and the A4 coarse loop PCB as serial data words. Refer to Section 2-3 for a functional overview of the frequency synthesis subsystem.

A9 YIG Assembly

The A9 YIG assembly contains the YIG-tuned oscillator and associated PCB assembly. The PCB assembly contains the driver circuitry that provides the tuning current and bias voltages for the YIG-tuned oscillator. The CPU controls the A9 YIG assembly via the dedicated data and address bus.

ALC/AM/Pulse Modulator

This ALC circuit subsystem consists of the A6 ALC PCB, the A6A1 AM module, and part of the A9 YIG PCB assembly. It provides the following:

- Level control of the RF output power
- Current drive signals to the PIN switches located in the A10 switched filter assembly (SWF), the A12 switched doubler module (SDM), and the source quadrupler module (SQM)
- Drive signals for the step attenuator (Option 2) and the diplexers (used with Option 22)

The CPU controls the A6 ALC PCB (and the A6A1 AM module via the A6 PCB) and the A9 YIG PCB assembly via the dedicated data and address bus. It sends control data to the A13 Pulse Generator PCB via the A1 Motherboard as serial data words. Refer to Section 2-4 for a functional overview of the ALC subsystem.

RF Deck

This subsystem contains those elements related to the generation, modulation, and control of the sweep- and CW-frequency RF signals. These elements include the A9 YIG-tuned oscillator/PCB assembly, the 0.01 to 2 GHz down converter assembly (A11), the A10 switched filter assembly, the A12 switched doubler module, the source quadrupler module, the directional coupler/level detector, and the optional step attenuator. Refer to Section 2-5 for a functional overview of the RF deck subsystem.

Power Supply

The power supply subsystem consists of the power input connector/filter module, the regulator PCB, the power supply PCB, the standby power supply PCB, and the power module fan unit. It supplies all the regulated DC voltages used by the MG369XA circuits. The voltages are routed throughout the instrument via the motherboard PCB.

Inputs/ Outputs

The A21 rear panel PCB and the A2 microprocessor PCB contain the interface circuits for the majority of the rear panel input and output connectors, including the AUX I/O connector.

The A5 Auxiliary PCB (or the optional A5 Analog Instruction PCB) provides a 0V to +10V ramp signal to the rear panel HORIZ OUT connector, a V/GHz signal to the rear panel AUX I/O connector, and a SLOPE signal to the A6 ALC PCB for slope-vs-frequency correction of the RF output power.

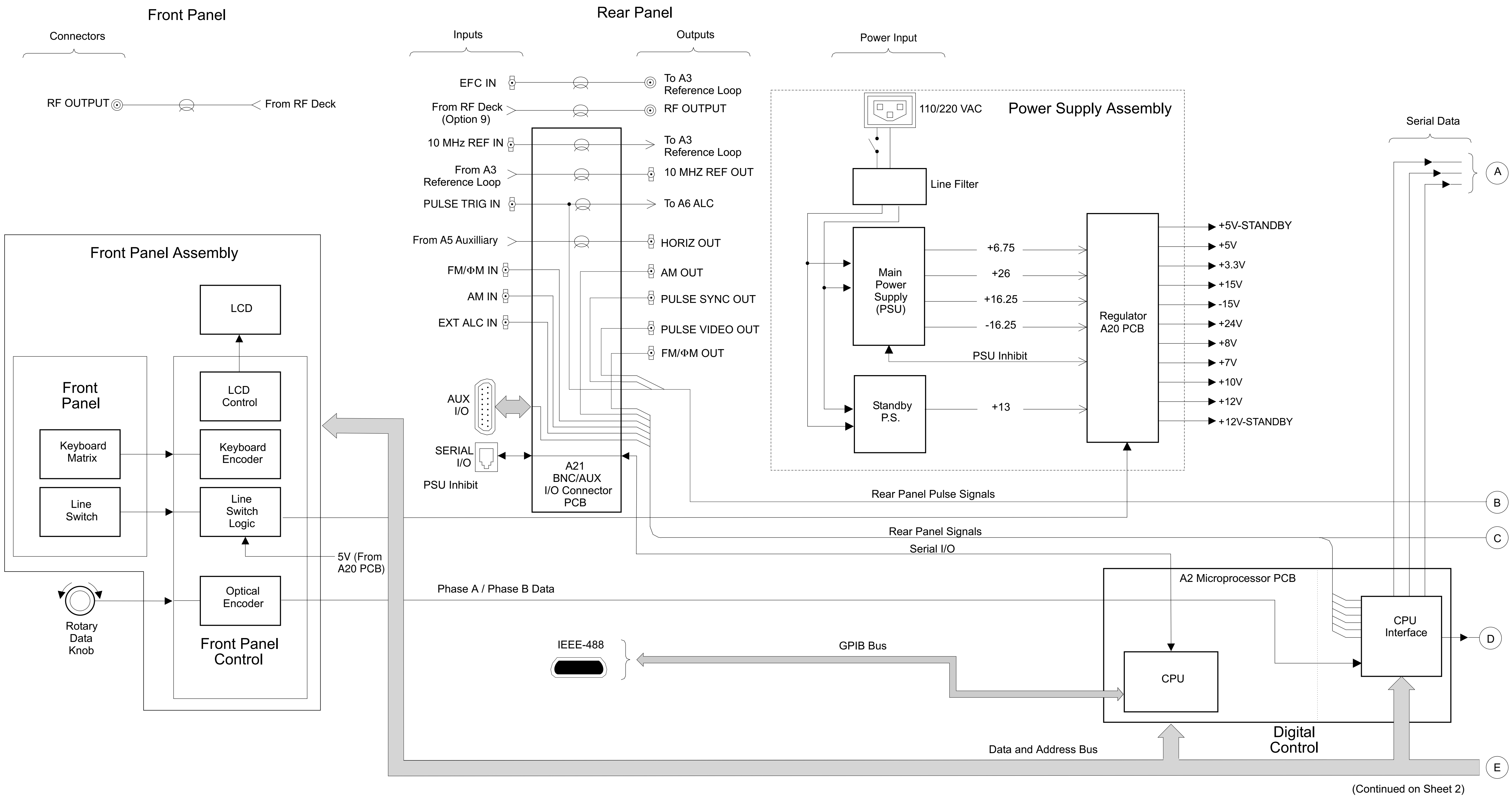
The rear panel EXT ALC IN, AM IN, and AM OUT are routed through the A21 rear panel PCB, and then through the motherboard PCB to the A6 ALC PCB. The rear panel connectors, 10 MHz REF OUT and 10 MHz REF IN, are routed through the A21 PCB and coupled to the A3 Reference/Fine Loop PCB via coaxial cables.

The rear panel FM/ΦM IN and FM/ΦM OUT connectors are routed through the A21 rear panel PCB and then through the Motherboard PCB to the A7 YIG-lock PCB. The rear panel PULSE TRIG IN connector is routed through the A21 rear panel PCB and then to the A6 ALC PCB (or optional A13 Pulse Generator PCB for units with Option 24 installed). The rear panel PULSE SYNC OUT and PULSE VIDEO OUT connectors are routed through the A21 rear panel PCB, and then to the optional A13 Pulse Generator PCB via coaxial cables. The rear panel EFC IN connector is routed to the A3 Reference/Fine Loop PCB via coaxial cables.

The rear panel IEEE-488 GPIB and SERIAL I/O connectors are routed through the A21 rear panel PCB and then through the motherboard to the A2 microprocessor PCB.

Motherboard/ Interconnections

The motherboard PCB and associated cables provide the interconnections for the flow of data, signals, and DC voltages between all internal components and assemblies throughout the MG369XA.



(Continued on Sheet 2)

Figure 2-1. *Block Diagram of a Typical MG369XA Synthesized Signal Generator (Sheet 1 of 2).*

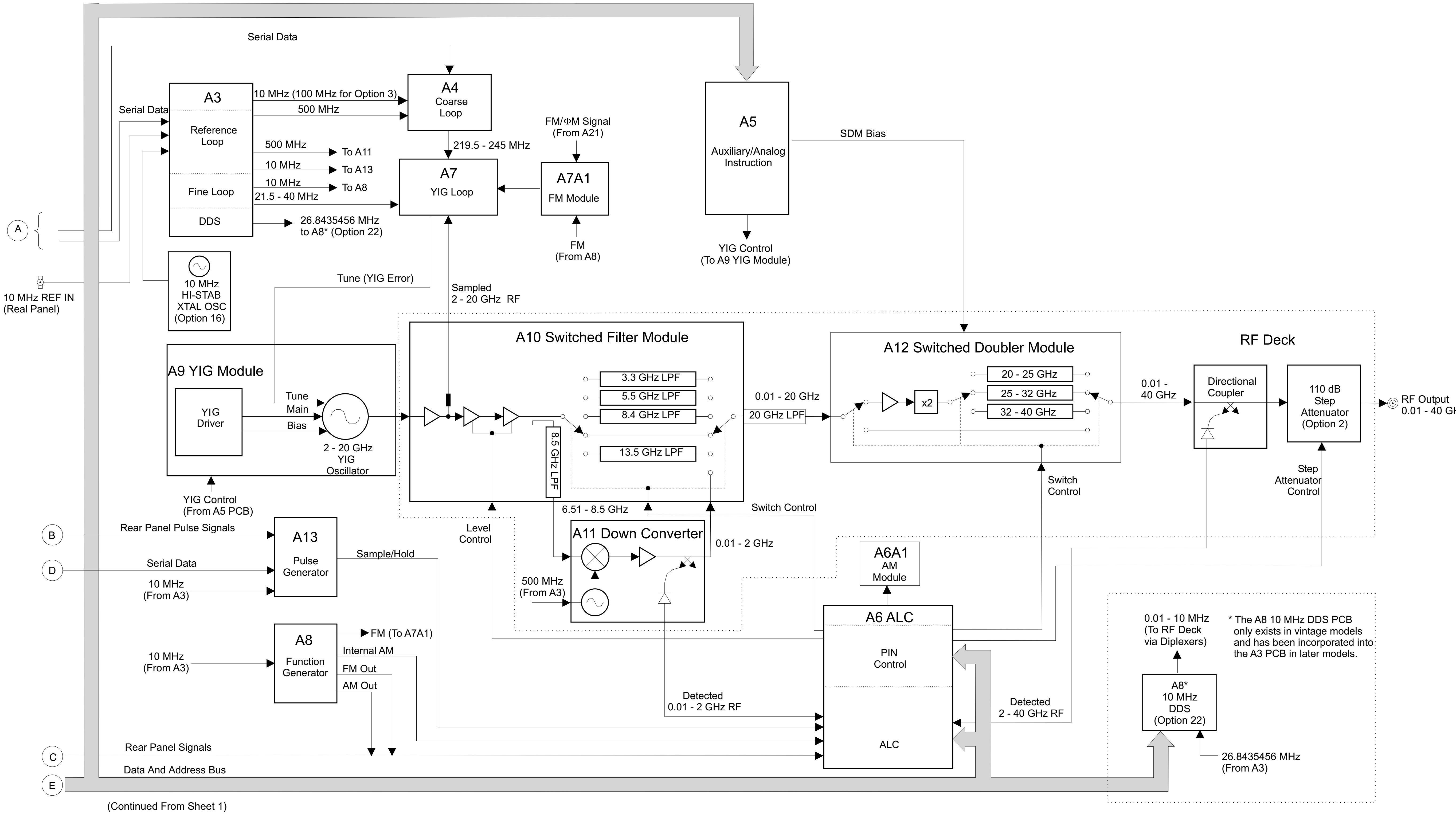


Figure 2-1. Block Diagram of a Typical MG369XA Synthesized Signal Generator (Sheet 2 of 2).

2-3 Frequency Synthesis

The frequency synthesis subsystem provides phase-lock control of the MG369XA output frequency. It consists of four phase-lock loops, the reference loop, the coarse loop, the fine loop, and the YIG loop. The four phase-lock loops, operating together, produce an accurately synthesized, low-noise RF output signal. Figure 2-2 (page 2-11) is an overall block diagram of the frequency synthesis subsystem. The following paragraphs describe phase-lock loops and the overall operation of the frequency synthesis subsystem.

Phase Lock Loops

The purpose of a phase-lock loop is to control the frequency of a variable oscillator in order to give it the same accuracy and stability as a fixed reference oscillator. It works by comparing two frequency inputs, one fixed and one variable, and supplying a correction signal to the variable oscillator to reduce the difference between the two inputs. For example, suppose we have a 10 MHz reference oscillator with a stability of 1 x 10^{-7}/day, and we wish to transfer that stability to a voltage controlled oscillator (VCO). The 10 MHz reference signal is applied to the reference input of a phase-lock loop circuit. The signal from the VCO is applied to the variable input. A phase detector in the phase-lock loop circuit compares the two inputs and determines whether the variable input waveform is leading or lagging the reference. The phase detector generates a correction signal that (depending on polarity) causes the VCO frequency to increase or decrease to reduce any phase difference. When the two inputs match, the loop is said to be *locked*. The variable input from the VCO then equals the reference input in phase, frequency, accuracy, and stability.

In practical applications a frequency divider is placed between the output of the variable oscillator and the variable input to the phase-lock loop. The circuit can then be used to control a frequency that is an exact multiple of the reference frequency. In this way, the variable oscillator acquires the stability of the reference without equaling its frequency. In the A3 reference loop, the 100 MHz VCXO can be controlled by the phase-lock loop using a 10 MHz reference. This is because a divide-by-ten circuit is between the VCXO's output and the variable input to the phase-lock loop. Both inputs to the phase detector will be 10 MHz when the loop is locked.

If a programmable frequency divider is used, a number of frequencies can be phase-locked to the same reference. The limitation is that all must be exact multiples of the reference. The A4 coarse loop and A3 fine loop section both use programmable frequency dividers.

Overall Operation

The YIG-tuned oscillator generates a high-power RF output signal that has low broadband noise and low spurious content. The frequency of the YIG-tuned oscillator is controlled by means of (1) its main tuning coil and (2) its FM (fine tuning) coil. The main tuning coil current from the YIG-driver PCB coarsely tunes the YIG-tuned oscillator to within a few megahertz of the final output frequency. The YIG phase-lock loop is then used to fine tune the YIG-tuned oscillator to the exact output frequency and to reduce FM noise close to the carrier.

One input to the YIG loop is the 219.5 to 245 MHz signal from the coarse loop. This signal is amplified to drive the step-recovery diode (located on the A7 PCB). The step-recovery diode produces harmonics of the coarse loop signal (≥1.9755 to >20 GHz). These harmonics are used by the sampler.

The other input to the sampler is a sampled RF output signal from the YIG-tuned oscillator. Mixing this RF output signal sample with the adjacent coarse-loop harmonic produces a low frequency difference signal that is the 21.5 to 40 MHz YIG IF signal.

The MG369XA CPU programs the coarse-loop oscillator's output frequency so that one of its harmonics will be within 21.5 to 40 MHz of the desired YIG-tuned oscillator's output frequency. The YIG loop phase detector compares the YIG IF signal to the 21.5 to 40 MHz reference signal from the fine loop. If there is a difference, the YIG phase detector fine tunes the YIG-tuned oscillator (via the FM circuitry and the FM coil drivers) to eliminate any frequency difference between the two signals.

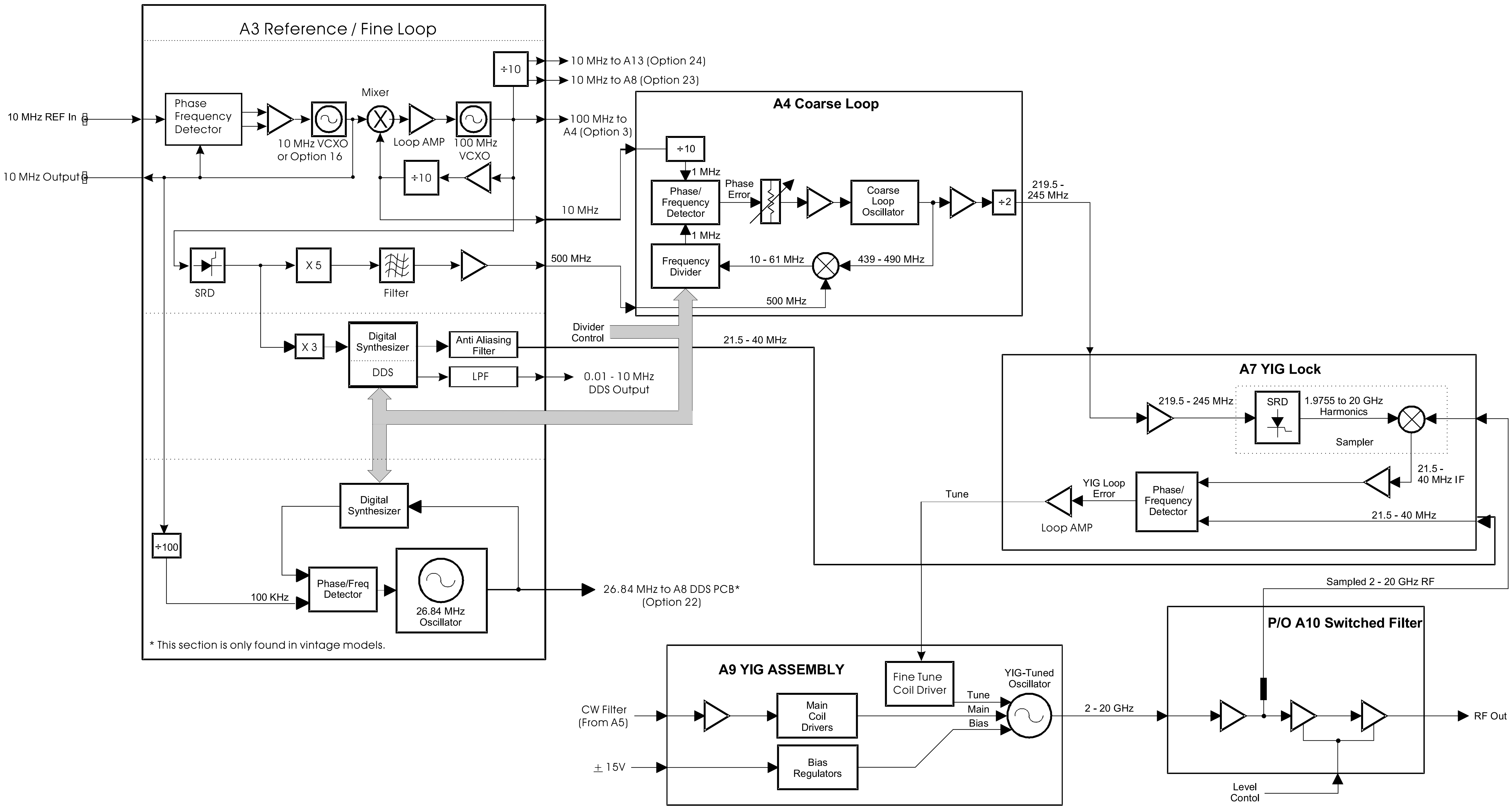


Figure 2-2. Block Diagram of the Frequency Synthesis Subsystem

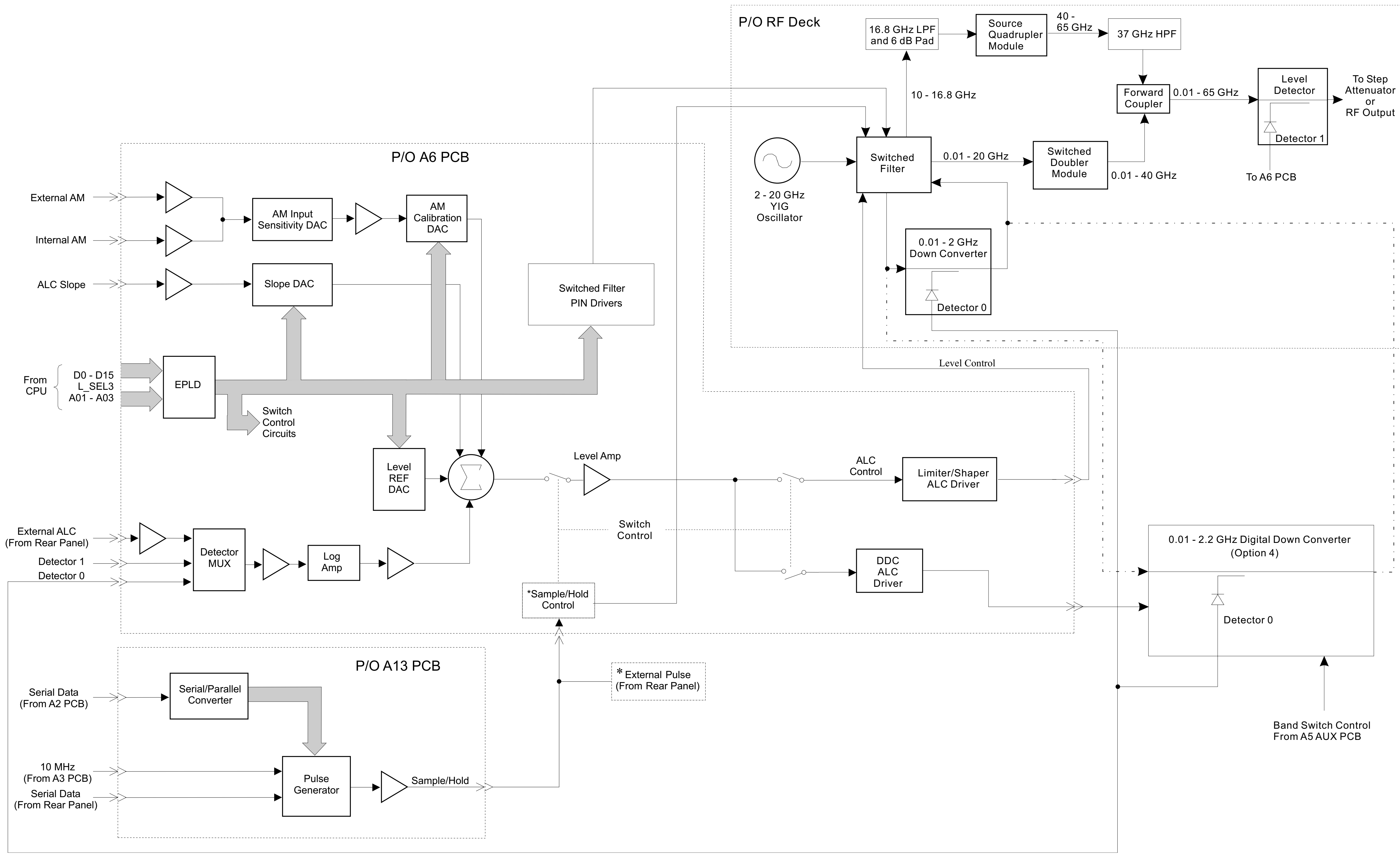


Figure 2-3. Block Diagram of the ALC Subsystem

Phase locking the instrument's output frequency over a broad frequency range is accomplished by programming the coarse-loop oscillator's output to various frequencies that have harmonics close to the desired operating frequencies. Exact frequency tuning for each desired operating frequency is accomplished by programming the fine-loop oscillator. In each case, the YIG-tuned oscillator is first tuned via the main tuning coil to the approximate desired operating frequency. Table 2-1 shows the coarse-loop and fine-loop frequencies for specific RF output frequencies.

The coarse-loop oscillator has a programming (tuning) range of 219.5 to 245 MHz and a resolution of 1 MHz. This provides harmonics from ≥1.9755 GHz to >20 GHz. This allows any YIG-tuned oscillator output frequency to be down converted to a YIG IF signal of 21.5 to 40 MHz.

The YIG loop is fine tuned by varying the 21.5 to 40 MHz reference signal applied to the YIG loop phase detector. By programming the fine-loop oscillator, this signal can be adjusted in 0.01 Hz increments over the 21.5 to 40 GHz range. The resolution of the fine-loop oscillator (hence the resolution of the RF output signal) is 0.01 Hz, which is much finer than is available from the coarse loop alone.

The coarse loop and fine loop outputs are derived from high-stability 10 MHz and 500 MHz signals generated by the A3 reference loop. For applications requiring even greater stability, the 100 MHz oscillator can be phase locked to an optional 10 MHz high stability reference (internal or external).

Table 2-1. *RF Output and Loop Frequencies*

RF OUTPUT/LOOP FREQUENCIES (in MHz)		
RF OUT	COARSE LOOP STD (opt 3)	FINE LOOP STD (opt 3)
2000	219.5 (218.1)	24.5 (37.5)
3000	229 (217.1)	23 (40)
4000	234 (212.6)	22 (40)
5000	237 (420)	23 (40)
6000	239 (464.6)	25 (40)
7000	240.5 (469.3)	25.5 (40)
8000	241.5 (472.9)	30.5 (40)
9000	242.5 (821.8)	27.5 (40)
10000	243 (836.7)	37 (40)
11000	238.5 (849.2)	29 (40)
12000	239.5 (926.2)	25 (40)
13000	240 (869.33)	40 (40)
14000	245 (877.5)	35 (40)
15000	241.5 (940)	27 (40)
16000	242 (943.5)	28 (40)
17000	242.5 (946.7)	25 (40)
18000	239.5 (859.1)	37.5 (40)
19000	240 (865.5)	40 (40)
20000	243.5 (871.3)	33 (40)

RF Outputs 0.01 MHz to 65 GHz

Refer to the block diagram of the RF Deck shown in Figure 2-4 (page 2-27) for the following description. The MG369XA uses one YIG-tuned oscillator capable of generating RF signals in the frequency range of 2.0 to 20 GHz (the MG3691A YIG-tuned oscillator generates RF signals in the frequency range of 2.0 GHz to 8.4 GHz). All other frequencies output by the instrument, except for 0.1Hz – 10 MHz (Option 22) are derived from the fundamental frequencies generated by the YIG-tuned oscillator.

0.01 to 2.2 GHz (Option 4)
RF output frequencies of 0.01 to 2.2 GHz are developed by down converting the fundamental frequencies of 2 to 4.4 GHz. This is achieved by using a series of dividers and 16 bandpass filters. Precise control of the 0.01 to 2.2 GHz frequencies to 0.01 Hz resolution is achieved through phase-lock control of the fundamental frequencies prior to division.

Table 2-2. *Digital Down Converter Frequency Bands*

Band	Frequency Range (in MHz)
0	10 - 12.5
1	12.5 - 17.5
2	17.5 - 22.5
3	22.5 - 31.25
4	31.25 - 43.75
5	43.75 - 62.5
6	62.5 - 87.5
7	87.5 - 125
8	125 - 175
9	175 - 250
10	250 - 350
11	350 - 500
12	500 - 700
13	700 - 1050
14	1050 - 1500
15	1500 - 2200

0.01 to 2 GHz (Option 5)
RF output frequencies of 0.01 to 2 GHz are developed by down converting the fundamental frequencies of 6.51 to 8.5 GHz. This is achieved by mixing the fundamental RF output with a 6.5 GHz local oscillator signal that is phase locked to the 500 MHz output of the reference loop. Precise control of the 0.01 to 2 GHz frequencies to 0.01 Hz resolution is accomplished by phase-lock control of the 6.51 to 8.5 GHz fundamental frequencies prior to down conversion.

20 to 30 GHz (Model MG3693A)
RF output frequencies of 20 to 30 GHz are produced by doubling the 10 to 15 GHz fundamental frequencies. Phase-lock control of the 10 to 15 GHz fundamental frequencies, accomplished prior to doubling, ensures precise control of the 20 to 30 GHz frequencies to 0.01 Hz resolution.

20 to 40 GHz (Model MG3694A)
RF output frequencies of 20 to 40 GHz are produced by doubling the 10 to 20 GHz fundamental frequencies. Phase-lock control of the 10 to 20 GHz fundamental frequencies, accomplished prior to doubling, ensures precise control of the 20 to 40 GHz frequencies to 0.01 Hz resolution.

40 to 50 GHz (Model MG3695A)
RF output frequencies of 40 to 50 GHz are produced by quadrupling the 10 to 12.5 GHz fundamental frequencies. Phase-lock control of the 10 to 12.5 GHz fundamental frequencies is accomplished prior to doubling. This ensures precise control of the 40 to 50 GHz frequencies to a 0.01 Hz resolution.

40 to 65 GHz (Model MG3696A)
RF output frequencies of 40 to 65 GHz are produced by quadrupling the 10 to 16.25 GHz fundamental frequencies. Phase-lock control of the 10 to 16.25 GHz fundamental frequencies is accomplished prior to doubling. This ensures precise control of the 40 to 50 GHz frequencies to a 0.01 Hz resolution.

0.1 Hz to 10 MHz (Option 22)
Output frequencies of 0.1 Hz to 10 MHz are produced by models with Option 22. The 0.1 Hz to 10 MHz signal is generated by a direct digital synthesizer (DDS) located on the A8 PCB (installed by Option 22). Precise control of the output frequencies to a 0.1 Hz resolution is achieved by phase-lock control of the 26.8435456 MHz signal generated by the fine loop circuitry on the A3 PCB.

Frequency Modulation

Frequency modulation (FM) of the YIG-tuned oscillator RF output is achieved by summing an external or internal modulating signal into the FM control path of the YIG loop (refer to Figures 2-1 and 2-2).

The external modulating signal comes from the rear panel FM/ΦM IN input connector; the internal modulating signal comes from the A8 Function Generator PCB. Circuits on the A7A1 FM Module adjust the modulating signal for the FM sensitivity selected, then sum it into the YIG loop FM control path. There, it frequency modulates the RF output signal by controlling the YIG-tuned oscillator's FM (fine tuning) coil current.

Phase Modulation

Phase modulation (ΦM) of the YIG-tuned oscillator RF output is achieved by summing an external or internal modulating signal into the FM control path of the YIG loop. The external modulating signal comes from the rear panel FM IN/ΦM IN input connector; the internal modulating signal comes from the A8 Function Generator PCB.

Circuits on the A7A1 FM Module adjust the modulating signal for the ΦM sensitivity selected, convert the modulating signal to a ΦM signal by differentiation, and then sum it into the YIG loop FM control path. There, it phase modulates the RF output signal by controlling the YIG-tuned oscillator's FM (fine tuning) coil current.

Analog Sweep Mode

Broad-band analog frequency sweeps (>100 MHz wide) of the YIG-tuned oscillator RF output are accomplished by applying appropriate analog sweep ramp signals, generated by the A5 Analog Instruction PCB, to the YIG-tuned oscillator's main tuning coil. In this mode, the start, stop, and bandswitching frequencies are phase-lock-corrected during the sweep.

Narrow-band analog frequency sweeps (≤100 MHz wide) of the YIG-tuned oscillator RF output are accomplished by summing appropriate analog sweep ramp signals, generated by the A5 Analog Instruction PCB, into the YIG-tuned oscillator's FM tuning coil control path. The YIG-tuned oscillator's RF output is then swept about a center frequency. The center frequency is set by applying a tuning signal (also from the A5 PCB) to the YIG-tuned oscillator's main tuning coil. In this mode, YIG loop phase locking is disabled except during center frequency correction, which occurs during sweep retrace.

NOTE

For units with Option 21B at frequencies of ≤2.2 GHz, broad-band analog frequency sweeps are >25 MHz wide; narrow-band analog frequency sweeps are ≤25 MHz.

Step Sweep Mode

Step (digital) frequency sweeps of the YIG-tuned oscillator RF output consist of a series of discrete, synthesized steps between a start and stop frequency. Each frequency step is generated by applying the tuning signal (from the A9 module PCB) to the YIG-tuned oscillator's main tuning coil, then phase-locking the RF output. Every frequency step in the sweep range is phase-locked.

2-4 ALC/AM/Pulse Modulation

The MG369XA ALC, AM, and pulse modulation subsystems provide automatic level control (ALC), amplitude modulation (AM), and pulse modulation of the RF output signal. The ALC loop consists of circuits located on the A6 ALC PCB, and the A9 YIG PCB assembly. These circuits interface with the A10 switched filter assembly, the A11 down converter assembly and the directional coupler/level detector (all located on the RF deck). AM circuits located on the A6 ALC PCB and A6A1 AM Module are also included in this loop. Pulse modulation of the RF output signal is provided by circuits on the A6 ALC PCB. These circuits interface directly with the switched filter assembly located on the RF deck via coaxial cables. (In units with Option 4, these circuits interface directly with the digital down converter and are looped through the digital down converter to the switched filter assembly.)

The ALC subsystem is shown in Figure 2-3, page 2-12. The following paragraphs describe the operation of the subsystem components.

ALC Loop Operation

In the MG369XA , a portion of the RF output is detected and coupled out of the directional coupler/level detector as the feedback input to the ALC loop. The feedback signal from the detector is routed to the A6 ALC PCB where it is compared with a reference voltage that represents the desired RF power output level. If the two voltages do not match, an error correction signal is fed to the modulator shaper amplifier circuits located on the A6 PCB. The resulting ALC control voltage output causes the level control circuits, located on the A10 switched filter assembly, to adjust the RF output level. Thus, the feedback signal voltage from the level detector will be set equal to the reference voltage.

> ***NOTE***
> The instrument uses two internal level detection circuits. For frequencies <2 GHz, the level detector is part of the down converter. The signal from this detector is routed to the A6 ALC PCB as the Detector 0 input. For frequencies ≥2 GHz, the level detector is part of the main directional coupler. The signal from this detector is routed to the A6 ALC PCB as the Detector 1 input.

The level reference DAC, under the control of the CPU, provides the RF level reference voltage. By setting the output of this DAC to the appropriate voltage, the CPU adjusts the RF output power to the level selected by the user.

External Leveling

In the external leveling mode, an external detector or power meter monitors the RF output level of the MG369XA instead of an internal level detector. The signal from the external detector or power meter goes to the A6 ALC PCB assembly from the rear panel input. The ALC controls the RF power output level as previously described.

ALC Slope

During analog sweeps, a slope-vs-frequency signal, from the A5 Analog Instruction PCB, is summed with the level reference and detector inputs into the ALC loop. The Slope DAC, under the control of the CPU, adjusts this ALC slope signal to compensate for an increasing or decreasing output power-vs-frequency characteristic caused by the level detectors and (optional) step attenuator. In addition, the Slope DAC lets the user adjust for the slope-vs-frequency characteristics of external components.

Power Sweep

In this mode, the CPU has the ALC step the RF output through a range of levels specified by the user. This feature can be used in conjunction with the sweep mode to produce a set of identical frequency sweeps, each with a different RF power output level.

Amplitude Modulation

Amplitude modulation (AM) of the RF output signal is accomplished by summing an external or internal modulating signal into the ALC loop. External modulating signals come from the rear panel AM IN inputs; the internal modulating signal comes from the A8 Function Generator PCB.

The AM Input Sensitivity DAC and the AM Calibration DAC, under the control of the CPU, adjust the modulating signal for the proper amount of AM in both the linear and the log modes of operation. The adjusted modulating signal is summed with the level reference, slope, and detector inputs into the ALC loop. This produces an ALC control signal that varies with the modulating signal. The action of the ALC loop then causes the envelope of the RF output signal to track the modulation signal.

Pulse Modulation Operation
During pulse modulation, the ALC level amplifier (A6 ALC PCB) is operated as a sample/hold amplifier. The level amplifier is synchronized with the modulating pulses from the A13 Pulse Generator PCB so that the ALC loop effectively operates only during the ON portion of the pulsed modulated RF output.

Pulse Generator Operation

The A13 Pulse Generator PCB provides the internal pulse generating function for the MG369XA. It also interfaces external pulse inputs from the rear panel connector to the pulse modulator driver in the external mode.

The pulse generator produces a pulse modulation waveform consisting of single, doublet, triplet, or quadruplet pulse trains at variable pulse rates, widths, and delays. It operates at two selectable clock rates—10 MHz and 40 MHz. In addition, the pulse generator produces a sync pulse and video pulse output that goes to the rear panel and a sample/hold signal that goes to the A6 ALC PCB. The sync pulse output is for synchronizing auxiliary instruments to the internally generated pulse; the video pulse is a TTL level copy of the RF output pulse; and the sample/hold signal synchronizes the ALC loop to the ON portion of the pulse modulating waveform.

The MG369XA has five pulse modulation modes:

- Internal pulse modulation mode—The pulse modulation waveform is generated and timed internally (Option 24 or 25X only).
- External pulse mode—The external pulse source signal from the front or rear panel connectors is interfaced by the pulse generator to the pulse modulation driver.
- External triggered mode—The pulse generator is triggered by the external pulse source signal to produce the pulse modulation waveform.
- External gated mode—The external pulse source signal gates the internal pulse generator on and off.
- Composite mode—The external pulse source signal triggers the internal pulse generator and also modulates the RF output signal. The pulse generator produces a delayed, single pulse waveform that also modulates the RF output signal (Option 24 or 25X only).

2-5 RF Deck Assemblies

The primary purpose of the RF deck assembly is to generate CW RF signals and route these signals to the front panel RF OUTPUT connector. It is capable of generating RF signals in the frequency range of 0.01 to 65 GHz (0.1Hz to 65 GHz with Option 22).

The series MG369XA use a single YIG-tuned oscillator. All other frequencies (except for 0.1Hz to 10 MHz), are derived from the fundamental frequencies generated by this oscillator, as follows:

- RF output frequencies of 0.01 to 2 GHz are developed by down converting the fundamental frequencies of 6.51 to 8.5 GHz
- RF output frequencies of 20 to 30 GHz are produced by doubling the fundamental frequencies of 10 to 15 GHz
- RF output frequencies of 20 to 40 GHz are produced by doubling the fundamental frequencies of 10 to 20 GHz
- RF output frequencies of 40 to 50 GHz are produced by quadrupling the fundamental frequencies of 10 to 12.5 GHz
- RF output frequencies of 40 to 65 GHz are produced by quadrupling the fundamental frequencies of 10 to 16.25 GHz
- Output frequencies of 0.1 Hz to 10 MHz (installed by Option 22) are generated by the A8 10 MHz DDS PCB (for the CW Generators), or are generated by an updated A3 Reference Loop PCB (for the Signal Generators)

RF Deck Configurations

All MG369XA RF deck assemblies contain a YIG-tuned oscillator, a switched filter assembly, and a directional coupler. Beyond that, the configuration of the RF deck assembly varies according to the particular instrument model and options installed.

Refer to the block diagram in Figure 2-4, which shows the various RF deck configurations and includes all of the common RF components found in the series MG369XA RF deck assemblies. Refer to this block diagram while reading the following paragraphs.

YIG-tuned Oscillator

There are two YIG-tuned oscillator configurations. The MG3691A uses a single-band, 2 to 8.4 GHz, YIG-tuned oscillator. All other MG369XA models use a dual-band, 2 to 20 GHz YIG-tuned oscillator. The dual-band YIG-tuned oscillator contains two oscillators—one covering the frequency range of 2 to 8.4 GHz and one covering the frequency range of 8.4 to 20 GHz. Both of these oscillators use a common internal amplifier.

The YIG-tuned oscillator generates RF output signals that have low broadband noise and low spurious content. It is driven by the main tuning coil current and bias voltages from the A9 YIG PCB assembly and the fine tuning coil current from the A7 YIG lock PCB. During CW mode, the main tuning coil current tunes the oscillator to within a few megahertz of the final output frequency. The phase-lock circuitry of the YIG loop then fine adjusts the oscillator's fine tuning coil current to make the output frequency exact.

RF Signal Filtering

The RF signal from the YIG-tuned oscillator is routed to the level control circuits located on the A10 switched filter assembly and then, via PIN switches, to switched low-pass filters. The PIN switch drive current signals are generated on the A6 ALC PCB and routed to the switch control input on the A10 assembly.

The switched low-pass filters provide rejection of the harmonics that are generated by the YIG-tuned oscillator. In MG369XA models, the 2 to 20 GHz RF signal from the level control circuits has four filtering paths and a through path. The four filtering paths are 3.3 GHz, 5.5 GHz, 8.4 GHz, and 13.5 GHz. Signals above 13.5 GHz are routed via the through path.

To generate RF signals from 0.01 to 2 GHz, the MG369XA couples the RF signal to the A11 down converter. A coupler in the A10 switched filter path provides this RF signal , which is routed through a 8.5 GHz low-pass filter to connector J3, and then to the down converter. The 0.01 to 2 GHz RF signal output from the down converter is routed back to the A10 assembly (connector J1) and then multiplexed through the same path to the switched filter output.

After routing through the appropriate path, the RF signal is multiplexed by the PIN switches and goes via a 20 GHz low-pass filter to the A10 switched filter assembly output connector J2. From J2, the RF signal goes to either the input of the directional coupler (model MG3692A) or input connector J1 of the A11 switched doubler module (models MG3693A/4A).

For models with Option 22, the RF signal from J2 goes to either input connector A of the diplexers (≤20 GHz models) or the input connector J1 of the switched doubler module (>20 GHz models).

0.01 to 2 GHz Down Converter (Option 5)

The 0.01 to 2 GHz down converter assembly (shown in Figure 2-4) contains a 6.5 GHz VCO that is phase-locked to the 500 MHz reference signal from the A3 reference loop PCB. The 6.5 GHz VCO's phase-lock condition is monitored by the CPU. The 6.5 GHz VCO is on at all times; however, the down converter amplifier is powered on by the A5 AUX PCB only when the 0.01 to 2 GHz frequency range is selected.

> ***NOTE***
>
> For models with Option 22 and without Option 2F, the 0.01 to 2 GHz (0.01 to 2.2 GHz with Option 4) RF output of the down converter is diplexed with the 0.1Hz to 10 MHz output of the A8 10 MHz DDS PCB. The resulting 0.1Hz to 2 GHz signal is then diplexed with the RF signal from the switched filter assembly (or switched doubler module for >20 GHz models) into the RF path to the directional coupler.

During CW or step frequency operations in the 0.01 to 2 GHz frequency range, the 6.51 to 8.5 GHz RF signal output from J3 of the switched filter assembly goes to input connector J1 of the down converter. This signal is then mixed with the 6.5 GHz VCO signal resulting in a 0.01 to 2 GHz RF signal. The resultant RF signal is fed through a 2 GHz low-pass filter, then amplified and routed to the output connector J3. A portion of the down converter's RF output signal is detected, amplified, and coupled out for use in internal leveling. This detected RF sample is routed to the A6 ALC PCB.

The 0.01 to 2 GHz RF output from the down converter goes to input connector J1 of the switched filter assembly. There, the 0.01 to 2 GHz RF signal is multiplexed into the switched filter’s output.

0.01 to 2.2 GHz Digital Down Converter (Option 4)

The 0.01 to 2.2 GHz digital down converter assembly maintains the same basic functionality and control as the 0.01 to 2 GHz down converter. During CW or step frequency operations in the 0.01 to 2.2 GHz frequency range, a 2 to 4.4 GHz RF signal output from J3 of the switched filter assembly goes to the input connector J1 of the down converter.

This signal is then down converted through a series of dividers resulting in a 0.01 to 2.2 GHz RF signal output. The resultant RF signal is fed through a series of band-pass filters, then detected, amplified, and coupled out for use in internal leveling before being routed to the output connector J3. The detected RF sample is routed to the A6 ALC PCB. Digital control signals from the A2 CPU PCB are routed through the A5 auxiliary PCB.

Switched Doubler Module

The A11 switched doubler module is used on all MG369XA models with RF output frequencies >20 GHz. Model MG3693A uses a SDM to double the fundamental frequencies of 10 to 15 GHz to produce RF output frequencies of 20 to 30 GHz. Similarly, model MG3694A uses a SDM to double the fundamental frequencies of 10 to 20 GHz to produce RF output frequencies of 20 to 40 GHz.

The RF signal from the switched filter assembly is input to the SDM at J1. During CW or step frequency operations in the 20 to 40 GHz frequency range, the 10 to 20 GHz RF signal input is routed by PIN switches to the doubler/amplifiers. PIN switch drive current is provided by the A6 ALC PCB and bias voltage is provided for the doubler/amplifiers by the A5 AUX PCB assembly. The RF signal is amplified, then doubled in frequency. From the doubler, the 20 to 40 GHz RF signal is routed by PIN switches to the bandpass filters. The A11 SDM has three bandpass filter paths that provide good harmonic performance. The filter frequency ranges are 20 to 25 GHz, 25 to 32 GHz, and 32 to 40 GHz.

After routing through the appropriate bandpass filter, the 20 to 40 GHz RF signal is multiplexed by the PIN switches to the SDM output at connector J2. RF signals input to the SDM of ≤20 GHz are multiplexed through by the PIN switches of the SDM to the output connector J2. From J2, The RF signal goes to the directional coupler.

For models with Option 22, the RF signal from J2 goes to input connector A of the diplexers. It is diplexed with the 0.01 to 2 GHz RF signal from the down converter and the 0.1 Hz to 10 MHz signal from the A8 10 MHz DDS PCB (for the CW Generators), or the A3 Reference Loop PCB (for the Signal Generators), into the RF path to the directional coupler.

Source Quadrupler Module

The source quadrupler module, found in >40 GHz models, is used to quadruple the fundamental frequencies of 10 to 16.25 GHz to produce RF output frequencies of 40 to 65 GHz. The RF signal inputs for the SQM come from the switched filter assembly. The modulator control signal for the SQM is received from the A6 ALC PCB where it is developed from the ALC control signal. The A6 PCB also supplies the amplifier bias voltage(s) for the SQM.

Model MG3695A (SQM P/N: ND60341)

During CW and swept frequency operations in the 40 to 50 GHz frequency range, the 10 to 12.5 GHz RF signal input is quadrupled and amplified, then goes to the modulator. The modulator provides for power level control. From the modulator, the 40 to 50 GHz RF signals goes via a band-pass filter to output connector J3 of the forward coupler. Note that on the 40 to 50 GHz SQM (P/N: ND60341), the forward coupler is an integral part of the SQM. The 0.01 to 40 GHz RF output signals from the SDM (0.1 Hz to 40 GHz RF output signals from the diplexers for MG3695A with Option 22) are routed to input connector J2 of the SQM forward coupler. The 0.01 to 50 GHz (0.1 Hz to 50 GHz for MG3695A with Option 22) RF output signals go from J3 of the SQM forward coupler to the directional coupler.

Model MG3696A (SQM P/N: ND60342)

During CW or swept frequency operations in the 40 to 65 GHz frequency range, the 10 to 16.25 GHz RF signal input is qaudrupled and amplified, then goes to the modulator. The modulator provides for power level control of the RF output signals. From the modulator, the 40 to 65 GHz RF signals go via a band-pass filter to the output connector of the SQM. From the SQM, the 40 to 65 GHz RF output signals go through a 37 GHz high pass filter and then to the input connector J1 of the forward coupler, P/N: C27184. From the SDM, the 0.01 to 40 GHz RF output signals (0.1 Hz to 40 GHz RF output signals from the diplexers for MG3696A with Option 22) are routed to input connector J2 of the forward coupler. The 0.01 to 65 GHz (0.1 Hz to 65 GHz for MG3696A with Option 22) RF output signals go from the output connector J3 of the forward coupler to the directional coupler.

Step Attenuators

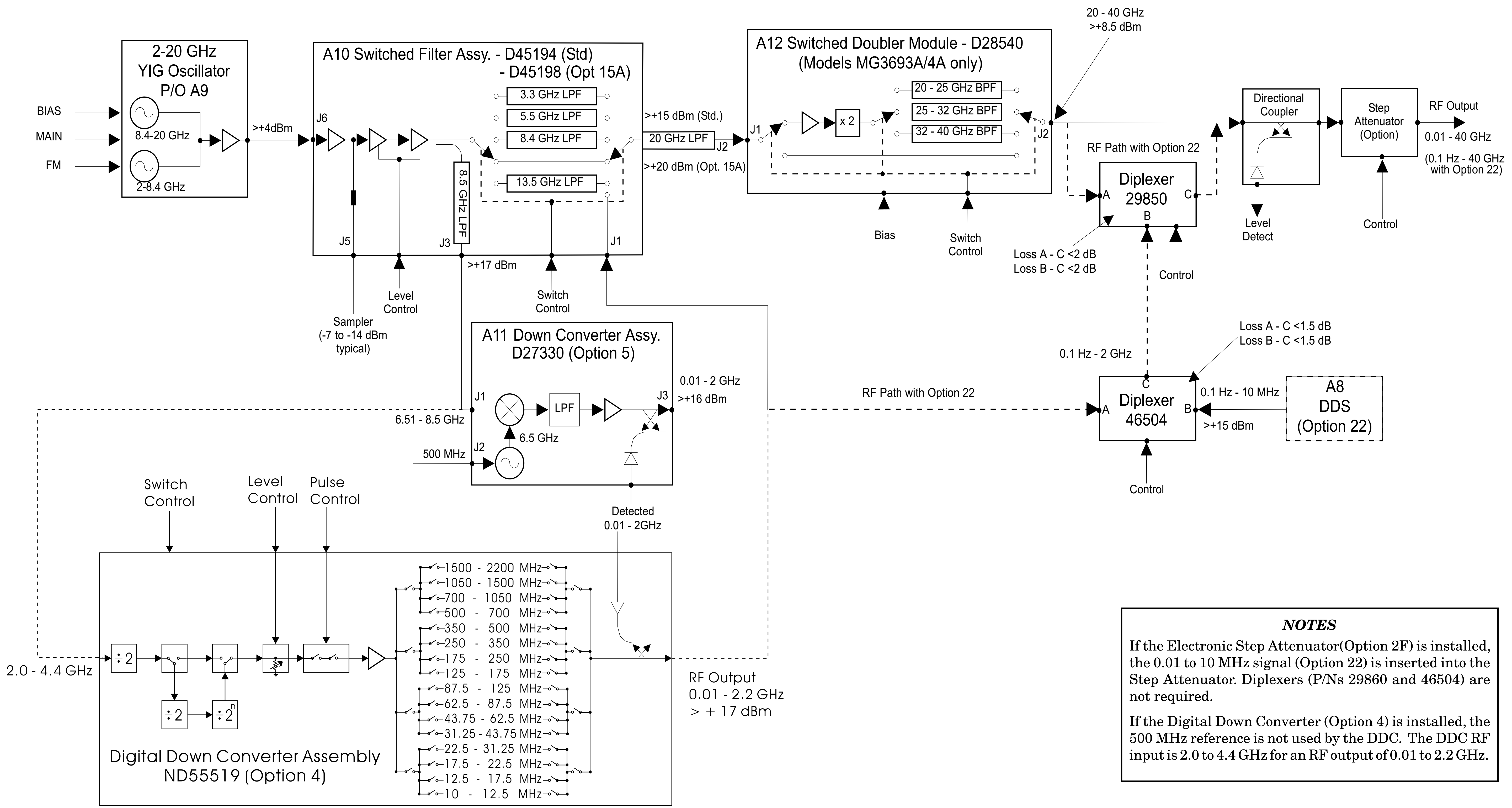
The optional step attenuators available for use with the MG369XA models are as follows:

- Mechanical step attenuator ≤20 GHz, with a 110 dB range, for model MG3692A (Option 2A)
- Mechanical step attenuator ≤40 GHz, with a 110 dB range, for models MG3693A and MG3694A (Option 2B)
- Mechanical step attenuator ≥40 GHz, with a 90 dB range, for models MG3695A and MG3696A (Option 2C)
- Electronic step attenuator ≤8.4 GHz, with a 120 dB range, for model MG3691A (Option 2E)
- Electronic step attenuator ≤20 GHz, with a 120 dB range, for model MG3692A (Option 2F*)

Step attenuators provide attenuation of the RF output in 10 dB steps. Maximum rated RF output power is reduced. The step attenuator drive current for Option 2 is supplied by the A6 PCB.

* Option 2F was limited and discontinued as of October 31, 2002. The following model serial numbers are the only models that were installed with Option 2F:

Model	Serial Number
MG3690A/2F	011008
MG3690A/2F	011011
MG3690A/2F	011115
MG3690A/2F	011115
MG3690A/2F	011123
MG3690A/2F	020311
MG3690A/2F	020606
MG3690A/2F	021004
MG3690A/2F	021005
MG3690A/2F	022409
MG3690A/2F	022603
MG3690A/2F	023001
MG3690A/2F	023103
MG3690A/2F	023305
MG3690A/2F	023308
MG3690A/2F	023309
MG3690A/2F	024001

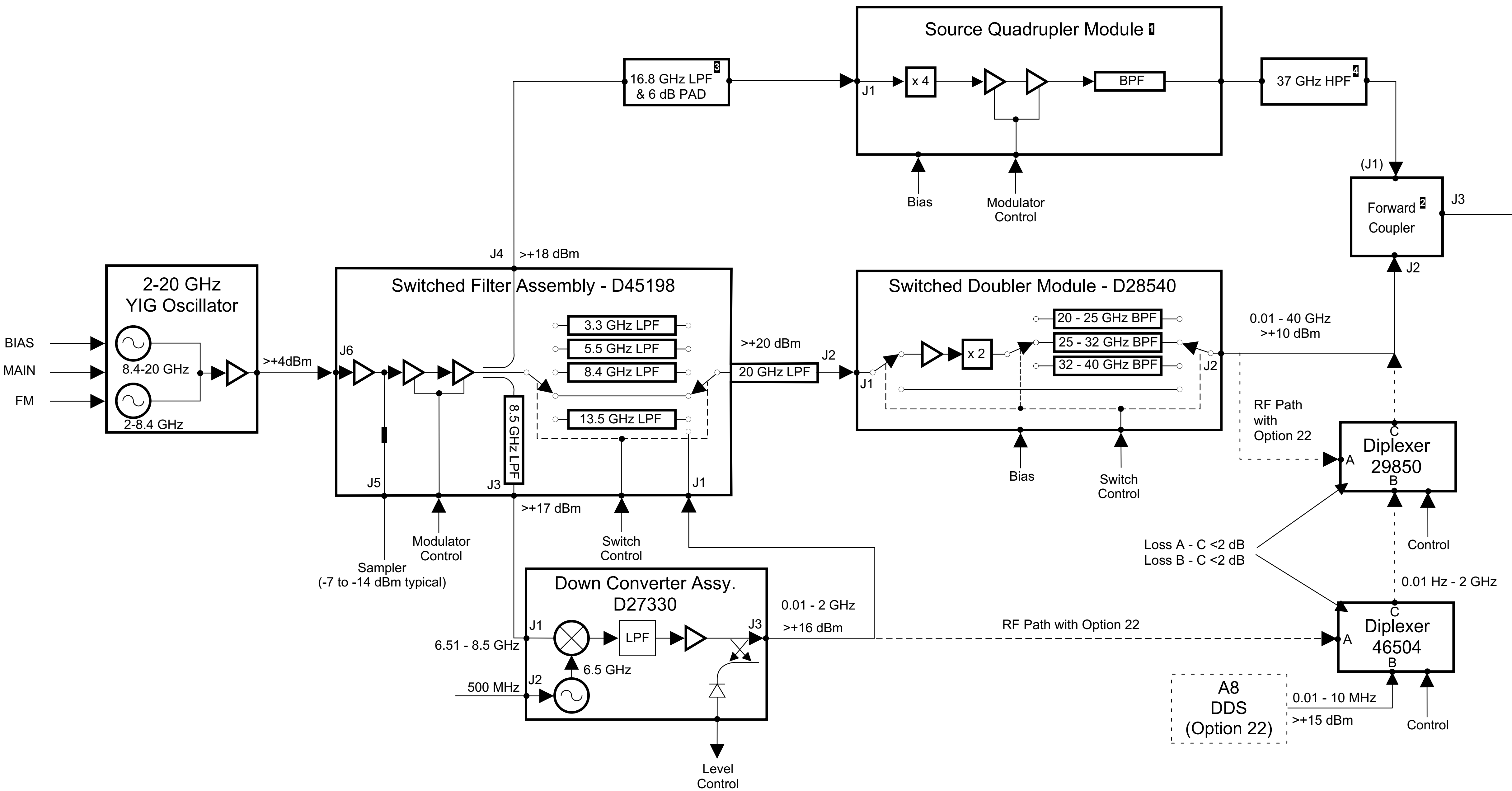


NOTES

If the Electronic Step Attenuator(Option 2F) is installed, the 0.01 to 10 MHz signal (Option 22) is inserted into the Step Attenuator. Diplexers (P/Ns 29860 and 46504) are not required.

If the Digital Down Converter (Option 4) is installed, the 500 MHz reference is not used by the DDC. The DDC RF input is 2.0 to 4.4 GHz for an RF output of 0.01 to 2.2 GHz.

Figure 2-4. *Block Diagram of the RF Deck Assembly for Models MG3693A and MG3694A*



1 Source Quadrupler Module Part Numbers:
ND60341 (40 to 50 GHz)
ND60342 (40 to 65 GHz)

2 SQM P/N: ND60341 contains a Forward Coupler.
Forward Coupler P/N: C27184 is used with SQM P/N: ND60342.

3 The 16.8 GHz LPF and 6 dB PAD, P/N: B28612, is used with SQM P/N: ND60342.

4 The 37 GHz HPF, P/N: 49247, is used with SQM P/N: ND60342.

Figure 2-5. *Block Diagram of the RF Deck Assembly for Models MG3695A and MG3696A*

Chapter 3
Performance Verification

Table of Contents

Chapter 3
Performance Verification

3-1 Introduction

This chapter contains tests that can be used to verify the performance of the series MG369XA Synthesized Signal Generators to specifications. These tests support all instrument models having any version of firmware and instrument models with the following options:

- Option 2X, MG369XA (mechanical step attenuator)
- Option 2E, MG3691A (electronic step attenuator)
- Option 3 (ultra low phase noise)
- Option 4 (digital down converter)
- Option 5 (analog down converter)
- Option 6 (analog sweep)
- Option 12 (external frequency and phase modulation)
- Option 13X (external pulse modulation)
- Option 15X (high power output)
- Option 16 (high stability time base)
- Option 22 (low frequency audio DDS)
- Option 23 (internal low frequency generator)
- Option 24 (internal pulse generator)
- Option 25X (modulation suite)

3-2 Test Records

A blank copy of a sample performance verification test record for each MG369XA model is provided in Appendix A. Each test record contains the model-specific variables called for by the test procedures. It also provides a means for maintaining an accurate and complete record of instrument performance. We recommend that you copy these pages and use them to record the results of your initial testing of the instrument. These initial test results can later be used as benchmark values for future tests of the same instrument.

3-3 Connector and Key Notation

The test procedures include many references to equipment interconnections and control settings. For all MG369XA references, specific labels are used to denote the appropriate menu key, data entry key, data entry control, or connector (such as RF Output). Most references to supporting test equipment use general labels for commonly used controls and connections (such as Span or RF Input). In some cases, a specific label is used that is a particular feature of the test equipment listed in Table 3-1 on page 3-5.

3-4 Recommended Test Equipment

Table 3-1 provides a list of the recommended test equipment for the performance verification tests. The test procedures refer to specific front panel control settings when the test equipment setup is critical to making an accurate measurement. In some cases, you may substitute test equipment having the same critical specifications as the test equipment indicated in the recommended test equipment list. Contact your local Anritsu service center if you need clarification of any equipment or procedural reference.

3-5 Measurement Uncertainty

The test records found in Appendix A specify a measurement uncertainty. The measurement uncertainty listed in each test record includes the best estimate of the errors contributed by the measurement, test equipment, standards, and other correction factors (for example, calibration factors and mismatch error) based on the suggested equipment, the equipment setup, and the prescribed test procedure. Most of the uncertainties are type-B per the ISO/IEC TAG 4 Guide for the expression of Uncertainty in Measurement (GUM).

Table 3-1. Recommended Test Equipment for Performance Verification Tests

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	TEST NUMBER
Spectrum Analyzer	Frequency: 0.01 to 50 GHz Resolution Bandwidth: 10 Hz	HP8565E	3-7, 3-11, 3-13
Phase Noise Measurement System	Frequency Range: 5 MHz to 26.5 GHz See Table 3-2 on page 3-11	Aeroflex/Comstron PN9000 with: PN9060-00 Status Module PN9470-00 Noise Output Module PN9450-00 Lock Control Module PN9342-00 Phase Detector Module PN9530-00 Crystal Oscillator Module	3-8
Modulation Analyzer	AM and FM Measurement Capability to >500 MHz and –20 dBm	HP8901A	3-10, 3-12
Frequency Counter	Frequency Range: 0.01 to 40 GHz Input Impedance: 50Ω Resolution: 1 Hz Other: External Time Base Input	Anritsu Model MF2414B	3-8
Power Meter with Power Sensor	Frequency: 0.01 to 65 GHz Power Range: –70 to +20 dBm	Anritsu Model ML2437A/38A with Power Sensor: MA2474A (0.01 to 40 GHz) SC6230 (0.01 to 65 GHz)	3-9
Power Supply	Output: +1V DC	Agilent E3631A	3-13
Digital Multimeter	Minimum 1% RMS ACV Accuracy at 100 kHz	Fluke 8840A	3-11, 3-12
Function Generator	DDS, 0.01 to 10 MHz	HP33120A	3-11, 3-12, 3-13
Digital Sampling Oscilloscope	Frequency: 50 GHz	Agilent 86100A with: 83484A 50 GHz Module	3-13
Measuring Receiver	Noise Floor: <–140 dBm @ 500 MHz	Anritsu Model ML2530A	3-9
Frequency Reference	Frequency: 10 MHz Accuracy: 5 x 10^{-12} parts/day	Absolute Time Corp., Model 300	3-6
Local Oscillator	Frequency: 0.01 to 40 GHz	Anritsu Model MG3694A with: Options 3, 4 and 15	3-8, 3-9, 3-10, 3-12
Attenuator	Frequency Range: DC to 40 GHz Max Input Power: >+17 dBm Attenuation: 3, 6, 10, and 20 dB	Anritsu, Model 41KC-3 Anritsu, Model 41KC-6 Anritsu, Model 41KC-10 Anritsu, Model 41KC-20	3-12, 3-13
Special AUX I/O Cable Assembly	Provides interface between the MG369XA and the Power Meter	Anritsu P/N: 806-97	3-9
Mixer	Frequency Range: 500 MHz to 40 GHz Conversion Loss: 10 dB (typical)	Anritsu P/N: 60-114	3-9, 3-10, 3-12
Adapter, 2.4 (m) mm to K (f)	Frequency Range: 0.01 to 40 GHz	Any common source (Agilent P/N: 11904-60003)	3-13
Adapter, 3.5 (m) mm to BNC (f)	50Ω	Any common source	3-13
Feed Through Termination	50Ω BNC	Any common source	3-13
Tee	Connectors: 50Ω BNC	Any common source	3-8, 3-9, 3-10, 3-11, 3-12
Cables	Connectors: 50Ω BNC RF Connections: K-Cables	Any common source	All tests

3-6 Internal Time Base Aging Rate Test

The following test can be used to verify that the MG369XA 10 MHz time base is within its aging specification. The instrument derives its frequency accuracy from an internal 10 MHz crystal oscillator standard. (With Option 16 installed, frequency accuracy is derived from an internal high-stability 10 MHz crystal oscillator.) An inherent characteristic of crystal oscillators is the effect of crystal *aging* within the first few days to weeks of operation. Typically, the frequency of the crystal oscillator increases slightly at first, then settles to a relatively constant value for the rest of its life.

> ***NOTE***
> Do not confuse crystal aging with other short term frequency instabilities, for example, noise and temperature. The internal time base of the instrument may not achieve its specified aging rate before the specified warm-up time of 7 to 30 days has elapsed; therefore, this performance test is optional.

For the greatest absolute frequency accuracy, allow the MG369XA to warm up until its RF output frequency has stabilized (usually 7 to 30 days). Once stabilized, the change in reference oscillator frequency should remain within the aging rate if (1) the time base oven is not allowed to cool, (2) the instrument orientation with respect to the earth's magnetic field is maintained, (3) the instrument does not sustain any mechanical shock, and (4) ambient temperature is held constant. This test should be performed upon receipt of the instrument and again after a period of several days to weeks to fully qualify the aging rate.

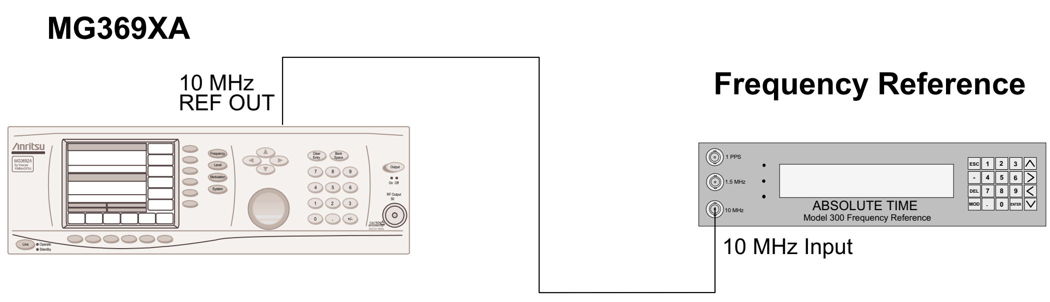


Figure 3-1. *Equipment Setup for Internal Time Base Aging Rate Tests*

Test Setup Connect the MG369XA rear panel 10 MHz REF OUT to the frequency reference front panel input connector labeled 10 MHz when directed to do so during the test procedure.

Test Procedure

The frequency error is measured at the start and finish of the test time period of 24 hours. The aging rate is the difference between the two error readings.

Step 1. Set up the frequency reference as follows:

a. Press the ESC key until the MAIN MENU is displayed.

b. At the MAIN MENU display, press 1 to select the CONFIGURATION MENU.

c. At the CONFIGURATION MENU display, press 8 to select MEAS.

d. Press the MOD key and use the Up/Down arrow keys to get to the menu display: MEASUREMENT = FREQ.

e. Press the ENTER key.

f. Press the ESC key until the MAIN MENU is displayed.

g. At the MAIN MENU display, press 3 to select the REVIEW MENU.

h. At the REVIEW MENU display, press 8 to select TFM.

Step 2. Connect the MG369XA rear panel 10 MHz REF OUT signal to the frequency reference front panel 10 MHz input.

Step 3. Wait approximately 90 minutes (default setting) until the FMFOM on the frequency reference display decreases from 9 to 1. (The default setting is recommended to achieve optimum measurements.)

Step 4. The frequency error in the signal under test is displayed in ps/s (picoseconds/second). For example, an error of –644681 ps/s is -644681×10^{-12} or -6.44681×10^{-7} away from the 10 MHz internal reference on the frequency reference.

Step 5. The frequency error display is continuously updated as a running 5000-second average. The averaging smooths out the short-term instability of the oscillator.

Step 6. Record the frequency error value displayed on the frequency reference in the test record.

Step 7. Wait for 24 hours, then record the frequency error value in the test record.

Step 8. The aging rate is the difference between the two frequency error values.

Step 9. Record the computed result in the test record. To meet the specification, the computed aging rate must be <$2x10^{-9}$ per day (<$5x10^{-10}$ per day with Option 16).

3-7 Spurious Signals Test

The following tests can be used to verify that the signal generator meets its spurious emissions specifications for RF output signals from 0.01 to 50 GHz.

The MG369XA's CW RF output signal is fed directly into a spectrum analyzer. The CW frequency and power level is referenced and a peak search function on the spectrum analyzer is utilized to find any spurious signals above the specified limit.

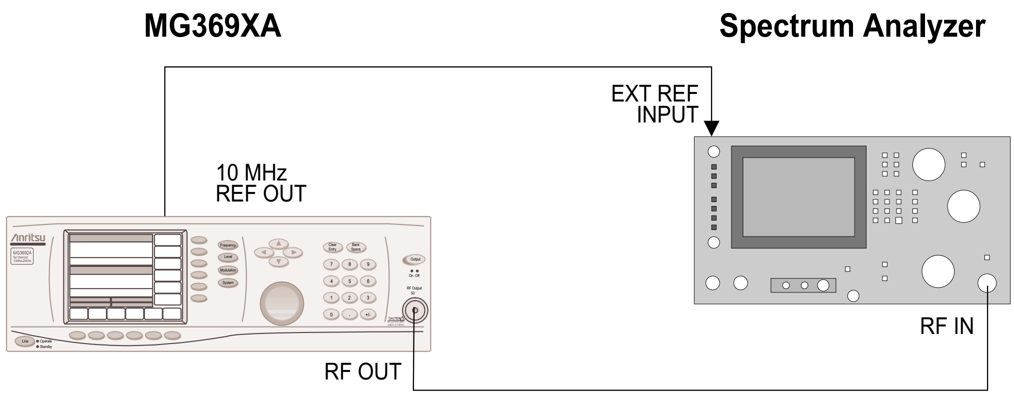


Figure 3-2. Equipment Setup for Spurious Signals Test

Test Setup Connect the equipment, shown in Figure 3-2, as follows:

Step 1. Connect the MG369XA rear panel 10 MHz REF OUT to the spectrum analyzer's external reference input.

Step 2. Connect the MG369XA RF Output to the spectrum analyzer's RF input.

Step 3. Set up the spectrum analyzer as follows:

- ***a.*** Press the PRESET key.
- ***b.*** Press the AMPLITUDE key and enter +10 dBm.
- ***c.*** Press the BW key, then select MAN (manual) and enter 30 kHz.
- ***d.*** Press the MKR key and select MORE 1 OF 2.
- ***e.*** Select PEAK THRESHOLD and enter –62 dBm.

> ***NOTE***
> Power line and fan rotation spurious emissions are tested as part of the single sideband phase noise test in Section 3-8.

Test Procedure

The following procedure lets you measure the worst case spurious signals (harmonic and non-harmonic up to 50 GHz) of the MG369XA's RF output.

Step 1. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 10 MHz (2 GHz for models without Options 4 or 5).

c. Press Edit L1 to open the current power level parameter for editing.

d. For models without Option 15, set L1 to the lesser of +10 dBm or to the maximum specified power level. For models with Option 15, set L1 to the maximum specified power level. (Refer to Appendix B, Performance Specifications, for the maximum specified power levels.)

Step 2. Set up the spectrum analyzer as follows:

a. Press the AMPLITUDE key and enter the current power level setting (L1) of the MG369XA.

b. Press the FREQUENCY key and enter the current frequency setting (F1) of the MG369XA.

c. Press the SPAN key and enter 10 MHz.

d. Press the PEAK SEARCH key, then select MARKER DELTA.

e. Press the SPAN key and select FULL SPAN.

f. Select NEXT PK LEFT or NEXT PK RIGHT to search for any spurs above the threshold level.

Step 3. Record the displayed marker delta values of any spurious signals above specification in the test record.

Step 4. Continue selecting NEXT PK LEFT and NEXT PK RIGHT until the entire span has been searched and record the displayed marker delta values of any spurious signals above specification in the test record.

Step 5. Repeat Steps 2 through 4 for each of the test frequencies listed in the test record.

NOTES

For greater accuracy, the frequency span can be searched piecewise by setting a narrower span. This is done by setting the desired START FREQ and STOP FREQ selections on the SPAN menu.

If no spurs peak above the threshold, then a peak will not be found.

Spurious signals tested in this section are grouped as harmonic related or non-harmonic. If spurious signals are found, it is important to determine the type of spur and use the appropriate specified limit.

3-8 Single Sideband Phase Noise Test

The following test can be used to verify that the MG369XA meets its single sideband phase noise specifications. For this test, an Anritsu MG3694A (with Options 3 and 4) signal generator is required to act as a local oscillator (LO). Table 3-2, below, lists the single side band requirements for the local oscillator.

The CW RF output of the MG369XA under test (DUT) is mixed with the CW RF output from the MG3694A LO, which is offset by 100 MHz. Single sideband phase noise is measured at offsets of 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, and 1 MHz away from the resultant 100 MHz IF.

Table 3-2. *Single Side Band Requirements for Local Oscillator*

Frequency Range	Offset From Carrier					
	10 Hz	100 Hz	1 kHz	10 kHz	100 kHz	1 MHz
≥10 MHz to ≤15.625 MHz	–105	–126	–139	–142	–141	–145
>15.625 MHz to ≤31.25 MHz	–99	–120	–134	–137	–137	–145
>31.25 MHz to ≤62.5 MHz	–90	–114	–129	–136	–136	–144
>62.5 MHz to ≤125 MHz	–84	–108	–127	–135	–133	–144
>125 MHz to ≤250 MHz	–88	–102	–125	–132	–130	–143
>15.625 MHz to ≤500 MHz	–77	–99	–123	–125	–124	–142
>500 MHz to ≤1050 MHz	–71	–93	–118	–121	–119	–138
>1050 MHz to ≤2200 MHz	–66	–86	–112	–115	–113	–135
>2.2 GHz to ≤6 GHz	–54	–77	–104	–108	–107	–130
>6 GHz to ≤10 GHz	–52	–73	–100	–107	–107	–128
>10 GHz to ≤20 GHz	–45	–68	–94	–102	–102	–125
>20 GHz to ≤40 GHz	–45	–63	–92	–98	–98	–119

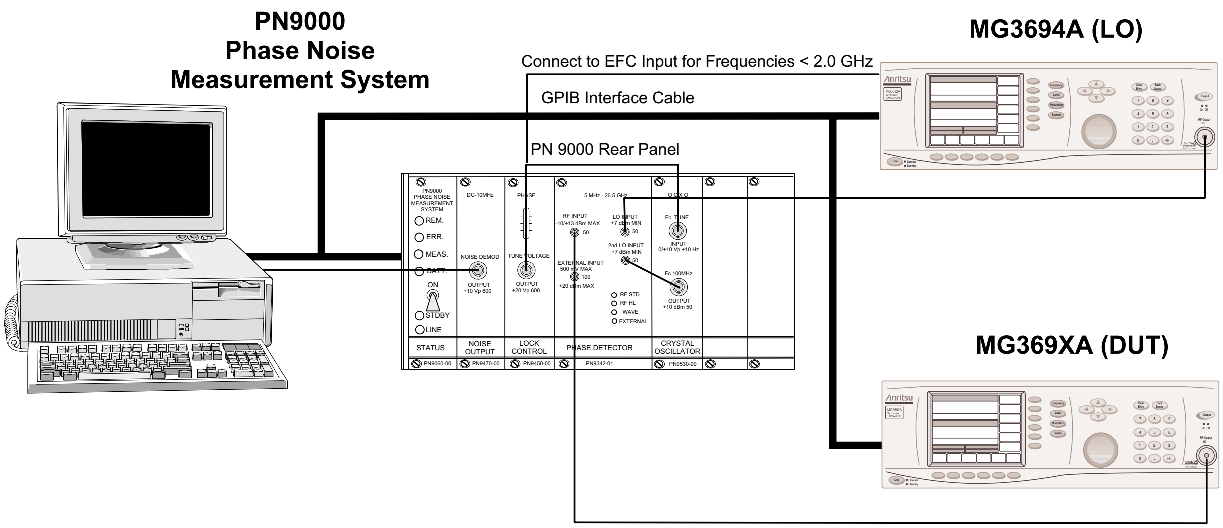


Figure 3-3. *Equipment Setup for Single Sideband Phase Noise Test*

Test Setup

The PN9000 software must be installed and set up in accordance with the instructions supplied with the phase noise measurement system before continuing with this procedure.

Connect the equipment, shown in Figure 3-3, as follows:

Step 1. Connect a GPIB interface cable from the PN9000 system to the MG3694A (LO) rear panel IEEE-488 GPIB connector.

Step 2. Connect a GPIB interface cable from the PN9000 system to the MG369XA (DUT) rear panel IEEE-488 GPIB connector.

Step 3. Connect the MG3694A (LO) RF Output to the LO INPUT of the PN9000 phase detector module.

Step 4. Connect the MG369XA (DUT) RF Output to the RF INPUT of the PN9000 phase detector module.

Step 5. On the PN9000 system, connect the Fc. 100 MHz OUTPUT of the crystal oscillator module to the 2nd LO INPUT of the phase detector module.

Step 6. On the PN9000 system, connect the TUNE VOLTAGE OUTPUT of the lock control module to the Fc. TUNE INPUT of the crystal oscillator module.

Test Procedure

The following procedure lets you measure the RF output single sideband phase noise levels to verify that they meet specifications.

Step 1. Set the MG369XA (DUT) GPIB address as follows:

a. Press SYSTEM, then Config. The System Configuration menu is displayed.

b. Press GPIB to display the Configure GPIB menu.

c. Press GPIB Address to change the current address of the MG369XA (DUT).

d. Enter a new address using the cursor control key or the data entry keypad and the Enter terminator key.

e. The new address will appear on the display. The entry must be between 1 and 30 to be valid.

Step 2. Set the MG3694A (LO) GPIB address by following the procedure in Step 1. The GPIB address set must be different from the one set for the MG369XA (DUT) in Step 1.

Step 3. Set up the PN9000 system as follows:

a. Select the **Measure/Graph** menu:

(1) Set Log. Fmin = 10 Hz

(2) Set Log. Fmax = 1 MHz

(3) Set Level max = –40 dB

(4) Set Level min = –150 dB

b. Select the **Status/Average** menu:

(1) Set Average = On

(2) Set 10/100Hz = 10*

(3) Set 100/1kHz = 20*

(4) Set 1K/10kHz = 20*

(5) Set 10K/100kHz = 20*

(6) Set 100K/1MHz = 20*

* For a test frequency of 9.999999 MHz, set this parameter to 40.

> **NOTE**
>
> When measuring frequencies less than 1.8 GHz, the Tune Voltage on the PN9000 must also be connected to the LO EFC input.

c. Set "Vcontrol = 5 Volts" (in the bottom status bar) by pressing the following on the keyboard:

Tab | Enter | 5 | Enter

This sets the "VCO-100MHz" frequency tune control to the middle of its range.

d. Select the **Calib/Input** menu:

(1) Set Source RF driver to Wiltron 6700

(2) Set Source LO driver to Wiltron 6700

(3) Set Offset LO to the value stated in Table 3-3 (page 3-17) for the current test frequency.

(4) Set RF Phase Detection to the mode stated in Table 3-3 for the current test frequency.

(5) For test frequencies greater than 1.8 GHz, set RF Phase Detection = Transposition.

For test frequencies less than 1.8 GHz, set RF Phase Detection = Standard 5 dBm and connect the LO EFC to the PN9000 Tune Voltage using a BNC tee.

e. Select the **Calib/RF** menu:

(1) Set Freq = to the frequency indicated in the test record

(2) Set Level = Value stated in Table 3-3 for the current test frequency.

f. Select the **Calib/LO** menu:

(1) Set Freq = Frequency stated in Table 3-3 for the current test frequency.

(2) Set Level = Value stated in Table 3-3 for the current test frequency.

When you exit the **Calib/LO** menu, the offset is automatically added to the LO frequency (displayed in the bottom status bar).

g. Select the **Calib/VCO** menu:

(1) For test frequencies greater than 1.8 GHz, set VCO1 = 100 MHz on.

For test frequencies less than 1.8 GHz, set VCO1 = Off.

h. Select the **Calib/Fcounter** menu:

- ***(1)*** Select **Freq IF** and press <Enter>
  A frequency close to the difference of the RF and LO frequencies is displayed in the menu item.
- ***(2)*** Press Esc to exit the menu

i. Press the CTRL + F keys to obtain a frequency beat. A very low frequency beat (<10 Hz) should be obtained, indicating that the correct carrier frequency is programmed.

Step 4. Calibrate and lock the PN9000 system as follows:

a. Select the **Lock/Def. Loop** menu:

- ***(1)*** Set Loop BW = Value stated in Table 3-3 for the current frequency parameter.
- ***(2)*** Set Tune Slope = Value stated in Table 3-3 for the current frequency parameter.
- ***(3)*** Set Maximum BW = Value stated in Table 3-3 for the current frequency parameter.

b. Offset the frequency of the MG369XA (DUT) as follows:

- ***(1)*** Press Local to return the instrument to local control
- ***(2)*** Offset the frequency by 1 kHz

c. On the PN9000 system, select the **Calib/Exec Cal** menu, then select OK.

d. After calibration, remove the 1 kHz offset on the MG362XA (DUT), then press <Enter> to continue.

e. For test frequencies greater 1.8 GHz, select the **Lock/AutoLock** menu:

- ***(1)*** Set Vmin = 0 V
- ***(2)*** Set Vmax = +10 V
- ***(3)*** Select OK MWAVE to perform the automatic locking process. The system will check that conditions for locking are met, measure the tune slope of the reference source, and look for the locking voltage.
- ***(4)*** When this process completes, press <Enter> to continue.

For test frequencies less than 1.8 GHz, select **Lock/ExecLock** to lock the PN9000 system.

Step 5. On the PN9000 system, select the **Measure** menu, then select OK to perform the measurement. When prompted for curve name, press N for no.

Step 6. When the measurement completes, select the **Process/Marker** menu:

a. Set Marker = curveM

b. Set Type = Vert.line

c. Set Color = Green (or color of choice)

d. Select OK and press Esc.

Step 7. Use the arrow keys on the keyboard to move the marker to the desired frequency offset (displayed on the lower right of the screen).

Step 8. Record the displayed phase noise levels at 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, and 1 MHz offset from the carrier frequency in the test record.

> ***NOTE***
> For test frequencies less than 1.8 GHz, select Lock/Lock Off to turn off locking prior to testing the next test frequency.

Step 9. Record any power line and fan rotation spurious emissions above the specified limits in the test record.

Step 10. Repeat Steps 3 through 9 for all frequencies listed in the test record.

Table 3-3. PN9000 Phase Noise Test Table (1 of 2)

Test Frequency	9.999999 MHz	15 MHz	30 MHz	60 MHz	120 MHz	250 MHz	499 MHz	600 MHz	1.99 GHz
Notes:	**Models with Option 22 Only**	**Models with Option 4 Only**						**Models with Option 5 Only**	
Calib/Input Menu:									
LO Offset	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	0 Hz	100 MHz
Phase Detection	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Transposi-tion
Calib/RF Menu:									
RF Frequency	9.999999 MHz	15 MHz	30 MHz	60 MHz	120 MHz	250 MHz	499 MHz	600 MHz	1.99 GHz
Power Level	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm
Calib/LO Menu:									
LO Frequency	10 MHz	15.1 MHz	30.1 MHz	60.1 MHz	120.1 MHz	250.1 MHz	499.1 MHz	600.1 MHz	2.09 GHz
Power Level	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm	10 dBm
Lock/Define Loop Menu:									
Loop BW	6 Hz	10 Hz	75 Hz	86 Hz	75 Hz	75 Hz	90 Hz	100 Hz	100 Hz
Tune Slope	25 Hz/V	40 Hz/V	40 Hz/V	86 Hz/V	172 Hz/V	172 Hz/V	333 Hz/V	420 Hz/V	210 Hz/V
Max BW	300 Hz	320 Hz	320 Hz	320 Hz	320 Hz	320 Hz	320 Hz	320 Hz	2 kHz

Table 3-3. PN9000 Phase Noise Test Table (2 of 2)

Test Frequency	2.01 GHz	2.19 GHz	2.21 GHz	6 GHz	8 GHz	10 GHz	19.99 GHz	20.01 GHz	25 GHz
Notes:	All Models without Option 4	Models with Option 4 Only		All Models	MG3691A Only	All Models		All Models >20 GHz Only	
Calib/Input Menu:									
LO Offset	0 Hz	0 Hz	0 Hz	–100 MHz	–100 MHz	–100 MHz	–100 MHz	–100 MHz	–100 MHz
Phase Detection	Transposition	Transposition	Transposition	Transposition	Transposition	Transposition	Transposition	Transposition	Transposition
Calib/RF Menu:									
RF Frequency	2.01 GHz	2.19 GHz	2.21 GHz	6 GHz	8 GHz	10 GHz	19.99 GHz	20.01 GHz	25 GHz
Power Level	The lesser of +10 dBm or maximum specified leveled output power								
Calib/LO Menu:									
LO Frequency	1.91 GHz	2.09 GHz	2.11 GHz	6 GHz	8 GHz	10 GHz	19.99 GHz	20.01 GHz	25 GHz
Power Level	The lesser of +10 dBm or maximum specified leveled output power								
Lock/Define Loop Menu:									
Loop BW	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz	100 Hz
Tune Slope	210 Hz/V	210 Hz/V	210 Hz/V	210 Hz/V	210 Hz/V	210 Hz/V	210 Hz/V	210 Hz/V	210 Hz/V
Max BW	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz	2 kHz

3-9 Power Level Accuracy and Flatness Tests

The following tests can be used to verify that the MG369XA meets its power level specifications. Power level verifications are divided into four parts—log conformity, power level accuracy (to –60 dBm), power level accuracy (–60 dBm to –120 dBm), and power level flatness.

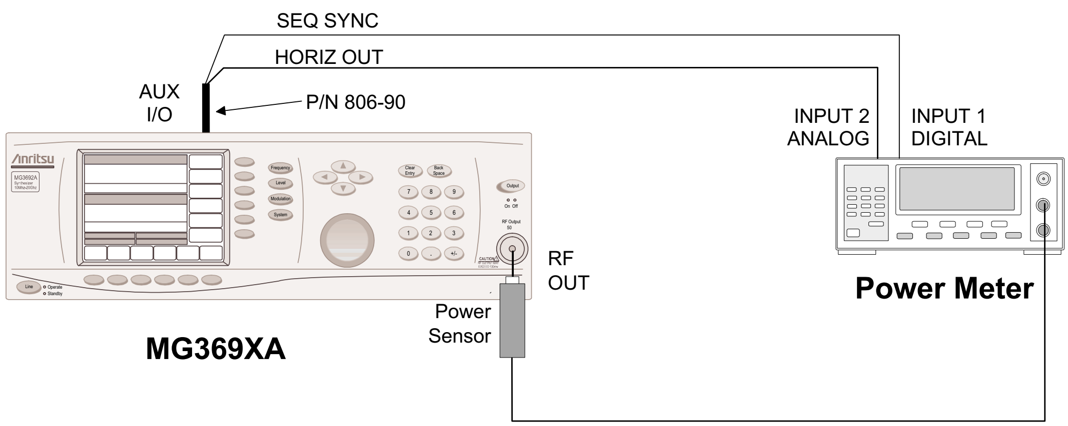


Figure 3-4. *Equipment Setup for Power Level Accuracy and Flatness Tests Above –60 dBm*

Test Setup For all power level measurements above –60 dBm, connect the equipment, shown in Figure 3-4, as follows:

Step 1. Calibrate the power meter with the appropriate power sensor.

Step 2. Connect the power sensor to the RF Output of the MG369XA.

Step 3. Connect the special AUX I/O interface cable (Anritsu Part No. 806-90) to the MG369XA rear panel AUX I/O connector. Connect the cable BNC connectors as follows:

a. Connect the cable labeled “SEQ SYNC” to the power meter rear panel INPUT 1 DIGITAL connector.

b. Connect the cable labeled “HORIZ OUT” to the power meter rear panel INPUT 2 ANALOG connector.

Power Level Log Conformity

The log conformity test verifies the dynamic range and level accuracy of the Automatic Level Control (ALC) loop. Power level accuracy is tested in both pulse (if equipped) and non-pulse modes by stepping the output power level down in 1 dB increments from its maximum rated power level and measuring the output power level at each step.

Step 1. Set up the power meter as follows:

a. Reset the power meter by pressing:
System | Setup | -more- | PRESET | RESET.

b. Configure the power meter to perform power measurements by pressing:
Sensor | Setup | MODE | Default.

c. Configure the power sensor's calibration factor source by pressing:
Sensor | CalFactor | SOURCE | V/GHz.

d. Press any hard key to begin the measurement.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing **SYSTEM**, then Reset. Upon reset, the CW menu is displayed.

b. If the DUT has a step attenuator (Option 2):

(1) Press **Level** to open the Level Control menu.

(2) Press ALC Mode, then press Attenuate> to open the Attenuator Control menu.

(3) Press Decouple to decouple the attenuator from the ALC loop.

c. Press **Frequency** to open the current frequency parameter for editing.

d. Set F1 to the CW frequency indicated in the test record.

e. Press Edit L1 to open the current power level parameter for editing.

f. Set L1 to the first applicable power level indicated in the test record.

Step 3. Measure the output power level with the power meter and record the reading in the test record.

> ***NOTE***
> For models with Option 22, rated output power is reduced by 2 dB.

Step 4. On the MG369XA, use the cursor control key (diamond-shaped key) to decrement L1 to the next test power level in the test record. Measure and record the power meter reading in the test record.

Step 5. Repeat Step 4 for each of the test power levels listed in the test record for the current CW frequency.

Step 6. Repeat Steps 2c through 5 for all CW frequencies listed in the test record.

Step 7. For models with pulse modulation:

a. Press **Modulation** to open the Modulation menu.

b. Press Pulse, then select external pulse mode by pressing Internal/External, if required.

c. Turn the pulse mode on by pressing On/Off.

d. Repeat Steps 2c through 6.

Power Level Accuracy (≥ –60 dBm) Power level accuracy for power levels of –60 dBm and above are tested by stepping the output power level down in 5 dB increments from its maximum rated power level and measuring the output power level using a power meter at each step.

Step 1. Set up the power meter as follows:

a. Reset the power meter by pressing:
System | Setup | -more- | PRESET | RESET.

b. Configure the power meter to perform power measurements by pressing:
Sensor | Setup | MODE | Default.

c. Configure the power sensor's calibration factor source by pressing:
Sensor | CalFactor | SOURCE | V/GHz.

d. Press any hard key to begin the measurement.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing **SYSTEM**, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the CW frequency indicated in the test record.

d. Press Edit L1 to open the current power level parameter for editing.

e. Set L1 to the power level indicated in the test record.

> ***NOTE***
> For models with Option 22, rated output power is reduced by 2 dB.

Step 3. Measure the output power level with the power meter and record the reading in the test record.

Step 4. On the MG369XA, use the cursor control key (diamond-shaped key) to decrement L1 to the next test power level in the test record. Measure and record the power meter reading in the test record.

Step 5. Repeat Step 4 for each of the test power levels listed in the test record (down to –60 dBm) for the current CW frequency.

Step 6. Repeat Steps 2b through 5 for all CW frequencies listed in the test record.

Power Level Accuracy (< –60 dBm)

Power level accuracy for power levels below –60 dBm is tested in two methods. First, by measuring the MG369XA's RF output directly on a measuring receiver; second, by down converting the MG369XA's RF output and measuring the down converted IF on a measuring receiver. In both cases, a reference power level is set on the measuring receiver and the output power level is stepped down in 5 dB increments. The relative output power level is then measured at each step.

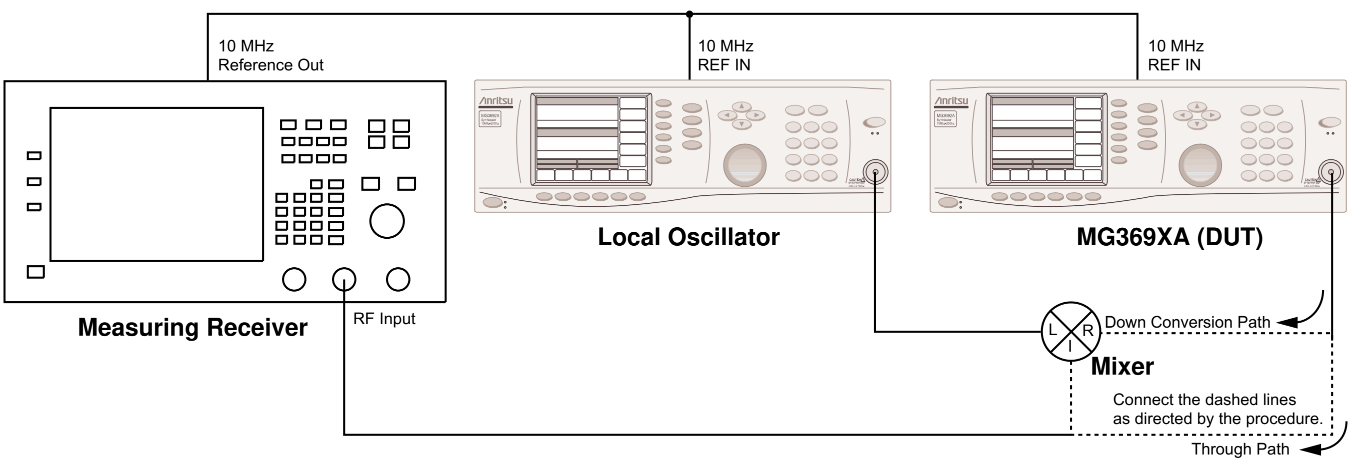


Figure 3-5. *Equipment Setup for Power Level Accuracy and Flatness Tests Below –60 dBm*

Test Setup

For all power level measurements below –60 dBm, connect the equipment, shown in Figure 3-5, as follows:

Step 1. For RF frequencies below 1300 MHz, connect the MG369XA RF Output to the RF input of the measuring receiver.

Step 2. For RF frequencies above 1300 MHz:

a. Connect the RF Output of the LO and the MG369XA to the mixer's (P/N: 60-114) L- and R-ports, respectively, using low loss cables.

b. Connect the mixer's I-port to the RF input of the measuring receiver.

Step 3. Using a BNC tee, connect the 10 MHz reference output from the measuring receiver to the MG369XA's and local oscillator's 10 MHz REF IN connectors.

Test Procedure The following procedure lets you verify the power accuracy and flatness for all power level measurements below –60 dBm.

Step 1. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the CW frequency indicated in the test record.

d. Press Edit L1 to open the current power level parameter for editing.

e. Set L1 to –50 dBm.

Step 2. If measuring frequencies below 1300 MHz, connect the MG369XA RF Output directly to the measuring receiver's RF input.

Step 3. If measuring frequencies above 1300 MHz, connect the MG369XA RF Output to the mixer's R-input port and set up the LO as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the LO CW frequency indicated in the test record.

d. Press Edit L1 to open the current power level parameter for editing.

e. Set L1 to +13 dBm.

Step 4. Set up the measuring receiver as follows:

a. Reset the receiver by pressing the Preset key.

b. Press the Freq key, then select Frequency Span and enter 10 kHz.

c. Press the BW key, then select Manual and enter 10 Hz.

d. Press the Average key and select Average On.

e. Press the Freq key and enter the CW frequency listed in the test record.

> ***NOTE***
> When measuring frequencies above 1300 MHz, the LO, DUT, and measuring receiver should be connected to the mixer and the measuring receiver should be set to measure 8.51 MHz.

f. Press Restart and wait for the averaging count to finish (Average: 8/8).

g. Read the measured value and calculate the line (and mixer) loss offset as follows:

|Receiver Reading| – 50 dBm = Offset

The offset value should be a positive number.

h. Press the Offset key and select Offset On.

i. Select Offset Value and enter the offset value that was calculated above. The displayed reading on the measuring receiver should be –50.000 dBm. If not, repeat Steps f through i.

NOTE

When making power level changes greater than 15 dB, the first measurement should be thrown out to allow for the measuring receiver to auto range.

Step 5. On the MG369XA, set L1 to the power level indicated in the test record starting with –65 dBm.

Step 6. Measure the relative output power level by pressing the Restart key on the measuring receiver and wait for the averaging count to complete (Average: 8/8). Record the reading in the test record.

Step 7. Repeat Steps 5 and 6 for each of the test power levels listed in the test record for the current CW frequency.

Step 8. Repeat Steps 1b through 7 for all CW frequencies listed in the test record.

Power Level Flatness

Power level flatness is tested by measuring the output power level variation during a full band sweep in the manual sweep mode.

Step 1. Connect the equipment as shown in Figure 3-4 on page 3-19.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. The CW menu is displayed.

b. Press Manual Sweep to place the instrument in the manual sweep frequency mode and to display the Manual Sweep menu.

c. With the Manual Sweep menu displayed, press the menu soft key:
FREQUENCY CONTROL

d. The Sweep Frequency Control menu is then displayed.

e. Press Full to select a full range frequency sweep.

f. Press Edit L1 to open the current power level parameter for editing.

g. Set L1 to the power level indicated in the test record.

h. Return to the Manual Sweep menu by pressing the <Previous soft key.

i. At the Manual Sweep menu, press Num of Steps to open the number-of-steps parameter for editing.

j. Set the number-of-steps to 200.

k. Press the menu soft key:
FREQUENCY CONTROL

Step 3. Using the rotary data knob, sweep the MG369XA through the full frequency range. Measure the maximum and minimum power meter readings and record the variation (difference between the maximum and minimum readings) in the test record. Verify that the variation does not exceed the value noted in the test record.

> ***NOTE***
> Be sure to use and calibrate the appropriate power sensor for the frequency being measured.

Maximum Leveled Power Maximum leveled power is tested by measuring the output power level during a full band sweep in the manual sweep mode.

Step 1. Connect the equipment as shown in Figure 3-4 on page 3-19.

Step 2. Set up the MG369XA for a manual sweep as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. The CW menu is displayed.

b. Press Manual Sweep to place the instrument in the manual sweep frequency mode and to display the Manual Sweep menu.

c. With the Manual Sweep menu displayed, press the menu soft key:

FREQUENCY CONTROL

d. The Sweep Frequency Control menu is then displayed.

e. Press Full to select a full range frequency sweep.

f. Press Edit L1 to open the current power level parameter for editing.

g. Set L1 to the power level noted in the test record.

h. Return to the Manual Sweep menu by pressing the <Previous soft key.

i. At the Manual Sweep menu, press the soft key Num of Steps to open the number-of-steps parameter for editing.

j. Set the number-of-steps to 200.

k. Press the menu soft key:

FREQUENCY CONTROL

Step 3. Using the rotary data knob, sweep the MG369XA through the full frequency range. Measure the minimum power meter readings and record the values in the test record. Verify that the minimum readings do not exceed the value noted in the test record.

NOTE

Be sure to use and calibrate the appropriate power sensor for the frequency being measured.

3-10 Residual FM Tests

This procedure verifies the frequency stability of the MG369XA RF output when in the locked mode and when the FM input circuitry is active, but not modulating the RF output.

The RF output of the MG369XA is down converted to a frequency that a modulation analyzer can read. This is accomplished with the use of an RF mixer and a local oscillator. The IF output from the mixer is fed to a modulation analyzer where the residual FM is measured.

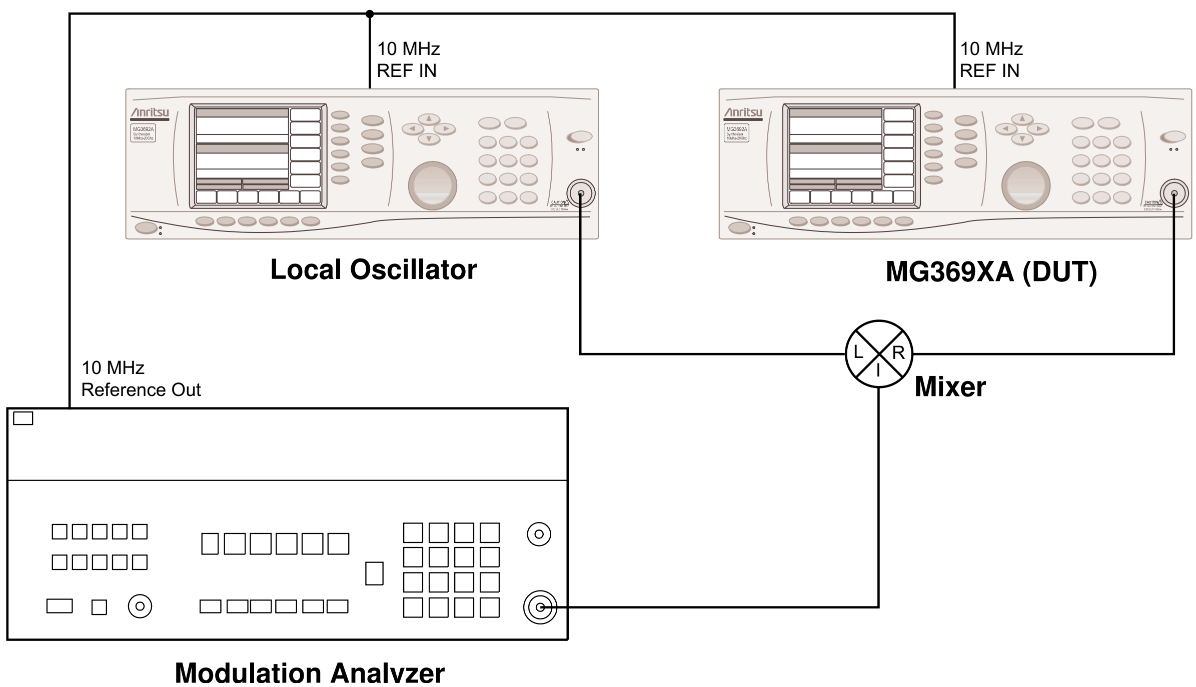


Figure 3-6. Equipment Setup for Residual FM Tests

Test Setup Connect the equipment, shown in Figure 3-6, as follows:

Step 1. Using a BNC tee, connect the 10 MHz reference output from the modulation analyzer to the MG369XA's and local oscillator's 10 MHz REF IN connectors.

Step 2. Connect the RF Output from the LO to the L-input on the mixer.

Step 3. Connect the RF Output from the DUT to the R-input on the mixer.

Step 4. Connect the RF input of the modulation analyzer to the I-output from the mixer.

Locked FM Mode Off

The following procedure lets you measure residual FM in the normal locked mode (modulation circuits not active):

Step 1. Set up the LO as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit L1 to open the current power level parameter for editing.

c. Set L1 to +13 dBm.

d. Press Edit F1 to open the current frequency parameter for editing.

e. Set F1 to 1800 MHz.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit L1 to open the current power level parameter for editing.

c. Set L1 to the lesser of +10 dBm or the maximum leveled power level for the instrument being tested (refer to Appendix B, Performance Specifications).

d. Press Edit F1 to open the current frequency parameter for editing.

e. Set F1 to 2100 MHz.

Step 3. Set up the modulation analyzer as follows:

a. Press the 50 Hz HP Filter key and the 15 KHz LP Filter key.

b. Press the FM key to set up an FM measurement.

c. Press the AVG key to set averaging mode on.

Step 4. Enter the reading from the modulation analyzer into the test record and verify that the measurement meets specification.

Step 5. Repeat the measurement for each of the LO and DUT frequency pairs listed in the test record.

Locked FM Mode On

The following procedure lets you measure residual FM with the locked FM mode on (modulation circuits active):

Step 1. Repeat Steps 1 through 3 in the Locked FM Mode Off test procedure above.

Step 2. On the DUT, access the FM Status menu by pressing **Modulation**, then FM.

Step 3. Select external FM by pressing the Internal/External key, if required.

Step 4. Turn on external FM by pressing the On/Off key.

> ***NOTE***
> Ensure that no connection is made to the rear panel FM input.

Step 5. Enter the reading from the modulation analyzer into the test record and verify that the measurement meets specification.

Step 6. Repeat the measurement for each of the LO and DUT frequency pairs in the test record.

Unlocked Narrow FM Mode On

The following procedure lets you measure residual FM with the unlocked narrow FM mode on (modulation circuits active):

Step 1. Repeat Steps 1 through 3 in the Locked FM Mode Off test procedure above.

Step 2. On the DUT, access the FM Status menu by pressing **Modulation**, then FM.

Step 3. Select external FM by pressing the Internal/External key, if required.

Step 4. Turn on external FM by pressing the On/Off key.

> ***NOTE***
> Ensure that no connection is made to the rear panel FM input.

Step 5. Access the FM modes by selecting Mode>.

Step 6. Select the Unlocked Narrow FM mode by pressing Unlocked Narrow.

Step 7. Enter the reading from the modulation analyzer into the test record and verify that the measurement meets specification.

Step 8. Repeat the measurement for each of the LO and DUT frequency pairs listed in the test record.

Unlocked Wide FM Mode On

The following procedure lets you measure residual FM with the unlocked wide FM mode on (modulation circuits active):

Step 1. Repeat Steps 1 through 3 in the Locked FM Mode Off test procedure above.

Step 2. On the DUT, access the FM Status menu by pressing Modulation, then FM.

Step 3. Select external FM by pressing the Internal/External key, if required.

Step 4. Turn on External FM by pressing the On/Off key.

> ***NOTE***
> Ensure that no connection is made to the rear panel FM input.

Step 5. Access the FM modes by selecting Mode>.

Step 6. Select the Unlocked Narrow FM mode by pressing Unlocked Wide.

Step 7. Enter the reading from the modulation analyzer into the test record and verify that the measurement meets specification.

Step 8. Repeat the measurement for each of the LO and DUT frequency pairs listed in the test record.

3-11 Frequency Modulation Tests

This section provides a manual procedure to verify the performance of the frequency and phase modulation of the MG369XA.

The RF Output of the MG369XA is modulated and monitored on a spectrum analyzer display. FM accuracy is determined by measuring the modulating input signal necessary to reduce the carrier level to its lowest level. When the carrier level reaches its lowest level, known as a Bessel null (Figure 3-8, following page), the actual deviation can be determined since the modulation rate is known. These tests quantify how the modulating input signal affects the signal generator's RF output.

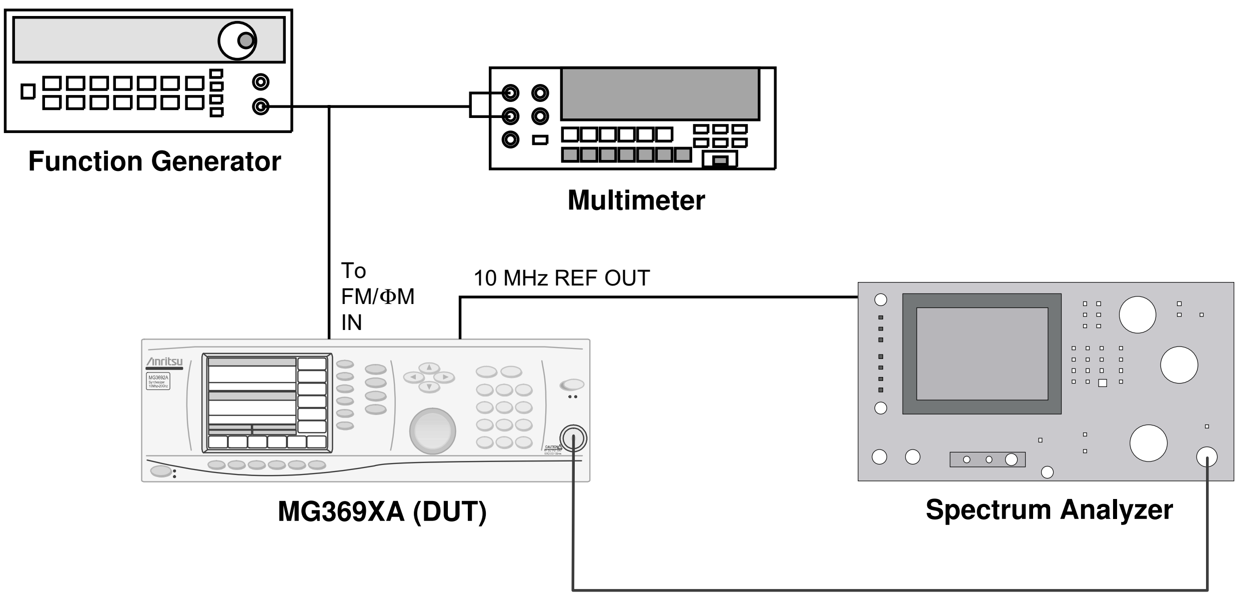


Figure 3-7. *Equipment Setup for Frequency Modulation Tests*

Test Setup Connect the equipment, shown in Figure 3-7, as follows:

> **NOTE**
> An alternate procedure is described breifly at the end of this section.

Step 1. Connect the MG369XA rear panel 10 MHz REF OUT to the spectrum analyzer's external reference input.

Step 2. Connect the RF OUTPUT of the MG369XA to the spectrum analyzer's RF input.

Step 3. Using a BNC tee, connect the function generator output to the multimeter's input, and to the MG369XA's rear panel FM/ΦM IN connector.

NOTES

The FM calibration procedures use narrow resolution bandwidth and zero span on the spectrum analyzer. For these measurements, it is important that the analyzer's center frequency be precisely aligned with the synthesizer's carrier frequency. A single 10 MHz reference should be used for the analyzer and synthesizer. Generally, the most accurate source of the 10 MHz should be used as the common reference.

The FM and ΦM test procedures use modulation rates of 99.7 and 99.8 kHz, instead of the specified 100 kHz, to avoid a spurious beat note that can interfere with the carrier frequency null measurement.

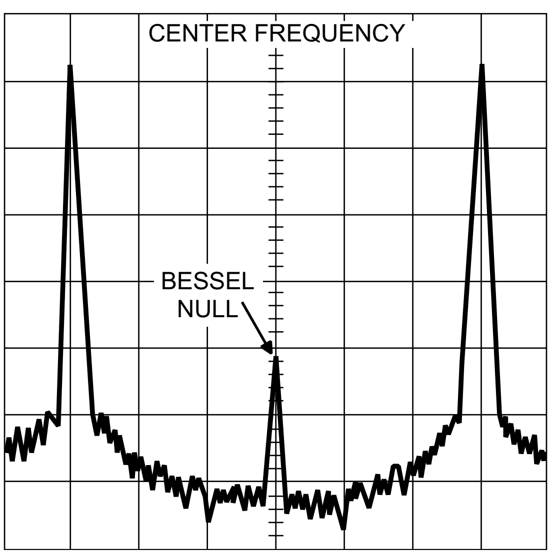


Figure 3-8. *Typical Spectrum Analyzer Display of a Bessel Null on an FM Waveform*

FM Attenuator The following procedure lets you measure the FM attenuators of the modulation circuit. The values calculated in this procedure are used to verify the performance of the modulated RF output of the MG369XA.

FM STEP ATTENUATOR

Step 1. Set up the function generator as follows:

a. Press the ∿ key to select the sine wave function.

b. Press the Freq key and use the rotary knob to adjust the frequency output to 8.32 kHz.

c. Press the Ampl key and use the rotary knob to adjust the amplitude to 1.8 V_{p-p}.

Step 2. Set the multimeter to measure an AC signal by pressing V AC, then Auto. The multimeter reading should be approximately 0.636 V_{rms}.

Step 3. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.

c. Press the Modulation | FM | Internal/External keys to select external FM.

d. Press Edit Sensitivity and set the sensitivity to 20 kHz/V.

Step 4. Set up the spectrum analyzer as follows:

a. Press the PRESET key to reset the instrument.

b. Press the FREQUENCY key and enter 5 GHz.

c. Press the BW key and set the RBW to 1 kHz and the VBW to 1 Hz.

d. Press the SPAN key and enter 0 MHz.

e. Press the PEAK SEARCH key, then select MARKER DELTA.

Step 5. On the MG369XA, press On/Off to turn the locked FM mode on.

> ***NOTES***
>
> When searching for a Bessel null using zero span on the spectrum analyzer, the displayed trace will appear as a horizontal line. When approaching the Bessel null, the RF carrier becomes much more sensitive to the modulating input level and the displayed trace will drop rapidly. If the carrier null is overshot, the trace will rapidly rise and begin to fall again when the second carrier null is approached. Be cautious to not overshoot the carrier null.

Step 6. Locate the first Bessel null as follows:

a. Increase the function generator's amplitude in 100 mV increments until the carrier level on the spectrum analyzer's display begins to drop, then adjust the function generator in 10 mV increments (within a range of 1.8 to 2.2 V_{p-p} on the function generator's display) until the carrier level is minimized.

b. Fine adjust the function generator's amplitude in 1 mV increments to achieve the absolute minimum carrier level. The Δmarker level should be at least –50 dBc at the null. Typically, –55 dBc can be achieved.

Step 7. Record the multimeter's reading as V_6 in the test record.

Step 8. On the MG369XA, set the FM sensitivity to 200 kHz/V.

Step 9. Set the function generator to 50 mV_{p-p}.

Step 10. Locate the eighth Bessel null as follows:

a. Increase the function generator's amplitude in 10 mV increments while observing the carrier level on the spectrum analyzer's display. Count the carrier nulls as the modulation level is increased.

b. At the eighth null, maximize the null depth by adjusting the function generator's amplitude in 1 mV increments to achieve the deepest null. The Δmarker level should be at least –50 dBc at the null. Typically, –60 dBc can be achieved.

Step 11. Record the multimeter's reading as V_5 in the test record.

Step 12. Set the function generator to 83.2 kHz and 1.8 V_{p-p}.

Step 13. Locate the first Bessel null as follows:

a. Increase the function generator's amplitude in 100 mV increments until the carrier level begins to drop, then adjust the function generator in 10 mV increments (within a range of 1.8 to 2.2 V_{p-p} on the function generator's display) until the carrier level is minimized.

b. Fine adjust the function generator in 1 mV increments to achieve absolute minimum carrier level. The Δmarker level should be at least –60 dBc at the null. Typically, –70 dBc can be achieved.

Step 14. Record the multimeter's reading as V_4 in the test record.

Step 15. On the MG369XA, set the FM sensitivity to 2.00 MHz/V.

Step 16. Set the function generator to 50 mV_{p-p}.

Step 17. Locate the eighth Bessel null as follows:

a. Increase the function generator's amplitude in 10 mV increments while observing the carrier level on the spectrum analyzer. Count the carrier nulls as the modulation level is increased.

b. At the eighth null, maximize the null depth by adjusting the function generator's amplitude in 1 mV increments to achieve the deepest null. The Δmarker level should be at least –50 dBc at the null. Typically, –60 dBc can be achieved.

Step 18. Record the multimeter's reading as V_3 in the test record.

Step 19. On the MG369XA, set the FM sensitivity to 240 kHz/V.

Step 20. Set the function generator to 99.7 kHz and 1.8 V_{p-p}.

Step 21. Find the first Bessel null as follows:

a. Increase the function generator's amplitude in 100 mV increments until the carrier level begins to drop, then adjust the function generator in 10 mV increments (within a range of 1.8 to 2.2 V_{p-p} on the function generator's display) until the carrier level is minimized.

b. Fine adjust the function generator's amplitude in 1 mV increments to achieve the absolute minimum carrier level. The Δmarker level should be at least –60 dBc at the null. Typically, –70 dBc can be achieved.

Step 22. Record the multimeter's reading as V_2 in the test record.

Step 23. On the MG369XA, set the FM sensitivity to 2.40 MHz/V.

Step 24. Set the function generator to 50 mV_{p-p}.

Step 25. Locate the eighth Bessel null as follows:

a. Increase the function generator's amplitude in 10 mV increments while observing the carrier level on the spectrum analyzer. Count the carrier nulls as the modulation level is increased.

b. At the eighth null, maximize the null depth by adjusting the function generator's amplitude in 1 mV increments to achieve the deepest null. The Δmarker level should be at least –50 dBc at the null. Typically, –60 dBc can be achieved.

Step 26. Record the multimeter's reading as V_1 in the test record.

> ***NOTE***
>
> If G_1, G_2, or G_3 is <0.980 or >1.020, the FM step attenuator should be checked for an out-of-tolerance condition.

Step 27. Calculate the following to four decimal places and record the results in the test record:

$$G_1 = 0.9877 \times \left(\frac{V_1}{V_2}\right)$$

$$G_2 = 0.9877 \times \left(\frac{V_3}{V_4}\right)$$

$$G_3 = 0.9877 \times \left(\frac{V_5}{V_6}\right)$$

$$G_{12} = G_1 \times G_2$$

$$G_{123} = G_1 \times G_2 \times G_3$$

$$G_{23} = G_2 \times G_3$$

FM VARIABLE ATTENUATOR

Step 28. On the MG369XA, set the FM sensitivity to 240 kHz/V.

Step 29. Set the function generator to 99.7 kHz and 1.8 $V_{p\text{-}p}$.

Step 30. Locate the first Bessel null as follows:

a. Increase the function generator's amplitude in 100 mV increments until the carrier level begins to drop, then adjust the function generator in 10 mV increments (within a range of 1.8 to 2.2 $V_{p\text{-}p}$ on the function generator display) until the carrier level is minimized.

b. Fine adjust the function generator in 1 mV increments to achieve the absolute minimum carrier level. The Δmarker level should be at least –60 dBc at the null. Typically, –70 dBc can be achieved.

Step 31. Record the multimeter's reading as V_7 in the test record.

Step 32. On the MG369XA, set the FM sensitivity to 863 kHz/V.

Step 33. Set the function generator to 100 $mV_{p\text{-}p}$.

Step 34. Locate the third Bessel null as follows:

a. Increase the function generator's amplitude in 10 mV increments while observing the carrier level. Count the carrier nulls as the modulation level is increased.

b. At the third null, maximize the null depth by adjusting the function generator's amplitude in 1 mV steps to achieve the deepest null. The Δmarker level should be at least –55 dBc at the null. Typically, –65 dBc can be achieved.

Step 35. Record the multimeter's reading as V_8 in the test record.

Step 36. On the MG369XA, set the FM sensitivity to 1.8 MHz/V.

Step 37. Set the function generator to 50 $mV_{p\text{-}p}$.

Step 38. Locate the sixth Bessel null as follows:

a. Increase function generator's amplitude in 10 mV increments while observing the carrier level on the spectrum analyzer. Count the carrier nulls as the modulation level is increased.

b. At the sixth null, maximize the null depth by adjusting the function generator's amplitude in 1 mV steps to achieve the deepest null. The Δmarker level should be at least –50 dBc at the null. Typically, –60 dBc can be achieved.

Step 39. Record the multimeter's reading as V_9 in the test record.

Step 40. Calculate the following to four decimal places and record the results in the test record:

$$G_4 = \frac{V_8}{V_7}$$

$$G_5 = \frac{V_8}{V_9}$$

> ***NOTE***
>
> If G_4 or G_5 is <0.980 or >1.020, the FM Variable Gain must be calibrated.

COMPOSITE FM ATTENUATOR ACCURACY

> ***NOTE***
> If any of the GT_1 through GT_{16} values are <0.950 or >1.050, the FM Attenuators need to repaired or calibrated.

Step 41. Calculate the following to four decimal places and record the results in the test record:

$$GT_1 = G_4 \times G_1$$

$$GT_2 = G_4 \times G_2$$

$$GT_3 = G_4 \times G_3$$

$$GT_4 = G_4 \times G_{12}$$

$$GT_5 = G_4 \times G_{123}$$

$$GT_6 = G_5 \times G_1$$

$$GT_7 = G_5 \times G_2$$

$$GT_8 = G_5 \times G_3$$

$$GT_9 = G_5 \times G_{12}$$

$$GT_{10} = G_5 \times G_{123}$$

$$GT_{11} = \frac{1}{G_1 \times G_4}$$

$$GT_{12} = \frac{G_2}{G_4}$$

$$GT_{13} = \frac{G_{23}}{G_4}$$

$$GT_{14} = \frac{G_5}{G_1 \times G_4}$$

$$GT_{15} = \frac{G_2 \times G_5}{G_4}$$

$$GT_{16} = \frac{G_{23} \times G_5}{G_4}$$

GTN_{max} = largest of 1.0000, GT_1, GT_4, GT_5, GT_6, GT_9, or GT_{10}.

GTN_{min} = smallest of 1.0000, GT_1, GT_4, GT_5, GT_6, GT_9, or GT_{10}.

GTW_{max} = largest of 1.0000, GT_2, GT_3, GT_4, GT_7, GT_8, or GT_9.

GTW_{min} = smallest of 1.0000, GT_2, GT_3, GT_4, GT_7, GT_8, or GT_9.

GTF_{max} = largest of 1.0000, GT_{11}, GT_{12}, GT_{13}, GT_{14}, GT_{15}, or GT_{16}.

GTF_{min} = smallest of 1.0000, GT_{11}, GT_{12}, GT_{13}, GT_{14}, GT_{15}, or GT_{16}.

Locked FM Accuracy

FM accuracy is verified at 5 GHz and 20 GHz in both locked and locked low-noise modes of operation.

LOCKED EXTERNAL FM ACCURACY AT 5 GHz

Step 1. Set up the test equipment as described on page 3-32.

Step 2. Set the multimeter to measure an AC signal by pressing V AC and Auto.

> ***NOTE***
> The first Bessel null at a modulation index of 2.405 will require a 99.8 kHz modulation rate at a deviation of 240 kHz.

Step 3. Set up the function generator as follows:

a. Press the ∿ key to select the sine wave function.

b. Press the Freq key and use the rotary knob to adjust the frequency output to 99.8 kHz.

c. Press the Ampl key and use the rotary knob to adjust the amplitude to 1.8 V_{p-p}.

Step 4. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.

c. Press the Modulation | FM | Internal/External keys to select external FM.

d. Press Edit Sensitivity and set the sensitivity to 240 kHz/V.

Step 5. Set up the spectrum analyzer as follows:

a. Press the PRESET key to reset the instrument.

b. Press the FREQUENCY key and enter 5 GHz.

c. Press the BW key and set the RBW to 1 kHz and the VBW to 1 Hz.

d. Press the SPAN key and enter 0 MHz.

e. Press the PEAK SEARCH key, then select MARKER DELTA.

Step 6. On the MG369XA, press On/Off to turn the locked FM mode on.

Step 7. Find the first Bessel null as follows:

a. Increase the function generator's amplitude in 10 mV increments (within a range of 1.8 to 2.2 V_{p-p} on the function generator display) such that the MG369XA carrier level is minimized.

b. Fine adjust the function generator in 1 mV increments to achieve an absolute minimum carrier level. The Δmarker level should be at least –48 dBc at the first null. Typically, –54 dBc can be achieved.

Step 8. Record the multimeter's reading in the test record as V_{null}.

Step 9. Calculate the following to three decimal places and record the results in the test record:

$$+FM_{error}\% = \frac{70.7GTF_{\max}}{V_{null}} - 100$$

$$-FM_{error}\% = \frac{70.7GTF_{\min}}{V_{null}} - 100$$

LOCKED LOW-NOISE EXTERNAL FM ACCURACY AT 5 GHz

Step 10. On the MG369XA, set Locked Low-Noise External FM mode on by pressing Mode>, then press Locked Low Noise.

Step 11. Find the first Bessel null as follows:

a. Adjust the function generator's amplitude in 10 mV increments (within a range of 1.8 to 2.2 $V_{p\text{-}p}$ on the function generator's display) such that the MG369XA carrier level is minimized.

b. Fine adjust the function generator in 1 mV increments to achieve an absolute minimum carrier level. The Δmarker level should be at least –48 dBc at the first null. Typically, –54 dBc can be achieved.

Step 12. Record the multimeter's reading in the test record as V_{null}.

Step 13. Calculate the following to three decimal places and record the results in the test record:

$$+FM_{error}\% = \frac{70.7GTF_{\max}}{V_{null}} - 100$$

$$-FM_{error}\% = \frac{70.7GTF_{\min}}{V_{null}} - 100$$

LOCKED EXTERNAL FM ACCURACY AT 20 GHz

Step 14. Set up the MG369XA as follows:

a. Press **Frequency** to open the current frequency parameter for editing.

b. Set the frequency to 20 GHz, then to 2.3 GHz, then back to 20 GHz.

c. Press **Modulation**, then press Mode> and select Locked.

d. Press <Previous, then press On/Off to turn locked external FM mode off.

Step 15. Set up the spectrum analyzer as follows:

a. Press the FREQUENCY key and enter 20 GHz.

b. Press the PEAK SEARCH key, then select MARKER DELTA.

Step 16. Press On/Off to turn locked external FM mode on.

Step 17. Find the first Bessel null as follows:

a. Adjust the function generator's amplitude in 10 mV increments (within a range of 1.8 to 2.2 V_{p-p} on the function generator's display) such that the MG369XA carrier level is minimized.

b. Fine adjust the function generator in 1 mV increments to achieve an absolute minimum carrier level. The Δmarker level should be at least –48 dBc at the first null. Typically, –54 dBc can be achieved.

Step 18. Record the multimeter's reading in the test record as V_{null}.

Step 19. Calculate the following to three decimal places and record the results in the test record:

$$+FM_{error}\% = \frac{70.7GTF_{max}}{V_{null}} - 100$$

$$-FM_{error}\% = \frac{70.7GTF_{min}}{V_{null}} - 100$$

LOCKED LOW-NOISE EXTERNAL FM ACCURACY AT 20 GHz

Step 20. On the MG369XA, select Locked Low Noise.

Step 21. Find the first Bessel null as follows:

a. Adjust the function generator's amplitude in 10 mV increments (within a range of 1.8 to 2.2 $V_{p\text{-}p}$ on the function generator's display) such that the MG369XA carrier level is minimized.

b. Fine adjust the function generator in 1 mV increments to achieve an absolute minimum carrier level. The Δmarker level should be at least –48 dBc at the first null. Typically, –54 dBc can be achieved.

Step 22. Record the multimeter's reading in the test record as V_{null}.

Step 23. Calculate the following to three decimal places and record the results in the test record:

$$+FM_{error}\% = \frac{70.7GTF_{\max}}{V_{null}} - 100$$

$$-FM_{error}\% = \frac{70.7GTF_{\min}}{V_{null}} - 100$$

LOCKED INTERNAL FM ACCURACY AT 5 GHz (Options 12 and 23 or Option 25)

Step 24. Disconnect the function generator from the MG369XA's rear panel FM/ΦM IN connector.

Step 25. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.

c. Press the Modulation key, then press FM.

d. Press Internal/External, to select the locked internal FM mode and ensure that the FM mode is off.

e. Press Edit Rate and set it to 99.8 kHz.

f. Press Edit Deviation and set it to 240 kHz.

Step 26. Set up the spectrum analyzer as follows:

a. Press FREQUENCY and set the center frequency to 5 GHz.

b. Press the PEAK SEARCH key, then select MARKER DELTA.

Step 27. On the MG369XA, press On/Off to turn the locked internal FM mode on.

Step 28. On the MG369XA, adjust the FM deviation in 1 kHz increments (within a range of 220 to 260 kHz) such that the carrier level is minimized on the spectrum analyzer display. The Δmarker level should be at least –48 dBc at the first null. Typically, –50 to –65 dBc can be achieved.

Step 29. Record the FM deviation setting that produces the deepest carrier null as FM_{null} in the test record.

Step 30. Calculate the following to three decimal places and record the results in the test record:

$$+FM_{error}\% = GTF_{\max} \times \left(\frac{24MHz}{FM_{null}}\right) - 100$$

$$-FM_{error}\% = GTF_{\min} \times \left(\frac{24MHz}{FM_{null}}\right) - 100$$

LOCKED LOW-NOISE INTERNAL FM ACCURACY AT 5 GHz (Options 12 and 23 or Option 25)

Step 31. On the MG369XA, press Mode> and select Locked Low Noise, then press <Previous.

Step 32. Adjust the FM deviation in 1 kHz increments (within a range of 220 to 260 kHz) such that the carrier level is minimized on the spectrum analyzer display. The Δmarker level should be at least –48 dBc at the first null. Typically, –50 to –65 dBc can be achieved.

Step 33. Record the FM deviation setting that produces the deepest carrier null as FM_{null} in the test record.

Step 34. Calculate the following to three decimal places and record the results in the test record:

$$+FM_{error}\,\% = GTF_{\max} \times \left(\frac{24MHz}{FM_{null}}\right) - 100$$

$$-FM_{error}\,\% = GTF_{\min} \times \left(\frac{24MHz}{FM_{null}}\right) - 100$$

LOCKED INTERNAL FM ACCURACY AT 20 GHz (Options 12 and 23 or Option 25)

Step 35. Set up the MG369XA as follows:

- ***a.*** Press Frequency and set the frequency to 20 GHz, then 2.3 GHz, then back to 20 GHz.
- ***b.*** Press Modulation, then press Mode> and select Locked.
- ***c.*** Press <Previous, then press On/Off to turn the FM mode off.

Step 36. Set up the spectrum analyzer as follows:

- ***a.*** Press FREQUENCY and set the center frequency to 20 GHz.
- ***b.*** Press the PEAK SEARCH key, then select MARKER DELTA.

Step 37. On the MG369XA, press On/Off to turn the FM mode on.

Step 38. On the MG369XA, adjust the FM deviation in 1 kHz increments (within a range of 220 to 260 kHz) such that the carrier level is minimized on the spectrum analyzer display. The Δmarker level should be at least –48 dBc at the first null. Typically, –50 to –65 dBc can be achieved.

Step 39. Record the FM deviation setting that produces the deepest carrier null as FM_{null} in the test record.

Step 40. Calculate the following to three decimal places and record the results in the test record:

$$+FM_{error}\,\% = GTF_{\max} \times \left(\frac{24MHz}{FM_{null}}\right) - 100$$

$$-FM_{error}\,\% = GTF_{\min} \times \left(\frac{24MHz}{FM_{null}}\right) - 100$$

LOCKED LOW-NOISE INTERNAL FM ACCURACY AT 20 GHz (Options 12 and 23 or Option 25)

Step 41. On the MG369XA, press Mode> and select Locked Low Noise, then press <Previous.

Step 42. Adjust the FM deviation in 1 kHz increments (within a range of 220 to 260 kHz) such that the carrier level is minimized on the spectrum analyzer display. The Δmarker level should be at least –48 dBc at the first null. Typically, –50 to –65 dBc can be achieved.

Step 43. Record the FM deviation setting that produces the deepest carrier null as FM_{null} in the test record.

Step 44. Calculate the following to three decimal places and record the results in the test record:

$$+FM_{error}\% = GTF_{\max} \times \left(\frac{24MHz}{FM_{null}}\right) - 100$$

$$-FM_{error}\% = GTF_{\min} \times \left(\frac{24MHz}{FM_{null}}\right) - 100$$

ΦM Accuracy

ΦM accuracy is verified at 5 GHz and 20 GHz in unlocked wide, unlocked narrow, locked, and locked low-noise for both external and internal modes of operation.

WIDE EXTERNAL ΦM ACCURACY AT 5 GHz

Step 1. Set up the test equipment as described on page 3-32.

Step 2. Set the multimeter to measure an AC signal by pressing V AC, then Auto.

Step 3. Set up the function generator as follows:

- ***a.*** Press the ∿ key to select the sine wave function.
- ***b.*** Press the Freq key and use the rotary knob to adjust the frequency output to 99.8 kHz.
- ***c.*** Press the Ampl key and use the rotary knob to adjust the amplitude to 1.8 $V_{p\text{-}p}$.

Step 4. Set up the MG369XA as follows:

- ***a.*** Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.
- ***b.*** Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.
- ***c.*** Press the Modulation | ΦM | Internal/External keys to select external ΦM.
- ***d.*** Press Mode> and select Wide, then press <Previous.
- ***e.*** Press Edit Sensitivity and set the sensitivity to 2.40 rad/V.

Step 5. Set up the spectrum analyzer as follows:

- ***a.*** Press the PRESET key to reset the instrument.
- ***b.*** Press the FREQUENCY key and enter 5 GHz.
- ***c.*** Press the BW key and set the RBW to 1 kHz and the VBW to 1 Hz.
- ***d.*** Press the SPAN key and enter 0 MHz.
- ***e.*** Press the PEAK SEARCH key, then select MARKER DELTA.

Step 6. On the MG369XA, press On/Off to turn the ΦM mode on.

Step 7. Locate the first Bessel null as follows:

a. Adjust the function generator's amplitude in 10 mV increments (within a range of 1.8 to 2.2 V_{p-p} on the function generator's display) such that the MG369XA carrier level is minimized on the spectrum analyzer display.

b. Fine adjust the function generator in 1 mV increments to achieve the absolute minimum carrier level. The Δmarker level should be at least –48 dBc at the first null. Typically, –54 dBc can be achieved.

Step 8. Record the multimeter's reading in the test record as V_{null}.

Step 9. Calculate the following to three decimal places and record the results in the test record:

$$+\Phi M_{error}\,\% = \frac{70.7GTW_{\max}}{V_{null}} - 100$$

$$-\Phi M_{error}\,\% = \frac{70.7GTW_{\min}}{V_{null}} - 100$$

NARROW EXTERNAL ΦM ACCURACY AT 5 GHz

Step 10. On the MG369XA, press Mode> and select Narrow, then press <Previous.

Step 11. Locate the first Bessel null as follows:

a. Adjust function generator's amplitude in 10 mV increments (within a range of 1.8 to 2.2 $V_{p\text{-}p}$ on the function generator's display) such that the MG369XA carrier level is minimized on the spectrum analyzer.

b. Fine adjust the function generator in 1 mV increments to achieve the absolute minimum carrier level. The Δmarker level should be at least –48 dBc at the first null. Typically, –54 dBc can be achieved.

Step 12. Record the multimeter's reading in the test record as V_{null}.

Step 13. Calculate the following to three decimal places and record the results in the test record:

$$+\Phi M_{error}\,\% = \frac{70.7 GTN_{\max}}{V_{null}} - 100$$

$$-\Phi M_{error}\,\% = \frac{70.7 GTN_{\min}}{V_{null}} - 100$$

WIDE EXTERNAL ΦM ACCURACY AT 20 GHz

Step 14. Set up the MG369XA as follows:

a. Press Frequency and set the frequency to 20 GHz, then 2.3 GHz, then back to 20 GHz.

b. Press Modulation, then press Mode>.

c. Select Wide, then press <Previous.

d. Press Edit Sensitivity and set the external ΦM sensitivity to 2.40 rad/V.

e. Press On/Off to turn the ΦM mode off.

Step 15. Set up the spectrum analyzer as follows:

a. Press FREQUENCY and set the center frequency to 20 GHz.

b. Press the PEAK SEARCH key, then select MARKER DELTA

Step 16. On the MG369XA, press On/Off to turn the ΦM mode on.

Step 17. Locate the first Bessel null as follows:

a. Adjust the function generator's amplitude in 10 mV increments (within a range of 1.8 to 2.2 V_{p-p} on the function generator's display) such that the MG369XA carrier level is minimized on the spectrum analyzer display.

b. Fine adjust the function generator in 1 mV increments to achieve the absolute minimum carrier level. The Δmarker level should be at least –48 dBc at the first null. Typically, –54 dBc can be achieved.

Step 18. Record the multimeter's reading in the test record as V_{null}.

Step 19. Calculate the following to three decimal places and record the results in the test record:

$$+\Phi M_{error}\,\% = \frac{70.7GTW_{max}}{V_{null}} - 100$$

$$-\Phi M_{error}\,\% = \frac{70.7GTW_{min}}{V_{null}} - 100$$

NARROW EXTERNAL ΦM ACCURACY AT 20 GHz

Step 20. On the MG369XA, press Mode> and select Narrow.

Step 21. Locate the first Bessel null as follows:

a. Adjust the function generator's amplitude in 10 mV increments (within a range of 1.8 to 2.2 V_{p-p} on the function generator's display) such that the MG369XA carrier level is minimized on the spectrum analyzer display.

b. Fine adjust the function generator in 1 mV increments to achieve the absolute minimum carrier level. The Δmarker level should be at least –48 dBc at the first null. Typically, –54 dBc can be achieved.

Step 22. Record the multimeter's reading in the test record as V_{null}.

Step 23. Calculate the following to three decimal places and record the results in the test record:

$$+\Phi M_{error}\,\% = \frac{70.7 GTW_{\max}}{V_{null}} - 100$$

$$-\Phi M_{error}\,\% = \frac{70.7 GTW_{\min}}{V_{null}} - 100$$

WIDE INTERNAL ΦM ACCURACY AT 5 GHz (Options 12 and 23 or Option 25)

Step 24. Disconnect the function generator from the MG369XA's rear panel FM/ΦM IN connector.

Step 25. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.

c. Press the Modulation | ΦM | Internal/External keys to select internal ΦM, then press On/Off to turn the locked internal ΦM mode off.

d. Press Mode> and select Wide, then press <Previous.

e. Press Edit Rate and set it to 99.8 kHz.

f. Press Edit Deviation and set it to 2.40 rad.

Step 26. Set up the spectrum analyzer as follows:

a. Press FREQUENCY and set the center frequency to 5 GHz.

b. Press the PEAK SEARCH key, then select MARKER DELTA.

Step 27. On the MG369XA, press On/Off to turn the locked internal ΦM mode on.

Step 28. Find the first Bessel null by adjusting the ΦM deviation in 0.01 radian increments (within a range of 2.15 to 2.65 rad) such that the carrier level is minimized on the spectrum analyzer display. The Δmarker level should be at least –48 dBc at the first null. Typically, –50 to –54 dBc can be achieved.

Step 29. Record the ΦM deviation setting in the test record as ΦM_{null}.

Step 30. Calculate the following to three decimal places and record the results in the test record:

$$+\Phi M_{error}\,\% = \frac{240GTW_{\max}}{\Phi M_{null}} - 100$$

$$-\Phi M_{error}\,\% = \frac{240GTW_{\min}}{\Phi M_{null}} - 100$$

NARROW INTERNAL ΦM ACCURACY AT 5 GHz (Options 12 and 23 or Option 25)

Step 31. On the MG369XA, press Mode> and select Narrow, then press <Previous.

Step 32. Find the first Bessel null by adjusting the ΦM deviation in 0.01 radian increments (within a range of 2.15 to 2.65 rad) such that the carrier level is minimized on the spectrum analyzer display. The Δmarker level should be at least –48 dBc at the first null. Typically, –50 to –54 dBc can be achieved.

Step 33. Record the ΦM deviation setting as ΦM_{null} in the test record.

Step 34. Calculate the following to three decimal places and record the results in the test record:

$$+\Phi M_{error}\,\% = \frac{240GTN_{\max}}{\Phi M_{null}} - 100$$

$$-\Phi M_{error}\,\% = \frac{240GTN_{\min}}{\Phi M_{null}} - 100$$

WIDE INTERNAL ΦM ACCURACY AT 20 GHz (Options 12 and 23 or Option 25)

Step 35. Set up the MG369XA as follows:

a. Press **Frequency** and set the frequency to 20 GHz, then to 2.3 GHz, then back to 20 GHz.

b. Press **Modulation**, then press Mode> and select Wide.

c. Press <Previous and set the ΦM sensitivity to 2.40 rad/V.

d. Press On/Off to turn the wide internal ΦM mode off.

Step 36. Set up the spectrum analyzer as follows:

a. Press FREQUENCY and set the center frequency to 20 GHz.

b. Press the PEAK SEARCH key, then select MARKER DELTA.

Step 37. Press On/Off to turn the wide internal ΦM mode on.

Step 38. Find the first Bessel null by adjusting the ΦM deviation in 0.01 radian increments (within a range of 2.15 to 2.65 rad) such that the carrier level is minimized on the spectrum analyzer display. The Δmarker level should be at least –48 dBc at the first null. Typically, –50 to –54 dBc can be achieved.

Step 39. Record the ΦM deviation setting as ΦM_{null} in the test record.

Step 40. Calculate the following to three decimal places and record the results in the test record:

$$+\Phi M_{error}\,\% = \frac{240 GTN_{\max}}{\Phi M_{null}} - 100$$

$$-\Phi M_{error}\,\% = \frac{240 GTN_{\min}}{\Phi M_{null}} - 100$$

NARROW INTERNAL ΦM ACCURACY AT 20 GHz (Options 12 and 23 or Option 25)

Step 41. On the MG369XA, press Mode> and select Narrow, then press <Previous.

Step 42. Find the first Bessel null by adjusting the ΦM deviation in 0.01 radian increments (within a range of 2.15 to 2.65 rad) such that the carrier level is minimized on the spectrum analyzer display. The Δmarker level should be at least –48 dBc at the first null. Typically, –50 to –54 dBc can be achieved.

Step 43. Record the ΦM deviation setting as ΦM_{null} in the test record.

Step 44. Calculate the following to three decimal places and record the results in the test record:

$$+\Phi M_{error}\,\% = \frac{240GTN_{\max}}{\Phi M_{null}} - 100$$

$$-\Phi M_{error}\,\% = \frac{240GTN_{\min}}{\Phi M_{null}} - 100$$

Unlocked Narrow FM Accuracy

The unlocked narrow FM accuracy procedure measures the FM accuracy in unlocked narrow FM mode.

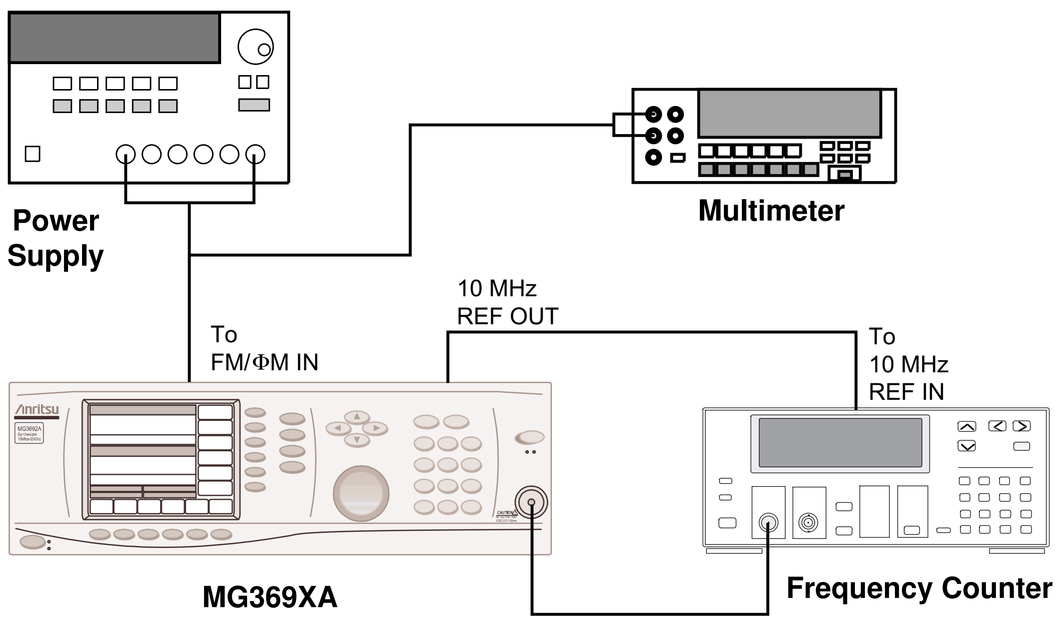


Figure 3-9. *Equipment Setup for FM Accuracy Test in Unlocked Narrow Mode*

Test Setup

Set up the equipment, shown in Figure 3-9, as follows:

Step 1. Connect the RF Output of the MG369XA to Input 1 of the frequency counter.

Step 2. Connect the 10 MHz REF OUT of the MG369XA to the 10 MHz reference input of the frequency counter.

Step 3. Using a BNC tee, connect the +5V output port of the power supply to the input of the multimeter and to the FM/ΦM IN connector of the MG369XA.

Test Procedure

The following procedure lets you verify the external FM accuracy of the MG369XA's RF output.

Step 1. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5.0 GHz.

c. Press Modulation | FM | Internal/External to select external FM.

d. Set the FM mode to unlocked narrow by pressing Mode> | Unlocked Narrow, then press <Previous to return to the External FM Status menu.

e. Set the sensitivity to 10 MHz/V by pressing Edit Sensitivity and enter 10 MHz.

f. Turn the external FM mode on by pressing On/Off.

Step 2. Set the multimeter to measure an AC signal by pressing V AC, then Auto.

Step 3. Set up the power supply for a +1V DC signal (measured on the multimeter).

Step 4. Disconnect the +1V DC signal from the MG369XA's FM/ΦM IN connector.

Step 5. Record the frequency counter's displayed frequency to the fourth decimal place in the test record as FM_{ref}. For example, 4.9982 GHz.

Step 6. Reconnect the +1V DC signal to the MG369XA's FM/ΦM IN connector.

Step 7. Record the frequency counter's displayed frequency to the fourth decimal place in the test record as FM_{mod}. For example, 5.0082 GHz.

Step 8. Calculate the FM accuracy error (FM_{err}) and record the result in the test record as follows:

$$FM_{err} = \left[1 - \left(\frac{FM_{\mathrm{mod}} - FM_{ref}}{0.010}\right)\right] \times 100$$

FM/ΦM Flatness

The FM/ΦM flatness tests verify that the MG369XA's modulated RF output meets specification while in the locked FM mode and in the narrow and wide ΦM modes.

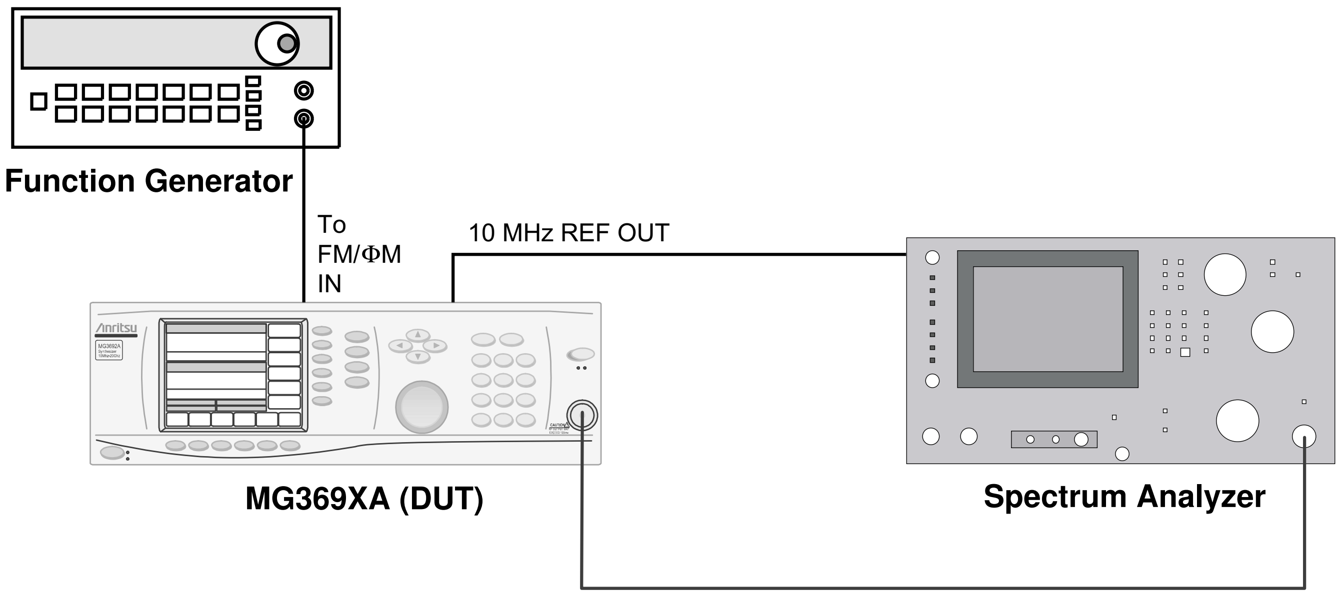


Figure 3-10. *Equipment Setup for Frequency/Phase Modulation Flatness and Bandwidth Tests*

Test Setup

Set up the equipment, shown in Figure 3-10, as follows:

Step 1. Connect the RF Output of the MG369XA to the RF input of the spectrum analyzer.

Step 2. Connect the 10 MHz REF OUT of the MG369XA to the 10 MHz reference input of the spectrum analyzer.

Step 3. Connect the output port of the function generator to the FM/ΦM IN connector of the MG369XA.

Locked FM Flatness

Step 1. Connect the equipment as shown in Figure 3-10.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.

c. Press Modulation | FM | Internal/External to select external FM.

d. Press Edit Sensitivity and set it to 240.5 kHz/V.

Step 3. Set up the Spectrum Analyzer as follows:

a. Press the PRESET key to reset the instrument.

b. Press the FREQUENCY key and enter 5 GHz.

c. Press the AMPLITUDE key and enter +5 dBm, then press LOG dB/DIV and enter 1 dB.

d. Press the BW key and set the RBW and the VBW to 30 Hz.

e. Press the SPAN key and enter 0 MHz.

Step 4. Set up the function generator as follows:

a. Press the ∿ key to select the sine wave function.

b. Press the Freq key and use the rotary knob to adjust the frequency output to 100.0 kHz.

c. Press the Ampl key and use the green Enter Number and enter 0.6364 $V_{rms.}$

> ***NOTE***
> A potential spur exists at 100 kHz, which could affect accuracy. The measurement can be performed with the function generator set to 99.8 kHz.

Step 5. Observe the trace on the spectrum analyzer. It should be just below the top of the screen at about 0 dBm.

Step 6. On the MG369XA, press On/Off to turn the FM mode on. The level on the spectrum analyzer should fall significantly.

Step 7. Find the minimum carrier level on the spectrum analyzer by adjusting the function generator's amplitude in 1 mV increments.

Step 8. Record the function generator's voltage setting in the test record as V_{null}.

Step 9. Calculate the equivalent power level and record the result as P_{null} in the test record as follows:

$$P_{null} = 20 \times Log(V_{null})$$

Step 10. Repeat Steps 7 through 9 for each of the function generator frequency and MG369XA FM sensitivity pairs listed in the test record.

Step 11. Calculate the FM flatness by subtracting each of the P_{null} values from the P_{null} value at the 100 kHz rate and record the results as FM_{flat} in the test record as follows:

$$FM_{flat} = (P_{null} @ xMHz) - (P_{null} @ 100kHz)$$

Narrow ΦM Flatness

Step 1. Connect the equipment as shown in Figure 3-10.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.

c. Press Modulation | ΦM | Internal/External to select external ΦM.

d. Press Mode> | Narrow | <Previous to select the narrow ΦM mode and return to the External ΦM Status menu.

e. Press Edit Sensitivity and set it to 2.405 rad/V.

Step 3. Set up the Spectrum Analyzer as follows:

a. Press the PRESET key to reset the instrument.

b. Press the FREQUENCY key and enter 5 GHz.

c. Press the AMPLITUDE key and enter +5 dBm, then press LOG dB/DIV and enter 1 dB.

d. Press the BW key and set the RBW and the VBW to 30 Hz.

e. Press the SPAN key and enter 0 MHz.

Step 4. Set up the function generator as follows:

a. Press the ∿ key to select the sine wave function.

b. Press the Freq key and use the rotary knob to adjust the frequency output to 100.0 kHz.

c. Press the Ampl key and use the rotary knob to adjust the amplitude to 2.0 $V_{p\text{-}p}$.

> ***NOTE***
> A potential spur exists at 100 kHz, which could affect accuracy. The measurement can be performed with the function generator set to 99.8 kHz.

Step 5. Observe the trace on the spectrum analyzer. It should be just below the top of the screen at about 0 dBm.

Step 6. On the MG369XA, press On/Off to turn the ΦM mode on. The level on the spectrum analyzer should fall significantly.

Step 7. Find the minimum carrier level on the spectrum analyzer by adjusting the function generator's amplitude in 1 mV increments.

Step 8. Record the function generator's voltage setting in the test record as V_{null}.

Step 9. Calculate the power level and record the result as P_{null} in the test record as follows:

$$P_{null} = 20 \times Log(V_{null})$$

Step 10. Repeat Steps 7 through 9 for each of the function generator frequency and FM sensitivity pairs listed in the test record.

Step 11. Calculate the ΦM flatness by subtracting each of the P_{null} values from the P_{null} value at the 100 kHz rate and record the result as ΦM_{flat} in the test record as follows:

$$\Phi M_{flat} = (P_{null} @ xMHz) - (P_{null} @ 100kHz)$$

Wide ΦM Flatness

Step 1. Connect the equipment as shown in Figure 3-10.

Step 2. Set up the MG369XA as follows:

- ***a.*** Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.
- ***b.*** Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.
- ***c.*** Press Modulation | ΦM | Internal/External to select external ΦM.
- ***d.*** Press Mode> | Wide | <Previous to select the wide ΦM mode and return to the External ΦM Status menu.
- ***e.*** Press Edit Sensitivity and set it to 2.405 rad/V.

Step 3. Set up the Spectrum Analyzer as follows:

- ***a.*** Press the PRESET key to reset the instrument.
- ***b.*** Press the FREQUENCY key and enter 5 GHz.
- ***c.*** Press the AMPLITUDE key and enter +5 dBm, then press LOG dB/DIV and enter 1 dB.
- ***d.*** Press the BW key and set the RBW and the VBW to 100 Hz.
- ***e.*** Press the SPAN key and enter 1 kHz.

Step 4. Set up the function generator as follows:

> ***NOTE***
> A potential spur exists at 100 kHz, which could affect accuracy. The measurement can be performed with the function generator set to 99.8 kHz.

- ***a.*** Press the ∿ key to select the sine wave function.
- ***b.*** Press the Freq key and use the rotary knob to adjust the frequency output to 100.0 kHz.
- ***c.*** Press the Ampl key and use the rotary knob to adjust the amplitude to 2.0 V_{p-p}.

Step 5. Observe the trace on the spectrum analyzer. It should be just below the top of the screen at about 0 dBm.

Step 6. On the MG369XA, press On/Off to turn the ΦM mode on. The level on the spectrum analyzer should fall significantly.

Step 7. Find the minimum carrier level on the spectrum analyzer by adjusting the function generator's amplitude in 1 mV increments.

Step 8. Record the function generator's voltage setting in the test record as V_{null}.

Step 9. Calculate the power level and record the result as P_{null} in the test record as follows:

$$P_{null} = 20 \times Log(V_{null})$$

Step 10. Repeat Steps 7 through 9 for each of the function generator frequency and FM sensitivity pairs listed in the test record.

Step 11. Calculate the ΦM flatness by subtracting each of the P_{null} values from the P_{null} value at the 100 kHz rate and record the result as ΦM_{flat} in the test record as follows:

$$\Phi M_{flat} = (P_{null} @\, xMHz) - (P_{null} @ 100kHz)$$

FM/*ΦM *Bandwidth

The FM/ΦM bandwidth tests verify that the MG369XA's modulated RF output meets specification while in the locked and locked low noise FM modes, and in the narrow ΦM mode.

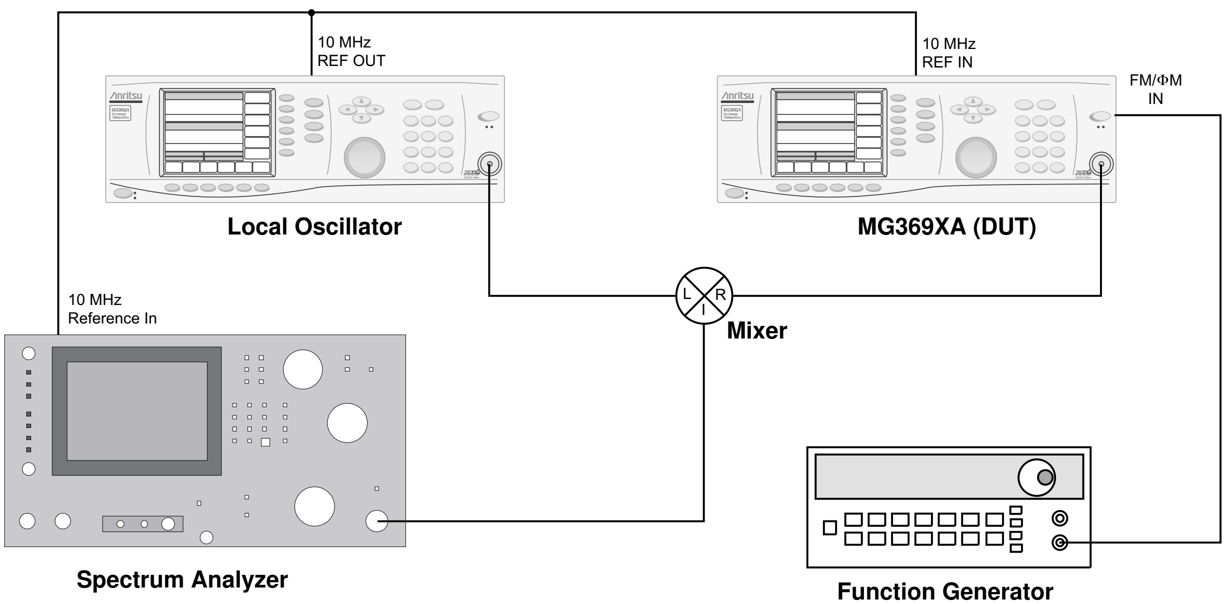


Figure 3-11. *Equipment Setup for Frequency and Phase Modulation Bandwidth Tests*

Test Setup

Connect the equipment, shown in Figure 3-11, as follows:

Step 1. Using a BNC tee, connect the local oscillator's rear panel 10 MHz REF OUT to the MG369XA's 10 MHZ REF IN and to the spectrum analyzer's 10 MHz reference input connectors.

Step 2. Connect the RF output of the local oscillator and the MG369XA to the mixer's L- and R-ports, respectively, then connect the IF output of the mixer to the spectrum analyzer's RF input.

Step 3. Connect the function generator's output to the MG369XA's FM/ΦM IN connector.

Locked FM Bandwidth

Step 1. Connect the equipment as shown in Figure 3-11.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.

c. Press Edit L1 to open the current frequency parameter for editing and set L1 to 10 dBm.

d. Press Modulation | FM | Internal/External to select external FM.

e. Press Mode> | Locked | <Previous to select the locked FM mode and return to the External FM Status menu.

f. Press Edit Sensitivity and set it to 20 MHz/V.

g. Press On/Off to turn the FM mode on.

Step 3. Set up the local oscillator as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5.0012 GHz.

c. Press Edit L1 to open the current frequency parameter for editing and set L1 to 10 dBm.

Step 4. Set up the Spectrum Analyzer as follows:

a. Press the PRESET key to reset the instrument.

b. Press the FREQUENCY key and enter 3.6 MHz.

c. Press the AMPLITUDE key and enter +5 dBm.

d. Press the BW key and set the RBW and the VBW to 30 Hz.

e. Press the SPAN key and enter 100 Hz.

Step 5. Set up the function generator as follows:

a. Press the ∿ key to select the sine wave function.

b. Press the Freq key and use the rotary knob to adjust the frequency output to 10 MHz.

c. Press the Ampl key, then press the green Enter Number key and enter 50 mV_{rms}.

Step 6. Find the minimum level of the third harmonic (3.6 MHz) on the spectrum analyzer by increasing the function generator's amplitude in 10 mV increments, then fine adjust in 1 mV increments to minimize the level.

Step 7. Record the function generator's voltage setting in the test record as V_{BW}.

Locked Low Noise FM Bandwidth

Step 1. Connect the equipment as shown in Figure 3-11.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.

c. Press Edit L1 to open the current frequency parameter for editing and set L1 to 10 dBm.

d. Press Modulation | FM | Internal/External to select external FM.

e. Press Mode> | Locked Low Noise | <Previous to select the locked low noise FM mode and return to the External FM Status menu.

f. Press Edit Sensitivity and set it to 20 MHz/V.

g. Press On/Off to turn the FM mode on.

Step 3. Set up the local oscillator as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5.0012 GHz.

c. Press Edit L1 to open the current frequency parameter for editing and set L1 to 10 dBm.

Step 4. Set up the Spectrum Analyzer as follows:

a. Press the PRESET key to reset the instrument.

b. Press the FREQUENCY key and enter 3.6 MHz.

c. Press the AMPLITUDE key and enter +5 dBm.

d. Press the BW key and set the RBW and the VBW to 30 Hz.

e. Press the SPAN key and enter 100 Hz.

Step 5. Set up the function generator as follows:

a. Press the ∿ key to select the sine wave function.

b. Press the Freq key and use the rotary knob to adjust the frequency output to 10 MHz.

c. Press the Ampl key, then press the green Enter Number key and enter 50 mV_{rms}.

Step 6. Find the minimum level of the third harmonic (3.6 MHz) on the spectrum analyzer by increasing the function generator's amplitude in 10 mV increments, then fine adjust in 1 mV increments to minimize the level.

Step 7. Record the function generator's voltage setting in the test record as V_{BW}.

Narrow ΦM Bandwidth

Step 1. Connect the equipment as shown in Figure 3-11.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5 GHz.

c. Press Edit L1 to open the current frequency parameter for editing and set L1 to 10 dBm.

d. Press Modulation | ΦM | Internal/External to select external ΦM.

e. Press Mode> | Narrow | <Previous to select the narrow ΦM mode and return to the External ΦM Status menu.

f. Press Edit Sensitivity and set it to 2.405 rad/V.

g. Press On/Off to turn the ΦM mode on.

Step 3. Set up the local oscillator as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing and set F1 to 5.0012 GHz.

c. Press Edit L1 to open the current frequency parameter for editing and set L1 to 10 dBm.

Step 4. Set up the Spectrum Analyzer as follows:

a. Press the PRESET key to reset the instrument.

b. Press the FREQUENCY key and enter 3.6 MHz.

c. Press the AMPLITUDE key and enter +5 dBm.

d. Press the BW key and set the RBW and the VBW to 30 Hz.

e. Press the SPAN key and enter 100 Hz.

Step 5. Set up the function generator as follows:

- ***a.*** Press the ∿ key to select the sine wave function.
- ***b.*** Press the Freq key and use the rotary knob to adjust the frequency output to 10 MHz.
- ***c.*** Press the Ampl key, then press the green Enter Number key and enter 50 mV_{rms}.

Step 6. Find the minimum level of the third harmonic (3.6 MHz) on the spectrum analyzer by increasing the function generator's amplitude in 10 mV increments, then fine adjust in 1 mV increments to minimize the level.

Step 7. Record the function generator's voltage setting in the test record as V_{BW}.

Alternate FM and ΦM Accuracy Tests

Frequency modulation measurements are most accurate when made using the "carrier null" technique and referencing the appropriate Bessel function. However, acceptable results can be obtained by using modulation meters, such as the Agilent 8901A (or equivalent), if the proper techniques are used. This section outlines the techniques to be used when making FM measurements using a modulation meter.

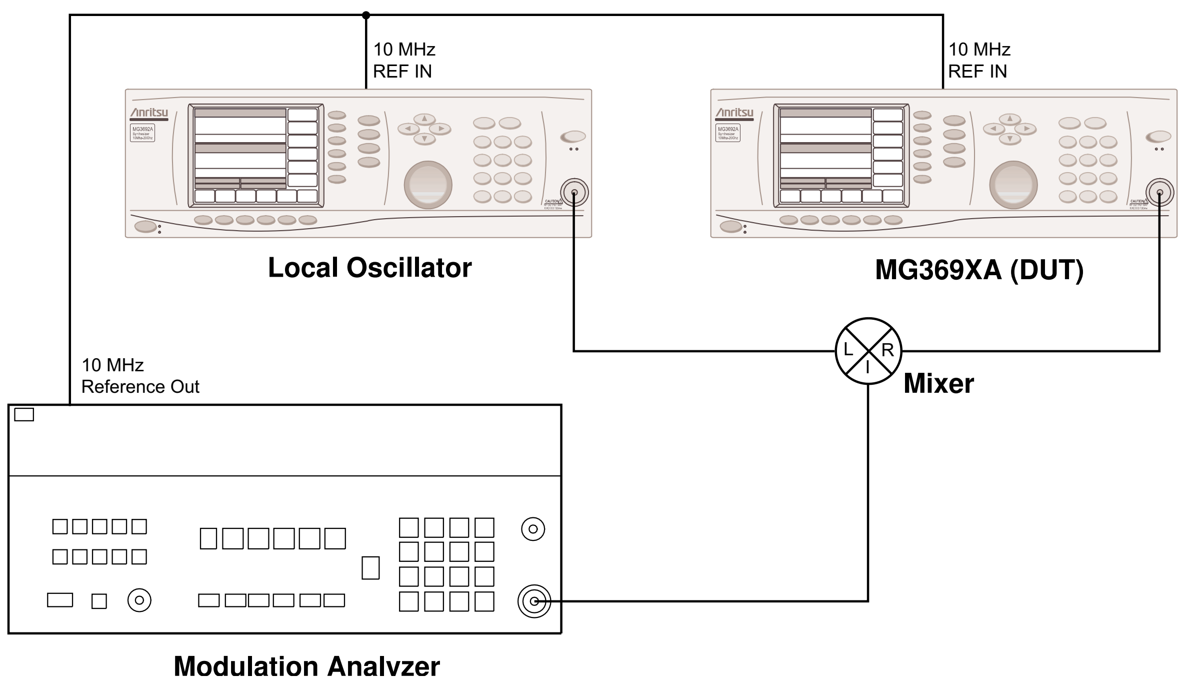


Figure 3-12. *Equipment Setup for Residual FM Tests*

Test Setup

Connect the equipment, shown in Figure 3-12, as follows:

> **NOTE**
> An external mixer with a high quality LO synthesizer is required to measure FM when the carrier is above 1.3 GHz.

Step 1. Using a BNC tee, connect the 10 MHz reference output from the modulation analyzer to the MG369XA's and local oscillator's 10 MHz REF IN connectors.

Step 2. Connect the RF Output from the LO to the L-input on the mixer.

Step 3. Connect the RF Output from the DUT to the R-input on the mixer.

Step 4. Connect the RF input of the modulation analyzer to the I-output from the mixer.

Locked FM Mode On

The following procedure lets you measure FM accuracy with the locked FM mode on (modulation circuits active):

Step 1. Set up the LO as follows:

- ***a.*** Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.
- ***b.*** Press Edit L1 to open the current power level parameter for editing.
- ***c.*** Set L1 to +13 dBm.
- ***d.*** Press Edit F1 to open the current frequency parameter for editing.
- ***e.*** Set F1 to 1800 MHz.

Step 2. Set up the MG369XA as follows:

- ***a.*** Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.
- ***b.*** Press Edit L1 to open the current power level parameter for editing.
- ***c.*** Set L1 to the lesser of +10 dBm or the maximum leveled power level for the instrument being tested (refer to Appendix B, Performance Specifications).
- ***d.*** Press Edit F1 to open the current frequency parameter for editing.
- ***e.*** Set F1 to 2100 MHz.

Step 3. Set up the modulation analyzer as follows:

- ***a.*** Press the FM key to set up an FM measurement.
- ***b.*** Press the AVG key to set averaging mode on.

Step 4. On the DUT, access the FM Status menu by pressing Modulation, then FM.

Step 5. Select external FM by pressing the Internal/External key, if required.

Step 6. Turn on external FM by pressing the On/Off key.

> ***NOTE***
> Ensure that no connection is made to the rear panel FM input.

Step 7. Enter the reading from the modulation analyzer into the test record as N.

Step 8. Turn off external FM by pressing the On/Off key.

Step 9. Select internal FM by pressing the Internal/External key.

Step 10. Edit the deviation to result in a modulation index of three by pressing the Edit Deviation key and entering 300.0 kHz.

Step 11. Turn on internal FM by pressing the On/Off key.

Step 12. Enter the reading from the modulation analyzer into the test record as S + N.

Step 13. Calculate your actual frequency deviation by using the following formula:

$S_{Actual} = (S + N) - N$

In this example, the actual frequency deviation is 300.0 kHz

Step 14. Repeat the measurement for each of the LO and DUT frequency pairs listed in the test record.

Locked Low-Noise FM Mode On

The following procedure lets you measure FM accuracy with the locked low-noise FM mode on (modulation circuits active):

Step 1. Repeat Steps 1 through 8 in the Locked FM Mode On test procedure above.

Step 2. Select internal Locked Low-Noise FM by pressing Internal/External | Mode | Locked Low Noise | < Previous.

Step 3. Edit the deviation to result in a modulation index of three by pressing the Edit Deviation key and entering 300.0 kHz.

Step 4. Turn on internal FM by pressing the On/Off key.

Step 5. Enter the reading from the modulation analyzer into the test record as S + N.

Step 6. Calculate your actual frequency deviation by using the following formula:

$S_{Actual} = (S + N) - N$

In this example, the actual frequency deviation is 300.0 kHz

Step 7. Repeat the measurement for each of the LO and DUT frequency pairs listed in the test record.

Unlocked Narrow FM Mode On

The following procedure lets you measure FM accuracy with the unlocked narrow FM mode on (modulation circuits active):

Step 1. Repeat Steps 1 through 8 in the Locked FM Mode On test procedure above.

Step 2. Select internal unlocked narrow FM by pressing Internal/External | Mode | Unlocked Narrow | < Previous.

Step 3. Turn on internal FM by pressing the On/Off key.

Step 4. Enter the reading from the modulation analyzer into the test record as S + N.

Step 5. Calculate your actual frequency deviation by using the following formula:

$S_{Actual} = (S + N) - N$

In this example, the actual frequency deviation is 300.0 kHz

Step 6. Repeat the measurement for each of the LO and DUT frequency pairs listed in the test record.

Unlocked Narrow ΦM Mode On
The following procedure lets you measure ΦM accuracy with the unlocked narrow ΦM mode on (modulation circuits active):

Step 1. Set up the LO as follows:

- ***a.*** Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.
- ***b.*** Press Edit L1 to open the current power level parameter for editing.
- ***c.*** Set L1 to +13 dBm.
- ***d.*** Press Edit F1 to open the current frequency parameter for editing.
- ***e.*** Set F1 to 1800 MHz.

Step 2. Set up the MG369XA as follows:

- ***a.*** Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.
- ***b.*** Press Edit L1 to open the current power level parameter for editing.
- ***c.*** Set L1 to the lesser of +10 dBm or the maximum leveled power level for the instrument being tested (refer to Appendix B, Performance Specifications).
- ***d.*** Press Edit F1 to open the current frequency parameter for editing.
- ***e.*** Set F1 to 2100 MHz.

Step 3. Set up the modulation analyzer as follows:

- ***a.*** Press the ΦM key to set up an ΦM measurement.
- ***b.*** Press the AVG key to set averaging mode on.

Step 4. On the DUT, access the ΦM Status menu by pressing Modulation, then ΦM.

Step 5. Select external ΦM by pressing the Internal/External key, if required.

Step 6. Turn on external ΦM by pressing the On/Off key.

> ***NOTE***
> Ensure that no connection is made to the rear panel ΦM input.

Step 7. Enter the reading from the modulation analyzer on the test record as N.

Step 8. Turn off external ΦM by pressing the On/Off key.

Step 9. Select internal unlocked narrow ΦM by pressing the Internal/External key.

Step 10. Edit the deviation by pressing the Edit Deviation key and entering 3.0 radians.

Step 11. Turn on internal ΦM by pressing the On/Off key.

Step 12. Enter the reading from the modulation analyzer into the test record as S + N.

Step 13. Calculate your actual phase deviation by using the following formula:

$S_{Actual} = (S + N) - N$

In this example, the actual phase deviation is 3.0 rad.

Step 14. Repeat the measurement for each of the LO and DUT frequency pairs listed in the test record.

Unlocked Wide ΦM Mode On

The following procedure lets you measure ΦM accuracy with the unlocked wide ΦM mode on (modulation circuits active):

Step 1. Repeat Steps 1 through 8 in the Unlocked Narrow ΦM Mode On test procedure above.

Step 2. Select internal unlocked narrow ΦM by pressing Internal/External | Mode | Wide | < Previous.

Step 3. Edit the deviation by pressing the Edit Deviation key and entering 3.0 radians.

Step 4. Turn on internal ΦM by pressing the On/Off key.

Step 5. Enter the reading from the modulation analyzer into the test record as S + N.

Step 6. Calculate your actual phase deviation by using the following formula:

$S_{Actual} = (S + N) - N$

In this example, the actual phase deviation is 3.0 rad.

Step 7. Repeat the measurement for each of the LO and DUT frequency pairs listed in the test record.

3-12 Amplitude Modulation Tests

This procedure verifies the operation of the MG369XA amplitude modulation input sensitivity circuits. The modulated RF output of the MG369XA is down converted and the (modulated) IF is then measured with a modulation analyzer. The actual modulation values are then computed from the modulation analyzer readings. (The absolute AM PK+ and AM PK– readings are used in the given procedures to compensate for non-linearity errors in the test equipment.)

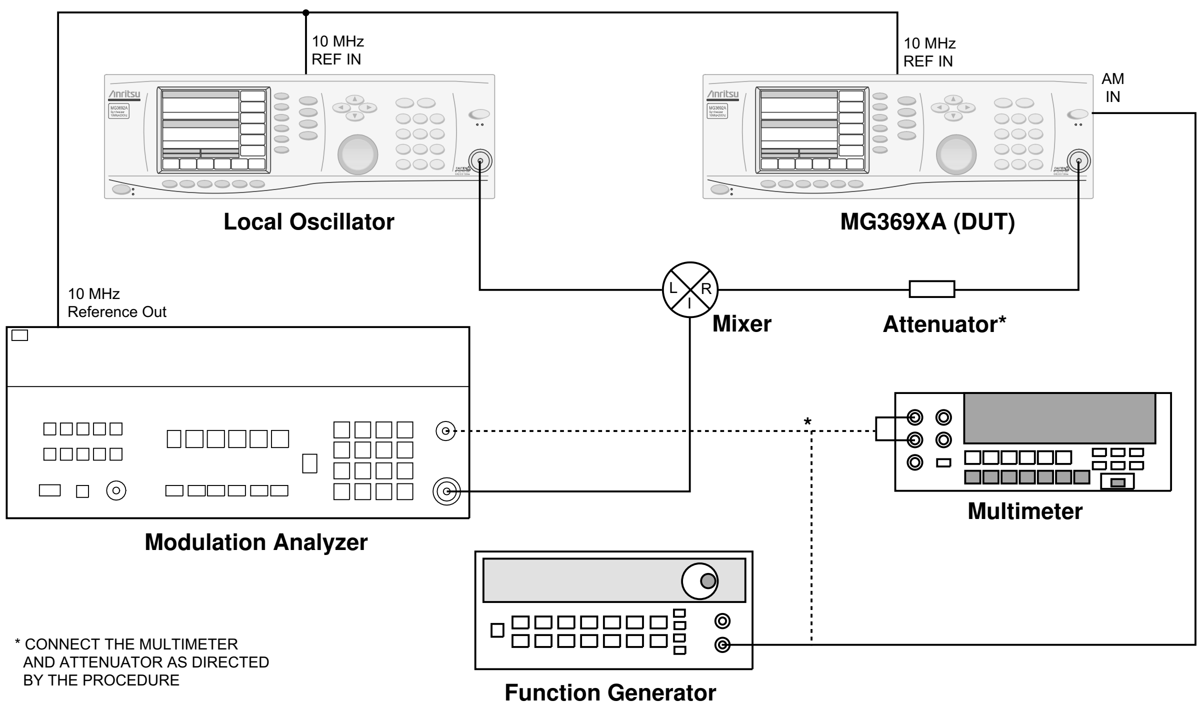


Figure 3-13. *Equipment Setup for Amplitude Modulation Tests*

Test Setup Connect the equipment, shown in Figure 3-13, as follows:

Step 1. Using a BNC tee, connect the rear panel 10 MHz reference output of the modulation analyzer to the MG369XA's and local oscillator's 10 MHz REF IN connectors.

Step 2. Connect the RF output of the local oscillator and the MG369XA to the mixer's L- and R-ports, respectively, then connect the IF output of the mixer to the modulation analyzer's RF input.

Step 3. Using a BNC tee, connect the function generator output to the AM IN connector of the MG369XA and to the multimeter input.

External AM Accuracy

The following procedure lets you measure the absolute peak external AM values for a 50% AM signal at 6 dB below maximum rated output power and calculate the modulation index.

Step 1. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable DUT frequency listed in the test record.

d. Press Edit L1 to open the current level parameter for editing.

e. Set L1 to 6 dB below the maximum rated leveled power for the full band (lowest of the maximum rated power levels) for the instrument being tested (refer to Appendix B, Performance Specifications).

f. Press Modulation, then Internal/External to select external AM.

g. Press Log/Linear to select linear modulation.

h. Press Edit Sensitivity and set the AM sensitivity to 50%.

Step 2. Connect attenuation for the following output power conditions:

- ❑ For L1 < 0 dBm: 6 dB attenuation
- ❑ For 0 ≤ L1 ≤ 3 dBm: 10 dB attenuation
- ❑ For 3 < L1 ≤ 13 dBm: 20 dB attenuation
- ❑ For 13 < L1 ≤ 20 dBm: 26 dB attenuation

Step 3. Set up the local oscillator as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable LO frequency listed in the test record.

d. Press Edit L1 to open the current level parameter for editing and set L1 to 13 dBm.

Step 4. Set the multimeter to measure an AC signal by pressing V AC, then Auto.

Step 5. Set up the function generator as follows:

a. Press the ∿ (sine wave) key, then the Freq key and adjust the frequency to 1 kHz using the rotary knob.

b. Press the Ampl key and adjust the voltage to 0.7071 V_{rms} using the rotary knob (read on the multimeter).

Step 6. Set up the modulation analyzer as follows:

a. Press the HP Filter 300 Hz key to set the high pass filter to 300 Hz.

b. Press the LP Filter 15 kHz key to set the low pass filter to 15 kHz.

c. Press AM, PK+, then PEAK HOLD to obtain a positive peak AM reading (Pk1).

d. Press AM, PK–, then PEAK HOLD to obtain a negative peak AM reading (Pk2).

Step 7. Calculate the modulation index (M) from the above values as follows:

$$M = \frac{Pk1 + Pk2}{200 + Pk1 - Pk2} \times 100$$

Step 8. Record the calculated result as M in the test record.

Step 9. Repeat the measurement for each of the local oscillator and MG369XA CW frequency pairs listed in the test record.

Internal AM Accuracy The following procedure (for instruments with Options 14 and 23 or Option 25 only) lets you measure the absolute peak internal AM values for a 50% AM signal at 6 dB below maximum rated output power and calculate the modulation index.

Step 1. Set up the equipment as shown in Figure 3-13.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable frequency in the test record.

d. Press Edit L1 to open the current level parameter for editing.

e. Set L1 to 6 dB below the maximum rated leveled power for the full band (lowest of the maximum rated power levels) for the instrument being tested (refer to Appendix B).

f. Press Modulation, then Internal/External to select internal AM.

g. Press Log/Linear to select linear modulation.

h. Press Edit Depth and set the AM depth to 50%.

i. Press Edit Rate and set the AM rate to 1 kHz.

Step 3. Connect attenuation for the following output power conditions:

- ❑ For L1 < 0 dBm: 6 dB attenuation
- ❑ For 0 ≤ L1 ≤ 3 dBm: 10 dB attenuation
- ❑ For 3 < L1 ≤ 13 dBm: 20 dB attenuation
- ❑ For 13 < L1 ≤ 20 dBm: 26 dB attenuation

Step 4. Set up the local oscillator as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable LO frequency listed in the test record.

d. Press Edit L1 to open the current level parameter for editing and set L1 to 13 dBm.

Step 5. Disconnect the function generator from the MG369XA's AM IN connector.

Step 6. Set up the modulation analyzer as follows:

a. Press the HP Filter 300 Hz key to set the high pass filter to 300 Hz.

b. Press the LP Filter 15 kHz key to set the low pass filter to 15 kHz.

c. Press AM, PK+, then PEAK HOLD to obtain a positive peak AM reading (Pk1).

d. Press AM, PK–, then PEAK HOLD to obtain a negative peak AM reading (Pk2).

Step 7. Calculate the modulation index (M) from the above values as follows:

$$M = \frac{Pk1 + Pk2}{200 + Pk1 - Pk2} \times 100$$

Step 8. Record the calculated result as M in the test record.

Step 9. Repeat the measurement for each of the local oscillator and MG369XA CW frequency pairs listed in the test record.

AM Roll Off The following procedure lets you measure the AM roll off of the external AM signal at 6 dB below maximum rated output power.

Step 1. Set up the equipment as shown in Figure 3-13.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing **SYSTEM**, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable DUT frequency listed in the test record.

d. Press Edit L1 to open the current level parameter for editing.

e. Set L1 to 6 dB below the maximum rated leveled power for the full band (lowest of the maximum rated power levels) for the instrument being tested (refer to Appendix B, Performance Specifications).

f. Press **Modulation**, then Internal/External to select external AM.

g. Press Log/Linear to select linear modulation.

h. Press Edit Sensitivity and set the AM sensitivity to 50%.

Step 3. Connect the attenuator for the following output power conditions:

- ❑ For L1 < 0 dBm: 6 dB attenuation
- ❑ For 0 ≤ L1 ≤ 3 dBm: 10 dB attenuation
- ❑ For 3 < L1 ≤ 13 dBm: 20 dB attenuation
- ❑ For 13 < L1 ≤ 20 dBm: 26 dB attenuation

Step 4. Set up the local oscillator as follows:

a. Reset the instrument by pressing **SYSTEM**, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable LO frequency listed in the test record.

d. Press Edit L1 to open the current level parameter for editing and set L1 to 13 dBm.

Step 5. Set the multimeter to measure an AC signal by pressing V AC, then Auto.

Step 6. Set up the function generator as follows:

a. Press the ∿ (sine wave) key, then the Freq key and adjust the frequency to 1 kHz using the rotary knob.

b. Press the Ampl key and adjust the voltage to 0.7071 V_{rms} with the rotary knob (read on the multimeter).

Step 7. Connect the multimeter to the modulation analyzer's demodulated output port and press AM.

Step 8. Record the multimeter's AC voltage value as V_1 in the test record.

Step 9. Set the function generator to 50 kHz and record the multimeter's AC voltage value as V_{50} in the test record.

Step 10. Calculate the AM roll off and record the result in the test record as AM_{ro} using the following equation:

$$AM_{ro} = 20 \times \log\left(\frac{V_{50}}{V_1}\right)$$

Step 11. Repeat Steps 6 through 10 for each of the MG369XA and local oscillator CW frequency pairs listed in the test record.

AM Flatness The following procedure lets you measure the AM flatness of the external AM signal at 6 dB below maximum rated output power from 10 Hz to 10 kHz rates.

Step 1. Set up the equipment as shown in Figure 3-13.

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable DUT frequency listed in the test record.

d. Press Edit L1 to open the current level parameter for editing.

e. Set L1 to 6 dB below the maximum rated leveled power for the full band (lowest of the maximum rated power levels) for the instrument being tested (refer to Appendix B, Performance Specifications).

f. Press Modulation then Internal/External to select external AM.

g. Press Log/Linear to select linear modulation.

h. Press Edit Sensitivity and set the AM sensitivity to 50%.

Step 3. Connect the attenuator for the following output power conditions:

- For L1 < 0 dBm: 6 dB attenuation
- For 0 ≤ L1 ≤ 3 dBm: 10 dB attenuation
- For 3 < L1 ≤ 13 dBm: 20 dB attenuation
- For 13 < L1 ≤ 20 dBm: 26 dB attenuation

Step 4. Set up the local oscillator as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable LO frequency listed in the test record.

d. Press Edit L1 to open the current level parameter for editing and set L1 to 13 dBm.

Step 5. Set up the multimeter to measure an AC signal by pressing V AC, then Auto.

Step 6. Set up the function generator as follows:

a. Press the ∿ (sine wave) key, then the Freq key and adjust the frequency to 10 Hz using the rotary knob.

b. Press the Ampl key and adjust the voltage to 0.7071 V_{rms} using the rotary knob (read on the multimeter).

Step 7. Connect the multimeter to the modulation analyzer's demodulated output port and press AM.

Step 8. Record the measured AC voltage value on the multimeter as V_0 in the test record.

Step 9. Repeat Steps 6 through 8 for each of the following function generator frequencies and record the results in the respective column in the test record:

V_1 = 1 kHz
V_2 = 2 kHz
V_3 = 3 kHz
V_4 = 4 kHz
V_5 = 5 kHz
V_6 = 6 kHz
V_7 = 7 kHz
V_8 = 8 kHz
V_9 = 9 kHz
V_{10} = 10 kHz

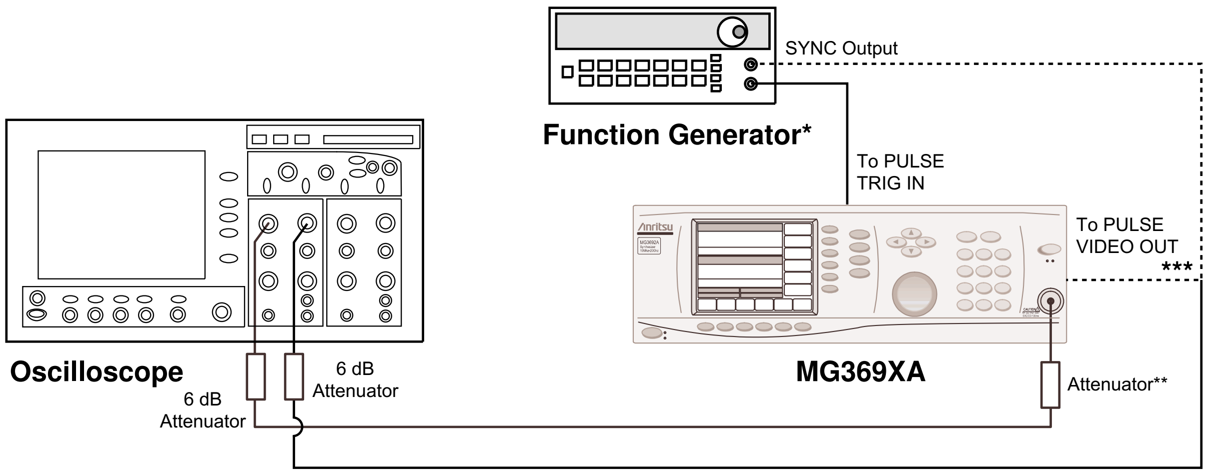
Step 10. Find the maximum (V_{max}) and minimum (V_{min}) voltage values for V_x and calculate the AM flatness (AM_{flat}) using the following equation:

$$AM_{flat} = 20 \times \log\left(\frac{V_{max}}{V_{min}}\right)$$

Step 11. Repeat Steps 8 through 10 for each of the MG369XA and local oscillator CW frequency pairs listed in the test record.

3-13 Pulse Modulation Tests

The pulse modulation tests verify the operation of the pulse modulation circuits in the MG369XA. Rise time, fall time, overshoot, and power accuracy of the pulsed RF output are verified using a high speed digital sampling oscilloscope. Pulse depth (on/off ratio) is measured using a spectrum analyzer.



* The function generator is only required if the MG369XA does not have Option 24.
** Connect the attenuator as specified in the procedure.
*** Connect the PULSE VIDEO OUT from the MG369XA or the SYNC output from the function generator as appropriate.

Figure 3-14. *Equipment Setup for the Pulse Modulation Tests*

Test Setup Connect the equipment, shown in figure 3-14, as follows:

Step 1. Using the 2.4 mm (f) to K (f) adapters, connect a 6 dB fixed attenuator to the oscilloscope's Channel 1 and Trigger inputs.

Step 2. Connect a RF coaxial cable to the 6 dB attenuator at the oscilloscope's Channel 1 input.

Step 3. For models without Option 24 or 25, use a BNC to SMA adapter to connect a 50Ω BNC cable from the function generator's SYNC output to the 6 dB attenuator at the oscilloscope's Trigger input.

Step 4. For models with Option 24 or 25, use a BNC to SMA adapter to connect a 50Ω BNC cable from the MG369XA's PULSE VIDEO OUT to the 6 dB attenuator at the oscilloscope's Trigger input.

Step 5. For models without Option 24 or 25, connect a 50Ω BNC cable from the function generator's signal output to the MG369XA's rear panel PULSE TRIG IN connector.

Step 6. Set up the oscilloscope as follows:

a. Press the Default Setup key.

b. From the title bar, select:
Measure | Math | Function 1

c. Set the operator to MAX and turn on the Function 1 display.

d. Select Close to close the open window.

e. Select the Trigger Level button on the bottom of the display.

f. Set the trigger level to 500 mV.

g. Set the bandwidth to DC to 2.5 GHz.

h. Select rising edge (⎍) triggering.

i. Select the left module as the source.

j. Select Close to close the open window.

k. Turn off channel 1 on the oscilloscope by pressing the 1 key above the module (LED off).

Step 7. For models without Option 24 or 25, set up the function generator as follows:

a. Turn the function generator off, then back on to reset the instrument.

b. Press the ⎍⎽ key to select the square wave function.

c. Press the Freq key, then the green Enter Number key and enter 250 kHz.

d. Press the blue Shift key, then the %Duty Cycle key and use the rotary knob to adjust the duty cycle to 25%.

e. Press the Ampl key, then the green Enter Number key and enter 2.2 Vp-p.

f. Press the Offset key, then the green Enter Number key and enter 1.1 Vrms.

Rise Time, Fall Time and Overshoot

The following procedure lets you measure the rise time, fall time, and overshoot of the MG369XA's pulse modulated RF output.

Rise Time

Step 1. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable frequency in the test record plus a 1 Hz offset.

d. Press Level to open the current power level parameter for editing.

e. Set L1 to the maximum specified leveled output power level for the instrument being tested (refer to Appendix B, Performance Specifications).

MG369XA Rated Power	Required Attenuation
≥18 dBm	20 dB
≥13 dBm	10 dB
≥10 dBm	6 dB
≥8 dBm	3 dB
<8 dBm	0 dB

f. Connect a fixed attenuator with the proper attenuation value (refer to the table at the left) to the MG369XA RF Output, then connect the RF coaxial cable from the Channel 1 input of the oscilloscope to the fixed attenuator.

g. For models without Option 24 or 25:

(1) Press Modulation | Pulse | Internal/External to select the External Pulse Status menu.

(2) Ensure that the polarity is set to High RF On.

(3) Press On/Off to turn the external pulse on.

Step 2. For models with Option 24 or 25:

(1) Press Modulation | Pulse | Internal/External to select the Internal Pulse Status menu.

(2) Press Edit Period and enter 1 ms.

(3) Press More> | Wdth/Dly List... | Edit Selected and enter 1 μs.

(4) Press Previous, then On/Off to turn the internal pulse mode on.

Step 3. Set up the oscilloscope as follows:

a. Select the Time/Delay button on the bottom of the display.

b. Set the sweep time to 10 ns/div

c. Press the Clear Display key. Allow the oscilloscope to sample the signal and wait for a clearly defined waveform to appear on the display.

d. Select the Scale button at the lower left corner of the display.

e. Set the scale and offset voltages so that the positive peak of the pulse is centered and the amplitude is optimally displayed.

f. Select the Rise Time button (on the left hand side of the display).

Step 4. Read the measured result from the bottom of the display and enter the result in the test record.

Fall Time

Step 5. Set up the oscilloscope as follows:

a. Select the Time/Delay button on the bottom of the display.

b. Set the delay time to 1 μs

c. Press the Clear Display key. Allow the oscilloscope to sample the signal and wait for a clearly defined waveform to appear on the display.

d. Select the Fall Time button (on the left hand side of the display).

Step 6. Read the measured result from the bottom of the display and enter the result in the test record.

Overshoot

Step 7. Set up the oscilloscope as follows:

a. Select the Time/Delay button on the bottom of the display.

b. Set the sweep time to 120 ns/div.

c. Press the Clear Display key. Allow the oscilloscope to sample the signal and wait for a clearly defined waveform to appear on the display.

d. Select the Amplitude button, then the Overshoot button (on the left hand side of the display).

Step 8. Read the measured result from the bottom of the display and enter the result in the test record.

Step 9. Repeat the measurements for each frequency listed in the test record.

Pulse Power Accuracy

The following procedure lets you measure the pulse power accuracy of the MG369XA's pulse modulated RF Output. The accuracy is tested with a 1 μS and a 0.5 μS pulse width.

Step 1. Set up the equipment as described on page 3-92.

Step 2. Set up the oscilloscope as follows:

a. Press the Default Setup key.

b. Select: Measure | Math | Function 1.

c. Set the operator to MAX and turn on the Function 1 display.

d. Select Close to close the open window.

e. Select the Trigger Level button on the bottom of the display.

f. Set the trigger level to 500 mV.

g. Set the bandwidth to DC to 2.5 GHz.

h. Select rising edge (⌠) triggering.

i. Select the left module as the source.

j. Select Close to close the open window.

k. Turn off channel 1 on the oscilloscope by press the 1 key above the module (LED off).

Step 3. For models without Option 24 or 25, set up the function generator as follows:

a. Turn the function generator off , then back on to reset the instrument.

b. Press the ⊓⊔ key to select the square wave function.

c. Press the Freq key, then the green Enter Number key and enter 250 kHz.

d. Press the blue Shift key, then the %Duty Cycle key and use the rotary knob to adjust the duty cycle to 25%.

e. Press the Ampl key, then the green Enter Number key and enter 2.2 Vp-p.

f. Press the Offset key, then the green Enter Number key and enter 1.1 Vrms.

MG369XA Rated Power	Required Attenuation
≥18 dBm	20 dB
≥13 dBm	10 dB
≥10 dBm	6 dB
≥8 dBm	3 dB
<8 dBm	0 dB

Step 4. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first applicable frequency in the test record plus a 1 Hz offset.

d. Press Level to open the current power level parameter for editing.

e. Set L1 to the maximum specified leveled output power level for the instrument being tested (refer to Appendix B, Performance Specifications).

f. Connect a fixed attenuator with the proper attenuation value (refer to the table at the left) to the MG369XA RF Output and then connect the RF coaxial cable from the Channel 1 Input of the Oscilloscope to the fixed attenuator.

g. For models without Option 24 or 25:

(1) Press Modulation | Pulse | Internal/External to select the External Pulse Status menu.

(2) Ensure that the polarity is set to High RF On.

(3) Press On/Off to turn the external pulse on.

Step 5. For models with Option 24 or 25:

(1) Press Modulation | Pulse | Internal/External to select the Internal Pulse Status menu.

(2) Press Edit Period and enter 1 ms.

(3) Press More> | Wdth/Dly List... | Edit Selected and enter 1 μs.

(4) Press Previous, then On/Off to turn the internal pulse mode on.

Step 6. Set up the oscilloscope as follows:

a. Select the Scale button at the lower left corner of the display and set the scale to 20 mV/div.

b. Set the Offset so that the trace is centered on the display.

c. Select the Amplitude button and then the Vavg button (on the left hand side of the display). Note: Use the scroll bar to locate the Vavg button.

Step 7. Read the measured result on the display and record the result as V_{ref} in the test record.

Step 8. On the MG369XA, press On/Off to turn pulse modulation on.

Step 9. Set up the oscilloscope as follows:

a. Press the Clear display key. Allow the oscilloscope to sample the signal and wait for a clearly defined waveform to appear on the display.

b. Set the sweep time and the delay time so that only the positive peak portion of the pulse fills the display (for example, set the sweep time to 90 ns/div and the delay time to 75 ns for a 1 µs pulse).

c. Select the Vavg button and read the measured result on the display.

Step 10. Record the result as V_{pulse} in the test record.

Step 11. Calculate the difference of the two voltages using the following equation, then record the result in the test record as $P_{accuracy}$.

$$P_{accuracy} = 20 \times Log\left(\frac{V_{pulse}}{V_{ref}}\right)$$

Step 12. Repeat the measurements for each frequency listed in the test record.

Step 13. For models without Option 24 or 25, repeat the test using a function generator square wave frequency input of 500 kHz with a 25% duty cycle.

Step 14. For models with option 24 or 25, repeat the test using a pulse width of 0.5 µs.

Pulse On/Off Ratio

The following procedure lets you measure the pulse on/off ratio of the MG369XA's pulse modulated RF output.

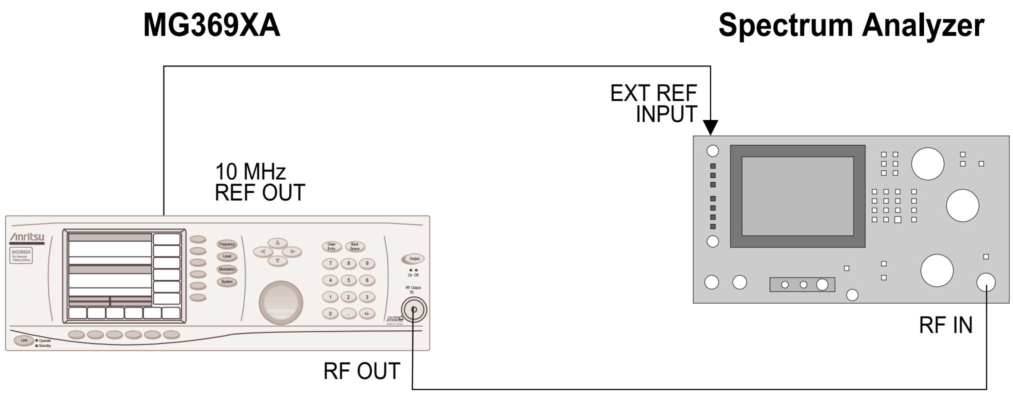


Figure 3-15. *Equipment Setup for Pulse On/Off Ratio Tests*

Test Setup

Set up the equipment, shown in Figure 3-15, as follows:

Step 1. Connect the MG369XA's rear panel 10 MHz REF OUT to the spectrum analyzer's external reference input.

Step 2. Connect the MG369XA RF Output to the spectrum analyzer's RF input.

Test Procedure

Measure the pulse on/off ratio as follows:

Step 1. Set up the MG369XA as follows:

- ***a.*** Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.
- ***b.*** Press Edit F1 to open the current frequency parameter for editing.
- ***c.*** Set F1 to the first applicable frequency in the test record for the model being tested.
- ***d.*** Press Level to open the current power level parameter for editing and set L1 to the maximum specified leveled output power level.
- ***e.*** Press Modulation, then Pulse to select the External Pulse Status menu.
- ***f.*** Press Low RF On and ensure that the pulse mode is turned off.

Step 2. Set up the spectrum analyzer as follows:

- ***a.*** Press the PRESET key.
- ***b.*** Press the AMPLITUDE key and enter the current power level setting of the MG369XA.
- ***c.*** Press the FREQUENCY key and enter the current frequency setting of the MG369XA.
- ***d.*** Press the SPAN key and enter 100 kHz.
- ***e.*** Press the MKR key, then select MARKER DELTA to set the marker reference.

Step 3. On the MG369XA's External Pulse Status menu, select On/Off to turn the pulse mode on.

Step 4. On the spectrum analyzer, read the marker delta value and record the value as P_{depth} in the test record.

Step 5. Repeat the test for each frequency listed in the test record.

> ***NOTE***
>
> The signal level may drift slowly after the pulse mode is turned on. (Make the measurement as soon as possible after turning the pulse mode on.) This drift is the result of the Sample/Hold circuit not holding the level because of a very low pulse duty factor (time ratio of RF ON to RF OFF). This drift will not be present in normal pulse operation as the minimum pulse repetition rate is 100 Hz.

Chapter 4
Calibration

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Table of Contents (Continued)

Chapter 4
Calibration

4-1 Introduction

This chapter contains procedures for calibrating the series MG369XA Synthesized Signal Generators. These procedures are typically performed because out-of-tolerance conditions have been noted during performance verification testing (see Chapter 3) or as a result of replacement of subassemblies or RF components.

> ***NOTE***
> The calibration procedures herein support operating firmware version 1.00 and above. It is recommended that you upgrade your instrument's operating firmware to the latest available version prior to calibration. Contact Anritsu customer service for more information.

4-2 Recommended Test Equipment

Table 4-1, on the following page, provides a list of the recommended test equipment for these calibration procedures.

The procedures refer to specific test equipment front panel control settings when the test setup is critical to making accurate measurements. In some cases, the user may substitute test equipment having the same critical specifications as those on the recommended test equipment list.

Contact your local Anritsu service center (refer to Table 6-4 on page 6-24) if you need clarification of any equipment or procedural reference.

4-3 Test Records

A blank copy of a sample calibration test record for each MG369XA model is provided in Appendix A. It provides a means for maintaining an accurate and complete record of instrument calibration. We recommend that you copy these pages and use them to record your calibration of out-of-tolerance MG369XA circuits or your calibration of the MG369XA following replacement of subassemblies or RF components.

4-4 Subassembly Replacement

Table 4-2, on the following page, lists the calibrations that should be performed following the replacement of many MG369XA subassemblies or RF components.

4-5 Connector and Key Notation

The calibration procedures include many references to equipment interconnections and control settings. For all MG369XA references, specific labels are used to denote the appropriate menu key, data entry key, data entry control, or connector (such as CW/SWEEP SELECT or RF OUTPUT). Most references to supporting test equipment use general labels for commonly used controls and connections (such as Span or RF Input). In some cases, a specific label is used that is a particular feature of the test equipment listed in Table 4-1.

Table 4-1. *Recommended Test Equipment for Calibration Procedures*

INSTRUMENT	CRITICAL SPECIFICATION	RECOMMENDED MANUFACTURER/MODEL	PROCEDURE NUMBER
Frequency Counter	*Frequency Range:* 1 to 40 GHz *Input Impedance:* 50Ω *Resolution:* 1 Hz	Anritsu, Model MF2414B	4-7
Frequency Reference	*Frequency:* 10 MHz *Accuracy:* 5×10^{-12} parts/day	Absolute Time Corp., Model 300	4-7
Scalar Network Analyzer, with RF Detector	*Frequency Range:* 0.01 to 40 GHz	Anritsu Model 56100A, with RF Detector: 560-7K50 (0.01 to 40 GHz) 560-7VA50 (0.01 to 50 GHz)	4-8
Attenuators (40 GHz models) or Attenuator (>40 GHz models)	*Frequency Range:* DC to 40 GHz *Max Input Power:* >+19 dBm *Attenuation:* 10 dB *Frequency Range:* DC to 60 GHz *Max Input Power:* >+12 dBm *Attenuation:* 10 dB	Anritsu, Model 41KC-10 Anritsu, Model 41VC-10	4-8
Personal Computer	*PC Configuration:* IBM AT or compatible *Operating System:* Windows 95, or 98 *Accessories:* Mouse	Any common source	All procedures
Serial Interface Assembly	Provides serial interface between the PC and the MG369XA	Anritsu P/N: T1678	All procedures
Cables	*Connectors:* 50Ω BNC	Any common source	4-7, 4-8, 4-9

Table 4-2. Calibration Following Subassembly/RF Component Replacement

Subassembly/RF Component Replaced	Perform the Following Calibration(s) in Section(s):
Front Panel Assembly	None
A2 Microprocessor PCB	4-7 thru 4-10
A3 Reference Loop PCB	4-7
A4 Coarse Loop PCB	4-7
A5 Auxiliary PCB	None
A6 ALC PCB	4-8, 4-9, 4-10
A7 YIG Lock PCB	None
A8 DDS PCB	4-9
A9 YIG PCB ASSEMBLY	4-7, 4-9
Power Supply	None
0.01 to 2.2 GHz Digital Down Converter Assembly	4-9
0.01 to 2 GHz Down Converter Assembly	4-8, 4-9, 4-10
Switched Filter Assembly	4-8, 4-9, 4-10
Switched Doubler Module	4-8, 4-9, 4-10
Source Quadrupler Module	4-8, 4-9, 4-10
Diplexing Switch	4-8, 4-9, 4-10
Directional Coupler	4-8, 4-9, 4-10
Step Attenuator	4-8, 4-9, 4-10
RF Output Connector	4-8, 4-9, 4-10

4-6 Initial Setup

The MG369XA is calibrated using an IBM compatible PC and external test equipment. The PC must have the Windows 95/98/ME or the Windows NT/2000 operating system installed and be equipped with a mouse. Initial setup consists of interfacing the PC to the MG369XA.

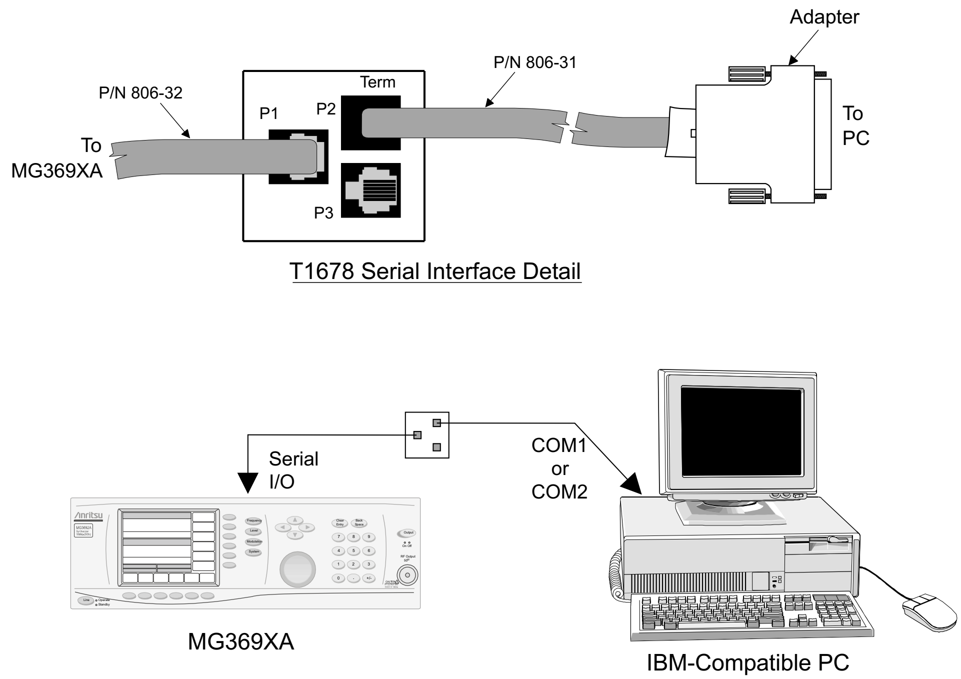


Figure 4-1. *PC to MG369XA Interconnection for Calibration*

Interconnection Using an Anritsu serial interface assembly (P/N: T1678), connect the PC to the MG369XA as follows:

Step 1. Connect the wide flat cable between the MG369XA rear panel SERIAL I/O connector and the P1 connector on the T1678 serial interface PCB.

Step 2. Connect the narrow flat cable between the P2 (TERM) connector on the T1678 serial interface PCB and the COM1 or COM2 connector on the PC. Use the RJ11-to-DB-9 or RJ11-to-B-25 adapter, provided with the T1678 serial interface assembly, to make the connection at the PC.

PC Setup

Configure the PC with the Windows operating system to interface with the MG369XA as follows:

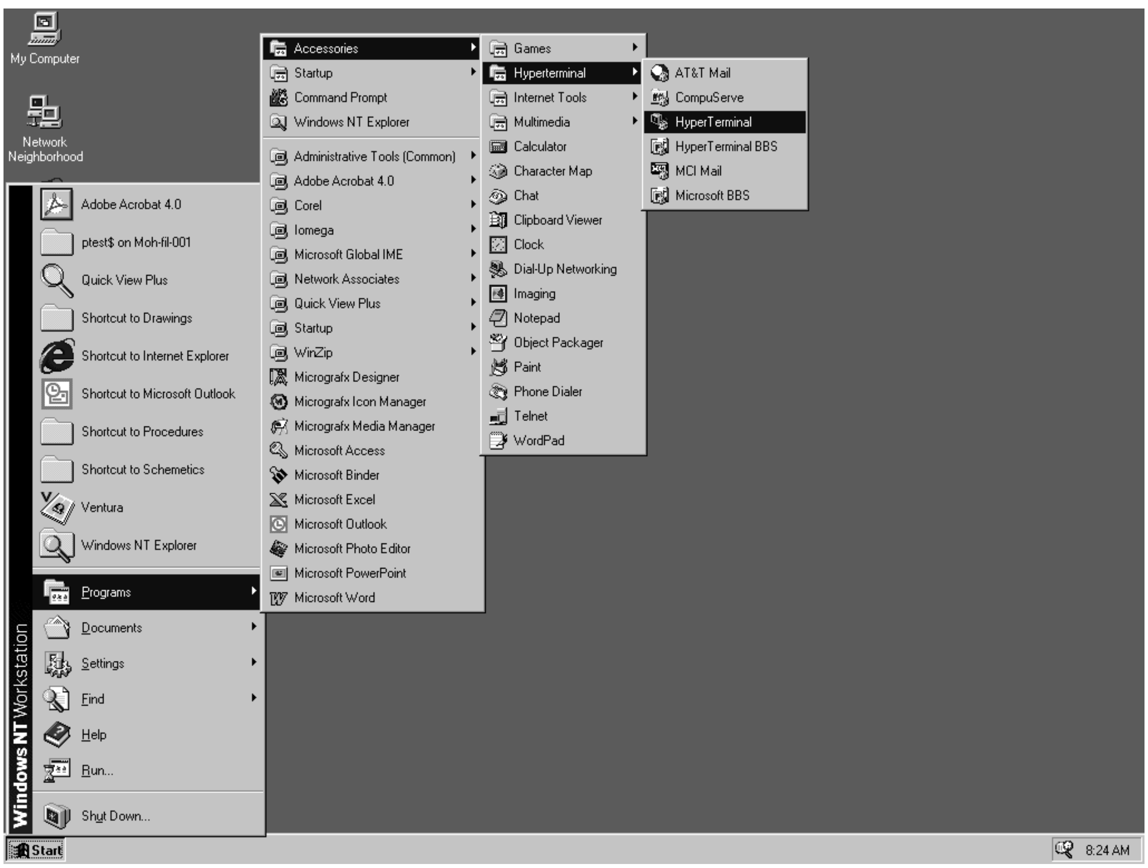
> ***NOTE***
> HyperTerminal may also appear under the Communications menu located on teh Accessories menu.
>
> If HyperTerminal is not present, it will need installation from the Windows Setup CD.

Step 1. Power up the MG369XA.

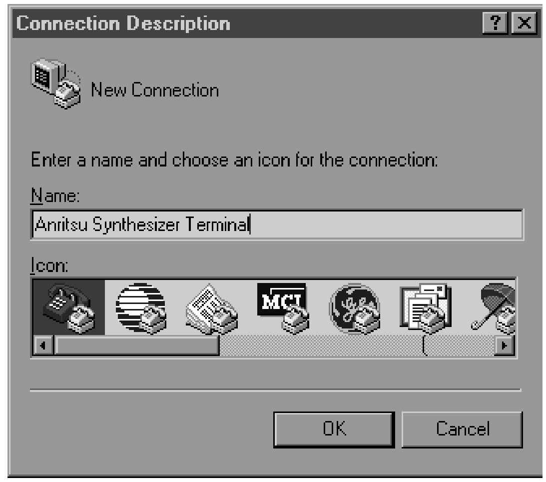
Step 2. Power up the PC in the Windows operating system.

Step 3. Go to Start/Programs/Accessories to highlight the HyperTerminal menu.

Step 4. Select HyperTerminal to bring up the selection window (below).



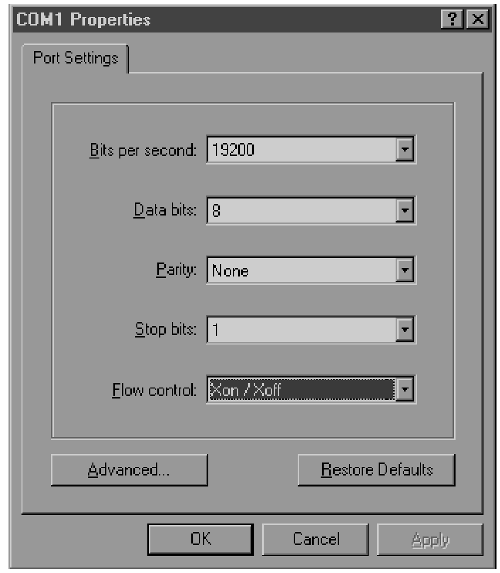
Step 5. Click on HyperTerminal (Hyperterm.exe) to bring up the New Connection window, below.



Step 6. In the Connection Description box, type a name for the new connection, then click on the OK button. The window below is now displayed.

Step 7. In the Connect using: box, type or select: **Direct to Com "_"** (Enter the number of the communications port being used, for example: Com 1).

Step 8. Click OK. The Communications Port Properties window is displayed.



Step 9. In the Properties window, make the following selections:

Bits per second	19200
Data bits	8
Parity	None
Stop bits	1
Flow control	Xon / Xoff

Step 10. After making the selections, click on the OK button.

Step 11. Press <ENTER> on the keyboard.

Step 12. Verify that the **$** prompt appears on the PC display.

Step 13. This completes the initial setup for calibration.

4-7 Preliminary Calibration

This procedure provides the steps necessary to initially calibrate the coarse loop, fine loop, frequency instruction, internal DVM circuitry and the 10 MHz reference oscillator of the MG369XA. If Option 16 is installed, the 10 MHz reference oscillator is calibrated.

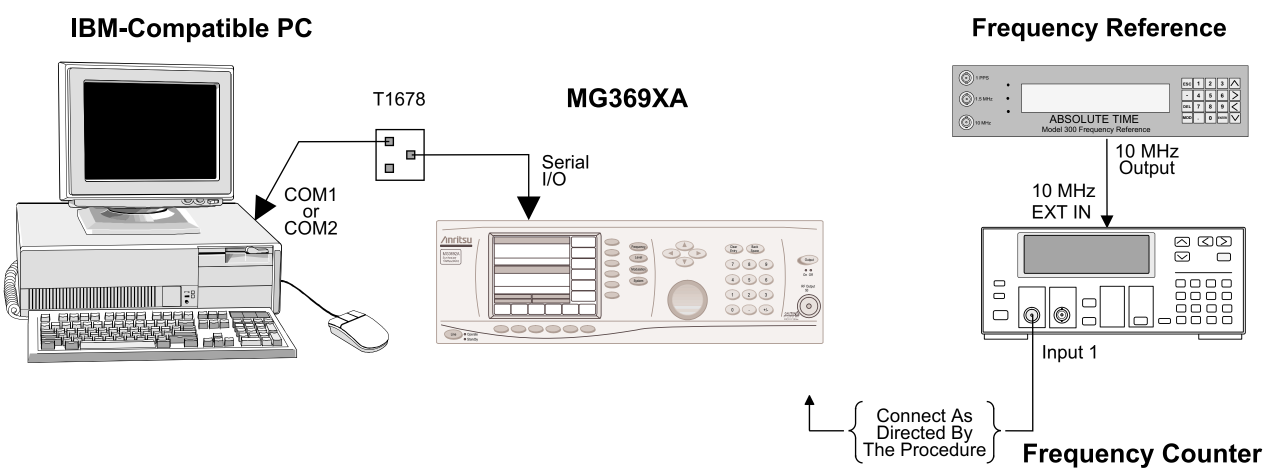


Figure 4-2. *Equipment Setup for Preliminary Calibration*

Equipment Setup Connect the equipment, shown in Figure 4-2, as follows:

> ***NOTE***
> Before beginning this calibration procedure, *always* let the MG369XA warm up for a minimum of one hour.

Step 1. Interface the PC to the MG369XA by performing the initial setup procedure, pages 4-6 to 4-9.

Step 2. Connect the frequency counter to the MG369XA when directed to do so during the calibration procedure.

Calibration Steps

Each of the steps in this procedure provides initial calibration of a specific MG369XA circuit or component. To ensure accurate instrument calibration, each step of this procedure must be performed in sequence.

Step 1. Calibrate the internal DVM circuitry as follows:

a. At the **$** prompt, type: **calterm 119** and press <ENTER>. The **$** prompt will appear on the screen when the calibration is complete.

b. Record step completion in the test record.

> ***NOTE***
>
> To save the calibration data after completing any calibration step, type: **calterm 787** and press <ENTER>.

Step 2. Calibrate the coarse loop pretune DAC as follows: (models without Option 3 only)

a. At the **$** prompt, type: **calterm 137** and press <ENTER>. The **$** prompt will appear on the screen when the calibration is complete.

b. Record step completion in the test record.

Step 3. Calibrate the sweep time DAC as follows:

a. At the **$** prompt, type: **calterm 132** and press <ENTER>. The **$** prompt will appear on the screen when the calibration is complete.

b. Record step completion in the test record.

Step 4. Calibrate the YIG frequency linearizer DACs as follows:

a. At the **$** prompt, type: **calterm 127** and press <ENTER>. The **$** prompt will appear on the screen when the calibration is complete.

b. Record step completion in the test record.

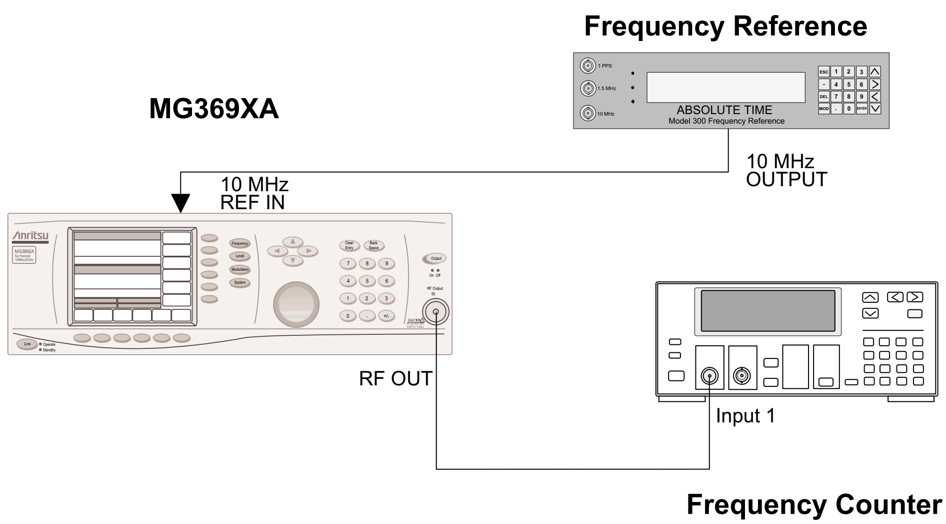


Figure 4-3. *Equipment Setup for 10 MHz Reference Oscillator Calibration*

> ***NOTES***
>
> For an alternate 10 MHz reference oscillator calibration procedure, go to Step 5a on page 4-14.

Step 5. For all MG369XA models, calibrate the 10 MHz reference oscillator per the procedure described in the steps below:

a. Connect the equipment as shown in Figure 4-3.

b. Connect the frequency counter to the MG369XA RF output connector.

c. At the **$** prompt, type: **calterm 130** and press <ENTER>.

d. Follow the instructions on the screen.

e. Record step completion in the test record.

Step 6. Calibrate the ramp center DAC as follows:

a. At the **$** prompt, type: **calterm 129** and press <ENTER>. The **$** prompt will appear on the screen when the calibration is complete.

b. Record step completion in the test record.

Step 7. Calibrate the sweep width DAC as follows:

a. At the **$** prompt, type: **calterm 133** and press <ENTER>. The **$** prompt will appear on the screen when the calibration is complete.

b. Record step completion in the test record.

Step 8. Calibrate the center frequency DAC as follows:

a. At the **$** prompt, type: **calterm 114** and press <ENTER>. The **$** prompt will appear on the screen when the calibration is complete.

b. Record step completion in the test record.

Step 9. Store the calibration data as follows:

a. At the **$** prompt, type: **calterm 787** and press <ENTER>. The **$** prompt will appear on the screen when the calibration data has been stored.

b. Record step completion in the test record.

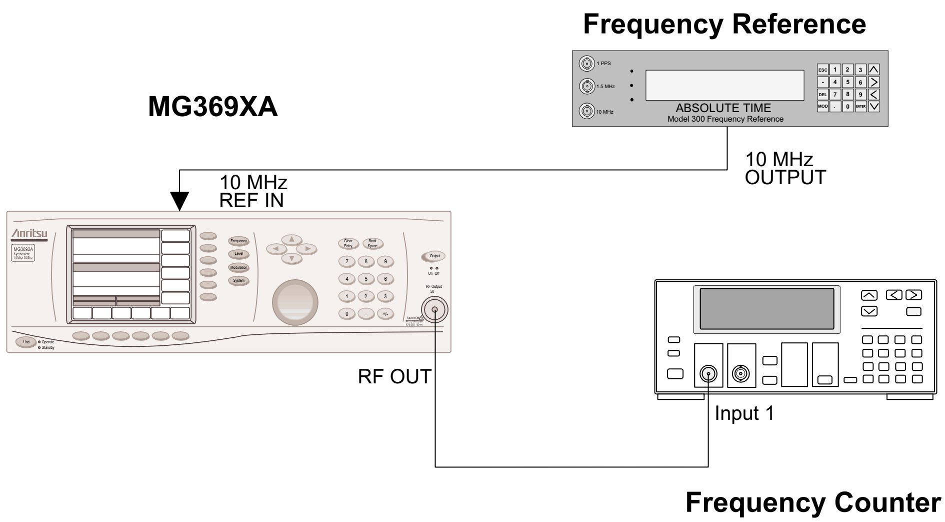


Figure 4-4. *Equipment Setup for the 10 MHz Reference Oscillator Calibration (Alternate Method)*

Alternate 10 MHz Reference Oscillator Calibration

This 10 MHz reference oscillator calibration procedure is an alternate to Step 5 of the preliminary calibration procedure (page 4-12).

> ***NOTE***
> If this procedure is used as a substitute for Step 5 of the preliminary calibration procedure, you must still perform Steps 6, 7, 8, and 9 to complete the preliminary calibration of the MG369XA.

Step 5a. Calibrate the 10 MHz reference oscillator as follows:

c. Connect the frequency reference 10 MHz OUTPUT to the 10 MHz REF IN connector on the MG369XA rear panel.

d. On the MG369XA, press the SYSTEM main menu key. At the System menu display, press Cal Menu to go to the Calibration menu.

e. Press Refrnce Cal to begin calibration. The Calibration Status menu is displayed.

f. Press Proceed to start the calibration. The date parameter opens for data entry.

g. Using the key pad, enter the current date (in any desired format). Then, press any terminator key. The Calibration Status menu display changes to indicate calibration is in progress.

h. When the reference oscillator calibration is complete, the Calibration menu is displayed.

i. Record step completion in the test record.

j. Proceed to Step 6 of the preliminary calibration procedure (page 4-12).

4-8 Frequency Synthesis Tests

The following tests can be used to verify correct operation of the frequency synthesis circuits. frequency synthesis testing is divided into two parts—coarse loop/YIG loop tests and fine loop tests.

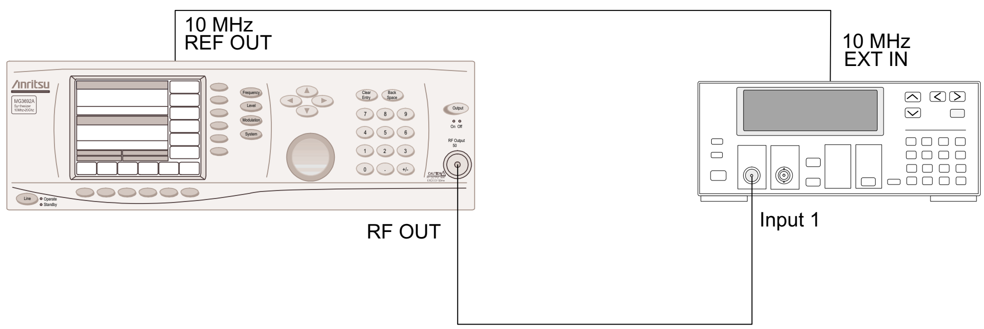


Figure 4-5. *Equipment Setup for Frequency Synthesis Tests*

Test Setup Connect the equipment, shown in Figure 4-5, as follows:

Step 1. Connect the MG369XA rear panel 10 MHz REF OUT to the frequency counter's 10 MHz external reference input.

Step 2. Connect the MG369XA RF OUTPUT to the frequency counter Input 1.

Coarse Loop/ YIG Loop The following procedure tests both the coarse loop and YIG loop by stepping the instrument through its YIG-tuned oscillator's frequency range in 1 GHz steps and measuring the RF output at each step.

Step 1. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first test frequency indicated in the test record for the model being tested.

NOTE

The frequency counter reading is typically within ±1 Hz because the instruments use a common time base. Differences of a few Hertz can be caused by noise or counter limitations. Differences of ≥±100 Hz indicate a frequency synthesis problem.

Step 2. Record the frequency counter reading in the test record. The frequency counter reading must be within ±100 Hz of the displayed MG369XA frequency to accurately complete this test.

Step 3. On the MG369XA, use the cursor control key (diamond-shaped key) to increment F1 to the next test frequency in the test record. Record the frequency counter reading in the test record.

Step 4. Repeat Step 3 until all frequencies listed in the test record have been recorded.

Fine Loop

The following procedure tests the fine loop by stepping the instrument through ten 100 Hz steps and measuring the RF output at each step.

CAUTION

When saving calibration data, turning off the instrument before the **$** prompt returns to the screen can cause all stored data to be lost.

Step 1. Set up the MG369XA as follows:

a. Reset the instrument by pressing SYSTEM, then Reset. Upon reset, the CW menu is displayed.

b. Press Edit F1 to open the current frequency parameter for editing.

c. Set F1 to the first test frequency indicated in the test record.

Step 2. Record the frequency counter reading in the test record. The frequency counter reading must be within ±10 Hz of the displayed MG369XA frequency to accurately complete this test.

Step 3. On the MG369XA, use the cursor control key (diamond-shaped key) to increment F1 to the next test frequency in the test record. Record the frequency counter reading in the test record.

Step 4. Repeat Step 3 until all frequencies listed in the test record have been recorded.

4-9 Switched Filter Shaper

This procedure provides the steps necessary to adjust the switched filter shaper amplifier gain to produce a more constant level amplifier gain with power level changes.

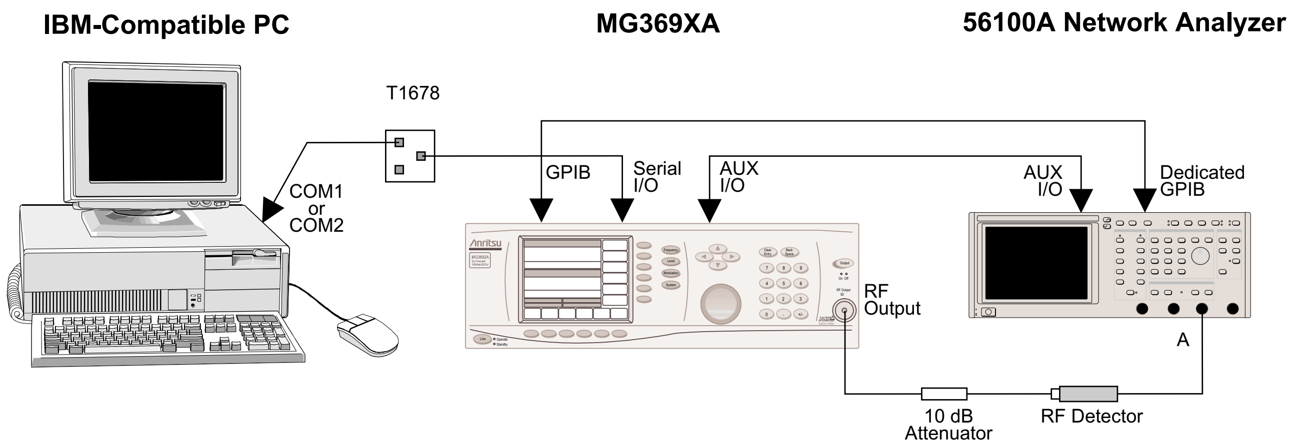


Figure 4-6. *Equipment Setup for Switched Filter Shaper Calibration*

Equipment Setup Connect the equipment, shown in Figure 4-6, as follows:

> ***NOTE***
> Before beginning this calibration procedure, *always* let the MG369XA warm up for a minimum of one hour.

Step 1. Interface the PC to the MG369XA by performing the initial setup procedure, pages 4-6 to 4-9.

Step 2. Using the auxiliary I/O cable, connect the MG369XA rear panel AUX I/O connector to the network analyzer's AUX I/O connector.

Step 3. Using the GPIB cable, connect the network analyzer's DEDICATED GPIB connector to the MG369XA IEEE-488 GPIB connector.

Step 4. Connect the RF detector to the network analyzer Channel A input connector.

Step 5. Connect the MG369XA RF OUTPUT connector to the RF detector via a 10 dB attenuator.

Log Amplifier Zero Calibration

Before the switched filter shaper amplifier can be adjusted, zero calibration of the ALC log amplifier must be performed to eliminate any DC offsets. Perform ALC log amplifier zero calibration as follows:

Step 1. At the **$** prompt on the PC display, type: **calterm 115** and press <ENTER>

Step 2. The **$** prompt will appear on the screen when ALC log amplifier zero calibration is complete. This can take up to three minutes for a 40 GHz unit.

Step 3. Record step completion in the test record.

> ***NOTE***
> The following limiter DAC adjustment procedure applies only to MG369XAs with Option 15 (high power output). If your instrument does not have this option, go directly to the shaper DAC adjustment procedure.

Limiter DAC Adjustment

The following steps in the procedure let you adjust the switched filter limiter DAC which controls the maximum gain of the switched filter shaper amplifier. Each frequency band will be scanned for the maximum unleveled power point before adjustment of the limiter DAC to ensure that the shaper amplifier is not driven to saturation.

Step 1. Set up the 56100A network analyzer as follows:

a. Press the System menu key.

b. From the System menu display, select RESET.

c. Press CHANNEL 2 DISPLAY: OFF.

d. Press CHANNEL 1 DISPLAY: ON.

e. Press the CHANNEL 1 MENU key.

f. From the Channel 1 menu display, select POWER.

g. Press OFFSET/RESOLUTION.

h. Set the resolution to 5 dB/Div.

i. Adjust the offset to center the display.

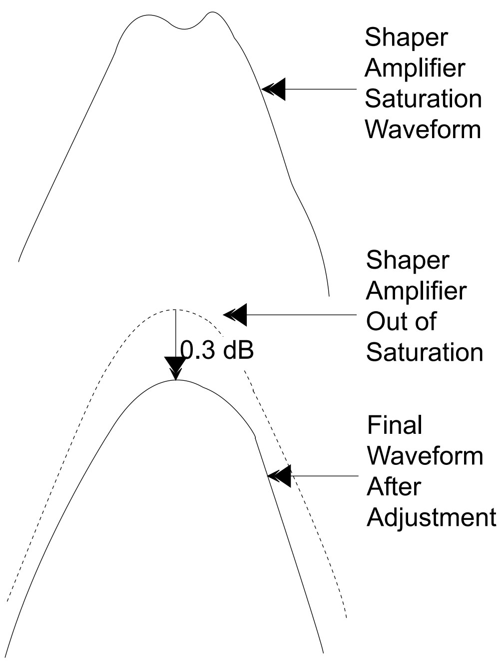


Figure 4-6. *Limiter DAC Adjustment Waveforms*

Step 2. Adjust the switched filter limiter DAC for each of the frequency bands as follows:

a. At the **$** prompt on the PC display, type: **calterm 145** and press <ENTER>.

b. On the 56100A network analyzer, set the resolution to 0.2 dB and adjust the offset to center the top of the triangle waveform on the display.

c. Observe the displayed waveform to determine whether the shaper amplifier is being driven to saturation. This is indicated by a dip in the top of the triangle waveform (Figure 4-6).

d. If the displayed waveform indicates that there is no saturation, proceed to Step *f*. If there is a dip in the waveform, go to Step *e*.

e. On the computer keyboard, use 8, 9, or 0 to decrement the value of the DAC's setting until the top of the triangle waveform starts to become rounded (the shaper amplifier is no longer being driven to saturation). Continue decrementing until the top of the waveform is 0.3 dB below this point.

f. Press **Q** on the keyboard to go to the next frequency band.

g. Repeat Steps *c* through *f* until the DAC has been checked and adjusted for all frequency bands.

h. Press **Q** on the keyboard to exit the program. The **$** prompt will appear on the screen.

i. Record step completion in the test record.

Shaper DAC Adjustment

The following step in the procedure adjusts the switch filter shaper DAC which controls the gain of the switched filter shaper amplifier. Each frequency band will be scanned for the minimum unleveled power point before automatic adjustment of the shaper DAC.

Step 1. At the **$** prompt on the PC display, type: **calterm 138** and press <ENTER>. The **$** prompt will appear on the screen when the calibration is complete.

> ***NOTE***
> The calibration routine may take up to 20 minutes depending on the frequency range of the MG369XA being calibrated.

> ***CAUTION***
> When saving calibration data, turning off the instrument before the **$** prompt returns to the screen can cause all stored data to be lost.

Step 2. Store the calibration data in non-volatile memory on the A2 CPU PCB as follows:

a. Type: **calterm 787** and press <ENTER>. The **$** prompt will appear on the screen when the data has been stored.

b. Record step completion in the test record.

4-10 RF Level Calibration

RF level calibration requires the use of an automated test system. A computer-controlled power meter measures the MG369XA power output at many frequencies throughout the frequency range of the instrument. Correction factors are then calculated and stored in non-volatile memory (EEPROM) located on the A2 microprocessor PCB.

This calibration is required following replacement of any of the following assemblies: the A6 ALC PCB, the A3 (only if Option 22 is installed), the A9 YIG assembly, the switched filter assembly, the down converter assembly, the digital down converter assembly (Option 4), the switched doubler module, the forward coupler, the directional coupler, or the step attenuator.

The RF level calibration software CD-ROM is available from Anritsu (P/N: 2300-497). The following test equipment is required for RF level calibration:

- ❑ Anritsu 2100-2 GPIB Interface Cable Assembly
- ❑ Anritsu Model 41KC-6 Fixed Attenuator (6 dB, DC to 40 GHz)
- ❑ Anritsu Model 41V-6 Fixed Attenuator (6 dB, DC to 60 GHz)
- ❑ Anritsu Model ML2530A Calibration Receiver
- ❑ Anritsu Model 69067B Synthesized Signal Generator (with Option 14 and SM5709)
- ❑ Anritsu Model T2579 Level Calibration Mixer Fixture
- ❑ Anritsu Model ML2437A/ML2438A Power Meter
- ❑ Anritsu Model MA2421A Power Sensor
- ❑ Anritsu Model MA2474A Power Sensor
- ❑ Anritsu Model SC6230 Power Sensor (10 MHz to 65 GHz)
- ❑ IBM Compatible PC with a National Instruments GPIB Interface

> **NOTE**
> The T2579 Mixer Fixture can be built using the information provided in Figure 4-7.

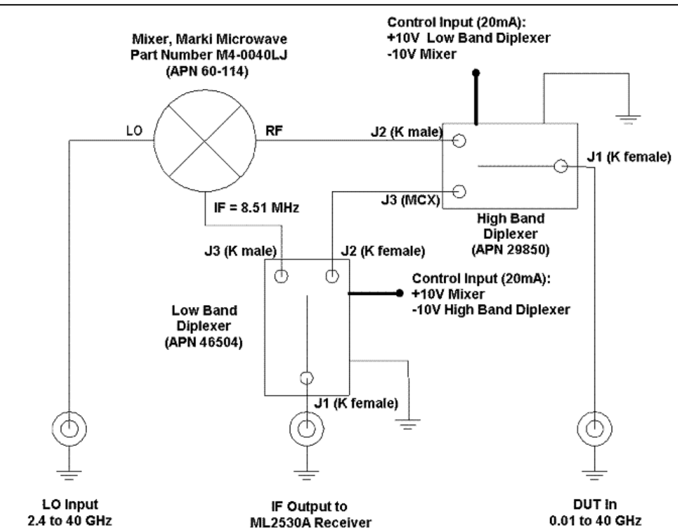


Figure 4-7. *T2579 Mixer Fixture Block Diagram*

For more information, contact your Anritsu service center (refer to Table 6-4 on page 6-24).

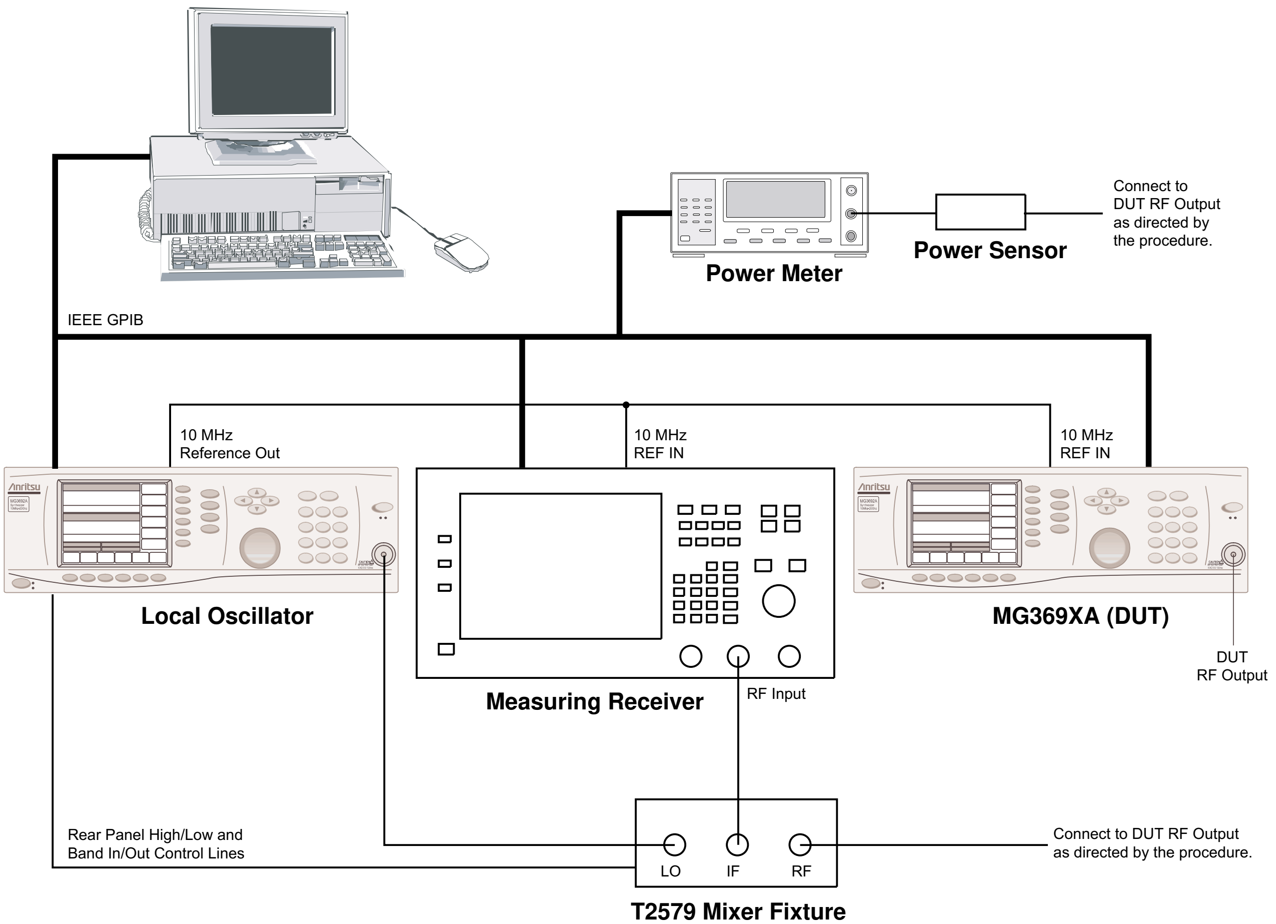


Figure 4-8. *Equipment Setup for Level Calibration*

Equipment Setup

Connect the equipment, shown in Figure 4-8, as follows:

> ***NOTES***
>
> Before beginning this calibration procedure, *always* let the MG369XA warm up for a minimum of one hour.
>
> Refer to the Local Oscillator's SM5709 documentation for information on connecting the T2579 control lines.

Step 1. Connect the PC IEEE GPIB to the MG369XA, Local Oscillator, Measuring Receiver, and Power Meter.

Step 2. Using a BNC tee, connect the 10 MHz reference output from the local oscillator's 10 MHz REF OUT to the measuring receiver's and MG369XA's 10 MHz reference input connectors.

Step 3. Connect the Rear Panel High/Low and Band In/Out control lines to the Local Oscillator's corresponding rear panel inputs.

Step 4. Connect the RF OUTPUT of the Local Oscillator to the LO port on the T2579, and connect the IF port of the T2579 to the RF Input port of the measuring receiver.

Step 5. Run the Level Calibration software and follow the on-screen prompts.

4-11 ALC Bandwidth Calibration

This procedure provides the steps necessary to perform ALC Bandwidth calibration. The ALC Bandwidth is adjusted to compensate for gain variations of the modulator. The adjustment is performed for each frequency band. This provides a more consistent bandwidth throughout the frequency range of the instrument.

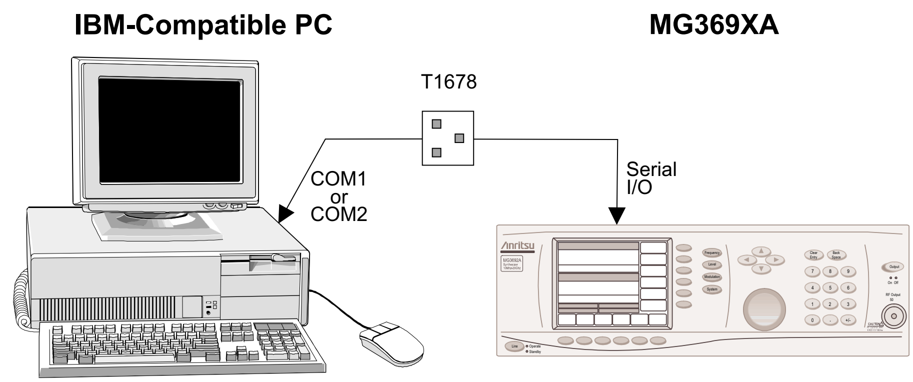


Figure 4-9. *Equipment Setup for ALC Bandwidth Calibration*

Equipment Setup Connect the equipment, shown in Figure 4-9, as follows:

> ***NOTE***
>
> Before beginning this calibration procedure, *always* let the MG369XA warm up for a minimum of one hour.

Step 1. Interface the PC to the MG369XA by performing the initial setup procedure, pages 4-6 to 4-9.

Step 2. Connect a 50Ω termination to the RF OUTPUT connector.

Bandwidth Calibration

The following procedure lets you (1) calibrate the ALC bandwidth and (2) store the calibration data in non-volatile memory on the A2 CPU PCB.

Step 1. Enter the ALC bandwidth calibration routine as follows:

a. At the **$** prompt on the PC display, type: **calterm 110** and press <ENTER>.

b. The **$** prompt will appear on the screen when the ALC bandwidth calibration is complete. This can take up to 15 minutes depending on the frequency range of the MG369XA.

c. Record step completion in the test record.

Step 2. Store the calibration data as follows:

a. At the **$** prompt, type: **calterm 787** and press <ENTER>. (The **$** prompt will appear on the screen when the calibration data has been stored.)

b. Record step completion in the test record.

CAUTION

When saving calibration data, turning off the instrument before the **$** prompt returns to the screen can cause all stored data to be lost.

4-12 ALC Slope Calibration (Option 6 Only)

This procedure provides the steps necessary to perform ALC Slope calibration. The ALC Slope is calibrated to adjust for decreasing output power-vs-output frequency in full band analog sweep.

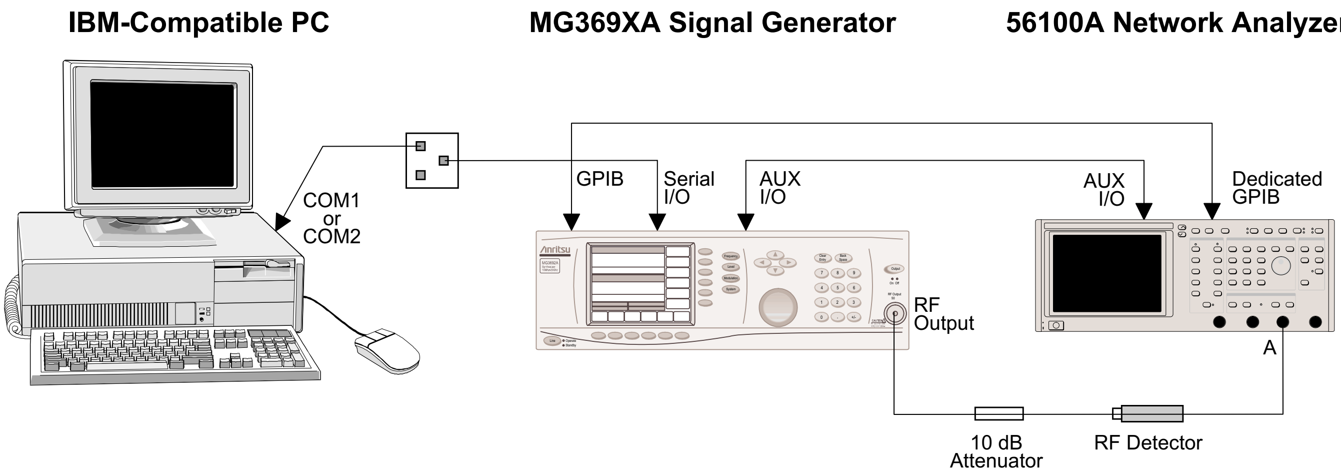


Figure 4-10. Equipment Setup for ALC Slope Calibration

> **NOTE**
> Before beginning this calibration procedure, always let the MG369XA warm up for a minimum of one hour.

Equipment Setup

Connect the equipment, shown in Figure 4-5, as follows:

Step 1. Interface the PC to the MG369XA by performing the initial setup procedure, pages 4-6 to 4-9.

Step 2. Using the Auxiliary I/O cable, connect the MG369XA rear panel AUX I/O connector to the 56100A Network Analyzer AUX I/O connector.

Step 3. Using the GPIB cable, connect the 56100A Network Analyzer DEDICATED GPIB connector to the MG369XA IEEE-488 GPIB connector.

Step 4. Connect the RF Detector to the 56100A Network Analyzer Channel A Input connector.

Step 5. Connect the MG369XA RF OUTPUT connector to the RF Detector via a 10 dB Attenuator.

ALC Slope DAC Adjustment

The following procedure lets you adjust the ALC Slope over individual frequency ranges to compensate for decreasing output power-vs-frequency in analog sweep.

> **NOTE**
> For units with Option 4, the frequency range for Band 1 is 2.2 to 8.4 GHz. Skip adjustment of Band 0 as full band anolog sweep is not available below 2.2 GHz.

The procedure begins by letting you adjust the ALC Slope for band 0 (0.01 to 2.0 GHz), if installed. It then continues letting you adjust the ALC Slope from 2 GHz to the top frequency of the instrument in up to four bands. The band frequency ranges are:

Band 1	2.0 to 8.4 GHz
Band 2	8.4 to 20.0 GHz
Band 3	20.0 to 40.0 GHz
Band 4	40.0 to 65.0 GHz

During band 1 thru 3/4 ALC Slope adjustment, the 56100A Network Analyzer display (Figure 4-6) shows the response from 2 GHz to the top frequency of the model, as adjustment is done band by band.

Step 1. Set up the 56100A Network Analyzer as follows:

a. Press the System Menu key.

b. From the System Menu display, select RESET.

c. Press CHANNEL 2 DISPLAY: OFF.

d. Press CHANNEL 1 DISPLAY: ON.

e. Press CHANNEL 1 MENU key.

f. From the Chanel 1 Menu Display, select POWER and SELECT INPUT (NON-RATIO A).

Step 2. Set up the MG369XA as follows:

a. Reset the instrument by pressing **SYSTEM** then Reset. Upon reset the CW Menu is displayed.

b. Press Step Sweep. The Step Sweep Menu is displayed.

c. Press **FREQUENCY CONTROL**, then Full to select the full frequency range of the unit being calibrated.

d. Press More, then Number of Steps and set the number of steps to 400.

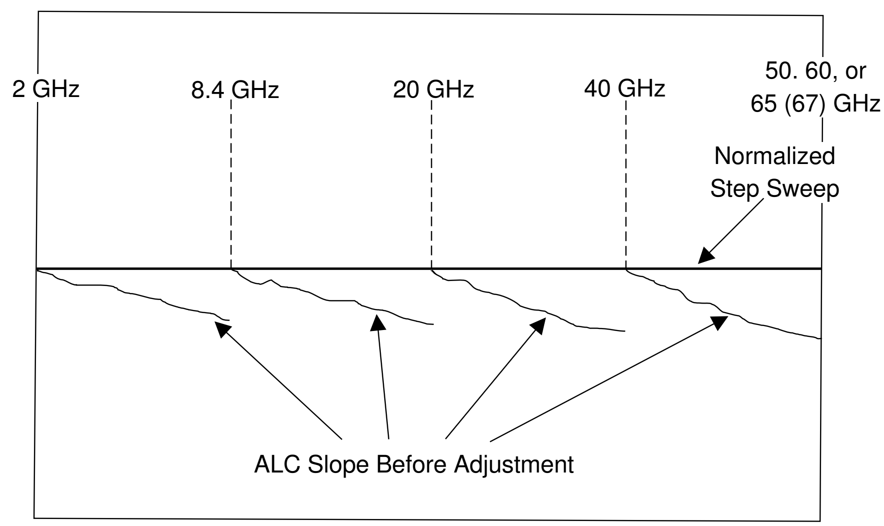


Figure 4-11. *ALC Slope Adjustment Waveform Display*

Step 3. Make the following selections on the 56100A Network Analyzer to normalize the step sweep.

a. Press MENU and select TRACE MEMORY on the display.

b. Select TRACE MEMORY STORAGE MENU, then TRACE DATA.

c. Select SUBTRACT MEMORY ON

d. Press OFFSET/RESOLUTION and set the Resolution to 0.5 dB.

Step 4. On the MG369XA, press Analog Sweep to select the analog sweep mode.

Step 5. Adjust the ALC Slope as follows:

a. At the $ prompt on the PC display, type: **slpcal** and press <ENTER>.
On the computer keyboard, the adjustment keys are:

Slope (all bands)	**E** (Up)	**D** (Down)
Offset (band 1-4 only)	**Q** (Up)	**A** (Down)

b. Adjust the ALC Slope so that the power at the start and stop frequencies (of the analog sweep for band 0) match as closely as possible the normalized straight line in step sweep mode. When completed, press **n** for the next band.

c. Using the Slope and Offset adjustment keys, continue until the ALC Slope for all bands has been adjusted.

d. Type: **X** and press <ENTER> to exit the calibration routine. (The **$** prompt will appear on the screen.)

e. Record step completion on the test record.

CAUTION

When saving calibration data, turning off the instrument before the **$** prompt returns to the screen can cause all stored data to be lost.

Step 6. Store the new DACs setting values in non-volatile memory (EEPROMs) on the A2 CPU PCB as follows:

a. Type: **calterm 787** and press <ENTER>. (The **$** prompt will appear on the screen when the data has been stored.)

b. Record step completion on the test record.

4-13 AM Calibration (Options 14 or 25X)

This procedure provides the steps necessary to perform AM calibration. This consists of calibrating the AM Calibration DAC and the AM Meter circuit. The AM Calibration DAC is calibrated for input sensitivities of 100%/V (linear mode) and 25 dB/V (logarithmic mode) for frequencies ≤2 GHz and >2 GHz (≤2.2 GHz and >2.2 GHz for units with Option 4).

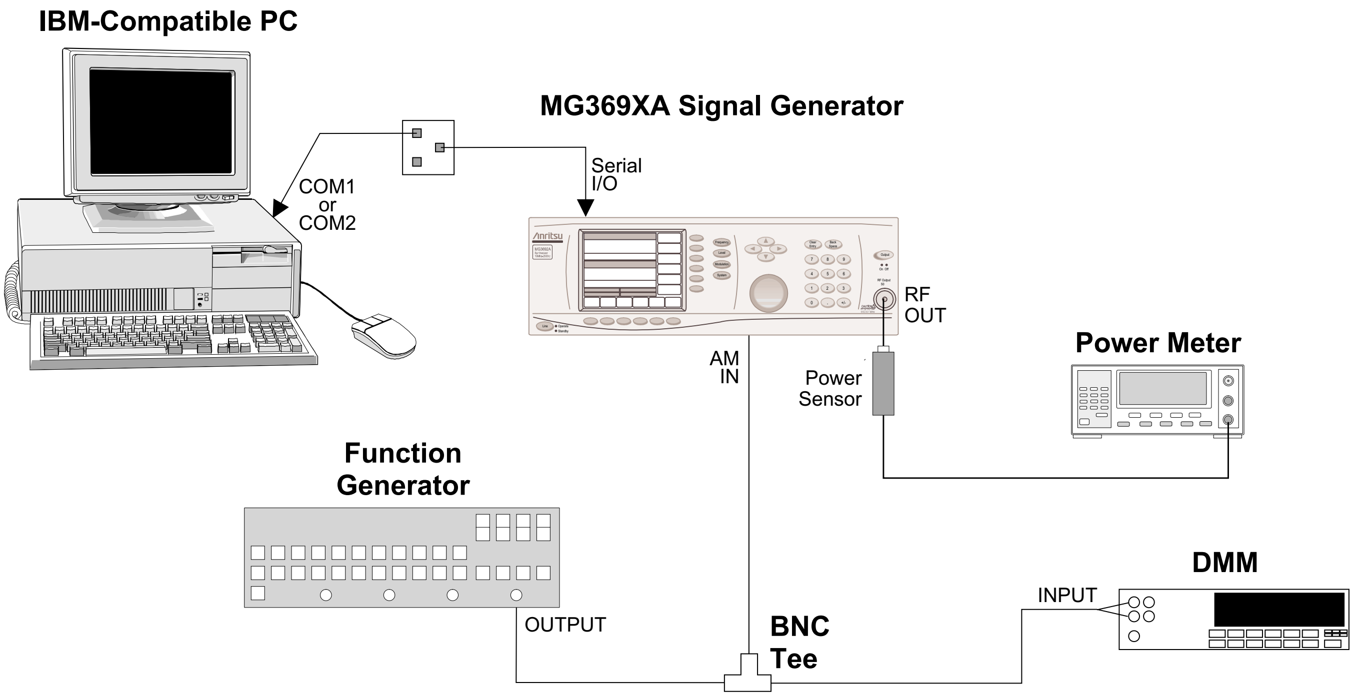


Figure 4-12. *Equipment Setup for AM Calibration*

Equipment Setup

Connect the equipment, shown in Figure 4-12, as follows:

> ***NOTE***
> For the ≤40 GHz models, use the MA2474A power sensor; for >40 GHz models, use the MA2475A power sensor.

Step 1. Interface the PC to the MG369XA by performing the initial setup procedure, pages 4-6 to 4-9.

Step 2. Connect the Function Generator Output to the BNC tee. Connect one leg of the tee to the MG369XA rear panel AM IN. Connect the other leg of the tee to the DMM input.

Step 3. Calibrate the Power Meter with the Power Sensor.

Step 4. Connect the Power Sensor to the RF OUTPUT of the MG369XA.

AM Calibration Procedure

The following procedure let you (1) adjust the AM Calibration DAC to provide the correct amount of AM in both linear (100%/V sensitivity) and log (25 dB/V sensitivity) modes of operation for frequencies of ≤2 GHz and >2 GHz, (2) calibrate the AM Meter circuit, and (3) store the results in non-volatile memory (EEPROM) on the A2 CPU PCB.

> ***NOTES***
>
> Before beginning this calibration procedure, always let the MG369XA warm up for a minimum of one hour.
>
> For units with Option 4 installed, the procedure for Linear AM and Log AM calibration must be performed twice—once for frequencies of ≤2.2 GHz and once for frequencies >2.2 GHz.
>
> Upon initial completion of each procedure, the program will automatically return you to the start to repeat the procedure.

Step 1. Set up the Function Generator as follows:

a. Mode: EXT

b. Signal: Square Wave

Step 2. Perform Linear AM calibration as follows:

a. At the **$** prompt on the PC screen, type: **calterm 112** and press <ENTER>.

b. Set the function generator to output 0.00 volts. When done, press any key on the keyboard to continue calibration.

c. Now, set the function generator to output ±0.50 volts. Use the COMPL button on the function generator to toggle the output between +0.50 volts and –0.50 volts.

d. On the computer keyboard, use 1, 2 or 3 to increment and 8, 9 and 0 to decrement the value of the DAC's setting to obtain a 9.54 dB difference in the power meter's reading when the function generator's output is toggled.

e. When the DAC has been adjusted, press **Q** on the keyboard to exit the program. (If the instrument has a Down Converter installed, you will be returned to the start of the program to perform this calibration for frequencies of >2 GHz.)

When the DAC has been completely adjusted, the program will exit to the **$** prompt.

f. Record step completion on the test record.

> ***NOTE***
>
> To save the calibration data after completing any calibration step, type: **calterm 787** and press <ENTER>.

> **CAUTION**
> When saving calibration data, turning off the instrument before the **$** prompt returns to the screen can cause all stored data to be lost.

Step 3. Perform Log AM calibration as follows:

a. At the **$** prompt, type: **calterm 113** and press <ENTER>.

b. Set the function generator for a ±0.20 volt output. Use the COMPL button to toggle the output between –0.20 volts and +0.20 volts.

c. On the computer keyboard, use 1, 2, or 3 to increment and 8, 9, and 0 to decrement the value of the DAC's setting to obtain a 10.00 dB difference in the power meter's reading when the function generator's output is toggled.

d. When the DAC has been adjusted, press **Q** on the keyboard to exit the program. (If the instrument has a Down Converter installed, you will be returned to the start of the program to perform this calibration for frequencies of >2 GHz.)

When the DAC has been completely adjusted, the program will exit to the **$** prompt.

e. Record step completion on the test record.

Step 4. Perform AM Meter calibration as follows:

a. At the **$** prompt, type: **calterm 147** and press <ENTER>.

b. Set up the Function Generator for a 1 kHz sinewave with an output level of 0.354 volts RMS (1 volt peak to peak). When done, press any key on the keyboard to continue calibration.

c. The **$** prompt will appear on the screen when the calibration is complete.

d. Record step completion on the test record.

Step 5. Store the calibration data as follows:

a. At the **$** prompt, type: **calterm 787** and press <ENTER>. (The **$** prompt will appear on the screen when the calibration data has been stored.)

b. Record step completion on the test record.

4-14 FM Calibration (Option 12 or 25X)

This procedure provides the steps necessary to perform FM calibration. This consists of calibrating the FM Meter circuit and the FM Gain Control DAC. The FM Gain Control DAC is calibrated for input sensitivities in both narrow and wide FM modes.

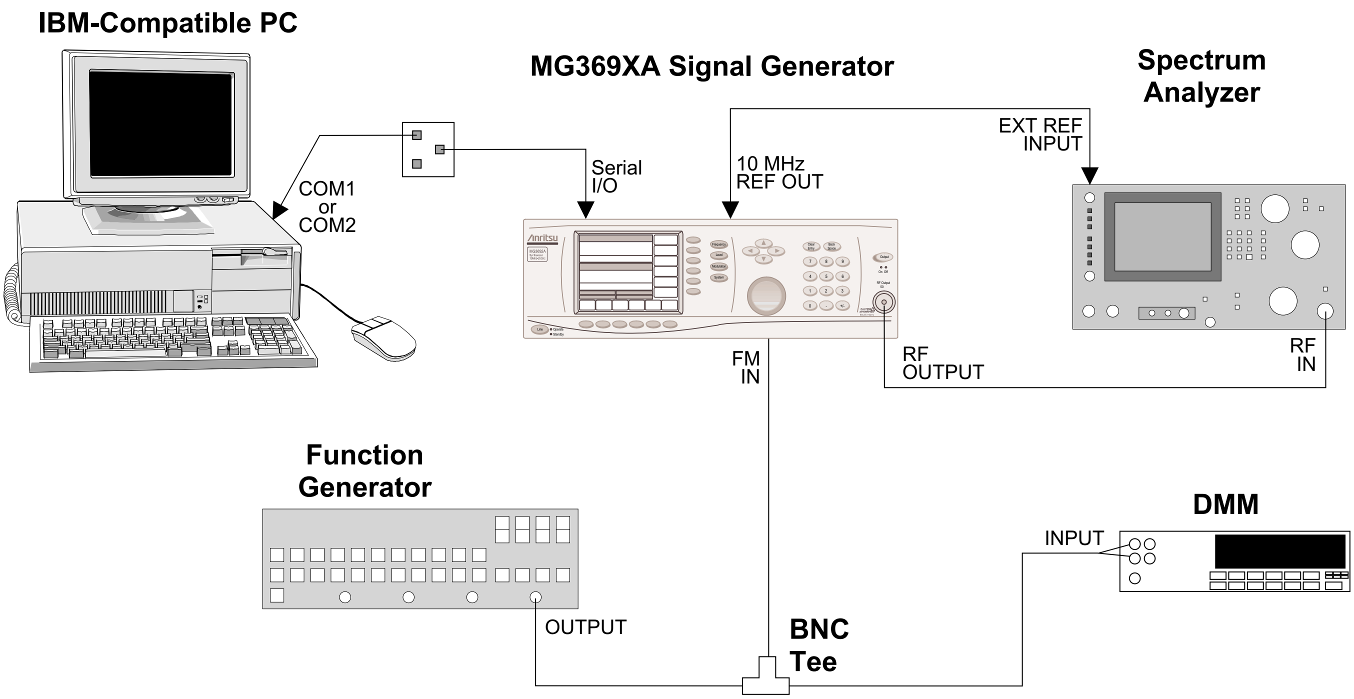


Figure 4-13. *Equipment Setup for FM Calibration*

Equipment Setup

Connect the equipment, shown in Figure 4-13, as follows:

> ***NOTE***
>
> Before beginning this calibration procedure, always let the MG369XA warm up for a minimum of one hour.

Step 1. Interface the PC to the MG369XA by performing the initial setup procedure, pages 4-6 to 4-9.

Step 2. Connect the MG369XA rear panel 10 MHz REF OUT to the Spectrum Analyzer External Reference input.

Step 3. Connect the Function Generator Output to the BNC tee. Connect one leg of the tee to the MG369XA rear panel FM IN. Connect the other leg of the tee to the DMM input.

Step 4. Connect the MG369XA RF OUTPUT to the Spectrum Analyzer RF Input.

FM Calibration Procedure

The following steps in the procedure lets you calibrate the (1) FM Meter circuit, (2) FM Variable Gain Linearity, (3) FM Narrow and Wide Mode Sensitivity, and (4) FM Rear Panel Input Gain, and store the results in non-volatile memory (EEPROM) on the A2 CPU PCB.

> ***NOTE***
> To ensure an accurate calibration, each step of this procedure must be performed in sequence.

Step 1. Perform FM Meter calibration as follows:

a. At the **$** prompt on the PC screen, type: **calterm 123** and press <ENTER>.

b. Set up the Function Generator for a 100 kHz sinewave with an output level of 0.707 volts RMS (2 volts peak-to-peak). Use a frequency counter to verify the output frequency of your function generator is set to ±1%. When done, press any key on the keyboard to continue calibration.

c. The **$** prompt will appear on the screen when the calibration is complete.

d. Record step completion on the test record.

Perform FM Variable Gain Linearity calibration as follows:

e. At the **$** prompt on the PC screen, type: **calterm 148** and press <ENTER>.

f. Set up the Function Generator for a +1.00 Vdc output. When done, press any key on the keyboard to continue calibration.

> ***NOTE***
> To save the calibration data after completing any calibration step, type: **calterm 787** and press <ENTER>.

g. The **$** prompt will appear on the screen when the calibration is complete.

h. Record step completion on the test record.

Step 2. FM Wide Mode Sensitivity calibration is accomplished by adjusting the FM Gain Control DAC to obtain 200 MHz and 20 MHz FM deviations at frequencies of 5 GHz and 15 GHz. Modulating signal inputs are from the external Function Generator.

Step 3. Perform the calibration as follows:

a. At the **$** prompt, type: **calterm 124** and press <ENTER>.

b. Set up the Function Generator for a 0.4 Hz square wave with an output level of 2 volts peak to peak.

c. On the Spectrum Analyzer, set the Span/Div to 50 MHz per division.

d. On the computer keyboard, use the **`**, **1**, **2**, and **3** keys to increment and the **7**, **8**, **9**, and **0** keys to decrement the value of the DAC's setting. Start calibration by pressing the **`** key.

e. While observing the Spectrum Analyzer display, adjust the value of the DAC's setting to obtain a 200 MHz peak to peak deviation. This is the coarse adjustment.

f. On the Spectrum Analyzer, set the Span/Div to 5 MHz per division and adjust the center frequency control to position the low carrier at the center of the display. Note the frequency reading.

g. Now, adjust the center frequency control to position the high carrier at the center of the display. Note the frequency reading.

h. The difference between these two frequencies is the actual peak-to-peak frequency deviation. It should be 200 MHz ±8 MHz. If not, fine adjust the value of the DAC's setting to obtain this deviation.

i. When finished setting the DAC, press **Q** on the keyboard to go to the next calibration step (adjusting the DAC to obtain 20 MHz deviation).

j. Start calibration by pressing the **1** key.

k. While observing the Spectrum Analyzer display, adjust the value of the DAC's setting to obtain a 20 MHz peak to peak deviation. This is the coarse adjustment.

l. On the Spectrum Analyzer, set the Span/Div to 1 MHz per division and adjust the center frequency control to position the low carrier at the center of the display. Note the frequency reading.

m. Now, adjust the center frequency control to position the high carrier at the center of the display. Note the frequency reading.

n. The difference between these two frequencies is the actual peak-to-peak frequency deviation. It should be 20 MHz ±0.8 MHz. If not, fine adjust the value of the DAC's setting to obtain this deviation.

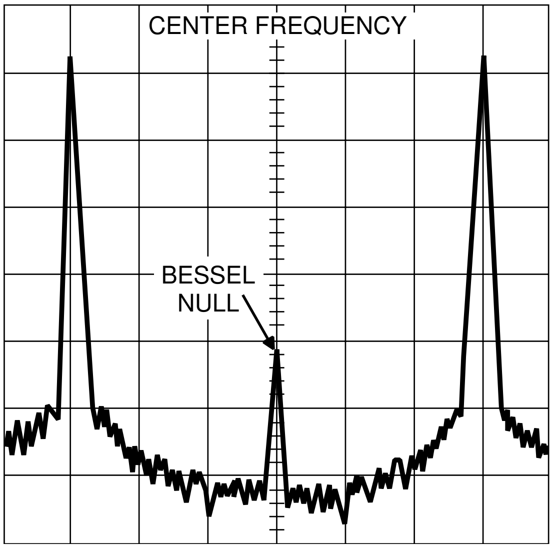


Figure 4-14. Typical Spectrum Analyzer Display of a Bessel Null on an FM Waveform

> **NOTE**
> You may need to adjust the RBW setting on the Spectrum Analyzer in order to see the >–40 dBc null.

o. When finished setting the DAC, press **Q** on the keyboard to go to the next calibration step (adjusting the DAC to obtain 200 MHz deviation at 15 GHz).

When the DAC has been completely adjusted, the program will exit to the **$** prompt.

p. Record step completion on the test record.

Step 4. FM Narrow Mode Sensitivity calibration is accomplished by adjusting the FM Gain Control DAC to reduce the carrier level as low as possible at frequencies of 5 GHz and 15 GHz. Modulating signal inputs are from the external Function Generator.

Perform the calibration as follows:

a. At the **$** prompt, type: **calterm 125** and press <ENTER>.

b. Set up the Function Generator for a 99.8 kHz sine wave with an output level of 0.707 volts RMS (2 volts peak to peak). Use a frequency counter to verify the output frequency of your function generator is set to ±1%.

c. On the Spectrum Analyzer, set the Span/Div to 50 kHz per division.

d. On the computer keyboard, use the **`**, **1**, **2**, and **3** keys to increment and the **7**, **8**, **9**, and **0** keys to decrement the value of the DAC's setting. Start calibration by pressing an increment key.

e. While observing the first Bessel null (Figure 4-14) on the Spectrum Analyzer display, adjust the value of the DAC's setting to reduce the carrier level as low as possible.

f. When finished setting the DAC, press **Q** on the keyboard to go to the next calibration step.

g. When the DAC has been completely adjusted, the program will exit to the **$** prompt.

h. Record step completion on the test record.

> **CAUTION**
>
> When saving calibration data, turning off the instrument before the **$** prompt returns to the screen can cause all stored data to be lost.

Step 5. The FM Rear Panel Input Gain is calibrated to balance the FM Narrow Mode Sensitivity obtained when the same external modulating signal is applied to either the front panel or rear panel FM input. Perform the calibration as follows:

a. On the MG369XA, disconnect the coaxial cable from the front panel FM IN connector and connect it to the rear panel FM IN connector.

b. At the **$** prompt, type: **calterm 149** and press <ENTER>.

c. Set up the Function Generator for a 99.8 kHz sine wave with an output level of 0.707 volts RMS (2 volts peak to peak). Use a frequency counter to verify the output frequency of your function generator is set to ±1%.

d. On the Spectrum Analyzer, set the Span/Div to 50 kHz per division.

e. On the computer keyboard, use the `, **1**, **2**, and **3** keys to increment and the **7**, **8**, **9**, and **0** keys to decrement the value of the DAC's setting. Start calibration by pressing an increment key.

f. While observing the first Bessel null (Figure 4-14) on the Spectrum Analyzer display, adjust the value of the DAC's setting to reduce the carrier level as low as possible.

g. When finished setting the DAC, press **Q** on the keyboard to exit the calibration routine.

h. Record step completion on the test record.

Step 6. Store the calibration data as follows:

a. At the **$** prompt, type: **calterm 787** and press <ENTER>. (The **$** prompt will appear on the screen when the calibration data has been stored.)

b. Record step completion on the test record.

Chapter 5
Troubleshooting

Table of Contents

Troubleshooting procedures presented in this chapter may require the removal of the instrument covers to gain access to test points on printed circuit boards and other subassemblies.

WARNING

Hazardous voltages are present inside the MG369XA whenever ac line power is connected. Turn off the instrument and remove the line cord before removing any covers or panels. Troubleshooting or repair procedures should only be performed by service personnel who are fully aware of the potential hazards.

CAUTION

Many subassemblies in the instrument contain static sensitive components. Improper handling of these subassemblies may result in damage to the components. ***Always*** observe the static-sensitive component handling precautions described in Chapter 1, Figure 1-2.

Chapter 5
Troubleshooting

5-1 Introduction

This chapter provides information for troubleshooting the MG369XA. The troubleshooting procedures presented in this chapter support fault isolation to a replaceable subassembly or RF component. Remove and replace procedures for the subassemblies and RF components are found in Chapter 6.

5-2 Recommended Test Equipment

The recommended test equipment for the troubleshooting procedures presented in this chapter is listed in Table 1-2.

5-3 Error Messages

During normal operation, the MG369XA generates error messages to indicate internal malfunctions, abnormal instrument operations, or invalid signal inputs or data entries. It also displays warning messages to alert the operator of conditions that could result in inaccurate MG369XA output. In addition, status messages are displayed to remind the operator of current menu selections or settings.

Self-Test Error Messages

The MG369XA firmware includes internal diagnostics that self-test the instrument. These self-test diagnostics perform a brief go/no-go test of most of the instrument PCBs and other internal assemblies.

You can perform an instrument self-test at any time during normal operation by pressing **SYSTEM** and then the system menu soft-key Selftest.

If the MG369XA fails self-test, error messages are displayed on the front panel data display. These error messages describe the malfunction and, in most cases, provide an indication of what has failed. Table 5-1, on the following page, is a summary listing of the self-test error messages. Included for each is a reference to the troubleshooting table that provides a description of the probable cause and a procedure for identifying the failed component or assembly.

Table 5-1. Self-Test Error Messages (1 of 3)

Error Message	Troubleshooting Table	Page Number
Error 100 DVM Ground Offset Failed	Table 5-5.	5-16
Error 101 DVM Positive 10V Reference	Table 5-5.	5-16
Error 102 DVM Negative 10V Reference	Table 5-5.	5-16
Error 108 Crystal Oven Cold	Table 5-6.	5-18
Error 109 The 100MHz Reference is not Locked to the External Reference	Table 5-6.	5-18
Error 110 The 100MHz Reference is not Locked to the High Stability 10MHz Crystal Oscillator	Table 5-6.	5-19
Error 112 Coarse Loop Osc Failed or Coarse Loop B Osc Failed (Option 3)	Table 5-7.	5-20
Error 113 YIG Loop Osc Failed	Table 5-8.	5-23
Error 114 (Option 5 only) Down Converter LO not Locked	Table 5-9.	5-24
Error 115 Not Locked Indicator Failed	Table 5-8.	5-23
Error 116 FM Loop Gain Check Failed	Table 5-10.	5-25
Error 117 Linearizer Check Failed	Table 5-11.	5-26
Error 118 Switch point DAC Failed	Table 5-11.	5-26
Error 119 Center Frequency Circuits Failed	Table 5-11.	5-26
Error 120 Delta-F Circuits Failed	Table 5-11.	5-26
Error 121 Unleveled Indicator Failed	Table 5-12.	5-27
Error 122 Level Reference Failed	Table 5-12.	5-27
Error 123 Detector Log Amp Failed	Table 5-12.	5-27
Error 124 Full Band Unlocked and Unleveled	Table 5-13.	5-28

Table 5-1. Self-Test Error Messages (2 of 3)

Error Message	Troubleshooting Table	Page Number
Error 125 8.4 – 20 GHz Unlocked and Unleveled	Table 5-13.	5-28
Error 126 2 – 8.4 GHz Unlocked and Unleveled	Table 5-13.	5-28
Error 127 Detector Input Circuit Failed	Table 5-12.	5-27
Error 128 .01 – 2 GHz Unleveled or Down Converter Unleveled (Option 4)	Table 5-14.	5-30
Error 129 Switched Filter or Level Detector Failed	Table 5-15.	5-33
Error 130 2 – 3.3 GHz Switched Filter	Table 5-16.	5-36
Error 131 3.3 – 5.5 GHz Switched Filter	Table 5-16.	5-36
Error 132 5.5 – 8.4 GHz Switched Filter	Table 5-16.	5-36
Error 133 8.4 – 13.25 GHz Switched Filter	Table 5-16.	5-36
Error 134 13.25 – 20 GHz Switched Filter	Table 5-16.	5-36
Error 135 Modulator or Driver Failed	Table 5-17.	5-37
Error 142 Sample and Hold Circuit Failed	Table 5-12.	5-27
Error 143 Slope DAC Failed	Table 5-12.	5-27
Error 144 RF was Off when Self-test started. Some tests were not performed.	Table 5-20.	5-40
Error 145 AM Meter or Associated Circuits Failed	Table 5-21.	5-41
Error 147 Internal FM Circuits Failed	Table 5-22.	5-42
Error 148 Pulse 40 MHz Reference Circuitry Failed	Table 5-23.	5-43
Error 149 Coarse Loop C Osc Failed	Table 5-7.	5-21
Error 152 Coarse Loop Module Failed	Table 5-7.	5-21

Table 5-1. *Self-Test Error Messages (3 of 3)*

Error Message	Troubleshooting Table	Page Number
MG369XA Models with SDM		
Error 138 SDM Unit or Driver Failed	Table 5-18.	5-38
Error 139 32 – 40 GHz SDM Section Failed	Table 5-19.	5-39
Error 140 25 – 32 GHz SDM Section Failed	Table 5-19.	5-39
Error 141 20 – 25 GHz SDM Section Failed	Table 5-19.	5-39
MG369XA Models with SQM		
Error 136 SQM Unit or Driver Failed	Table 5-24.	5-44

Normal Operation Error and Warning/Status Messages

When an abnormal condition is detected during operation, the MG369XA displays an error message to indicate that the output is abnormal or that a signal input or data entry is invalid. It also displays warning messages to alert you of conditions that could cause an inaccurate signal generator output. Status messages to remind you of current menu selections or settings are also generated.

Tables 5-2 and 5-3 is a summary list of possible error messages that may be displayed during normal operations. Table 5-4 is a summary list of possible warning/status messages.

Table 5-2. *Possible Error Messages during Normal Operations (1 of 2)*

Error Message	Description
ERROR	Displayed on the frequency mode title bar when the output frequency is not phase-locked, an invalid frequency parameter entry causes a frequency range error, or an invalid pulse parameter entry causes a pulse modulation error.
LOCK ERROR	Displayed in the frequency parameters area when the output frequency is not phase-locked. The frequency accuracy and stability of the RF output is greatly reduced. This is normally caused by an internal component failure. Run self-test to verify the malfunction.
RANGE	Displayed in the frequency parameters area when the dF value entered results in a sweep outside the range of the instrument, the step size value entered is greater than the sweep range, the number of steps entered results in a step size of less than 0.01 Hz or 0.01 dB (0.001 mV in linear mode), the step sweep time entered divided by the number of steps entered results in a dwell time of <10 ms, or when the analog sweep start frequency entered is greater than the stop frequency. Entering valid values usually clears the error.
SLAVE	Displayed in the frequency parameters area of the Master MG369XA during master-slave operation in VNA mode when the slave frequency offset value entered results in a CW frequency or frequency sweep outside the range of the slave MG369XA. Entering a valid offset value clears the error.
ERR	Displayed in the modulation status area when one or more of the following error conditions occurs: (1) The external AM modulating signal exceeds the input voltage range. In addition, the message “**Reduce AM Input Level**” appears at the bottom of the AM status display. (*Continued on next page*)

Table 5-3. *Possible Error Messages during Normal Operations (2 of 2)*

Error Message	Description
ERR	*Continued:* (2) The external FM (or ΦM) modulating signal exceeds the input voltage range. In addition, the message "**Reduce FM (or ΦM) Input Level**" appears at the bottom of the FM (or ΦM) status display. (3) A pulse parameter setting is invalid for the current pulse modulation state, as follows: **Pulse Period:** <125 ns (40 MHz clock) or <500 ns (10 MHz clock) longer than pulse widths + delays **Single Pulse Mode:** Free Run or Gated Trigger: Width1 > PRI Delayed Trigger: Delay1 + Width1 > PRI **Doublet Pulse Mode:** Free Run Trigger: Width1 > Delay2 *or* Width1 + (Delay2 – Width1) + Width2 > PRI Delayed Trigger: Width1 > Delay2 *or* Delay1 + Width1 + (Delay2 – Width1) +Width2 > PRI External Trigger with or without Delay: Width1 > Delay2 **Triplet Pulse Mode:** Free Run Trigger: Width1 > Delay2 *or* Width2 > Delay3 *or* Width1 + (Delay2 – Width1) + Width2 + (Delay3 – Width2) + Width 3 > PRI Delayed Trigger: Width1 > Delay2 *or* Width2 > Delay3 *or* Delay1 + Width1 + (Delay2 – Width1) + Width2 + (Delay3 – Width2) + Width 3 > PRI External Trigger with or without Delay: Width1 > Delay2 *or* Width2 > Delay3 **Quadruplet Pulse Mode:** Free Run Trigger: Width1 > Delay2 *or* Width2 > Delay3 *or* Width3 > Delay4 *or* Width1 + (Delay2 – Width1) + Width2 + (Delay3 – Width2) + Width3 + (Delay4 – Width3) + Width4 > PRI Delayed Trigger: Width1 > Delay2 *or* Width2 > Delay3 *or* Width3 > Delay4 *or* Delay1 + Width1 + (Delay2 – Width1) + Width2 + (Delay3 – Width2) + Width3 + (Delay4 – Width3) + Width4 > PRI External Trigger with or without Delay: Width1 > Delay2 *or* Width2 > Delay3 *or* Width3 > Delay4

Table 5-4. Possible Warning/Status Messages during Normal Operations

Warning/Status Message	Description
COLD	This warning message indicates that the 100 MHz Crystal oven (or the 10 MHz Crystal oven if Option 16 is installed) has not reached operating temperature. Normally displayed during a cold start of the MG369XA. If the message is displayed during normal operation, it could indicate a malfunction. Run self-test to verify.
UNLEVELED	Displayed when the RF output goes unleveled. Normally caused by exceeding the specified leveled-power rating. Reducing the power level usually clears the warning message. If the warning message is displayed only when AM is selected ON, the modulating signal may be driving the RF output unleveled. Reducing the modulating signal or adjusting the power level usually clears the warning.
UNLOCKED	When Unlocked/Narrow FM or Unlocked/Wide FM is selected ON, this warning message appears indicating that the instrument is not phase-locked during this FM mode of operation.
REDUCE RATE	This warning message is displayed when the AM rate, FM rate, or ΦM rate is set >100 kHz for a non-sine wave modulating waveform. Amplitude, frequency, or phase modulation of the output signal will continue but the modulating waveform may be distorted.
SLOPE	This status message indicates that a power slope correction has been applied to the ALC.
EXTL REF	This status message indicates that an external 10 MHz signal is being used as the reference signal for the MG369XA.
OFFSET	This status message indicates that a constant (offset) has been applied to the displayed power level.
CW RAMP	This status message appears on all CW menu displays to indicate that the CW ramp has been turned on.
USER 1...5	This status message indicates that a user level flatness correction power-offset table has been applied to the ALC.

5-4 No Error Message

The MG369XA must be operating to run self-test. Therefore, malfunctions that cause the instrument to be non-operational do not produce error messages. These problems are generally a failure of the MG369XA to power up properly. Table 5-4, beginning on page 5-13, provides troubleshooting procedures for these malfunctions.

5-5 Troubleshooting Tables

Tables 5-5 through 5-24, beginning on page 5-16, provide procedures for isolating malfunctions displaying self-test errors to a replaceable subassembly or RF component. In those cases where any of several subassemblies or RF components could have caused the problem, subassembly/RF component replacement is indicated. The recommended replacement order is to replace first the subassemblies/RF components that are most likely to have failed.

Figures 5-1a and 5-1b, on the following pages, show the location of the MG369XA connectors and test points that are called out in the troubleshooting procedures of Tables 5-4 through 5-24.

CAUTION

Never remove or replace a subassembly or RF component with power applied. ***Always*** remove the power cord before disassembly and removal of any component or PCB. Serious damage to the instrument or personal injury may occur.

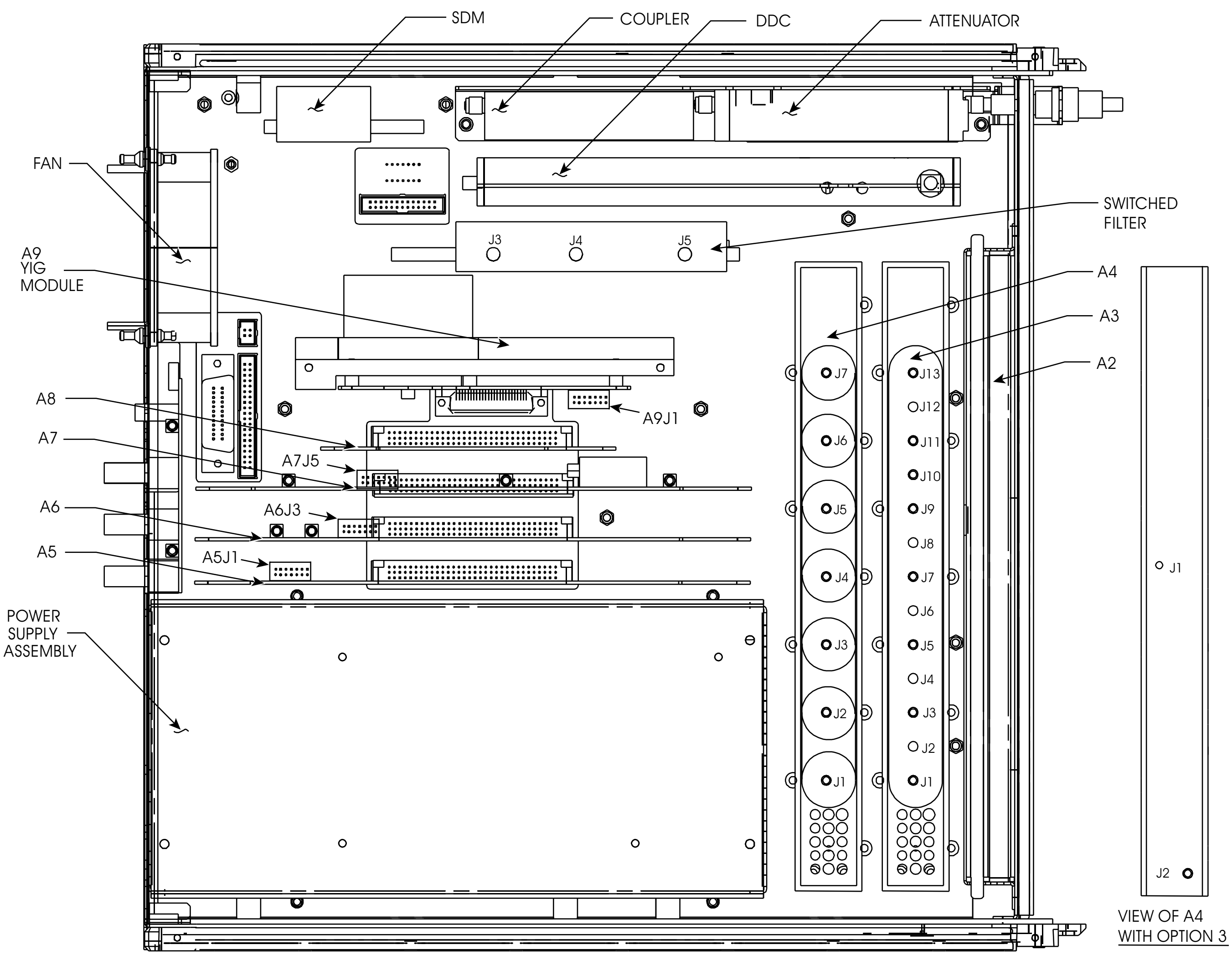


Figure 5-1a. *Top View of the MG369XA Showing Connector and Test Point Locations*

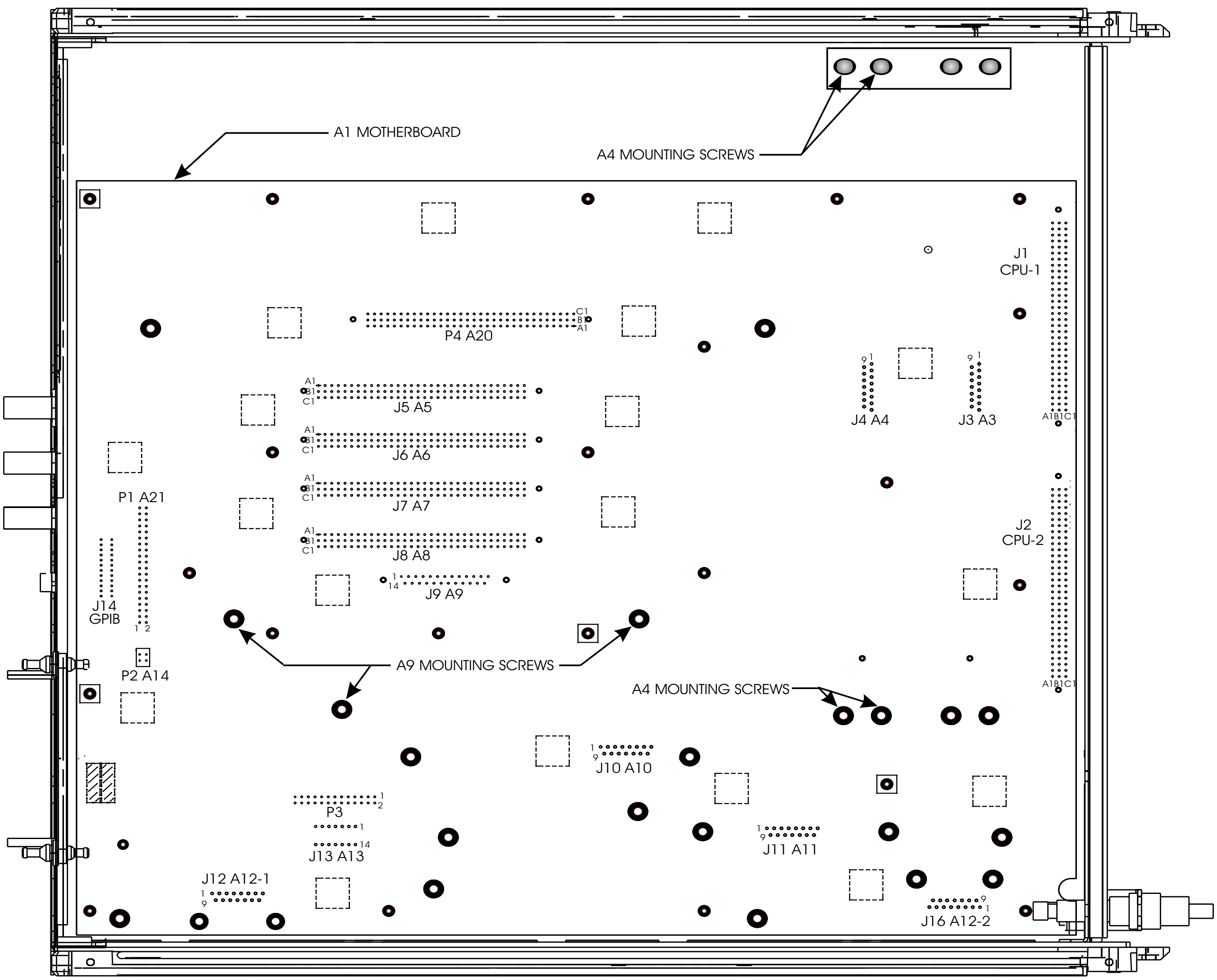


Figure 5-1b. *Bottom View of the MG369XA Showing Connector and Test Point Locations*

Table 5-4. Malfunctions Not Displaying an Error Message (1 of 2)

MG369XA Will Not Turn On (OPERATE light and FAN are OFF)

Normal Operation: When the MG369XA is connected to the power source and the rear panel line switch is turned on, the OPERATE light should illuminate and the instrument should power up. When the MG369XA is set to standby mode, the fans should run slow and the STANDBY light should illuminate.

Step 1. Disconnect the MG369XA from the power source, then check the line fuses on the rear panel.

- ❑ If the line fuses are good, go to Step 2.
- ❑ If the line fuses are defective, replace the fuses.

Step 2. Apply power to the instrument.

- ❑ If the instrument powers up, the problem is cleared.
- ❑ If the instrument fails to power up, go to Step 3.

Step 3. Disconnect the MG369XA from the power source, then remove the MG369XA top cover and the cover located over the A5—A9 PCBs.

Step 4. Remove the four outer screws to the top cover of the power supply module and lift the cover with the main power supply attached. Refer to the R&R procedures in Chapter 6 as needed.

Step 5. Inspect the ac line supply/switch block and the wiring to the main power supply and standby power supply for defects.

- ❑ If a defect is found, replace as necessary.
- ❑ If no defect is found, go to Step 6.

Step 6. Replace the standby and main power supplies.

- ❑ If the instrument powers up, the problem is cleared.
- ❑ If the instrument fails to power up, contact your local Anritsu service center for assistance.

Malfunctions Not Displaying an Error Message (2 of 2)

MG369XA Will Not Turn On
(OPERATE light is ON)

Normal Operation: When the MG369XA is connected to the power source and the rear panel line switch is turned on, the OPERATE light should illuminate and the instrument should power up. When the MG369XA is set to standby mode, the fans should run slow and the STANDBY light should illuminate.

Step 1. Remove the MG369XA top and bottom cover and the cover located over the A5—A9 PCBs.

Step 2. Apply power and measure the regulated voltages at A1P4 per table 5-4a on the following page.

- ❑ If one or more, but not all of the related voltages are out of regulation, a malfunction of the regulation circuitry is indicated. Replace the A20 voltage regulator PCB.
- ❑ If all of the related voltages are out of regulation, a malfunction of the regulator supply source is indicated. Replace the related supply source as shown in Table 5-4a.

Step 3. Check for normal operation.

- ❑ If the instrument powers up, the problem is cleared.
- ❑ If the instrument fails to power up, go to Step 4.

Step 4. Press the front panel RF OUTPUT ON/OFF button.

- ❑ If the red and yellow LEDs toggle, the malfunction may be caused by a failed front panel circuit. Replace the front panel assembly.
- ❑ If the LEDs do not toggle or if both LEDs are lit, the problem may be caused by a CPU malfunction. Replace the A2 PCB.

Step 5. Check for normal operation.

- ❑ If the instrument powers up, the problem is cleared.
- ❑ If the instrument fails to power up, contact your local Anritsu service center for assistance.

Table 5-4a. *Power Supply Module Regulated Outputs*

A1P4 Pin #	Regulator Output (V)	Related Source
10A	12	Standby Power Supply (13VS)
32B	12	
32C	12	
1A	5	
18A	24	Main Power Supply (26V)
29A	24	
6A	15	Main Power Supply (16V)
14A	15	
27A	15	
31A	15	
20A	10	
24A	8	
24B	8	
26B	7	
4A	5	Main Power Supply (6.75V)
12A	5	
22A	5	
2A	3.3	
8A	-15	Main Power Supply (-16V)
16A	-15	
31C	-15	

Table 5-5. Error Messages 100, 101 and 102 (1 of 2)

Internal DVM Tests

Error 100 DVM Ground Offset Failed, *or*
Error 101 DVM Positive 10V Reference, *or*
Error 102 DVM Negative 10V Reference

Description: The DVM circuitry, located on the A2 CPU PCB, is calibrated using the ±10 volts from the reference supplies on the A5 auxiliary PCB. The error messages indicate a calibration-related problem or a defective ±10 volt reference.

Step 1. Perform a manual pre-calibration. (Refer to Chapter 4 for the calibration procedure.)

Step 2. Run self-test.

- ❑ If no error message is displayed, the problem is cleared.
- ❑ If any of the error messages, 100, 101, and 102, are displayed, go to Step 3.

Step 3. Connect the negative lead of the digital multimeter to A5J1 pin 1.

Step 4. Measure the ±10V reference voltages at A5J1* pin 19 and A5J1* pin 21. A5J1* pin 19 should be –10V ±0.036V; A5J1* pin 21 should be +10V ±0.036V.

* If the A5 PCB is part number 52225-3, measure the voltages at A5P102.

- ❑ If the ±10V reference voltages are correct, go to Step 5.
- ❑ If incorrect, replace the A5 PCB and perform a manual pre-calibration.

> ***NOTE***
> Even if the ±10V reference voltages are correct, there could still be a malfunction of the DVM multiplexer on the A5 PCB or the DVM circuitry on the A2 CPU PCB.

Step 5. Replace the A5 PCB, perform a manual pre-calibration and run self-test again.

- ❑ If no error message is displayed, the problem is cleared.
- ❑ If any of the error messages, 100, 101, and 102, are displayed, go to Step 6.

Error Messages 100, 101 and 102 (2 of 2)

Step 6. Replace the A2 PCB, perform a manual pre-calibration and run self-test.

- ❑ If no error message is displayed, the problem is cleared.
- ❑ If any of the error messages, 100, 101, and 102, are displayed, contact your local Anritsu service center for assistance.

Table 5-6. Error Messages 108, 109 and 110 (1 of 2)

A3 Reference/Fine Loop

Error 108 Crystal Oven Cold

Description: The oven of the 100 MHz crystal oscillator or the Option 16 high-stability 10 MHz crystal oscillator has not reached operating temperature.

Step 1. Allow a 30 minute warm up, then run self-test.

- ❑ If error 108 is not displayed, the problem is cleared.
- ❑ If error 108 displays, go to Step 2.

Step 2. Replace the A3 PCB. Allow a 30 minute warm up, then run self-test.

- ❑ If error 108 is not displayed, the problem is cleared.
- ❑ If error 108 displays, go to Step 3.

Step 3. Replace the A2 PCB. Allow a 30 minute warm up, then run self-test.

- ❑ If error 108 is not displayed, the problem is cleared.
- ❑ If error 108 is displayed, contact your local Anritsu service center for assistance.

Error 109 The 100 MHz Reference is not phase-locked to the External Reference

Description: The reference loop is not phase-locked to the external 10 MHz reference.

Step 1. Using a coaxial cable with BNC connectors, connect the rear panel 10 MHz REF IN connector to the rear panel 10 MHz REF OUT connector.

Step 2. Disconnect the MCX cable W158 from A3J13.

Step 3. Using an oscilloscope, verify the presence of a 10 MHz signal at the end of the MCX cable W158. The signal amplitude should be >0.5 volts peak-to-peak (into 50Ω).

- ❑ If present, replace the A3 PCB.
- ❑ If not present, replace the MCX cable W158.

Error Messages 108, 109 and 110 (2 of 2)

Error 110 The 100 MHz Reference is not Locked to the High Stability 10 MHz Crystal Oscillator

Description: The reference loop is not phase-locked to the Option 16 high stability 10 MHz crystal oscillator.

Step 1. Replace the A3 PCB.

- ❑ If error 110 is not displayed, the problem is cleared.
- ❑ If error 110 is displayed, go to Step 2.

Step 2. Replace the A2 PCB.

- ❑ If error 110 is not displayed, the problem is cleared.
- ❑ If error 110 is displayed, contact your local Anritsu service center for assistance.

Table 5-7. Error Messages 112, 149 and 152 (1 of 3)

A4 Coarse Loop

Error 112 Coarse Loop Osc Failed (models without Option 3)

Description: The coarse loop oscillator is not phase-locked.

Step 1. Disconnect the MCX cable W151 at A4J1 and the MCX cable W154 at A4J6.

Step 2. Using a spectrum analyzer, verify the presence of a +7 dBm ±4 dB, 500 MHz signal at the end of the MCX cable W151 from A4J1 and a 0 dBm ±3 dB, 10 MHz signal at the end of the MCX cable W154 from A4J6.

- ❑ If present, go to Step 5.
- ❑ If one or both of the signals are not present, go to Step 3.

Step 3. Disconnect the MCX cable W151 at A3J3 and the MCX cable W154 at A3J10.

Step 4. Using the spectrum analyzer, verify the presence of a +7 dBm ±4 dB, 500 MHz signal at A3J3 and a 0 dBm ±3 dB, 10 MHz signal at A3J10.

- ❑ If the 500 MHz signal is present, replace the MCX cable W151.
- ❑ If the 10 MHz signal is present, replace the MCX cable W154.
- ❑ If either signal is not present, replace the A3 PCB.

Step 5. Reconnect the MCX cables to A4J1 and A4J6, then disconnect the MCX cable W158 at A4J3.

Step 6. Set up the MG369XA to generate the CW frequencies listed in Table 5-7a.

Table 5-7a. *Coarse Loop Frequencies*

MG369XA CW Frequency	Measured Frequency at A4J3
2.000 GHz	219.5 MHz ±10 kHz
2.050 GHz	225.0 MHz ±10 kHz
2.225 GHz	244.5 MHz ±10 kHz

Error Messages 112, 149 and 152 (2 of 3)

Step 7. Using a spectrum analyzer, measure the frequency and amplitude of the signal at A4J3 for each of the CW frequencies generated. In each case, the signal amplitude should be +4 dBm ±6 dB with sidebands at <–50 dBc.

- ❑ If the signals are correct in both frequency and amplitude, go to Step 8.
- ❑ If the signals are incorrect, replace the A4 PCB.

Step 8. Reconnect the MCX cable W158 to A4J3 and run self-test again.

- ❑ If error 112 is not displayed, the problem is cleared.
- ❑ If error 112 is still displayed, contact your local Anritsu service center for assistance.

Error 112 Coarse Loop B Osc Failed (models with Option 3)
Error 149 Coarse Loop C Osc Failed
Error 152 Coarse Loop Module Failed

Description: One of the oscillators within the coarse loop is not phase-locked.

Step 1. Disconnect the MCX cable W153 at A4J1.

Step 2. Using a spectrum analyzer, verify the presence of a +3 dBm ±3 dB, 100 MHz signal at the end of the MCX cable W153.

- ❑ If present, go to Step 5.
- ❑ If not present, go to Step 3.

Step 3. Disconnect the MCX cable W153 at A3J7.

Step 4. Using the spectrum analyzer, verify the presence of the +3 dBm ±3 dB, 100 MHz signal at A3J7.

- ❑ If present, replace the MCX cable W153.
- ❑ If not present, replace the A3 PCB.

Step 5. Reconnect the MCX cable W153 to A4J1, then disconnect the MCX cable W157 at A4J2.

Error Messages 112, 149 and 152 (3 of 3)

Step 6. Set up the MG369XA to generate the CW frequencies listed in Table 5-7b.

Table 5-7b. *Coarse Loop Frequencies*

MG369XA CW Frequency	Measured Frequency at A4J2
2.215 GHz	205.0 MHz ±10 kHz
4.335 GHz	437.5 MHz ±10 kHz
13.190 GHz	945.0 MHz ±10 kHz

Step 7. Using a spectrum analyzer, measure the frequency and amplitude of the signal at A4J2 for each of the CW frequencies generated. In each case, the signal amplitude should be 0 dBm ±6 dB with sidebands at <–65 dBc.

- ❑ If the signals are correct in both frequency and amplitude, go to Step 8.
- ❑ If the signals are incorrect, replace the A4 PCB.

Step 8. Reconnect the MCX cable W157 to A4J2 and run self-test again.

- ❑ If error 112, 149 or 152 is not displayed, the problem is cleared.
- ❑ If error 112, 149 or 152 is still displayed, contact your local Anritsu service center for assistance.

Table 5-8. Error Messages 113 and 115

A7 YIG Loop

Error 113 YIG Loop Osc Failed
Error 115 Not Locked Indicator Failed

Description: Error 113 indicates that the YIG loop is not phase-locked. Error 115 indicates a failure of the not phased-locked indicator circuit.

Step 1. Verify the signal output from the A4 coarse loop PCB by performing Steps 5 through 7 in Table 5-7.

- ❑ If the coarse loop signals are correct in both frequency and amplitude, go to Step 2.
- ❑ If the coarse loop signals are incorrect, replace the A4 PCB.

Step 2. Verify the signal output from the A3 reference loop PCB by performing Steps 1 thru 4 in Table 5-7.

- ❑ If the reference loop signals are correct in both frequency and amplitude, go to Step 3.
- ❑ If the reference loop signals are incorrect, replace the A3 PCB.

Step 3. Disconnect the semi-rigid cable at the output port J5 of the switched filter assembly.

Step 4. Set up the MG369XA to generate a CW frequency of 2.000 GHz.

Step 5. Using a spectrum analyzer, measure the frequency and amplitude of the signal at J5 of the switched filter assembly. The frequency should be 2.000 GHz ±25 MHz and the amplitude should be from –7 to –14 dBm.

- ❑ If the signal is correct in both frequency and amplitude, go to Step 6.
- ❑ If the signals are incorrect, replace the switched filter assembly.

Step 6. Repeat Steps 4 and 5, incrementing the CW frequency in 1 GHz steps up to 20.000 GHz.

Step 7. If the signals from the coarse loop, reference loop, and switched filter assembly are all correct, replace the A7 YIG loop PCB.

Step 8. Run self-test.

- ❑ If error 113 or 115 are not displayed, the problem is cleared.
- ❑ If either error 113 or 115 are displayed, contact your local Anritsu service center for assistance.

Table 5-9. Error Message 114

A11 Down Converter

Error 114 Down Converter LO not Locked (Option 5 only)

Description: The local oscillator in the down converter assembly is not phase-locked.

Step 1. Disconnect the MCX cable W152 at A3J5.

Step 2. Using a spectrum analyzer, verify the presence of a +7 dBm ±4 dB, 500 MHz signal at A3J5.

- ❑ If present, go to Step 3.
- ❑ If not present, replace the A3 PCB.

Step 3. Reconnect the MCX cable W152 to A3J5, then disconnect the MCX cable W152 at J2 of the down converter assembly.

Step 4. Using a spectrum analyzer, verify the presence of a +7 dBm ±4 dB, 500 MHz signal at the end of the MCX cable W152.

- ❑ If present, replace the down converter assembly.
- ❑ If not present, replace the MCX cable W152.

Table 5-10. Error Message 116

A7A1 FM PCB

Error 116 FM Loop Gain Check Failed

Description: The FM loop has failed or the loop gain is out of tolerance.

Step 1. Perform a preliminary calibration. (Refer to chapter 4 for the calibration procedure.)

Step 2. Run self-test.

- ❑ If error 116 is not displayed, the problem is cleared.
- ❑ If error 116 is still displayed, go to Step 3.

Step 3. Replace the A7A1 PCB and run self-test again.

- ❑ If error 116 is not displayed, the problem is cleared.
- ❑ If error 116 is displayed, contact your local Anritsu service center.

Table 5-11. Error Messages 107, 117, 118, 119, and 120

A5 Analog Instruction PCB

Error 107 Sweep Time Check Failed
Error 117 Linearizer Check Failed
Error 118 Switch point DAC Failed
Error 119 Center Frequency Circuits Failed
Error 120 Delta-F Circuits Failed

Description: Each of these error messages indicates a problem in the circuitry on the A5 Analog Instruction PCB or the A9 YIG module that provides frequency tuning voltages for the YIG-tuned oscillator.

Step 1. Perform a preliminary calibration. (Refer to Chapter 4 for the calibration procedure.)

Step 2. Run self-test.

- ❑ If no error message is displayed, the problem is cleared.
- ❑ If error 107, 117, 118, or 120 is displayed, replace the A5 auxiliary PCB.
- ❑ If error 119 is displayed, replace the A9 YIG module.

Step 3. Perform a preliminary calibration and run self-test again.

- ❑ If no error message is displayed, the problem is cleared.
- ❑ If any of the error messages, listed above, is displayed, contact your local Anritsu service center for assistance.

Table 5-12. Error Messages 121, 122, 123, 127, 142, and 143

A6 ALC

Error 121 Unleveled Indicator Failed
Error 122 Level Reference Failed
Error 123 Detector Log Amp Failed
Error 127 Detector Input Circuit Failed
Error 142 Sample and Hold Circuit Failed
Error 143 Slope DAC Failed

Description: Error 121 indicates a failure of the circuit that alerts the CPU whenever the RF output power becomes unleveled. Each of the other error messages indicate a problem in the circuitry on the A6 ALC PCB that provides control of the RF output power level.

Step 1. Replace the A6 PCB, and run self-test.

- ❑ If no error message is displayed, the problem is cleared.
- ❑ If error message 121, 122, 123, 127, or 142 is displayed, contact your local Anritsu service center for assistance.
- ❑ If error message 143 is displayed, proceed to Step 2.

Step 2. Calibrate the ALC slope. (Refer to Chapter 4 for the calibration procedure.)

Step 2. Run self-test.

- ❑ If error 143 is not displayed, the problem is cleared.
- ❑ If error 143 is still displayed, go to Step 3.

Step 3. Replace the A6 PCB and run self-test again.

- ❑ If error 143 is not displayed, the problem is cleared.
- ❑ If error 143 is still displayed, go to Step 4.

Step 4. Replace the A5 PCB and run self-test again.

- ❑ If error 143 is not displayed, the problem is cleared.
- ❑ If error 143 is still displayed, contact your local Anritsu service center for assistance.

Table 5-13. Error Messages 124, 125 and 126 (1 of 2)

A9 YIG-tuned Oscillator Module

Error 124 Full Band Unlocked and Unleveled
Error 125 8.4-20 GHz Unlocked and Unleveled
Error 126 2-8.4 GHz Unlocked and Unleveled

Description: These error messages indicate a failure of the YIG-tuned oscillator module.

Model MG369XA YIG-tuned oscillator failure

Step 1. Connect a 56100A scalar network analyzer to the MG369XA as follows:

a. Connect the MG369XA AUX I/O to the 56100A AUX I/O.

b. Connect the 56100A DEDICATED GPIB to the MG369XA IEEE-488 GPIB.

c. Connect the RF detector to the 56100A Channel A input.

Step 2. Set up the MG369XA as follows:

a. Frequency: Step Sweep

b. F1: 2.000 GHz (2.21 GHz with Option 4)

c. F2: 20.000 GHz

d. More: Number of Steps: 400

Step 3. Set up the 56100A Scalar Network Analyzer as follows:

a. Press SYSTEM MENU key.

b. From System menu display, select RESET.

c. Press CHANNEL 2 DISPLAY: OFF

d. Press CHANNEL 1 DISPLAY: ON

e. Press the CHANNEL 1 MENU key.

f. From the Channel 1 menu display, select POWER.

Step 4. Using the scalar network analyzer, measure the RF output directly at the YIG-tuned oscillator's output connector. The amplitude of the RF signal should be >4 dBm throughout the full sweep.

- ❑ If the RF signal is correct in both frequency and amplitude throughout the full sweep, go to Step 9.
- ❑ If there is no RF signal for all or part of the sweep or if the amplitude of the RF signal is low, go to Step 5.

Error Messages 124, 125 and 126 (2 of 2)

Step 5. Using the oscilloscope, check for the YIG module power supply voltages shown in Table 5-13a.

- ❑ If the voltages are correct, go to Step 6.
- ❑ If the voltages are incorrect, refer to the troubleshooting Table 5-4 to determine if the power supply or regulator PCB needs to be replaced.

Step 6. Connect the X input of an oscilloscope to the MG369XA rear panel HORIZ OUT connector.

Step 7. Using the oscilloscope, check for a –0.2 to –3.5 volt YIG tuning ramp at A9J1 pin 3.

- ❑ If the ramp signal is correct, go to Step 8.
- ❑ If the ramp signal is incorrect or not present, replace the A9 YIG module assembly.

Step 8. Using the oscilloscope, check for the YIG-tuned oscillator bias voltages at the test points shown in Table 5-13a.

- ❑ If the YIG-tuned oscillator bias voltages are correct, replace the A9 YIG module assembly.
- ❑ If the YIG bias voltages are incorrect, go to Step 9.

Step 9. Perform the preliminary calibration in Section 4-7, then run self-test again.

- ❑ If no error message is displayed, the problem is cleared.
- ❑ If any of the error messages, listed above, are displayed, contact your local Anritsu service center for assistance.

Table 5-13a. *YIG Module Assembly Bias Voltages*

Test Point	YIG Module Power Supply Bias Voltages	
A1J9 pin 1	+24 volts	
A1J9 pin 2	+15 volts	
A1J9 pin 4	-15 volts	
	YIG-tuned Oscillator Bias Voltages	
Test Point	**2 to 8.4 GHz**	**8.4 to 20 GHz**
A1J9 pin 9	+7 volts	+7 volts
A1J9 pin 7	0 volts	+8 volts
A1J9 pin 11	–5 volts	–5 volts
A1J9 pin 5	+8 volts	0 volts

Table 5-14. Error Message 128 (1 of 3)

Output Power Level Related Problems (0.01 to 20 GHz)

Error 128 0.01-2 GHz Unleveled or
Down Converter Unleveled (Option 4)

Description: Error 128 indicates a failure of the down converter leveling circuitry. The MG369XA may or may not produce an RF output in the 0.01 to 2 GHz frequency range. Thus, there are two troubleshooting paths for this problem—unleveled with output power and unleveled with no/low output power.

Unleveled with output power (The warning message **UNLEVELED** appears on the front panel display):

Step 1. Set up the MG369XA as follows:

- **a.** Frequency: Step Sweep
- **b.** F1: 0.010 GHz
- **c.** F2: 2.000 GHz (2.2 GHz with Option 4)
- **d.** More: Number of Steps: 400
- **e.** Previous: L1: +1.00 dBm
- **f.** Level: ALC Mode: Leveling
- **g.** Leveling: External Detector

Step 2. Connect a detector to the MG369XA RF OUTPUT connector and connect the detected DC output of the detector to the rear panel EXTERNAL ALC IN connector.

- ❑ If the warning message **UNLEVELED** no longer appears on the front panel display, replace the down converter
- ❑ If the warning message **UNLEVELED** is still displayed, replace the A6 PCB

Error Message 128 (2 of 3)

Unleveled with no/low output power:

Step 1. Set up the MG369XA as follows:

a. Frequency: Step Sweep

b. F1: 0.010 GHz

c. F2: 2.000 GHz (2.2 GHz with Option 4)

d. More: Number of Steps: 400

e. Previous: L1: +1.00 dBm

f. Level: ALC Mode: Leveling

g. Leveling: External Detector

Step 2. Connect the X input of an oscilloscope to the MG369XA rear panel HORIZ OUT connector.

Step 3. Using the oscilloscope, check at the end of the MCX cable W160 that is connected to A6J2 for a >2.0 volt down converter detector output throughout the full sweep.

- ❑ If the detector voltage is correct, replace the A6 PCB.
- ❑ If the detector voltage is incorrect, go to Step 4.

Step 4. Using the oscilloscope, check for a +15 volt down converter bias voltage at A1J11 pin 10.

- ❑ If the bias voltage is correct, go to Step 5.
- ❑ If the bias voltage is not correct, replace the A5 PCB.

Step 5. Using the oscilloscope, check for a –2 volt PIN switch drive voltage at A1J10 pin 11. If the MG369XA has a SDM installed, also check for a +20 volt PIN switch drive voltage at A1J6 pin 3B.

- ❑ If the PIN switch drive voltages are correct, go to Step 6.
- ❑ If the PIN switch drive voltages are not correct, replace the A6.

Error Message 128 (3 of 3)

Step 6. Connect a 56100A scalar network analyzer to the MG369XA as follows:

a. Connect the MG369XA AUX I/O to the 56100A AUX I/O.

b. Connect the 56100A DEDICATED GPIB to the MG369XA IEEE-488 GPIB.

c. Connect the RF detector to the 56100A Channel A input.

Step 7. Set up the 56100A scalar network analyzer as follows:

a. Press the SYSTEM MENU key.

b. From the System menu display, select RESET.

c. Press CHANNEL 2 DISPLAY: OFF

d. Press CHANNEL 1 DISPLAY: ON

e. Press the CHANNEL 1 MENU key.

f. From the Channel 1 menu display, select POWER.

Step 8. Using the scalar network analyzer with a 10 dB pad, measure the RF output at J3 of the switched filter assembly. The amplitude of the RF signal should be >+17 dBm throughout the full sweep.

- ❑ If the amplitude of the RF signal is correct, replace the down converter assembly.
- ❑ If there is no RF signal or if the amplitude of the RF signal is low, replace the switched filter assembly.

Step 9. Run self-test again.

- ❑ If no error message is displayed, the problem is cleared.
- ❑ If any of the error messages, listed above, are displayed, contact your local Anritsu service center for assistance.

Table 5-15. Error Message 129 (1 of 3)

Error 129 Switched Filter or Level Detector Failed

Description: Error 129 indicates a failure of either the switched filter or level detector circuitry. The MG369XA may or may not produce an RF output in the 2 to 20 GHz frequency range. Thus, there are two troubleshooting paths for this problem—unleveled with output power and unleveled with no/low output power.

Unleveled with output power (The warning message UNLEVELED appears on the front panel display):

Step 1. Set up the MG369XA as follows:

- **a.** Frequency: Step Sweep
- **b.** F1: 2.000 GHz (2.21 GHz with Option 4)
- **c.** F2: 20.000 GHz
- **d.** More: Number of Steps: 400
- **e.** Previous: L1: +1.00 dBm
- **f.** Level: ALC Mode: Leveling
- **g.** Leveling: External Detector

Step 2. Connect a detector to the MG369XA RF OUTPUT connector and connect the detected DC output of the detector to the rear panel EXTERNAL ALC IN connector.

- ❑ If the warning message UNLEVELED no longer appears on the front panel display, replace the directional coupler.
- ❑ If the warning message UNLEVELED is still displayed, replace the A6 PCB.

Error Message 129 (2 of 3)

Unleveled with no/low output power:

Step 1. Set up the MG369XA as follows:

- **a.** Frequency: Step Sweep
- **c.** F1: 2.000 GHz (2.21 GHz with Option 4)
- **d.** F2: 20.000 GHz
- **e.** More: Number of Steps: 400
- **f.** Previous: L1: +1.00 dBm
- **f.** Level: ALC Mode: Leveling
- **g.** Leveling: External Detector

Step 2. Connect the X input of an oscilloscope to the MG369XA rear panel HORIZ OUT connector.

Step 3. Using the oscilloscope, check the switched filter bias voltages at A1J10 pin13 and A1J10 pin 9. The bias voltage at A1J10 pin 13 should be +7 volts; the bias voltage at A1J10 pin 9 should be +8 volts. If the MG369XA has a SDM installed, also check for a +20 volt PIN switch drive voltage at A1J6 pin 3B.

- ❑ If the bias and the PIN switch drive voltages are correct, go to Step 4.
- ❑ If the bias voltages are not correct, refer to the troubleshooting Table 5-4 to determine if the power supply or regulator PCB needs to be replaced.
- ❑ If the PIN switch drive voltage is not correct, replace the A6 PCB.

Step 4. Connect a 56100A Scalar Network Analyzer to the MG369XA as follows:

- **a.** Connect the MG369XA AUX I/O to the 56100A AUX I/O.
- **b.** Connect the 56100A DEDICATED GPIB to the MG369XA IEEE-488 GPIB.
- **c.** Connect the RF detector to the 56100A Channel A input.

Error Message 129 (3 of 3)

Step 5. Set up the 56100A scalar network analyzer as follows:

a. Press the SYSTEM MENU key.

b. From System menu display, select RESET.

c. Press CHANNEL 2 DISPLAY: OFF

d. Press CHANNEL 1 DISPLAY: ON

e. Press the CHANNEL 1 MENU key.

f. From the Channel 1 menu display, select POWER.

Step 6. Using the scalar network analyzer with a 10 dB pad, measure the RF output at J2 of the switched filter assembly. The amplitude of the RF signal should be >+15 dBm (>+20 dBm with Option 15) throughout the full sweep.

- ❑ If the amplitude of the RF signal is correct, check for bad RF cables.
- ❑ If there is no RF signal or if the amplitude of the RF signal is low, replace the A10 switched filter assembly.

Table 5-16. Error Messages 130, 131, 132, 133 and 134

Error 130 2-3.3 GHz Switched Filter
Error 131 3.3-5.5 GHz Switched Filter
Error 132 5.5-8.4 GHz Switched Filter
Error 133 8.4-13.25 GHz Switched Filter
Error 134 13.25-20 GHz Switched Filter

Description: Each of these error messages indicates a failure in a switched filter path within the switched filter assembly. The MG369XA may or may not produce an RF output in the frequency range of the failed switched filter path.

Step 1. Set up the MG369XA as follows:

a. Frequency: Step Sweep

b. F1: 2.000 GHz (2.21 GHz with Option 4)

c. F2: 20.000 GHz

d. More: Number of Steps: 400

e. Previous: L1: +1.00 dBm

f. Level: ALC Mode: Leveling

g. Leveling: External Detector

Step 2. Connect the X input of an oscilloscope to the MG369XA rear panel HORIZ OUT connector.

Step 3. Using the oscilloscope, check for the switched filter PIN switch drive voltages at the test points shown in Table 5-16a.

- ❑ If the PIN switch drive voltages are correct, replace the switched filter assembly.
- ❑ If the PIN switch drive voltages are incorrect, replace the A6 ALC PCB.

Table 5-16a. *Switched Filter PIN Switch Drive Voltages*

Test Point	Active Frequency Range	Active Voltage	Inactive Voltage
A1J10 pin 14	2 to 3.3 GHz	–2.3V	+1.0V
A1J10 pin 5	3.3 to 5.5 GHz	–2.0V	+1.0V
A1J10 pin 4	5.5 to 8.4 GHz	–2.0V	+1.0V
A1J10 pin 3	8.4 to 13.25 GHz	–2.0V	+1.0V
A1J10 pin 2	13.25 to 20 GHz	–2.0V	+1.0V
A1J10 pin 6	2 to 8.4 GHz	–2.3V	+1.0V

Table 5-17. Error Message 135

Error 135 Modulator or Driver Failed

Description: Error 135 indicates a failure of the modulator in the switched filter assembly or the modulator driver circuitry on the A6 ALC PCB.

Step 1. Replace the A6 PCB and run self-test.

- ❑ If error 135 is not displayed, the problem is cleared.
- ❑ If error 135 is still displayed, go to Step 2.

Step 2. Replace the switched filter assembly and run self-test again.

- ❑ If error 135 is not displayed, the problem is cleared.
- ❑ If error 135 is still displayed, contact your local Anritsu service center for assistance.

Table 5-18. Error Message 138

Output Power Level Related Problems
MG369XA Models with SDM (30 or 40 GHz)

Error 138 SDM Unit or Driver Failed

Description: Error 138 indicates a failure of the SDM or a failure of the SDM bias regulator or frequency band selection circuitry on the A6 ALC PCB. The MG369XA will not produce an RF output in the 20 to 40 GHz frequency range.

Step 1. Set up the MG369XA as follows:

- **a.** Frequency: Step Sweep
- **b.** F1: 20.000 GHz
- **c.** F2: 40.000 GHz (30 GHz for MG3693A)
- **d.** More: Number of Steps: 400
- **e.** Previous: L1: +1.00 dBm
- **f.** Level: ALC Mode: Leveling
- **g.** Leveling: External Detector

Step 2. Connect the X input of an oscilloscope to the MG369XA rear panel HORIZ OUT connector.

Step 3. Using the oscilloscope, check for a +8 volts SDM bias voltage at A1J5 pin 6A throughout the full sweep.

- ❑ If the SDM bias voltage is correct, replace the SDM.
- ❑ If the SDM bias voltage is not correct, go to Step 4.

Step 4. Using the oscilloscope, check for a +8 volts SDM bias voltage at A1J5 pin 5A.

- ❑ If the +8 volt bias is correct, replace the A5 PCB.
- ❑ If the +8 volt bias is not correct, refer to the troubleshooting Table 5-4 to determine if the power supply or regulator needs to be replaced.

Step 5. Run self-test.

- ❑ If error 138 is not displayed, the problem is cleared.
- ❑ If error 138 is still displayed, contact your local Anritsu service center for assistance.

Table 5-19. Error Messages 139, 140 and 141

Error 139 32-40 GHz SDM Section Failed
Error 140 25-32 GHz SDM Section Failed
Error 141 20-25 GHz SDM Section Failed

Description: Each of these error messages indicates a failure in a switched doubler filter path within the SDM. The MG369XA will not produce an RF output in the frequency range of the failed switched doubler filter path.

Step 1. Set up the MG369XA as follows:

a. Frequency: Step Sweep

b. F1: 2.000 GHz

c. F2: 40.000 GHz (30 GHz for MG3693A)

d. More: Number of Steps: 400

e. Previous: L1: +1.00 dBm

f. Level: ALC Mode: Leveling

g. Leveling: External Detector

Step 2. Connect the X input of an oscilloscope to the MG369XA rear panel HORIZ OUT connector.

Step 3. Using the oscilloscope, check the PIN switch drive voltages shown in Table 5-19a.

- ❑ If the PIN switch drive voltages are correct, replace the SDM.
- ❑ If the PIN switch drive voltages are not correct, replace the A9 PCB.

Table 5-19a. *SDM PIN Switch Drive Voltages*

Test Point	Active Frequency Range	Active Voltage	Inactive Voltage
A1J6 pin 3B	0.01 to 20 GHz	+20V	–15V
A1J6 pin 3C	20 to 25 GHz	+20V	–15V
A1J6 pin 4A	25 to 32 GHz	+20V	–15V
A1J6 pin 4B	32 to 40 GHz	+20V	–15V

Table 5-20. Error Message 144

Error 144 RF was Off when Self-test started. Some tests were not performed

Description: Indicates that some self-tests were not performed because the RF output was selected OFF on the front panel.

Step 1. Press the OUTPUT key on the front panel to turn the RF output ON.

Step 2. Run self-test again. If error 144 is still displayed, contact your local Anritsu service center for assistance.

Table 5-21. Error Message 145

A6 AM Module

Error 145 AM Meter or associated circuitry failed

Description: Indicates a failure of the internal amplitude modulation function. The MG369XA may or may not provide amplitude modulation of the RF output signal using modulating signals from an external source.

Step 1. Set up the MG369XA as follows:

- **a.** Press SYSTEM, then Reset.
- **b.** Press MODULATION, then AM to go to the Internal AM Status display.
- **c.** Press On/Off to turn internal amplitude modulation on.

Step 2. Using an oscilloscope, verify the presence of a 2 volt peak-to-peak sine wave signal with a period of 100 μs at the rear panel AM OUT connector.

- ❑ If present, replace the A6A1 module.
- ❑ If not present, replace the A8 PCB.

Step 3. Run self-test again. If error 145 is still displayed, contact your local Anritsu service center for assistance.

Table 5-22. Error Message 147

A7 FM Module

Error 147 Internal FM circuitry failed

Description: Indicates a failure of the internal frequency modulation function. The MG369XA may or may not provide frequency modulation of the RF output signal using modulating signals from an external source.

Step 1. Set up the MG369XA as follows:

- **a.** Press SYSTEM, then Reset.
- **b.** Press MODULATION, then FM to go to the Internal FM Status display.
- **c.** Press On/Off to turn internal frequency modulation on.

Step 2. Using an oscilloscope, verify the presence of a 2 volt peak to peak sine wave signal with a period of 10 μs at the rear panel FM OUT connector.

- ❑ If present, replace the A7A1 FM module.
- ❑ If not present, replace the A8 PCB.

Step 3. Run self-test again. If error 147 is still displayed, contact your local Anritsu service center for assistance.

Table 5-23. Error Message 148

Pulse Reference Circuitry

Error 148 Pulse 40 MHz reference circuitry failed.

Description: Indicates a failure of the pulse generator 40 MHz oscillator circuitry. The pulse generator may still function; however, the 40 MHz oscillator is not phase locked to the 10 MHz reference timebase. The pulse modulation function may or may not operate. Error 106 (Power Supply not Phase-locked) may also be displayed.

Step 1. Disconnect the MCX cable at A13J1.

Step 2. Using an oscilloscope, verify the presence of a 10 MHz at the end of the MCX cable.

- ❑ If present, replace the A13 PCB.
- ❑ If not present, go to Step 3.

Step 3. Reconnect the MCX cable to A13J1 and disconnect the MCX cable at A3J10.

Step 4. Using the oscilloscope, verify the presence of a 10 MHz TTL signal at A3J10.

- ❑ If present, replace the MCX cable.
- ❑ If not present, replace the A3 PCB.

Step 5. Run self-test again. If error 148 is still displayed, contact your local Anritsu service center for assistance.

Table 5-24. Error Message 136

Output Power Related Problems (>40 GHz) MG369XA Models with SQM

Error 136 SQM Unit or Driver Failed

Description: Error 136 indicates a failure of the SQM or a failure of the SQM bias regulator or frequency band selection circuitry on the A6 PCB. The MG369XA will not produce an RF output above 40 GHz.

Step 1. Set up the MG369XA as follows:

a. MG369XA Setup:
CW/SWEEP SELECT: Step
F1: 40.0 GHz
F2: 50.0, 60.0, or 65.0 GHz (Model dependent)
Number of Steps: 400
L1: –2.0 dBm

Step 2. Connect the X input of an oscilloscope to the MG369XA rear panel HORIZ OUT connector.

Step 3. Using the oscilloscope, check the following voltages:

a. For the MG3695A, check the SQM bias voltages at A6P3 pin 1 and A6P3 pin 5. The bias voltage at A6P3 pin 1 should be +10 volts; the bias voltage at A6P3 pin 5 should be –5 volts.

For the MG3696A, check for a +10 volts SQM bias voltage at A6P3 pin 1.

b. For all models, check for a –2 volt PIN switch drive voltage at A1J10 pin 10.

- ❑ If the SQM bias and the PIN switch drive voltages are correct, go to Step 4.
- ❑ If the pin switch drive or SQM bias voltage(s) is not correct, replace the A6 PCB.

Step 4. Connect a 56100A Scalar Network Analyzer to theMG369XA as follows:

a. Connect the MG369XA AUX I/O to the 56100A AUX I/O.

b. Connect the 56100A DEDICATED GPIB to the MG369XA IEEE-488 GPIB.

c. Connect the RF Detector to the 56100A Channel A Input.

Step 5. Set up the 56100A Scalar Network Analyzer as follows:

a. Press SYSTEM MENU display.

b. From System Menu display, select RESET.

c. Press CHANNEL 2 DISPLAY: OFF.

d. Press CHANNEL 1 DISPLAY: ON.

e. Press CHANNEL 1 Menu key.

f. From the Channel 1 Menu display, select POWER.

Step 6. Using the scalar network analyzer, measure the RF output at J4 of the switched filter assembly. The amplitude of the RF signal should be >+18 dBm throughout the full sweep.

- ❑ If the amplitude of the RF signal is correct, replace the SQM.
- ❑ If there is no RF signal or if the amplitude of the RF signal is low, replace the switched filter assembly.

Step 7. Run self-test again. If error 136 is still displayed, contact your local Anritsu service center for assistance.

Chapter 6
Removal and Replacement Procedures

Table of Contents

Chapter 6 Removal and Replacement Procedures

6-1 Introduction

This chapter provides procedures for gaining access to the major MG369XA assemblies, subassemblies, and components for troubleshooting or replacement. Replacing most assemblies will require additional adjustments to the instrument. Refer to Chapter 4—Calibration.

WARNING
Hazardous voltages are present inside the MG369XA whenever AC line power is connected. Turn off the unit and remove the line cord before removing any covers or panels. Troubleshooting and repair procedures should only be performed by service personnel who are fully aware of the potential hazards.

CAUTION
Many subassemblies in the instrument contain static-sensitive components. Improper handling of these subassemblies may result in damage to the components. **Always** observe the static-sensitive component handling procedures described in Chapter 1, Figure 1-2.

NOTE
Many assemblies, subassemblies, and components within the MG369XA family of instruments are type and model dependent. Before replacing an assembly, subassembly, or component, **always** verify the part number of the replacement item. Part numbers can be found in Table 6-1 and Table 6-2 on the following pages.

6-2 Exchange Assembly Program

Anritsu maintains an exchange assembly program for selected MG369XA subassemblies and RF components. If one of these subassemblies malfunction , the defective unit can be exchanged. All exchange subassemblies and RF components are warranted for 90 days from the date of shipment, or for the balance of the original equipment warranty, whichever is longer.

Please have the exact model number and serial number of your unit available when requesting this service, as the information about your unit is filed according to the instrument's model and serial number. For more information about the program, contact your local sales representative or call your local Anritsu service center. Refer to Table 6-4, on page 6-24, for a list of current Anritsu service centers.

Table 6-1 lists the replaceable PCB subassemblies, and Table 6-2 lists the RF components, of the MG369XA that are presently covered by the Anritsu exchange assembly program.

Table 6-1. *Replaceable Subassemblies (1 of 2)*

For the MG369XA Series CW Generators

ASSEMBLY NUMBER	PCB SUBASSEMBLY OR PART NAME	ANRITSU PART NUMBER	Model or Option List
	Front Panel Assembly	52349	
	Model ID, MG3691A	57184-6	
	Model ID, MG3692A	57184-1	
	Model ID, MG3693A	57184-2	
	Model ID, MG3694A	57184-3	
	Model ID, MG3695A	57184-4	
	Model ID, MG3696A	57184-5	
	AC Input Module with EMI Filter	260-23	
	Power Supply	40-147	
	Standby Power Supply	40-148	
A2	Microprocessor PCB Assembly	52202-3	
A3	Reference/Fine Loop PCB Assembly	ND58464	
A3	Reference/Fine Loop PCB Assembly	ND58466	3
A3	Reference/Fine Loop PCB Assembly	ND58465	16
A3	Reference/Fine Loop PCB Assembly	ND58467	3 and 16
A4	Coarse Loop PCB Assembly	D40624-3	3
A4	Coarse Loop PCB Assembly	D40634-3	
A5	Auxiliary PCB Assembly	52213-3	
A6	ALC PCB Assembly	52208-3	
A6	ALC PCB Assembly	52220-3	13X
A6	ALC PCB Assembly (for instrument S/N: 021901 and later)	52226-3	
A7	YIG Lock PCB with Sampler	ND57368	3
A7	YIG Lock PCB with Sampler	ND57369	22
A8	DDS PCB Assembly	52214-3	
A20	Regulator PCB Assembly (for instrument S/N: 021899 and below)	52209-3	
A20	Regulator PCB Assembly (for instrument S/N: 021901 and above)	52236-3	
A21	Rear Panel PCB Assembly	52215-3	

Table 6-1. Replaceable Subassemblies (2 of 2)

For the MG369XA Series Signal Generators			
ASSEMBLY NUMBER	**PCB SUBASSEMBLY OR PART NAME**	**ANRITSU PART NUMBER**	**Model or Option List**
	Front Panel Assembly	52349	
	Model ID: MG3691A	60124-6	
	Model ID: MG3692A	60124-1	
	Model ID: MG3693A	60124-2	
	Model ID: MG3694A	60124-3	
	Model ID: MG3695A	60124-4	
	Model ID: MG3696A	60124-5	
	AC Input Module with EMI Filter	260-23	
	Power Supply	40-147	
	Standby Power Supply	40-148	
A2	Microprocessor PCB Assembly	52202-3	
A3	Reference/Fine Loop PCB Assembly	ND61814	
A3	Reference/Fine Loop PCB Assembly	ND61816	3
A3	Reference/Fine Loop PCB Assembly	ND61815	16
A3	Reference/Fine Loop PCB Assembly	ND61817	3 and 16
A4	Coarse Loop PCB Assembly	D40624-3	3
A4	Coarse Loop PCB Assembly	D40634-3	
A5	Auxiliary PCB Assembly	52245-3	
A5	Analog Instruction PCB Assembly	52225-3	6
A6	ALC PCB Assembly	52247-3	
A6A1	AM Module	52232-3	14
A7	YIG Lock PCB Assembly with Sampler	ND61818	
A7	YIG Lock PCB Assembly with Sampler	ND61819	3
A7A1	FM Module	52234-3	12
A8	Function Generator PCB Assembly	52233-3	23
A13	Pulse Generator PCB Assembly	52222-3	24
A20	Regulator PCB Assembly	52236-3	
A21	Rear Panel PCB Assembly	52244-3	

Table 6-2. Replaceable RF Components

ASSEMBLY NUMBER	RF SUBASSEMBLY OR PART NAME	ANRITSU PART NUMBER	Model or Option List
A9	YIG Module (2 to 20 GHz)	ND56503	MG369XA CW Gen.
A9	YIG Module (2 to 8.4 GHz)	ND59717	MG3691A CW Gen.
A9	YIG Module (2 to 20 GHz)	ND61820	MG369XA Signal Gen.
A9	YIG Module (2 to 8.4 GHz)	ND61821	MG3691A Signal Gen.
A10	Standard Switched Filter Assembly	D45194	
A10	Pulsed Switched Filter Assembly	D45196	13
A10	Hi Power Switched Filter Assembly	D45198	15X
A10	Hi Power Pulsed Switched Filter Assembly	D45200	13 and 15X
A11	Down Converter	D27330	5
A11	Pulsed Digital Down Converter Assembly	ND55519	4
A12	Switched Doubler Assembly	D28540	
A12	Hi Power Switched Doubler Assembly	47520	
A13	Electronic Step Attenuator Assembly	45720	2E and 2F
A13	Step Attenuator Assembly, 20 GHz	D27152	2A
A13	Step Attenuator Assembly, 40 GHz	D25080	2B
A13	Step Attenuator Assembly, 65 GHz	D28957	2C
	Coupler Assembly, 40 GHz	ND60339	
	Coupler Assembly, 65 GHz	ND60340	
	Diplexing Switch Assembly	29860	22
	Lo-band Diplexing Switch Assembly	46504	22
	K-K Panel Connector Assembly	C27310	
	V-V Panel Connector Assembly	C27300	
	40 GHz Microwave Mixer	60-276	7
	Source Quadrupler Assembly (50 GHz unit only)	ND60341	
	Source Quadrupler Assembly (65 GHz unit only)	ND60342	
	16.8 GHz Low Pass Filter (65 GHz unit only)	B28612	
	Forward Coupler (65 GHz unit only)	C27184	
	37 GHz High Pass Filter (65 GHz unit only)	49247	

Table 6-3 lists the internal RF cables and part numbers for all of the various instrument configurations.

Table 6-3. *MG369XA Series Cable Part Number List (1 of 3)*

Cable Reference Designator	Part Number	Connector Type	Connection	Notes
W150	B37319-50	MCX	A3J1 to A7J5	
W151	B37319-51	MCX	A3J3 to A4J1	
W152	B37319-52	MCX	A3J5 to DC LO	For models with Option 5 only
W153	B37319-53	MCX	A3J7 to A4J1	For models with Option 3 only
W154	B37319-54	MCX	A3J10 to A4J6	
W155	B37319-55	MCX	A3J12 to A21J14	
W156	B37319-56	MCX	A3J13 to A21J13	
W157	B37319-57	MCX	A4J2 to A7J1	For models with Option 3 only
W158	B37319-58	MCX	A4J3 to A7J1	
W159	B37319-59	MCX	Coupler to A6J1	
W160	B37319-60	MCX	DC DET to A6J2	For models with Option 4 only
W161	B37319-61	MCX	A21J17 to A6J4	
W162	B37319-62	MCX	A6J5 to SFJ7	
W163	B37319-63	MCX	DDCJ4 to SFJ7	For models with Option 4 and 13
W164	B37319-64	MCX	A3J11 to A8J1	For models with Option 22 only
W165	B37319-65	MCX	A8J3 to Diplexer	For models with Option 22 only
W166	B37319-66	MCX	A3J1 to A7J7	For models with Option 3 only
W167	B37319-67	MCX	A6J3 to DDCJ5	For models with Option 4 and 13
W168	B37319-68	MCX	A6J1 to DET	
W169	B37319-69	MCX	A6J2 to DC DET J1	For models with Option 5 only
W170	B37319-70	MCX	A6J3 to SFJ7	For models with Option 13 only
W171	B37319-71	MCX	A21J17 to A6J5	For models with Option 13 only
W172	B37319-72	MCX	A21J15 to A7AIJ1	For models with Option 12 only
W173	B37319-73	MCX	A9J2 to A7AIJ3	For models with Option 12 only
W174	B37319-74	MCX	A8J9 to A7AIJ2	For models with Options 12 and 23 only
W175	B37319-75	MCX	A8J1 to A3J8	For models with Option 23 only
W176	B37319-76	MCX	A13J1 to A3J10	For models with Options 3 and 24 only
W177	B37319-77	MCX	A13J2 to A6J4	For models with Option 13 and 24 only
W178	B37319-78	MCX	A13J3 to A21J18	For models with Option 13 and 24 only
W179	B37319-79	MCX	A13J4 to A21J16	For models with Option 13 and 24 only
W180	B37319-80	MCX	A3J9 to Diplexer	For models with Options 4 and 22 only
W181	B37319-81	MCX	A13J7 to A6J5	For models with Option 13 and 24 only
W182	B37319-82	MCX	A13J6 to A21J17	For models with Option 13 and 24 only
W185	B37319-85	MCX	A13J1 to A4J7	For models with Option 12 and 24 only

Table 6-3. *MG369XA Series Cable Part Number List (2 of 3)*

Cable Reference Designator	Part Number	Connector Type	Connection	Notes
W200	B37323-200	SMA	SWFJ5 to Sampler	For CW Generators Only
W201	B37323-201	SMA	YIG to SWFJ6	
W202	B37323-202	SMA	SWFJ1 to DCJ3	For models with Option 5 only
W203	B37323-203	SMA	SWFJ3 to DCJ4	For models with Option 5 only
W204	B37323-204	SMA	SWFJ2 to SDMJ1	For >20 GHz models
W205	B37323-205	SMA	DDC to SWFJ1	For models with Option 4 only
W206	B37321-206	SMA	SWFJ3 to DDC	For models with Option 4 only
W209	B37323-209	SMA	SWFJ2 to Diplexer	For models with Option 22 only
W210	B37323-210	SMA	SWFJ4 to SQM Filter	For 65 GHz models
W211	B37323-211	SMA	SWFJ4 to SQMJ1	For 50 GHz models
W212	B37323-212	SMA	SWFJ5 to Sampler	For Signal Generators Only
W213	B37323-213	SMA	SWFJ2 to Diplexer	For models with Options 5 and 22
W214	B37323-214	SMA	SWFJ2 to Diplexer	For models with Options 4 and 22
W300	B37391-300	SMA	Diplexer to Diplexer	For models with Option 22 (CW Generators Only)
W301	B37391-301	SMA	Diplexer to Diplexer	For models with Options 4 and 22 (CW Generators Only)
W304	B37391-304	SMA	Diplexer to Diplexer	For models with Options 5 and 22 (CW Generators Only)
W250	B37324-250	K	SWFJ2 to Coupler	
W251	B37324-251	K	SWFJ2 to Coupler	For models with Option 2X
W252	B37324-252	K	SDM to Coupler	For >20 GHz models (CW Generators Only)
W253	B37324-253	K	SDM to Coupler	For >20 GHz models (Signal Generators Only)
W254	B37324-254	K	SWF to Coupler	For models with Option 9K
W255	B37324-255	K	SWF to SDM	For models with Option 9K
W258	B37324-258	K	SWF to Coupler	For models with Options 2X and 9K
W259	B37324-259	K	Diplexer to Coupler	For models with Options 2X and 22
W260	B37324-260	K	SWFJ2 to Diplexer	For models with Options 4 or 5 and 22
W261	B37324-261	K	Diplexer to Coupler	
W262	B37324-262	K	SDM to A16J2	For models with Options 4 or 5, 9X and 22
W267	B37324-267	K	Diplexer to Coupler	For models with Options 9K and 22
W268	B37324-268	K	Diplexer to Coupler	For models with Options 2X, 9K and 22
W271	B37324-271	K	SDM to SQM FWD Coupler	For 50/65 GHz models
W272	B37324-272	K	Diplexer to SQM FWD Coupler	For models with Option 22
W273	B37324-273	K	RP to Mixer	For models with Option 7
W274	B37324-274	K	RP to Mixer	For models with Option 7

Table 6-3. MG369XA Series Cable Part Number List (3 of 3)

Cable Reference Designator	Part Number	Connector Type	Connection	Notes
W275	B37324-275	K	RP to Mixer	For models with Option 7
W276	B37324-276	K	SDM to SQM FWD Coupler	For models with Option 9V
W277	B37324-277	K	Diplexer to Coupler	For models with Options 5 and 22
W278	B37324-278	K	Diplexer to Coupler	For models with Options 2X, 5, and 22
W279	B37324-279	K	Diplexer to Coupler	For models with Options 4 and 22
W280	B37324-280	K	Diplexer to Coupler	For models with Options 2X, 4, and 22
W281	B37324-281	K	Diplexer to Coupler	For models with Options 5, 9K, and 22
W282	B37324-282	K	Diplexer to Coupler	For models with Options 2X, 5, 9K, and 22
W283	B37324-283	K	Diplexer to Coupler	For models with Options 4, 9K, and 22
W284	B37324-284	K	Diplexer to Coupler	For models with Options 2X, 4, 9K, and 22
W285	B37324-285	K	SDMJ2 to Diplexer	For models with Options 5, 7, and 22
W286	B37324-286	K	SDMJ2 to Diplexer	For models >20 GHz and with Options 5 and 22
W287	B37324-287	K	Diplexer to SDMJ2	For models >20 GHz and with Options 5, 9X and 22
W288	B37324-288	K	Diplexer to SDMJ2	For models >20 GHz and with Options 4, 9X and 22
W289	B37324-289	K	Diplexer to SQM FWD Coupler	For models >20 GHz and with Options 5 and 22
W500	B37393-500	V	SQM FWD Coupler to Coupler	For models >40 GHz
W501	B37393-501	V	SQM FWD Coupler to Coupler	For models >40 GHz and with Option 2
W502	B37393-502	V	SQM FWD Coupler to Coupler	For models >40 GHz and with Options 2 and 9V
W503	B37393-503	V	SQM FWD Coupler to Coupler	For models >40 GHz and with Option 9V

6-3 Chassis Covers

Troubleshooting procedures require removal of the top and bottom covers. Replacement of some MG369XA assemblies and parts require removal of all covers. The following procedure describes this process.

Tool Required # 1 Phillips screwdriver

Preliminary Disconnect the power cord from the unit.

Procedure Remove and replace the chassis covers as follows:

> ***NOTE***
>
> The screws with green heads have metric threads. When it becomes necessary to replace any of these screws, *always* use the exact replacement green-headed screws to avoid damage to the instrument. Anritsu P/N's: 905-8 (long); Z-951102 (short).

Step 1. Use a Phillips screwdriver to remove the screws and the front handle assemblies from the instrument (see Figure 6-1). For models not having front handles, remove the screws and the front top and bottom feet from the instrument. Retain the screws.

Step 2. Use a Phillips screwdriver to remove the four feet from the rear of the instrument. Retain the screws.

Step 3. Remove the screw that fastens the top cover to the chassis (see Figure 6-2 on the following page).

Step 4. Slide the cover out along the grooves in the chassis and set them aside.

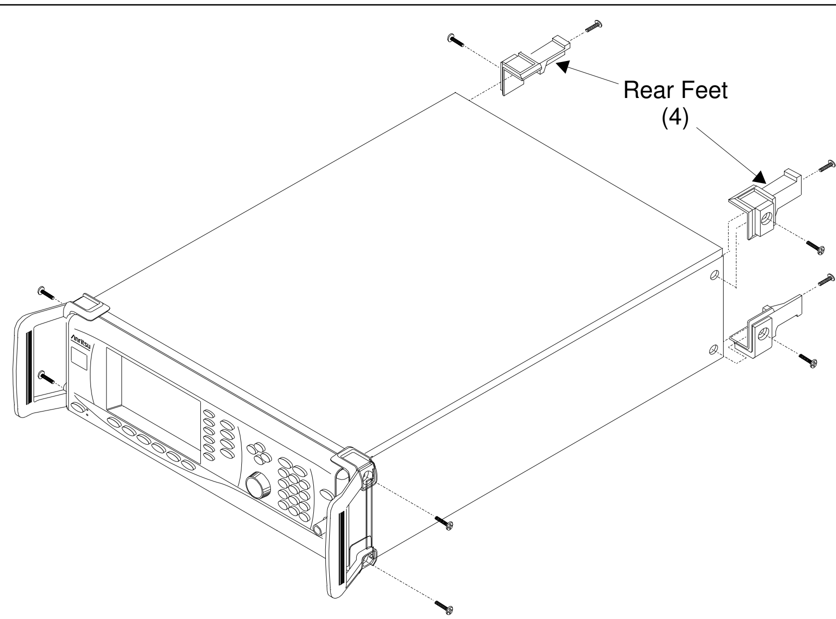


Figure 6-1. *Front Handle and Rear Feet Removal*

> **NOTE**
> It is necessary to remove the side covers only if the front panel is to be removed in a later step.

Step 5. Turn the instrument over so that the bottom cover is on top.

Step 6. Remove the screw that fastens the bottom cover to the chassis. See Figure 6-2.

Step 7. Slide the bottom cover out along the grooves in the chassis and set it aside.

Step 8. Turn the instrument over to return it to the upright position.

Step 9. Remove the screw that fastens the left side cover to the chassis. See Figure 6-2.

Step 10. Remove the side cover and set it aside.

Step 12. Remove the screw that fastens the right side cover to the chassis. See Figure 6-2.

Step 13. Remove the side cover and set it aside.

Step 14. To replace the chassis covers, reverse the procedure used to remove them.

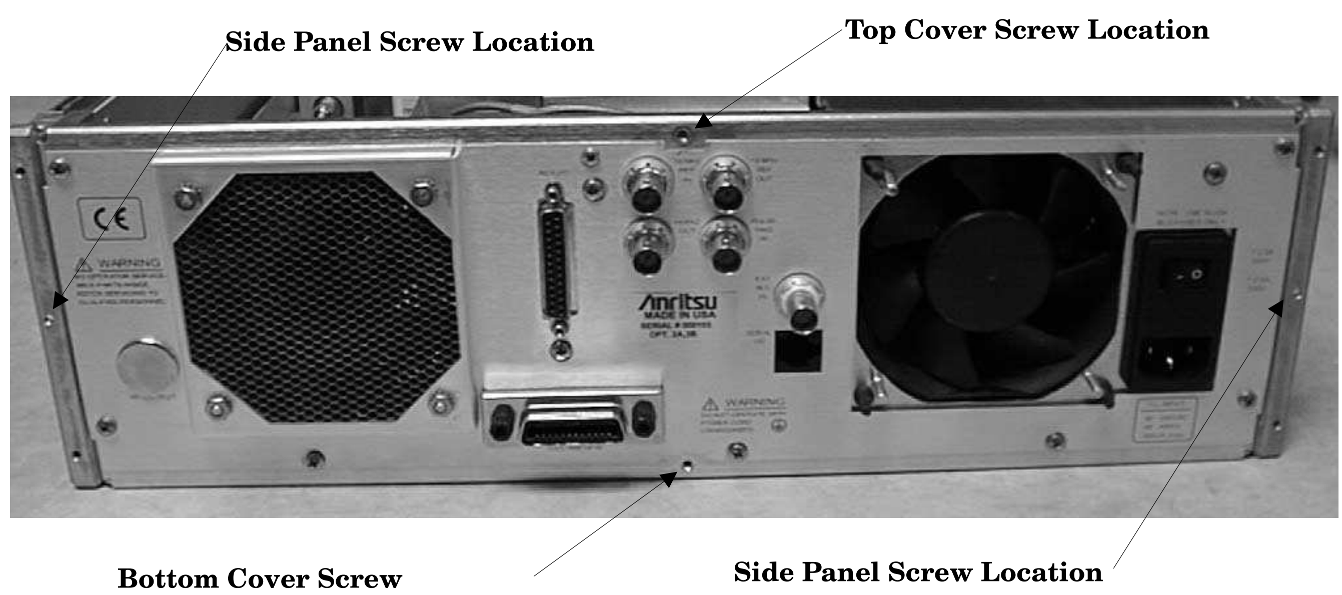


Figure 6-2. *Rear Panel Retaining Screw Locations*

6-4 Front Panel Assembly

This paragraph provides instructions for removing and replacing the front panel assembly of the MG369XA. The front panel assembly contains the A1 front panel PCB. Refer to Figures 6-3 and Figure 6-4 during this procedure.

Preliminary Remove the front handles, rear feet, and chassis covers as described in Section 6-3.

Procedure Remove and replace the front panel assembly as follows:

Step 1. With the front handles and chassis covers removed, place the MG369XA on a flat surface, with the top side up.

Step 2. Carefully pull the front panel away from the chassis to gain access to the front panel ribbon cable that connects the front panel PCB assembly to the microprocessor PCB assembly. See Figure 6-4.

Step 3. Disconnect the front panel ribbon cable from the connector on the front panel PCB assembly. See Figure 6-3.

Step 4. Carefully pull the front panel assembly forward until it is clear of the RF OUTPUT connector. Set front panel aside.

Step 5. To replace the front panel assembly, reverse the removal process.

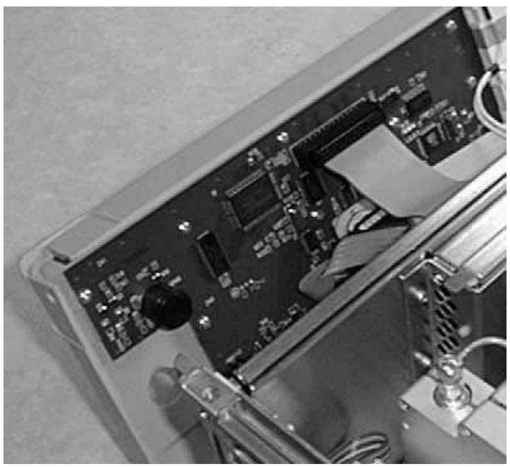


Figure 6-3. *Front Panel Ribbon Connector Detail*

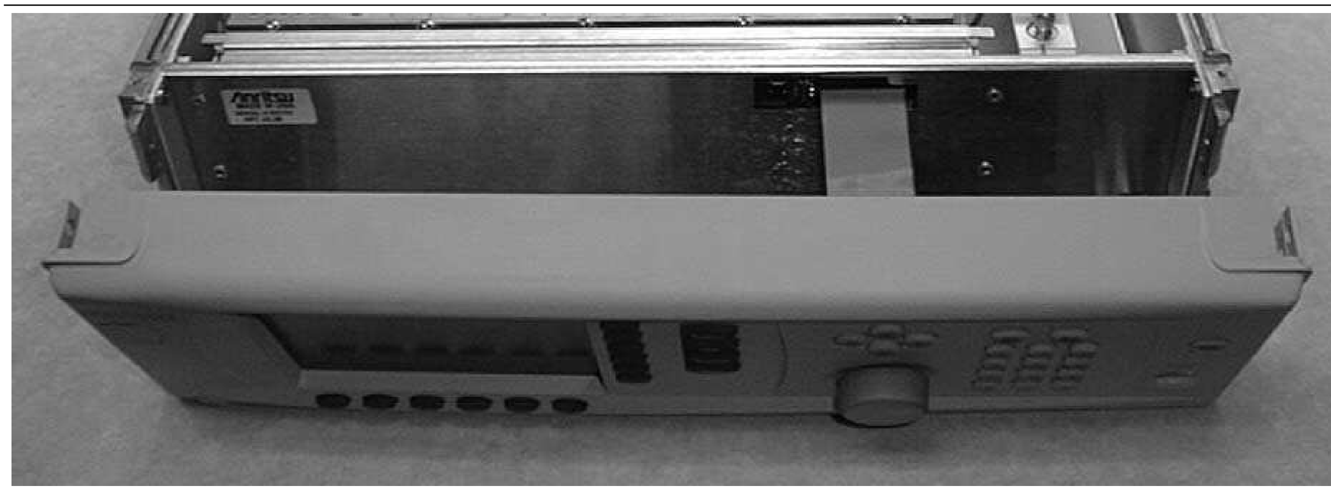


Figure 6-4. *Front Panel Removal*

6-5 A2 Microprocessor PCB Board

This paragraph provides instructions for removing and replacing the A2 microprocessor PCB which is located immediately behind the front panel in a shielded card cage. See Figure 6-5.

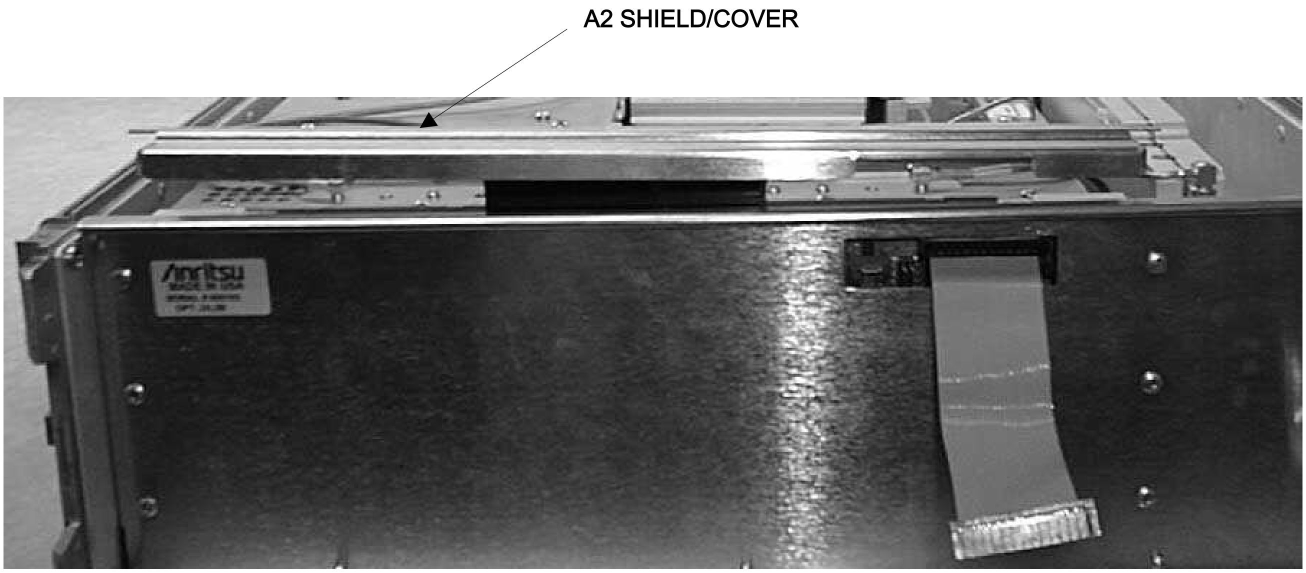


Figure 6-3. A2 Microprocessor PCB Removal

Preliminary Remove the front panel assembly as described in Section 6-4.

Procedure Remove and replace the A2 microprocessor PCB as follows:

Step 1. Grasp the lifting tabs on the sides of the microprocessor shield/cover and remove. Set shield/cover aside.

Step 2. Carefully disconnect the ribbon cable from the connector J2 of the microprocessor board. Note the orientation of the red stripe.

> ***NOTE***
> When reconnecting the ribbon cable, the edge with the red stripe should be located to the right as seen from the front of the instrument.

Step 3. Using the card extractor handles, lift and remove the microprocessor board from the card cage.

Step 4. To replace the microprocessor board, reverse the removal process.

6-6 A3 Reference/Fine Loop PCB

This paragraph provides instructions for removing and replacing the A3 reference/fine loop PCB, which is located in a shielded enclosure immediately behind the microprocessor board card cage.

Preliminary Remove the front handles, rear feet, and top cover as described in Section 6-3.

Procedure Remove and replace the reference/fine loop PCB as follows:

Step 1. Carefully disconnect the coaxial cables from the top connectors of the A3 PCB assembly. See Figures 6-6 and 6-7.

Step 2. Use a Phillips screwdriver to remove the nine retaining screws from the A3 shield cover. Retain the screws.

Step 3. Remove cover and set aside.

Step 4. Using the card extractor handles, lift and remove the A3 PCB from its enclosure.

Step 5. To replace the A3 PCB, reverse the removal process.

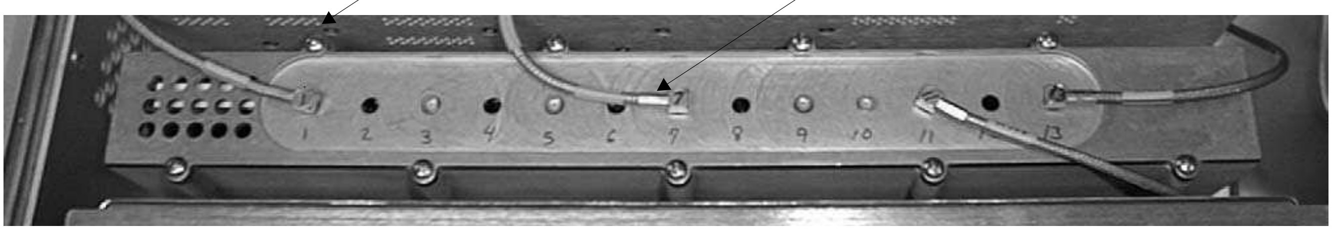


Figure 6-4. *A3 Reference/Fine Loop PCB Cover Removal*

6-7 A4 Coarse Loop PCB

This paragraph provides instructions for removing and replacing the A4 coarse loop PCB assembly, which is located immediately behind the A3 reference/fine loop PCB assembly.

Preliminary Remove the front handles, rear feet, and top cover as described in Section 6-3. For models with Option 3, the A4 PCB and shield assembly are removed as a single unit and the bottom cover to the instrument must also be removed.

Procedure Remove and replace the A4 PCB assembly as follows: (models without Option 3)

Step 1. Carefully disconnect the coaxial cables from the top connectors of the A4 PCB assembly. Refer to Figure 6-7.

Step 2. Use a Phillips screwdriver to remove the nine retaining screws from the A4 shield cover assembly. Retain the screws.

Step 3. Remove the cover and set it aside.

Step 4. Using the card extractor handles, lift and remove the A4 PCB from its enclosure.

Step 5. To replace the A4 PCB assembly, reverse the removal process.

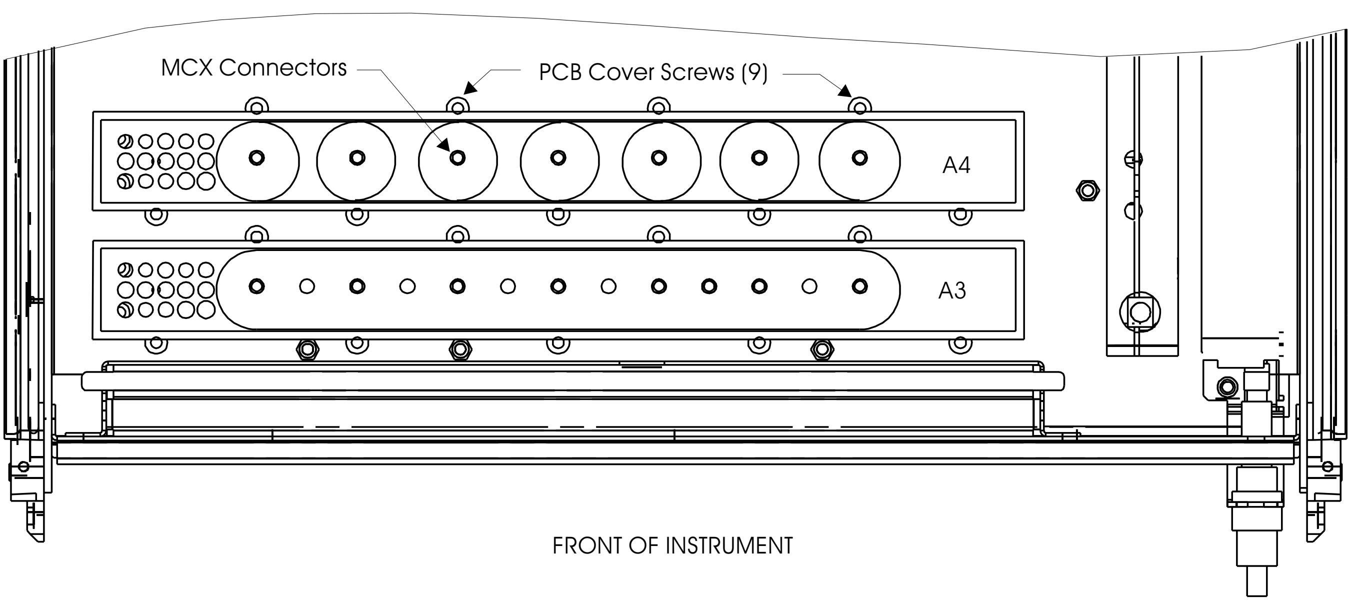


Figure 6-5. *A3 Reference/Fine Loop and A4 Coarse Loop PCB Assembly Removal*

Remove and replace the A4 PCB assembly as follows: (models with Option 3)

Step 1. Carefully disconnect the coaxial cables from the top connectors of the A4 PCB assembly.

Step 2. Turn the chassis upside down and locate the four retaining screws for the A4 board assembly. Refer to Figure 6-8.

Step 3. Use a Phillips screwdriver to remove the retaining screws. Retain the screws.

Step 4. Turn the chassis right side up. Disconnect the A4 PCB assembly by lifting it from the chassis connector and set it aside.

Step 5. To replace the A4 PCB assembly, reverse the removal process.

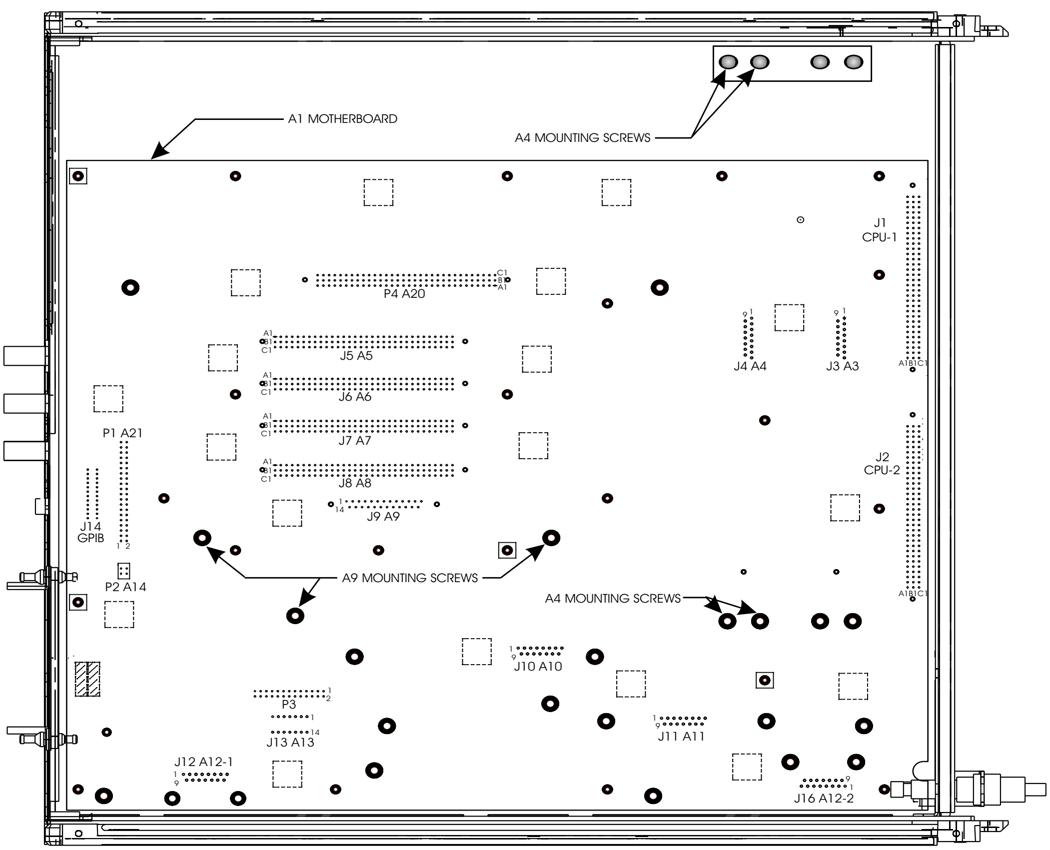


Figure 6-6. *Location of Retaining Screws for A4 PCB Assembly and A9 YIG Assembly*

6-8 A5—A9 PCB Removal

For access to the A5, A6, A7, A8, and A9 PCB assemblies the card cage cover must be removed first, as follows:

Preliminary Remove the front handles, rear feet, and top cover as described in Section 6-3.

Card Cage Cover Remove the card cage cover as follows:

Step 1. Use a Phillips screwdriver to remove the two screws that secure the card cage cover; see Figure 6-9. Retain the screws.

Step 2. Pull the cover up and to the right, as seen from the front, to remove. Set the cover aside.

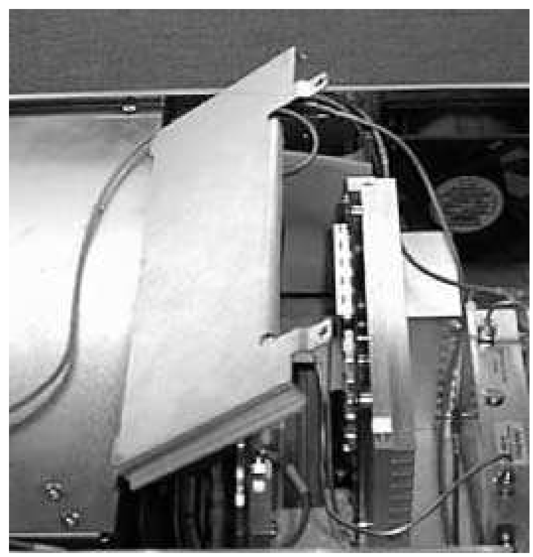


Figure 6-9. *Removal of Card Cage Cover Retaining Screws*

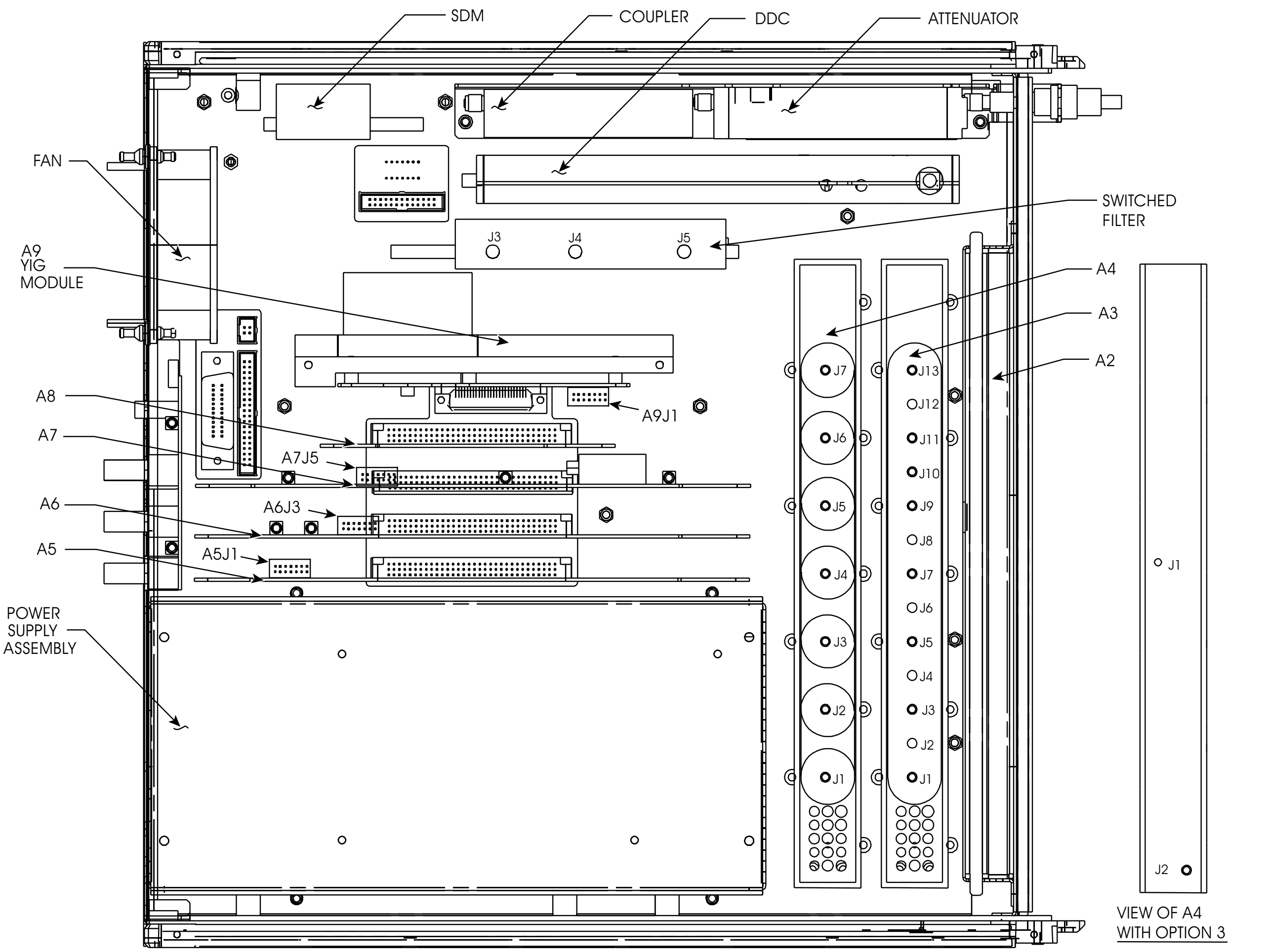


Figure 6-10. *Locations of A5, A6, A7, A8, and A9 PCB Assemblies*

A5 Auxiliary PCB

To remove the A5 auxiliary PCB, proceed as follows:

Step 1. Grasp the A5 PCB by the edges and pull up to remove the board from the chassis connector. See Figure 6-10 for locations of the A5, A6, A7, A8, and A9 PCB's .

Step 2. To install the A5 PCB, reverse the removal process.

A6 ALC PCB

To remove the A6 ALC PCB, proceed as follows:

Step 1. Disconnect the coaxial cables from the top edge of the A6 PCB.

Step 2. Grasp the A6 PCB by the edges and pull up to remove the board from the chassis connector.

Step 3. To install the A6 ALC PCB, reverse the removal process.

A7 YIG Lock PCB

To remove the A7 YIG lock PCB, proceed as follows:

Step 1. Disconnect the miniature coax cable connectors from the top edge of the A7 PCB.

Step 2. Disconnect the hard coax cable line from the A7 board sampler at the coax connector on the switched filter assembly.

Step 3. Grasp the A7 PCB by the edges and gently pull up to remove the board from the chassis connector.

Step 4. To install the A7 YIG lock PCB, reverse the removal process.

A8 DDS PCB

To remove the A8 DDS PCB, proceed as follows:

Step 1. Disconnect the coax cable connectors from the top edge of the A8 PCB.

Step 2. Grasp the A8 PCB by the edges and pull up to remove the board from the chassis connector.

Step 3. To install the A8 PCB, reverse the removal process.

A9 YIG Assembly

To remove the A9 YIG assembly, proceed as follows:

Step 1. Disconnect the hard coax cable line that connects the A9 module to the switched filter assembly at the coax connector on the switched filter assembly.

Step 2. Turn the chassis upside down and locate the three retaining screws for the A9 YIG assembly. Refer to Figure 6-8 (page 6-16).

Step 3. Use a Phillips screwdriver to remove the three retaining screws. Retain screws.

Step 4. Turn the chassis right side up. Disconnect the A9 assembly from the chassis connector and set aside.

Step 5. To install the A9 YIG assembly, reverse the removal process.

6-9 Power Supply Assembly

This section provides instructions for removing and replacing the power supply assembly, which is located in a shielded enclosure at the left rear of the unit.

Preliminary It is necessary to first remove the card cage cover and instrument side cover, as described in Section 6-8.

Power Supply Top Assembly To remove and replace the power supply top cover/ top assembly, proceed as follows:

Step 1. At the rear of the unit, remove the four screws from the fan filter guard located immediately behind the power supply assembly. (Refer to Figure 1-3 on page 1-8.) Remove the fan filter guard (and honeycomb) and set it aside. Retain the screws.

Step 2. Locate the five screws that secure the rear panel to the chassis and power supply (see Figure 6-10, below). Use a Phillips screw driver to remove the screws (retain the screws). The last screw is found on the side panel.

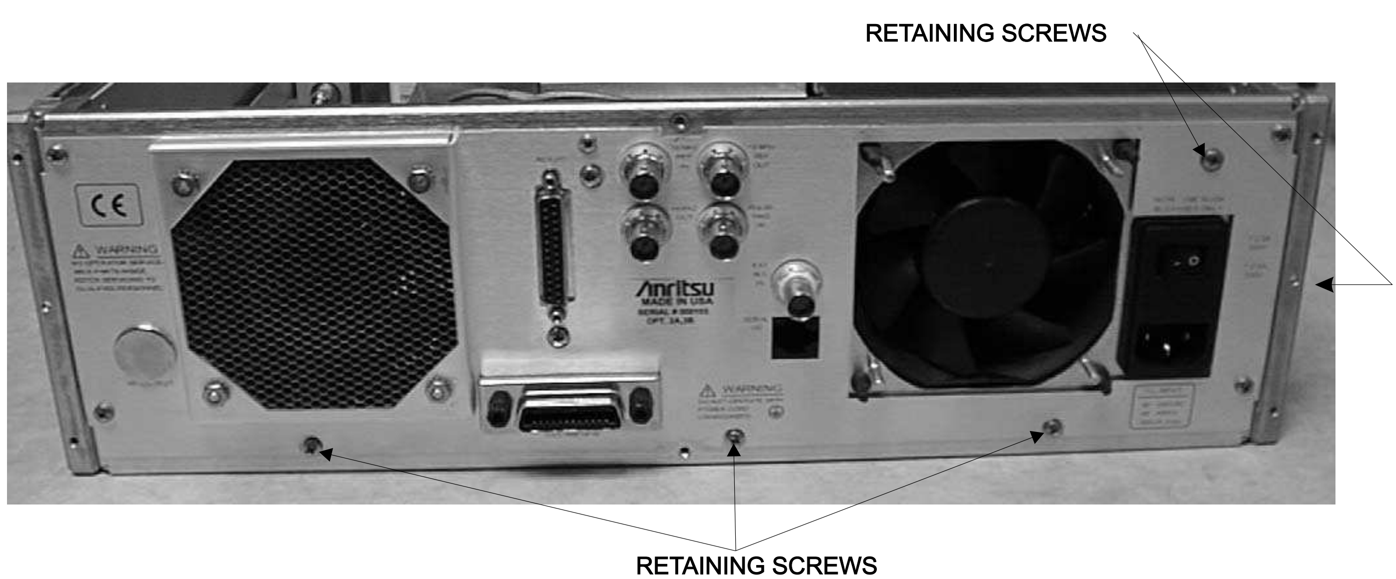


Figure 6-11. *Rear Panel Retaining Screw Locations*

Power Supply Regulator PCB

To remove and replace the lower power supply subassembly from the bottom of the power supply enclosure, proceed as follows:

Step 1. If not done previously, remove the upper power supply top assembly and 12 volt power supply PCB (previous procedures).

Step 2. Disconnect the 2-wire cable from the fan assembly at the JP2 connector of the power regulator PCB.

Step 3. Use a Phillips screwdriver to remove the seven screws that fasten the regulator PCB to the power supply assembly. Retain screws. Remove the lower power supply subassembly from the power supply enclosure.

Step 5. To install the power supply regulator, reverse the removal process.

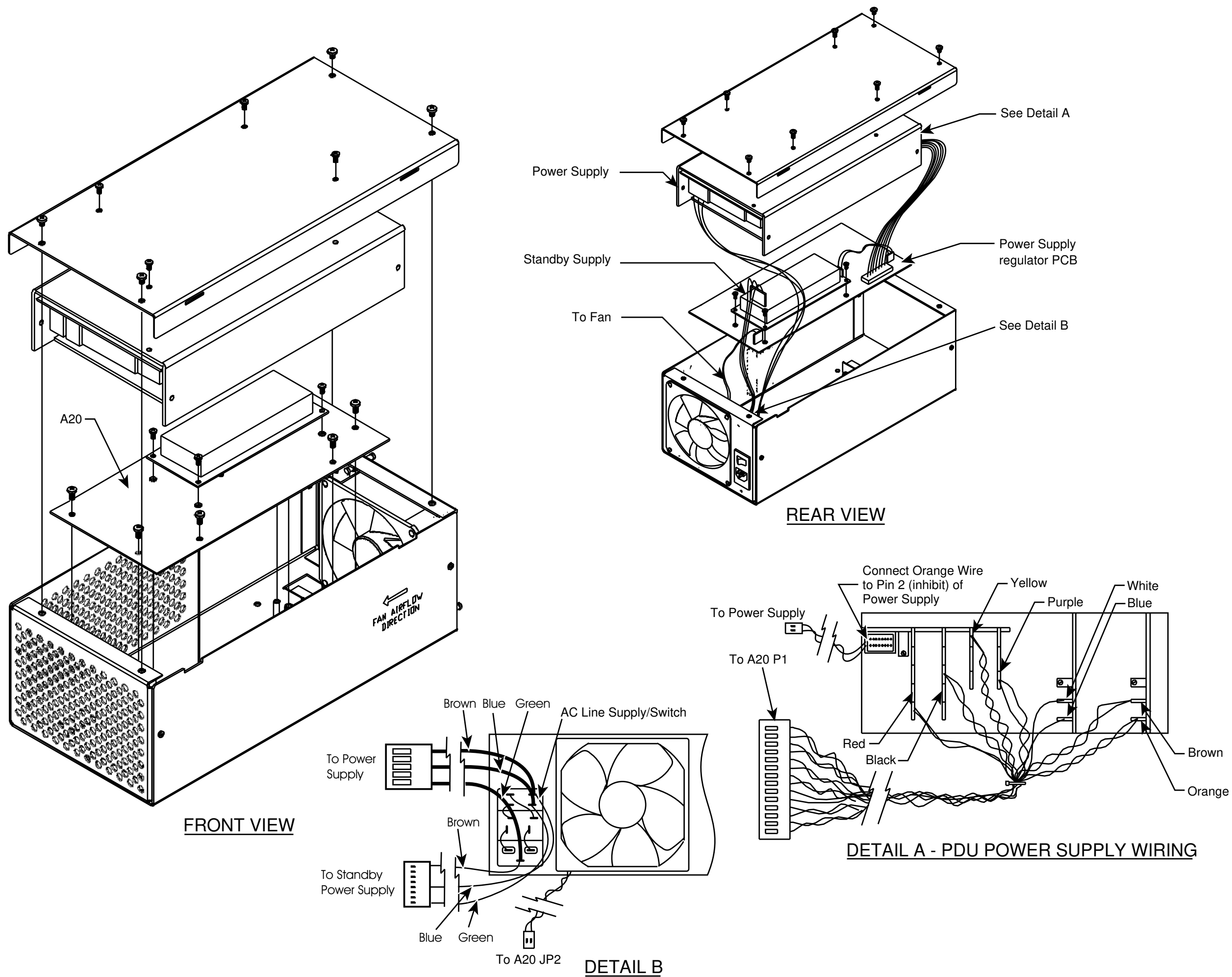


Figure 6-12. *Power Supply Assembly*

6-10 Anritsu Customer Service Centers

Table 6-4, below, lists the contact information for Anritsu service centers around the world.

Table 6-4. *Anritsu Service Centers*

UNITED STATES
ANRITSU COMPANY
490 Jarvis Drive
Morgan Hill, CA 95037-2809
Telephone: (408) 776-8300
1-800-ANRITSU
FAX: 408-776-1744

ANRITSU COMPANY
10 New Maple Ave., Unit 305
Pine Brook, NJ 07058
Telephone: (973) 227-8999
1-800-ANRITSU
FAX: 973-575-0092

ANRITSU COMPANY
1155 E. Collins Blvd
Richardson, TX 75081
Telephone: 1-800-ANRITSU
FAX: 972-671-1877

AUSTRALIA
ANRITSU PTY. LTD.
Unit 3, 170 Foster Road
Mt Waverley, VIC 3149
Australia
Telephone: 03-9558-8177
FAX: 03-9558-8255

BRAZIL
ANRITSU ELECTRONICA LTDA.
Praia de Botafogo, 440, Sala 2401
CEP22250-040, Rio de Janeiro, RJ, Brasil
Telephone: 021-527-6922
FAX: 021-53-71-456

CANADA
ANRITSU INSTRUMENTS LTD.
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Appendix A
Test Records

A-1 Introduction

This appendix provides test records for recording the results of the performance verification tests (Chapter 3) and the calibration procedures (Chapter 4). They jointly provide the means for maintaining an accurate and complete record of instrument performance. Test records are provided for all models of the series MG369XA Synthesized Signal Generators.

Some test records have been customized to cover particular MG369XA models. These test records contain specific references to frequency parameters and power levels that apply only to that instrument model and its available options. When a test record is customized, it is labeled with the specific model and option list for the particular instrument it covers. Test records, which are not customized, do not specify a specific model or option list. These test records are generic and may contain specific references to frequency parameters and power levels that exceed the operational limits of the instrument being tested. When using generic test records, only use the parameters that meet the operational limits of the instrument being tested.

A-2 Uncertainty Specifications

The uncertainty specifications provided in these test records apply only when the recommended manufacturer and model of test equipment (Table 3-1), test setups, calibration and performance verification procedures, and other test guidelines found in this manual are used. For a description of measurement uncertainty, refer to Section 3-5.

A-3 Test Records

We recommend that you make a copy of the test record pages each time a test procedure is performed. By dating each test record copy, a detailed history of the instrument's performance can be accumulated.

Anritsu Model MG369_A

with Options: __________________ **Date: __________________________**

Serial Number: _________________ **Tested By: __________________________**

3-6 Internal Time Base Aging Rate Test: All MG369XA Models

	Measured Value	Upper Limit	Measurement Uncertainty
Frequency Error Value	_______________		
Frequency Error Value (after 24 hours)	_______________		
Computed Aging Rate	_______________per day	$2x10^{-9}$ per day ($5x10^{-10}$ per day with Option 16)	$2x10^{-12}$ per day

3-7 Spurious Signals Test: All MG369XA Models without Option 15 (1 of 2)

Frequencies: 0.1 Hz to 10 MHz (Models with Option 22 Only)

Test Frequency (kHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
100	________	________	–30	–30	2.5
750	________	________	–30	–30	2.5
1 000	________	________	–30	–30	2.5
9 999	________	________	–30	–30	2.5

Frequencies: 10 MHz to ≤100 MHz (Models with Option 4 Only)

Test Frequency (MHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
10	________	________	–40	–60	2.5
15	________	________	–40	–60	2.5
60	________	________	–40	–60	2.5
100	________	________	–40	–60	2.5

Frequencies: >100 MHz to ≤2.2 GHz (Models with Option 4 Only)

Test Frequency (MHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
100.1	________	________	–50	–60	0.8
500	________	________	–50	–60	0.8
1 500	________	________	–50	–60	0.8
2 000	________	________	–50	–60	0.8
2 200	________	________	–50	–60	0.8

Frequencies: 10 MHz to ≤50 MHz (Models with Option 5 Only)

Test Frequency (MHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
10	________	________	–30	–40	2.5
15	________	________	–30	–40	2.5
30	________	________	–30	–40	2.5
45	________	________	–30	–40	2.5
50	________	________	–30	–40	2.5

Note: Spurious signals are grouped as harmonic related or non-harmonic. If spurious signals are found, it is important to determine the type of spur and use the appropriate specified limit.

3-7 Spurious Signals Test: All MG369XA Models without Option 15 (2 of 2)

Frequencies: >50 MHz to ≤2 GHz (Models with Option 5 Only)

Test Frequency (MHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
50.1	__________	__________	–40	–40	0.8
600	__________	__________	–40	–40	0.8
1 500	__________	__________	–40	–40	0.8
2 000	__________	__________	–40	–40	0.8

Frequencies: >2 GHz (2.2 GHz for Models with Option 4) to ≤20 GHz

Test Frequency (GHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
2.0	__________	__________	–60	–60	0.8
2.2	__________	__________	–60	–60	0.8
8.39	__________	__________	–60	–60	2.5
8.41	__________	__________	–60	–60	2.5
20.0	__________	__________	–60	–60	2.5

Frequencies: >20 GHz (MG3693A, MG3694A, and MG3695A Only)

Test Frequency (GHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
20.01	__________	__________	–40	–60	2.5
25.0	__________	__________	–40	–60	2.5
30.0	__________	__________	–40	–60	2.9
40.0	__________	__________	–40	–60	2.4
50.0	__________	__________	–40	–60	3.0

Frequencies: >20 GHz (MG3696A Only)

Test Frequency (GHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
20.01	__________	__________	–40	–60	2.5
25.0	__________	__________	–40	–60	2.2
30.0	__________	__________	–40	–60	2.9
40.0	__________	__________	–40	–60	2.4
50.0	__________	__________	–25	–60	3.0

Note: Spurious signals are grouped as harmonic related or non-harmonic. If spurious signals are found, it is important to determine the type of spur and use the appropriate specified limit.

3-7 Spurious Signals Test: All MG369XA Models with Option 15 (1 of 2)

Frequencies: 0.1 Hz to 10 MHz (Models with Option 22 Only)

Test Frequency (kHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
100	________	________	–30	–30	2.5
750	________	________	–30	–30	2.5
1 000	________	________	–30	–30	2.5
9 999	________	________	–30	–30	2.5

Frequencies: 10 MHz to ≤100 MHz (Models with Option 4 Only)

Test Frequency (MHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
10	________	________	–40	–60	2.5
15	________	________	–40	–60	2.5
60	________	________	–40	–60	2.5
100	________	________	–40	–60	2.5

Frequencies: >100 MHz to ≤2.2 GHz (Models with Option 4 Only)

Test Frequency (MHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
100.1	________	________	–50	–60	0.8
500	________	________	–50	–60	0.8
1 500	________	________	–50	–60	0.8
2 000	________	________	–50	–60	0.8
2 200	________	________	–50	–60	0.8

Frequencies: 10 MHz to ≤50 MHz (Models with Option 5 Only)

Test Frequency (MHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
10	________	________	–30	–40	2.5
15	________	________	–30	–40	2.5
30	________	________	–30	–40	2.5
45	________	________	–30	–40	2.5
50	________	________	–30	–40	2.5

Note: Spurious signals are grouped as harmonic related or non-harmonic. If spurious signals are found, it is important to determine the type of spur and use the appropriate specified limit.

3-7 Spurious Signals Test: All MG369XA Models with Option 15 (2 of 2)

Frequencies: >50 MHz to ≤2 GHz (Models with Option 5 Only)

Test Frequency (MHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
50.1	__________	__________	–40	–40	0.8
600	__________	__________	–40	–40	0.8
1 500	__________	__________	–40	–40	0.8
2 000	__________	__________	–40	–40	0.8

Frequencies: >2 GHz (2.2 GHz for Models with Option 4) to ≤20 GHz

Test Frequency (GHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
2.0	__________	__________	–50	–60	0.8
2.2	__________	__________	–50	–60	0.8
8.39	__________	__________	–50	–60	2.2
8.41	__________	__________	–50	–60	2.2
20.0	__________	__________	–50	–60	2.5

Frequencies: >20 GHz to ≤40 GHz

Test Frequency (GHz)	Spur Frequency	Measured Value (dBc)	Harmonic Related Upper Limit (dBc)	Non-harmonic Upper Limit (dBc)	Measurement Uncertainty (dB)
20.01	__________	__________	–20*	–60	2.5
25.0	__________	__________	–30*	–60	2.2
30.0	__________	__________	–30*	–60	2.9
40.0	__________	__________	–30*	–60	2.4

* Typical (frequencies < 21 GHz: –20 dBc typical)

Note: Spurious signals are grouped as harmonic related or non-harmonic. If spurious signals are found, it is important to determine the type of spur and use the appropriate specified limit.

3-8 Single Sideband Phase Noise Test: All MG369XA Models without Option 3 (1 of 3)

Test Frequency: 9.99 MHz (Models with Option 22 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–90	2.5
1 kHz	__________	–120	2.5
10 kHz	__________	–130	2.5
100 kHz	__________	–130	2.5

Test Frequency: 15.0 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–94	2.5
1 kHz	__________	–106	2.5
10 kHz	__________	–104	2.5
100 kHz	__________	–120	2.5

Test Frequency: 60.0 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–94	2.5
1 kHz	__________	–106	2.5
10 kHz	__________	–104	2.5
100 kHz	__________	–120	2.5

Test Frequency: 499 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–94	2.5
1 kHz	__________	–106	2.5
10 kHz	__________	–104	2.5
100 kHz	__________	–120	2.5

Test Frequencies: 600 MHz (Models with Option 5 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–77	2.5
1 kHz	__________	–88	2.5
10 kHz	__________	–85	2.5
100 kHz	__________	–100	2.5

3-8 Single Sideband Phase Noise Test: MG369XA Models without Option 3 (2 of 3)

Test Frequencies: 1.99 GHz (Models with Option 5 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–77	2.5
1 kHz	__________	–88	2.5
10 kHz	__________	–85	2.5
100 kHz	__________	–100	2.5

Test Frequency: 2.01 GHz (Models without Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–77	2.5
1 kHz	__________	–88	2.5
10 kHz	__________	–86	2.5
100 kHz	__________	–102	2.5

Test Frequency: 2.19 GHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–82	2.5
1 kHz	__________	–94	2.5
10 kHz	__________	–92	2.5
100 kHz	__________	–108	2.5

Test Frequency: 6.0 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–77	2.5
1 kHz	__________	–88	2.5
10 kHz	__________	–86	2.5
100 kHz	__________	–102	2.5

Test Frequency: 10.0 GHz (8 GHz for MG3691A)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–66	2.5
1 kHz	__________	–78	2.5
10 kHz	__________	–77	2.5
100 kHz	__________	–100	2.5

3-8 Single Sideband Phase Noise Test: MG369XA Models without Option 3 (3 of 3)

Test Frequency: 19.99 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–66	2.5
1 kHz	__________	–78	2.5
10 kHz	__________	–77	2.5
100 kHz	__________	–100	2.5

Test Frequency: 20.01 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–60	2.5
1 kHz	__________	–75	2.5
10 kHz	__________	–72	2.5
100 kHz	__________	–94	2.5

Test Frequency: 25.0 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
100 Hz	__________	–60	2.5
1 kHz	__________	–75	2.5
10 kHz	__________	–72	2.5
100 kHz	__________	–94	2.5

3-8 Single Sideband Phase Noise Test: All MG369XA Models with Option 3 (1 of 4)

Test Frequency: 9.999999 MHz (Models with Option 22 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–60	2.5
100 Hz	__________	–90	2.5
1 kHz	__________	–120	2.5
10 kHz	__________	–130	2.5
100 kHz	__________	–130	2.5
1 MHz	__________	–130	2.5

Test Frequency: 15 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–105	2.5
100 Hz	__________	–126	2.5
1 kHz	__________	–139	2.5
10 kHz	__________	–142	2.5
100 kHz	__________	–141	2.5
1 MHz	__________	–145	2.5

Test Frequency: 30 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–99	2.5
100 Hz	__________	–120	2.5
1 kHz	__________	–134	2.5
10 kHz	__________	–137	2.5
100 kHz	__________	–137	2.5
1 MHz	__________	–145	2.5

Test Frequency: 60 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–90	2.5
100 Hz	__________	–114	2.5
1 kHz	__________	–129	2.5
10 kHz	__________	–136	2.5
100 kHz	__________	–136	2.5
1 MHz	__________	–144	2.5

3-8 Single Sideband Phase Noise Test: All MG369XA Models with Option 3 (2 of 4)

Test Frequency: 120 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–84	2.5
100 Hz	__________	–108	2.5
1 kHz	__________	–127	2.5
10 kHz	__________	–135	2.5
100 kHz	__________	–133	2.5
1 MHz	__________	–144	2.5

Test Frequency: 250 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–88	2.5
100 Hz	__________	–102	2.5
1 kHz	__________	–125	2.5
10 kHz	__________	–132	2.5
100 kHz	__________	–130	2.5
1 MHz	__________	–143	2.5

Test Frequency: 499 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–77	2.5
100 Hz	__________	–99	2.5
1 kHz	__________	–123	2.5
10 kHz	__________	–125	2.5
100 kHz	__________	–124	2.5
1 MHz	__________	–142	2.5

Test Frequencies: 600 MHz (Models with Option 5 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–64	2.5
100 Hz	__________	–83	2.5
1 kHz	__________	–100	2.5
10 kHz	__________	–102	2.5
100 kHz	__________	–102	2.5
1 MHz	__________	–111	2.5

3-8 Single Sideband Phase Noise Test: All MG369XA Models with Option 3 (3 of 4)

Test Frequencies: 1.99 GHz (Models with Option 5 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–64	2.5
100 Hz	__________	–83	2.5
1 kHz	__________	–100	2.5
10 kHz	__________	–102	2.5
100 kHz	__________	–102	2.5
1 MHz	__________	–111	2.5

Test Frequency: 2.01 GHz (Models without Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–54	2.5
100 Hz	__________	–77	2.5
1 kHz	__________	–104	2.5
10 kHz	__________	–108	2.5
100 kHz	__________	–107	2.5
1 MHz	__________	–130	2.5

Test Frequency: 2.19 GHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–66	2.5
100 Hz	__________	–86	2.5
1 kHz	__________	–112	2.5
10 kHz	__________	–115	2.5
100 kHz	__________	–113	2.5
1 MHz	__________	–135	2.5

Test Frequency: 6.0 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–54	2.5
100 Hz	__________	–77	2.5
1 kHz	__________	–104	2.5
10 kHz	__________	–108	2.5
100 kHz	__________	–107	2.5
1 MHz	__________	–130	2.5

3-8 Single Sideband Phase Noise Test: All MG369XA Models with Option 3 (4 of 4)

Test Frequency: 10.0 GHz (8 GHz for MG3691A)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–52	2.5
100 Hz	__________	–73	2.5
1 kHz	__________	–100	2.5
10 kHz	__________	–107	2.5
100 kHz	__________	–107	2.5
1 MHz	__________	–128	2.5

Test Frequency: 19.99 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–45	2.5
100 Hz	__________	–68	2.5
1 kHz	__________	–94	2.5
10 kHz	__________	–102	2.5
100 kHz	__________	–102	2.5
1 MHz	__________	–125	2.5

Test Frequency: 20.01 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–45	2.5
100 Hz	__________	–63	2.5
1 kHz	__________	–92	2.5
10 kHz	__________	–98	2.5
100 kHz	__________	–98	2.5
1 MHz	__________	–119	2.5

Test Frequency: 25.0 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
10 Hz	__________	–45	2.5
100 Hz	__________	–63	2.5
1 kHz	__________	–92	2.5
10 kHz	__________	–98	2.5
100 kHz	__________	–98	2.5
1 MHz	__________	–119	2.5

3-8 Single Sideband Phase Noise Test: Power Line and Fan Rotation Emissions All MG369XA Models (1 of 3)

Test Frequency: 15 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–68	2.5
300 Hz to 1 kHz	__________	–72	2.5
>1 kHz	__________	–72	2.5

Test Frequency: 30 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–68	2.5
300 Hz to 1 kHz	__________	–72	2.5
>1 kHz	__________	–72	2.5

Test Frequency: 60 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–68	2.5
300 Hz to 1 kHz	__________	–72	2.5
>1 kHz	__________	–72	2.5

Test Frequency: 120 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–68	2.5
300 Hz to 1 kHz	__________	–72	2.5
>1 kHz	__________	–72	2.5

Test Frequency: 250 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–68	2.5
300 Hz to 1 kHz	__________	–72	2.5
>1 kHz	__________	–72	2.5

3-8 Single Sideband Phase Noise Test: Power Line and Fan Rotation Emissions All MG369XA Models (2 of 3)

Test Frequency: 499 MHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–68	2.5
300 Hz to 1 kHz	__________	–72	2.5
>1 kHz	__________	–72	2.5

Test Frequencies: 600 MHz (Models with Option 5 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–50	2.5
300 Hz to 1 kHz	__________	–60	2.5
>1 kHz	__________	–60	2.5

Test Frequency: 1.050 GHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–62	2.5
300 Hz to 1 kHz	__________	–72	2.5
>1 kHz	__________	–72	2.5

Test Frequencies: 1.99 GHz (Models with Option 5 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–50	2.5
300 Hz to 1 kHz	__________	–60	2.5
>1 kHz	__________	–60	2.5

Test Frequency: 2.01 GHz (Models without Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–50	2.5
300 Hz to 1 kHz	__________	–60	2.5
>1 kHz	__________	–60	2.5

Test Frequency: 2.19 GHz (Models with Option 4 Only)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–56	2.5
300 Hz to 1 kHz	__________	–66	2.5
>1 kHz	__________	–66	2.5

3-8 Single Sideband Phase Noise Test: Power Line and Fan Rotation Emissions All MG369XA Models (3 of 3)

Test Frequency: 6.0 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–46	2.5
300 Hz to 1 kHz	__________	–56	2.5
>1 kHz	__________	–60	2.5

Test Frequency: 10.0 GHz (8 GHz for MG3691A)

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–46	2.5
300 Hz to 1 kHz	__________	–56	2.5
>1 kHz	__________	–60	2.5

Test Frequency: 19.99 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–46	2.5
300 Hz to 1 kHz	__________	–56	2.5
>1 kHz	__________	–60	2.5

Test Frequency: 20.01 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–40	2.5
300 Hz to 1 kHz	__________	–50	2.5
>1 kHz	__________	–54	2.5

Test Frequency: 25.0 GHz

Frequency Offset	Measured Value (dBc)	Upper Limit (dBc)	Measurement Uncertainty (dB)
<300 Hz	__________	–34	2.5
300 Hz to 1 kHz	__________	–44	2.5
>1 kHz	__________	–48	2.5

3-9 Power Level Log Conformity Test: All MG369XA Models (1 of 2)

	Set F1 to 2.199 GHz (Option 4) or 1.999 GHz (Option 5) Only		Set F1 to 2.201 GHz (Option 4) or 2.001 GHz (All Others)			
Set L1 to:	Measured Power Non-pulse Mode (dBm)	Measured Power Pulse Mode (dBm)	Measured Power Non-pulse Mode (dBm)	Measured Power Pulse Mode (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+17 dBm	________	________	________	________	+16 to +18	0.44
+16 dBm	________	________	________	________	+15 to +17	0.44
+15 dBm	________	________	________	________	+14 to +16	0.44
+14 dBm	________	________	________	________	+13 to +15	0.44
+13 dBm	________	________	________	________	+12 to +14	0.44
+12 dBm	________	________	________	________	+11 to +13	0.44
+11 dBm	________	________	________	________	+10 to +12	0.44
+10 dBm	________	________	________	________	+9 to +11	0.44
+9 dBm	________	________	________	________	+8 to +10	0.44
+8 dBm	________	________	________	________	+7 to +9	0.44
+7 dBm	________	________	________	________	+6 to +8	0.44
+6 dBm	________	________	________	________	+5 to +7	0.44
+5 dBm	________	________	________	________	+4 to +6	0.44
+4 dBm	________	________	________	________	+3 to +5	0.44
+3 dBm	________	________	________	________	+2 to +4	0.44
+2 dBm	________	________	________	________	+1 to +3	0.44
+1 dBm	________	________	________	________	+0 to +2	0.44
+0 dBm	________	________	________	________	–1 to +1	0.44
–1 dBm	________	________	________	________	–2 to +0	0.44
–2 dBm	________	________	________	________	–3 to –1	0.44
–3 dBm	________	________	________	________	–4 to –2	0.44
–4 dBm	________	________	________	________	–5 to –3	0.44
–5 dBm	________	________	________	________	–6 to –4	0.44

3-9 Power Level Log Conformity Test: All MG369XA Models Without Option 15 (2 of 2)

Set L1* to:	Set F1 to 2.199 GHz (Option 4) or 1.999 GHz (Option 5) Only: Measured Power Non-pulse Mode (dBm)	Set F1 to 2.199 GHz (Option 4) or 1.999 GHz (Option 5) Only: Measured Power Pulse Mode (dBm)	Set F1 to 2.201 GHz (Option 4) or 2.001 GHz (All Others): Measured Power Non-pulse Mode (dBm)	Set F1 to 2.201 GHz (Option 4) or 2.001 GHz (All Others): Measured Power Pulse Mode (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
–6 dBm	________	________	________	________	–7 to –5	0.44
–7 dBm	________	________	________	________	–8 to –6	0.44
–8 dBm	________	________	________	________	–9 to –7	0.44
–9 dBm	________	________	________	________	–10 to –8	0.44
–10 dBm	________	________	________	________	–11 to –9	0.44
–11 dBm	________	________	________	________	–12 to –10	0.44
–12 dBm	________	________	________	________	–13 to –11	0.44
–13 dBm	________	________	________	________	–14 to –12	0.44
–14 dBm	________	________	________	________	–15 to –13	0.44
–15 dBm	________	________	________	________	–16 to –14	0.44

* Models without Option 15 only.

3-9 Power Level Accuracy Test: All MG369XA Models Without Option 2 (1 of 6)

Instrument Setup	DUT F1: 9.999 MHz	DUT F1: 15 MHz	DUT F1: 60 MHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44

Instrument Setup	DUT F1: 499 MHz	DUT F1: 600 MHz	DUT F1: 1.99 GHz**		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44

* Start with the highest power level within instrument specification.
** Log Conformity test results may be used as an alternative.

3-9 Power Level Accuracy Test: All MG369XA Models Without Option 2 (2 of 6)

Instrument Setup	DUT F1: 2.01 GHz**	DUT F1: 2.19 GHz**	DUT F1: 2.21 GHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	___________	___________	___________	+14 to +16	0.44
+10 dBm	___________	___________	___________	+9 to +11	0.44
+5 dBm	___________	___________	___________	+4 to +6	0.44
+0 dBm	___________	___________	___________	–1 to +1	0.44
–5 dBm	___________	___________	___________	–6 to –4	0.44
–10 dBm	___________	___________	___________	–11 to –9	0.44
–15 dBm	___________	___________	___________	–16 to –14	0.44

Instrument Setup	DUT F1: 3.29 GHz	DUT F1: 3.31 GHz	DUT F1: 4.40 GHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	___________	___________	___________	+14 to +16	0.44
+10 dBm	___________	___________	___________	+9 to +11	0.44
+5 dBm	___________	___________	___________	+4 to +6	0.44
+0 dBm	___________	___________	___________	–1 to +1	0.44
–5 dBm	___________	___________	___________	–6 to –4	0.44
–10 dBm	___________	___________	___________	–11 to –9	0.44
–15 dBm	___________	___________	___________	–16 to –14	0.44

* Start with the highest power level within instrument specification.
** Log Conformity test results may be used as an alternative.

3-9 Power Level Accuracy Test: All MG369XA Models Without Option 2 (3 of 6)

Instrument Setup	DUT F1: 5.49 GHz	DUT F1: 5.51 GHz	DUT F1: 6.95 GHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44

Instrument Setup	DUT F1: 8.39 GHz	DUT F1: 8.41 GHz	DUT F1: 10.825 GHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44

* Start with the highest power level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models Without Option 2 (4 of 6)

Instrument Setup	DUT F1: 13.24 GHz	DUT F1: 13.26 GHz	DUT F1: 16.625 GHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44

Instrument Setup	DUT F1: 19.99 GHz	DUT F1: 20.01 GHz	DUT F1: 22.50 GHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dBm)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44

* Start with the highest power level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models Without Option 2 (5 of 6)

Instrument Setup	DUT F1: 24.99 GHz	DUT F1: 25.01 GHz	DUT F1: 27.50 GHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44

Instrument Setup	DUT F1: 31.99 GHz	DUT F1: 32.01 GHz	DUT F1: 36.0 GHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dBm)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44

* Start with the highest power level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models Without Option 2 (6 of 6)

Instrument Setup	DUT F1: 39.99 GHz	DUT F1: 40.01 GHz	DUT F1: 50.0 GHz		
Set L1* to:	**Measured Power (dBm)**	**Measured Power (dBm)**	**Measured Power (dBm)**	**Specification (dBm)**	**Measurement Uncertainty (dB)**
+15 dBm	___________	___________	___________	+14 to +16	0.44
+10 dBm	___________	___________	___________	+9 to +11	0.44
+5 dBm	___________	___________	___________	+4 to +6	0.44
+0 dBm	___________	___________	___________	–1 to +1	0.44
–5 dBm	___________	___________	___________	–6 to –4	0.44
–10 dBm	___________	___________	___________	–11 to –9	0.44
–15 dBm	___________	___________	___________	–16 to –14	0.44

* Start with the highest power level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models With Option 2 (1 of 10)

Instrument Setup	DUT F1: 10 MHz Receiver: 10 MHz LO: N/A	DUT F1: 15 MHz Receiver: 15 MHz LO: N/A	DUT F1: 60 MHz Receiver: 60 MHz LO: N/A		
Set L1* to:	**Measured Power (dBm)**	**Measured Power (dBm)**	**Measured Power (dBm)**	**Specification (dBm)**	**Measurement Uncertainty (dB)**
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44
–20 dBm	________	________	________	–21 to –19	0.44
–25 dBm	________	________	________	–26 to –24	0.44
–30 dBm	________	________	________	–31 to –29	0.44
–35 dBm	________	________	________	–36 to –34	0.44
–40 dBm	________	________	________	–41 to –39	0.44
–45 dBm	________	________	________	–46 to –44	0.44
–54 dBm	________	________	________	–51 to –59	0.44
–55 dBm	________	________	________	–56 to –54	0.44
–60 dBm	________	________	________	–61 to –59	0.44
–65 dBm	________	________	________	–66 to –64	0.20
–70 dBm	________	________	________	–71 to –69	0.20
–75 dBm	________	________	________	–76 to –74	0.20
–80 dBm	________	________	________	–81 to –79	0.20
–85 dBm	________	________	________	–86 to –84	0.20
–90 dBm	________	________	________	–91 to –89	0.20
–95 dBm	________	________	________	–96 to –94	0.20
–100 dBm	________	________	________	–101 to –99	0.20
–105 dBm	________	________	________	–106 to –104	0.20
–110 dBm	________	________	________	–111 to –109	0.20
–115 dBm	________	________	________	–116 to –114	0.20
–120 dBm	________	________	________	–121 to –119	0.20

* Start with the highest level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models With Option 2 (2 of 10)

Instrument Setup	DUT F1: 499 MHz Receiver: 499 MHz LO: N/A	DUT F1: 600 MHz Receiver: 600 MHz LO: N/A	DUT F1: 1.99 GHz Receiver: 8.51 MHz LO: 1981.49 MHz		
Set L1* to:	**Measured Power (dBm)**	**Measured Power (dBm)**	**Measured Power (dBm)**	**Specification (dBm)**	**Measurement Uncertainty (dB)**
+15 dBm	___________	___________	___________	+14 to +16	0.44
+10 dBm	___________	___________	___________	+9 to +11	0.44
+5 dBm	___________	___________	___________	+4 to +6	0.44
+0 dBm	___________	___________	___________	–1 to +1	0.44
–5 dBm	___________	___________	___________	–6 to –4	0.44
–10 dBm	___________	___________	___________	–11 to –9	0.44
–15 dBm	___________	___________	___________	–16 to –14	0.44
–20 dBm	___________	___________	___________	–21 to –19	0.44
–25 dBm	___________	___________	___________	–26 to –24	0.44
–30 dBm	___________	___________	___________	–31 to –29	0.44
–35 dBm	___________	___________	___________	–36 to –34	0.44
–40 dBm	___________	___________	___________	–41 to –39	0.44
–45 dBm	___________	___________	___________	–46 to –44	0.44
–54 dBm	___________	___________	___________	–51 to –59	0.44
–55 dBm	___________	___________	___________	–56 to –54	0.44
–60 dBm	___________	___________	___________	–61 to –59	0.44
–65 dBm	___________	___________	___________	–66 to –64	0.20/0.49**
–70 dBm	___________	___________	___________	–71 to –69	0.20/0.49**
–75 dBm	___________	___________	___________	–76 to –74	0.20/0.49**
–80 dBm	___________	___________	___________	–81 to –79	0.20/0.49**
–85 dBm	___________	___________	___________	–86 to –84	0.20/0.49**
–90 dBm	___________	___________	___________	–91 to –89	0.20/0.49**
–95 dBm	___________	___________	___________	–96 to –94	0.20/0.49**
–100 dBm	___________	___________	___________	–101 to –99	0.20/0.49**
–105 dBm	___________	___________	___________	–106 to –104	0.20/0.49**
–110 dBm	___________	___________	___________	–111 to –109	0.20/0.49**
–115 dBm	___________	___________	___________	–116 to –114	0.20/0.49**
–120 dBm	___________	___________	___________	–121 to –119	0.20/0.49**

* Start with the highest level within instrument specification.
** When measuring frequencies greater than 1300 MHz

3-9 Power Level Accuracy Test:
All MG369XA Models With Option 2 (3 of 10)

Instrument Setup	DUT F1: 2.01 GHz Receiver: 8.51 MHz LO: 2001.49 MHz	DUT F1: 2.19 GHz Receiver: 8.51 MHz LO: 2181.49 MHz	DUT F1: 2.21 GHz Receiver: 8.51 MHz LO: 2201.49 MHz		
Set L1* to:	**Measured Power (dBm)**	**Measured Power (dBm)**	**Measured Power (dBm)**	**Specification (dBm)**	**Measurement Uncertainty (dB)**
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44
–20 dBm	________	________	________	–21 to –19	0.44
–25 dBm	________	________	________	–26 to –24	0.44
–30 dBm	________	________	________	–31 to –29	0.44
–35 dBm	________	________	________	–36 to –34	0.44
–40 dBm	________	________	________	–41 to –39	0.44
–45 dBm	________	________	________	–46 to –44	0.44
–54 dBm	________	________	________	–51 to –59	0.44
–55 dBm	________	________	________	–56 to –54	0.44
–60 dBm	________	________	________	–61 to –59	0.44
–65 dBm	________	________	________	–66 to –64	0.49
–70 dBm	________	________	________	–71 to –69	0.49
–75 dBm	________	________	________	–76 to –74	0.49
–80 dBm	________	________	________	–81 to –79	0.49
–85 dBm	________	________	________	–86 to –84	0.49
–90 dBm	________	________	________	–91 to –89	0.49
–95 dBm	________	________	________	–96 to –94	0.49
–100 dBm	________	________	________	–101 to –99	0.49
–105 dBm	________	________	________	–106 to –104	0.49
–110 dBm	________	________	________	–111 to –109	0.49
–115 dBm	________	________	________	–116 to –114	0.49
–120 dBm	________	________	________	–121 to –119	0.49

* Start with the highest level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models With Option 2 (4 of 10)

Instrument Setup	DUT F1: 3.29 GHz Receiver: 8.51 MHz LO: 2201.49 MHz	DUT F1: 3.31 GHz Receiver: 8.51 MHz LO: 2201.49 MHz	DUT F1: 4.40 GHz Receiver: 8.51 MHz LO: 2201.49 MHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44
–20 dBm	________	________	________	–21 to –19	0.44
–25 dBm	________	________	________	–26 to –24	0.44
–30 dBm	________	________	________	–31 to –29	0.44
–35 dBm	________	________	________	–36 to –34	0.44
–40 dBm	________	________	________	–41 to –39	0.44
–45 dBm	________	________	________	–46 to –44	0.44
–54 dBm	________	________	________	–51 to –59	0.44
–55 dBm	________	________	________	–56 to –54	0.44
–60 dBm	________	________	________	–61 to –59	0.44
–65 dBm	________	________	________	–66 to –64	0.49
–70 dBm	________	________	________	–71 to –69	0.49
–75 dBm	________	________	________	–76 to –74	0.49
–80 dBm	________	________	________	–81 to –79	0.49
–85 dBm	________	________	________	–86 to –84	0.49
–90 dBm	________	________	________	–91 to –89	0.49
–95 dBm	________	________	________	–96 to –94	0.49
–100 dBm	________	________	________	–101 to –99	0.49
–105 dBm	________	________	________	–106 to –104	0.49
–110 dBm	________	________	________	–111 to –109	0.49
–115 dBm	________	________	________	–116 to –114	0.49
–120 dBm	________	________	________	–121 to –119	0.49

* Start with the highest level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models With Option 2 (5 of 10)

Instrument Setup	DUT F1: 5.49 GHz Receiver: 8.51 MHz LO: 5481.49 MHz	DUT F1: 5.51 GHz Receiver: 8.51 MHz LO: 5501.49 MHz	DUT F1: 6.95 GHz Receiver: 8.51 MHz LO: 6941.49 MHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44
–20 dBm	________	________	________	–21 to –19	0.44
–25 dBm	________	________	________	–26 to –24	0.44
–30 dBm	________	________	________	–31 to –29	0.44
–35 dBm	________	________	________	–36 to –34	0.44
–40 dBm	________	________	________	–41 to –39	0.44
–45 dBm	________	________	________	–46 to –44	0.44
–54 dBm	________	________	________	–51 to –59	0.44
–55 dBm	________	________	________	–56 to –54	0.44
–60 dBm	________	________	________	–61 to –59	0.44
–65 dBm	________	________	________	–66 to –64	0.49
–70 dBm	________	________	________	–71 to –69	0.49
–75 dBm	________	________	________	–76 to –74	0.49
–80 dBm	________	________	________	–81 to –79	0.49
–85 dBm	________	________	________	–86 to –84	0.49
–90 dBm	________	________	________	–91 to –89	0.49
–95 dBm	________	________	________	–96 to –94	0.49
–100 dBm	________	________	________	–101 to –99	0.49
–105 dBm	________	________	________	–106 to –104	0.49
–110 dBm	________	________	________	–111 to –109	0.49
–115 dBm	________	________	________	–116 to –114	0.49
–120 dBm	________	________	________	–121 to –119	0.49

* Start with the highest level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models With Option 2 (6 of 10)

Instrument Setup	DUT F1: 8.39 GHz Receiver: 8.51 MHz LO: 8381.49 MHz	DUT F1: 8.41 GHz Receiver: 8.51 MHz LO: 8401.49 MHz	DUT F1: 10.825 GHz Receiver: 8.51 MHz LO: 10816.49 MHz		
Set L1* to:	**Measured Power (dBm)**	**Measured Power (dBm)**	**Measured Power (dBm)**	**Specification (dBm)**	**Measurement Uncertainty (dB)**
+15 dBm				+14 to +16	0.44
+10 dBm				+9 to +11	0.44
+5 dBm				+4 to +6	0.44
+0 dBm				–1 to +1	0.44
–5 dBm				–6 to –4	0.44
–10 dBm				–11 to –9	0.44
–15 dBm				–16 to –14	0.44
–20 dBm				–21 to –19	0.44
–25 dBm				–26 to –24	0.44
–30 dBm				–31 to –29	0.44
–35 dBm				–36 to –34	0.44
–40 dBm				–41 to –39	0.44
–45 dBm				–46 to –44	0.44
–54 dBm				–51 to –59	0.44
–55 dBm				–56 to –54	0.44
–60 dBm				–61 to –59	0.44
–65 dBm				–66 to –64	0.49
–70 dBm				–71 to –69	0.49
–75 dBm				–76 to –74	0.49
–80 dBm				–81 to –79	0.49
–85 dBm				–86 to –84	0.49
–90 dBm				–91 to –89	0.49
–95 dBm				–96 to –94	0.49
–100 dBm				–101 to –99	0.49
–105 dBm				–106 to –104	0.49
–110 dBm				–111 to –109	0.49
–115 dBm				–116 to –114	0.49
–120 dBm				–121 to –119	0.49

* Start with the highest level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models With Option 2 (7 of 10)

Instrument Setup	DUT F1: 13.24 GHz Receiver: 8.51 MHz LO: 13231.49 MHz	DUT F1: 13.26 GHz Receiver: 8.51 MHz LO: 13251.49 MHz	DUT F1: 16.625 GHz Receiver: 8.51 MHz LO: 16616.49 MHz		
Set L1* to:	**Measured Power (dBm)**	**Measured Power (dBm)**	**Measured Power (dBm)**	**Specification (dBm)**	**Measurement Uncertainty (dB)**
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44
–20 dBm	________	________	________	–21 to –19	0.44
–25 dBm	________	________	________	–26 to –24	0.44
–30 dBm	________	________	________	–31 to –29	0.44
–35 dBm	________	________	________	–36 to –34	0.44
–40 dBm	________	________	________	–41 to –39	0.44
–45 dBm	________	________	________	–46 to –44	0.44
–54 dBm	________	________	________	–51 to –59	0.44
–55 dBm	________	________	________	–56 to –54	0.44
–60 dBm	________	________	________	–61 to –59	0.44
–65 dBm	________	________	________	–66 to –64	0.49
–70 dBm	________	________	________	–71 to –69	0.49
–75 dBm	________	________	________	–76 to –74	0.49
–80 dBm	________	________	________	–81 to –79	0.49
–85 dBm	________	________	________	–86 to –84	0.49
–90 dBm	________	________	________	–91 to –89	0.49
–95 dBm	________	________	________	–96 to –94	0.49
–100 dBm	________	________	________	–101 to –99	0.49
–105 dBm	________	________	________	–106 to –104	0.49
–110 dBm	________	________	________	–111 to –109	0.49
–115 dBm	________	________	________	–116 to –114	0.49
–120 dBm	________	________	________	–121 to –119	0.49

* Start with the highest level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models With Option 2 (8 of 10)

Instrument Setup	DUT F1: 19.99 GHz Receiver: 8.51 MHz LO: 19981.49 MHz	DUT F1: 20.01 GHz Receiver: 8.51 MHz LO: 20001.49 MHz	DUT F1: 22.50 GHz Receiver: 8.51 MHz LO: 22491.49 MHz		
Set L1* to:	Measured Power (dBm)	Measured Power (dBm)	Measured Power (dBm)	Specification (dBm)	Measurement Uncertainty (dB)
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44
–20 dBm	________	________	________	–21 to –19	0.44
–25 dBm	________	________	________	–26 to –24	0.44
–30 dBm	________	________	________	–31 to –29	0.44
–35 dBm	________	________	________	–36 to –34	0.44
–40 dBm	________	________	________	–41 to –39	0.44
–45 dBm	________	________	________	–46 to –44	0.44
–54 dBm	________	________	________	–51 to –59	0.44
–55 dBm	________	________	________	–56 to –54	0.44
–60 dBm	________	________	________	–61 to –59	0.44
–65 dBm	________	________	________	–66 to –64	0.49
–70 dBm	________	________	________	–71 to –69	0.49
–75 dBm	________	________	________	–76 to –74	0.49
–80 dBm	________	________	________	–81 to –79	0.49
–85 dBm	________	________	________	–86 to –84	0.49
–90 dBm	________	________	________	–91 to –89	0.49
–95 dBm	________	________	________	–96 to –94	0.49
–100 dBm	________	________	________	–101 to –99	0.49
–105 dBm	________	________	________	–106 to –104	0.49
–110 dBm	________	________	________	–111 to –109	0.49
–115 dBm	________	________	________	–116 to –114	0.49
–120 dBm	________	________	________	–121 to –119	0.49

* Start with the highest level within instrument specification.

3-9 Power Level Accuracy Test: All MG369XA Models With Option 2 (9 of 10)

Instrument Setup	DUT F1: 25.01 GHz Receiver: 8.51 MHz LO: 25001.49 MHz	DUT F1: 31.99 GHz Receiver: 8.51 MHz LO: 31981.49 MHz	DUT F1: 32.01 GHz Receiver: 8.51 MHz LO: 32001.49 MHz		
Set L1* to:	**Measured Power (dBm)**	**Measured Power (dBm)**	**Measured Power (dBm)**	**Specification (dBm)**	**Measurement Uncertainty (dB)**
+15 dBm	________	________	________	+14 to +16	0.44
+10 dBm	________	________	________	+9 to +11	0.44
+5 dBm	________	________	________	+4 to +6	0.44
+0 dBm	________	________	________	–1 to +1	0.44
–5 dBm	________	________	________	–6 to –4	0.44
–10 dBm	________	________	________	–11 to –9	0.44
–15 dBm	________	________	________	–16 to –14	0.44
–20 dBm	________	________	________	–21 to –19	0.44
–25 dBm	________	________	________	–26 to –24	0.44
–30 dBm	________	________	________	–31 to –29	0.44
–35 dBm	________	________	________	–36 to –34	0.44
–40 dBm	________	________	________	–41 to –39	0.44
–45 dBm	________	________	________	–46 to –44	0.44
–54 dBm	________	________	________	–51 to –59	0.44
–55 dBm	________	________	________	–56 to –54	0.44
–60 dBm	________	________	________	–61 to –59	0.44
–65 dBm	________	________	________	–66 to –64	0.49
–70 dBm	________	________	________	–71 to –69	0.49
–75 dBm	________	________	________	–76 to –74	0.49
–80 dBm	________	________	________	–81 to –79	0.49
–85 dBm	________	________	________	–86 to –84	0.49
–90 dBm	________	________	________	–91 to –89	0.49
–95 dBm	________	________	________	–96 to –94	0.49
–100 dBm	________	________	________	–101 to –99	0.49
–105 dBm	________	________	________	–106 to –104	0.49
–110 dBm	________	________	________	–111 to –109	0.49
–115 dBm	________	________	________	–116 to –114	0.49
–120 dBm	________	________	________	–121 to –119	0.49

* Start with the highest level within instrument specification.

3-9 Power Level Accuracy Test:
All MG369XA Models With Option 2 (10 of 10)

Instrument Setup	DUT F1: 39.99 GHz Receiver: 8.51 MHz LO: 39981.49 MHz	DUT F1: 40008.51 MHz Receiver: 8.51 MHz LO: 40000.00 MHz	DUT F1: 50.0 GHz Receiver: N/A LO: N/A		
Set L1* to:	**Measured Power (dBm)**	**Measured Power (dBm)**	**Measured Power (dBm)**	**Specification (dBm)**	**Measurement Uncertainty (dB)**
+10 dBm	__________	__________	__________	+9 to +11	0.44
+5 dBm	__________	__________	__________	+4 to +6	0.44
+0 dBm	__________	__________	__________	–1 to +1	0.44
–5 dBm	__________	__________	__________	–6 to –4	0.44
–10 dBm	__________	__________	__________	–11 to –9	0.44
–15 dBm	__________	__________	__________	–16 to –14	0.44
–20 dBm	__________	__________	__________	–21 to –19	0.44
–25 dBm	__________	__________	__________	–26 to –24	0.44
–30 dBm	__________	__________	__________	–31 to –29	0.44
–35 dBm	__________	__________	__________	–36 to –34	0.44
–40 dBm	__________	__________	__________	–41 to –39	0.44
–45 dBm	__________	__________	__________	–46 to –44	0.44
–54 dBm	__________	__________	__________	–51 to –59	0.44
–55 dBm	__________	__________	__________	–56 to –54	0.44
–60 dBm	__________	__________	__________	–61 to –59	0.44
–65 dBm	__________	__________	__________	–66 to –64	0.49
–70 dBm	__________	__________	–	–71 to –69	0.49
–75 dBm	__________	__________	–	–76 to –74	0.49
–80 dBm	__________	__________	–	–81 to –79	0.49
–85 dBm	__________	__________	–	–86 to –84	0.49
–90 dBm	__________	__________	–	–91 to –89	0.49
–95 dBm	__________	__________	–	–96 to –94	0.49
–100 dBm	__________	__________	–	–101 to –99	0.49
–105 dBm	__________	__________	–	–106 to –104	0.49
–110 dBm	__________	__________	–	–111 to –109	0.49
–115 dBm	__________	__________	–	–116 to –114	0.49
–120 dBm	__________	__________	–	–121 to –119	0.49

* Start with the highest level within instrument specification.

3-9 Power Level Flatness Test: All MG369XA Models Without Option 2

MG3691A and MG3692A

Set L1 to: +13 dBm*	Maximum Power (dBm)	Minimum Power (dBm)	Variation (Max – Min) (dB)	Variation Specification (dB)	Measurement Uncertainty (dB)
Manual Sweep	__________	__________	__________	1.6	**0.44**

* For models with Option 22, set L1 to +11 dBm.

MG3693A and MG3694A

Set L1 to: +6 dBm*	Maximum Power (dBm)	Minimum Power (dBm)	Variation (Max – Min) (dB)	Variation Specification (dB)	Measurement Uncertainty (dB)
Manual Sweep	__________	__________	__________	1.6	**0.44**

* For models with Option 22, set L1 to +4 dBm.

MG3695A and MG3696A

Set L1 to: +3 dBm*	Maximum Power (dBm)	Minimum Power (dBm)	Variation (Max – Min) (dB)	Variation Specification (dB)	Measurement Uncertainty (dB)
Manual Sweep	__________	__________	__________	2.2	**0.44**

* For models with Option 22, set L1 to +1 dBm.

3-9 Power Level Flatness Test: All MG369XA Models With Option 2

MG3691A and MG3692A

Set L1 to: +11 dBm*	Maximum Power (dBm)	Minimum Power (dBm)	Variation (Max – Min) (dB)	Variation Specification (dB)	Measurement Uncertainty (dB)
Manual Sweep	________	________	________	1.60	**0.44**

* For models with Option 22, set L1 to +9 dBm.

MG3693A and MG3694A

Set L1 to: +3 dBm*	Maximum Power (dBm)	Minimum Power (dBm)	Variation (Max – Min) (dB)	Variation Specification (dB)	Measurement Uncertainty (dB)
Manual Sweep	________	________	________	1.60	**0.44**

* For models with Option 22, set L1 to +1 dBm.

MG3695A and MG3696A

Set L1 to: +0 dBm*	Maximum Power (dBm)	Minimum Power (dBm)	Variation (Max – Min) (dB)	Variation Specification (dB)	Measurement Uncertainty (dB)
Manual Sweep	________	________	________	1.60	**0.44**

* For models with Option 22, set L1 to –2 dBm.

3-9 Maximum Leveled Power Test: All MG369XA Models Without Options 2 and 15

MG3691A and MG3692A

Set L1 to:	Minimum Power (dBm) ≤2.0 GHz W/Option 5 ≤2.2 GHz W/Option 4	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	__________	**+17.0***	__________	+13.0**	**0.44**

* For models with Option 22, specification is +15 dBm.
** For models with Option 22, specification is +11 dBm.

MG3693A and MG3694A

Set L1 to:	Minimum Power (dBm) ≤2.0 GHz W/Option 5 ≤2.2 GHz W/Option 4	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	__________	**+13.0***	__________	+9.0**	**0.44**

Set L1 to:	Minimum Power (dBm) ≤40 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	__________	**+6.0*****	**0.44**

* For models with Option 22, specification is +11 dBm.
** For models with Option 22, specification is +7 dBm.
*** For models with Option 22, specification is +4 dBm.

MG3695A and MG3696A

Set L1 to:	Minimum Power (dBm) ≤2.0 GHz W/Option 5 ≤2.2 GHz W/Option 4	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	__________	**+12.0***	__________	+10.0**	**0.44**

Set L1 to:	Minimum Power (dBm) ≤40 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	__________	**+3.0*****	**0.44**

* For models with Option 22, specification is +10 dBm.
** For models with Option 22, specification is +8 dBm.
*** For models with Option 22, specification is +1 dBm.

3-9 Maximum Leveled Power Test: All MG369XA Models With Option 2 and Without Option 15

MG3691A and MG3692A

Set L1 to:	Minimum Power (dBm) ≤2.0 GHz W/Option 5 ≤2.2 GHz W/Option 4	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	________	**+15.0***	________	+11.0**	**0.44**

* For models with Option 22, specification is +13 dBm.
** For models with Option 22, specification is +9 dBm.

MG3693A and MG3694A

Set L1 to:	Minimum Power (dBm) ≤2.0 GHz W/Option 5 ≤2.2 GHz W/Option 4	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	________	**+11.0***	________	+7.0**	**0.44**

Set L1 to:	Minimum Power (dBm) ≤40 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	________	**+3.0*****	**0.44**

* For models with Option 22, specification is +9 dBm.
** For models with Option 22, specification is +5 dBm.
*** For models with Option 22, specification is +1 dBm.

MG3695A and MG3696A

Set L1 to:	Minimum Power (dBm) ≤2.0 GHz W/Option 5 ≤2.2 GHz W/Option 4	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	________	**+10.0***	________	+8.0**	**0.44**

Set L1 to:	Minimum Power (dBm) ≤40 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	________	**+0.0*****	**0.44**

* For models with Option 22, specification is +8 dBm.
** For models with Option 22, specification is +6 dBm.
*** For models with Option 22, specification is –2 dBm.

3-9 Maximum Leveled Power Test: All MG369XA Models With Option 15 and Without Option 2

MG3691A and MG3692A

Set L1 to:	Minimum Power (dBm) ≤2.0 GHz W/Option 5 ≤2.2 GHz W/Option 4	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	__________	**+19.0***	__________	+17.0**	**0.44**

* For models with Option 22, specification is +17 dBm.
** For models with Option 22, specification is +15 dBm.

MG3693A and MG3694A

Set L1 to:	Minimum Power (dBm) ≤10.0 GHz	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	__________	**+15.0***	__________	+12.0**	**0.44**

Set L1 to:	Minimum Power (dBm) ≤40 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	__________	**+14.0*****	**0.44**

* For models with Option 22, specification is +13 dBm.
** For models with Option 22, specification is +10 dBm.
*** For models with Option 22, specification is +12 dBm.

3-9 Maximum Leveled Power Test: All MG369XA Models With Options 2 and 15

MG3691A and MG3692A

Set L1 to:	Minimum Power (dBm) ≤2.0 GHz W/Option 5 ≤2.2 GHz W/Option 4	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	________	**+18.0***	________	+15.0**	**0.44**

* For models with Option 22, specification is +16 dBm.
** For models with Option 22, specification is +13 dBm.

MG3693A and MG3694A

Set L1 to:	Minimum Power (dBm) ≤10.0 GHz	Specification (dBm)	Minimum Power (dBm) ≤20 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	________	**+14.0***	________	+10.0**	**0.44**

Set L1 to:	Minimum Power (dBm) ≤40 GHz	Specification (dBm)	Measurement Uncertainty (dB)
+20 dBm	________	**+12.0*****	**0.44**

* For models with Option 22, specification is +12 dBm.
** For models with Option 22, specification is +8 dBm.
*** For models with Option 22, specification is +10 dBm.

3-10 Residual FM Test: All MG369XA Models with Options 3 and 4 (1 of 2)

Locked FM Mode Off

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading (kHz)	Upper Limit (Specification) (Hz RMS)	Measurement Uncertainty (±Hz)
1.0	1.3	___________	40	3.2
2.1	1.8	___________	40	3.2
5.0	5.3	___________	40	3.2
8.3	8.6	___________	40	3.2
8.5	8.8	___________	40	3.2
14.0	14.3	___________	40	3.2
19.9	20.2	___________	40	3.2
20.1	20.4	___________	80	3.2
25.0	25.3	___________	80	3.2
30.0	30.3	___________	80	3.2
40.0	39.7	___________	80	3.2
40.3	40.0	___________	160	3.2

Locked FM Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading (kHz)	Upper Limit (Specification) (Hz RMS)	Measurement Uncertainty (±Hz)
1.0	1.3	___________	40	3.2
2.1	1.8	___________	40	3.2
5.0	5.3	___________	40	3.2
8.3	8.6	___________	40	3.2
8.5	8.8	___________	40	3.2
14.0	14.3	___________	40	3.2
19.9	20.2	___________	40	3.2
20.1	20.4	___________	80	3.2
25.0	25.3	___________	80	3.2
30.0	30.3	___________	80	3.2
40.0	39.7	___________	80	3.2
40.3	40.0	___________	160	3.2

3-10 Residual FM Test: All Models with Options 3 and 4 (2 of 2)

Unlocked Narrow FM Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading (kHz)	Upper Limit (Specification) (kHz RMS)	Measurement Uncertainty (±Hz)
1.0	1.3	__________	5	3.2
2.1	1.8	__________	5	3.2
5.0	5.3	__________	5	3.2
8.3	8.6	__________	5	3.2
8.5	8.8	__________	5	3.2
14.0	14.3	__________	5	3.2
19.9	20.2	__________	5	3.2
20.1	20.4	__________	10	3.2
25.0	25.3	__________	10	3.2
30.0	30.3	__________	10	3.2
40.0	39.7	__________	10	3.2
40.3	40.0	__________	20	3.2

Unlocked Wide FM Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading (kHz)	Upper Limit (Specification) (kHz RMS)	Measurement Uncertainty (±Hz)
1.0	1.3	__________	25	3.2
2.1	1.8	__________	25	3.2
5.0	5.3	__________	25	3.2
8.3	8.6	__________	25	3.2
8.5	8.8	__________	25	3.2
14.0	14.3	__________	25	3.2
19.9	20.2	__________	25	3.2
20.1	20.4	__________	50	3.2
25.0	25.3	__________	50	3.2
30.0	30.3	__________	50	3.2
40.0	39.7	__________	50	3.2
40.3	40.0	__________	100	3.2

3-10 Residual FM Test: All Models without Options 3 and 4 (1 of 2)

Locked FM Mode Off

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading (kHz)	Upper Limit (Specification) (Hz RMS)	Measurement Uncertainty (±Hz)
1.0	1.3	__________	120	3.2
2.1	1.8	__________	120	3.2
5.0	5.3	__________	120	3.2
8.3	8.6	__________	120	3.2
8.5	8.8	__________	220	3.2
14.0	14.3	__________	220	3.2
19.9	20.2	__________	220	3.2
20.1	20.4	__________	440	3.2
25.0	25.3	__________	440	3.2
30.0	30.3	__________	440	3.2
40.0	39.7	__________	440	3.2
40.3	40.0	__________	880	3.2

Locked Low-Noise FM Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading (kHz)	Upper Limit (Specification) (Hz RMS)	Measurement Uncertainty (±Hz)
1.0	1.3	__________	120	3.2
2.1	1.8	__________	120	3.2
5.0	5.3	__________	120	3.2
8.3	8.6	__________	120	3.2
8.5	8.8	__________	220	3.2
14.0	14.3	__________	220	3.2
19.9	20.2	__________	220	3.2
20.1	20.4	__________	440	3.2
25.0	25.3	__________	440	3.2
30.0	30.3	__________	440	3.2
40.0	39.7	__________	440	3.2
40.3	40.0	__________	880	3.2

3-10 Residual FM Test: All Models without Options 3 and 4 (2 of 2)

Unlocked Narrow FM Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading (kHz)	Upper Limit (Specification) (kHz RMS)	Measurement Uncertainty (±Hz)
1.0	1.3	___________	5	3.2
2.1	1.8	___________	5	3.2
5.0	5.3	___________	5	3.2
8.3	8.6	___________	5	3.2
8.5	8.8	___________	5	3.2
14.0	14.3	___________	5	3.2
19.9	20.2	___________	5	3.2
20.1	20.4	___________	10	3.2
25.0	25.3	___________	10	3.2
30.0	30.3	___________	10	3.2
40.0	39.7	___________	10	3.2
40.3	40.0	___________	20	3.2

Unlocked Wide FM Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading (kHz)	Upper Limit (Specification) (kHz RMS)	Measurement Uncertainty (±Hz)
1.0	1.3	___________	25	3.2
2.1	1.8	___________	25	3.2
5.0	5.3	___________	25	3.2
8.3	8.6	___________	25	3.2
8.5	8.8	___________	25	3.2
14.0	14.3	___________	25	3.2
19.9	20.2	___________	25	3.2
20.1	20.4	___________	50	3.2
25.0	25.3	___________	50	3.2
30.0	30.3	___________	50	3.2
40.0	39.7	___________	50	3.2
40.3	40.0	___________	100	3.2

3-11 Frequency Modulation Test: All MG369XA Models with Option 12 or 25 (1 of 7)

FM Step Attenuator and FM Variable Attenuator

Voltage Measurement	FM Attenuator Accuracy Calculation	FM Attenuator Accuracy Specification	Measurement Uncertainty
V_1 = ________	G_1 = ________	0.980 to 1.020	0.01
V_2 = ________	G_2 = ________	0.980 to 1.020	0.01
V_3 = ________	G_3 = ________	0.980 to 1.020	0.01
V_4 = ________	G_4 = ________	0.980 to 1.020	0.01
V_5 = ________	G_5 = ________	0.980 to 1.020	0.01
V_6 = ________	G_{12} = ________		–
V_7 = ________	G_{123} = ________		–
V_8 = ________	G_{23} = ________		–
V_9 = ________			–

Composite FM Attenuator Accuracy

FM Attenuator Accuracy Calculation	FM Attenuator Accuracy Specification	Measurement Uncertainty	FM Mode Attenuator Variable Calculation
GT_1 = ________	0.950 to 1.050	0.02	GTN_{max} = ________
GT_2 = ________	0.950 to 1.050	0.02	GTN_{min} = ________
GT_3 = ________	0.950 to 1.050	0.02	GTW_{max} = ________
GT_4 = ________	0.950 to 1.050	0.02	GTW_{min} = ________
GT_5 = ________	0.950 to 1.050	0.02	GTF_{max} = ________
GT_6 = ________	0.950 to 1.050	0.02	GTF_{min} = ________
GT_7 = ________	0.950 to 1.050	0.02	
GT_8 = ________	0.950 to 1.050	0.02	
GT_9 = ________	0.950 to 1.050	0.02	
GT_{10} = ________	0.950 to 1.050	0.02	
GT_{11} = ________	0.950 to 1.050	0.02	
GT_{12} = ________	0.950 to 1.050	0.02	
GT_{13} = ________	0.950 to 1.050	0.02	
GT_{14} = ________	0.950 to 1.050	0.02	
GT_{15} = ________	0.950 to 1.050	0.02	
GT_{16} = ________	0.950 to 1.050	0.02	

3-11 Frequency Modulation Test: All MG369XA Models with Option 12 or 25 (2 of 7)

Locked External FM Accuracy at 5 GHz

Test Results	Specification	Measurement Uncertainty
V_{null} = ___________	0.6364 to 0.7778 V_{rms}	0.01 V_{rms}
$+FM_{error}$% = ___________	10%	1.6%
$–FM_{error}$% = ___________	10%	1.6%

Locked Low-Noise External FM Accuracy at 5 GHz

Test Results	Specification	Measurement Uncertainty
V_{null} = ___________	0.6364 to 0.7778 V_{rms}	0.01 V_{rms}
$+FM_{error}$% = ___________	10%	1.6%
$–FM_{error}$% = ___________	10%	1.6%

Locked External FM Accuracy at 20 GHz

Test Results	Specification	Measurement Uncertainty
V_{null} = ___________	0.6364 to 0.7778 V_{rms}	0.01 V_{rms}
$+FM_{error}$% = ___________	10%	1.6%
$–FM_{error}$% = ___________	10%	1.6%

Locked Low-Noise External FM Accuracy at 20 GHz

Test Results	Specification	Measurement Uncertainty
V_{null} = ___________	0.6364 to 0.7778 V_{rms}	0.01 V_{rms}
$+FM_{error}$% = ___________	10%	1.6%
$–FM_{error}$% = ___________	10%	1.6%

3-11 Frequency Modulation Test: All MG369XA Models with Option 12 or 25 (3 of 7)

Locked Internal FM Accuracy at 5 GHz

Test Results	Specification	Measurement Uncertainty
FM_{null} = ___________	220 to 260 kHz	3 kHz
$+FM_{error}$% = ___________	10%	0.7%
$–FM_{error}$% = ___________	10%	0.7%

Locked Low-Noise Internal FM Accuracy at 5 GHz

Test Results	Specification	Measurement Uncertainty
FM_{null} = ___________	220 to 260 kHz	3 kHz
$+FM_{error}$% = ___________	10%	0.7%
$–FM_{error}$% = ___________	10%	0.7%

Locked Internal FM Accuracy at 20 GHz

Test Results	Specification	Measurement Uncertainty
FM_{null} = ___________	220 to 260 kHz	3 kHz
$+FM_{error}$% = ___________	10%	1.16%
$–FM_{error}$% = ___________	10%	1.16%

Locked Low-Noise Internal FM Accuracy at 20 GHz

Test Results	Specification	Measurement Uncertainty
FM_{null} = ___________	220 to 260 kHz	3 kHz
$+FM_{error}$% = ___________	10%	1.16%
$–FM_{error}$% = ___________	10%	1.16%

3-11 Frequency Modulation Test: All MG369XA Models with Option 12 or 25 (4 of 7)

Wide External ΦM Accuracy at 5 GHz

Test Results	Specification	Measurement Uncertainty
V_{null} = ___________	0.6364 to 0.7778 V_{rms}	0.01 V_{rms}
$+\Phi M_{error}\%$ = ___________	10%	1.6%
$-\Phi M_{error}\%$ = ___________	10%	1.6%

Narrow External ΦM Accuracy at 5 GHz

Test Results	Specification	Measurement Uncertainty
V_{null} = ___________	0.6364 to 0.7778 V_{rms}	0.01 V_{rms}
$+\Phi M_{error}\%$ = ___________	10%	1.6%
$-\Phi M_{error}\%$ = ___________	10%	1.6%

Wide External ΦM Accuracy at 20 GHz

Test Results	Specification	Measurement Uncertainty
V_{null} = ___________	0.6364 to 0.7778 V_{rms}	0.01 V_{rms}
$+\Phi M_{error}\%$ = ___________	10%	1.6%
$-\Phi M_{error}\%$ = ___________	10%	1.6%

Narrow External ΦM Accuracy at 20 GHz

Test Results	Specification	Measurement Uncertainty
V_{null} = ___________	0.6364 to 0.7778 V_{rms}	0.01 V_{rms}
$+\Phi M_{error}\%$ = ___________	10%	1.6%
$-\Phi M_{error}\%$ = ___________	10%	1.6%

3-11 Frequency Modulation Test: All MG369XA Models with Option 12 or 25 (5 of 7)

Wide Internal ΦM Accuracy at 5 GHz

Test Results	Specification	Measurement Uncertainty
ΦM_{null} = ___________	2.15 to 2.65 rad	0.03 rad
$+\Phi M_{error}\%$ = ___________	10%	0.66%
$-\Phi M_{error}\%$ = ___________	10%	0.66%

Narrow Internal ΦM Accuracy at 5 GHz

Test Results	Specification	Measurement Uncertainty
ΦM_{null} = ___________	2.15 to 2.65 rad	0.03 rad
$+\Phi M_{error}\%$ = ___________	10%	0.66%
$-\Phi M_{error}\%$ = ___________	10%	0.66%

Wide Internal ΦM Accuracy at 20 GHz

Test Results	Specification	Measurement Uncertainty
ΦM_{null} = ___________	2.15 to 2.65 rad	0.03 rad
$+\Phi M_{error}\%$ = ___________	10%	0.66%
$-\Phi M_{error}\%$ = ___________	10%	0.66%

Narrow Internal ΦM Accuracy at 20 GHz

Test Results	Specification	Measurement Uncertainty
ΦM_{null} = ___________	2.15 to 2.65 rad	0.03 rad
$+\Phi M_{error}\%$ = ___________	10%	0.66%
$-\Phi M_{error}\%$ = ___________	10%	0.66%

Unlocked Narrow External FM Accuracy at 5 GHz

FM_{ref} (GHz)	FM_{mod} (GHz)	FM_{err} (%)	Specification (%)	Measurement Uncertainty (%)
___________	___________	___________	10	0.1

3-11 Frequency Modulation Test: All MG369XA Models with Option 12 or 25 (6 of 7)

Locked External FM Flatness

Function Generator Frequency	MG369XA FM Sensitivity	V_{null} (V_{rms})	P_{null} (dBm)	FM_{flat} (dB)	Specification (dB)	Measurement Uncertainty (dB)
10 kHz	24.05 kHz/V	__________	__________	__________	±1.0	0.10
20 kHz	48.10 kHz/V	__________	__________	__________	±1.0	0.10
50 kHz	120.3 kHz/V	__________	__________	__________	±1.0	0.10
100 kHz*	240.5 kHz/V	__________	__________	0 dB	–	–
200 kHz	481.0 kHz/V	__________	__________	__________	±1.0	0.15
500 kHz	1.203 MHz/V	__________	__________	__________	±1.0	0.15
1 MHz	2.405 MHz/V	__________	__________	__________	±1.0	0.15

Narrow External ΦM Flatness

Function Generator Frequency	MG369XA ΦM Sensitivity	V_{null} (V_{rms})	P_{null} (dBm)	ΦM_{flat} (dB)	Specification (dB)	Measurement Uncertainty (dB)
10 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.10
20 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.10
50 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.10
100 kHz*	2.405 rad/V	__________	__________	0 dB	–	–
200 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.15
500 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.15
1 MHz	2.405 rad/V	__________	__________	__________	±1.0	0.15

Wide External ΦM Flatness

Function Generator Frequency	MG369XA ΦM Sensitivity	V_{null} (V_{rms})	P_{null} (dBm)	ΦM_{flat} (dB)	Specification (dB)	Measurement Uncertainty (dB)
10 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.10
20 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.10
50 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.10
100 kHz*	2.405 rad/V	__________	__________	0 dB	–	–
200 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.15
500 kHz	2.405 rad/V	__________	__________	__________	±1.0	0.15

* A potential spurious beat note exists at a 100 kHz rate that can interfere with the carrier frequency null measurement. Therefore, the measurement can be performed at a 99.8 kHz rate with a function generator multimeter reading of 0.7070 V_{rms}.

3-11 Frequency Modulation Test: All MG369XA Models with Option 12 or 25 (7 of 7)

Locked FM Bandwidth

Function Generator Frequency	MG369XA FM Sensitivity	V_{BW} (V_{rms})	Specification (V_{rms})	Measurement Uncertainty (V_{rms})
10 MHz	20 MHz/V	__________	<0.401	0.015

Locked Low Noise FM Bandwidth

Function Generator Frequency	MG369XA FM Sensitivity	V_{BW} (V_{rms})	Specification (V_{rms})	Measurement Uncertainty (V_{rms})
10 MHz	20 MHz/V	__________	<0.401	0.015

Narrow ΦM Bandwidth

Function Generator Frequency	MG369XA FM Sensitivity	V_{BW} (V_{rms})	Specification (V_{rms})	Measurement Uncertainty (V_{rms})
10 MHz	2.405 rad/V	__________	<0.333	0.015

3-11 Alternate Frequency Modulation Accuracy Test: All MG369XA Models with Option 23 or 25 (1 of 3)

FM Accuracy, Locked Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading N (kHz)	Modulation Analyzer Reading S + N (kHz)	Actual Frequency Deviation S_{Actual} (kHz)	Limits (kHz)	Measurement Uncertainty (±kHz)
1.0	1.3	________	________	________	270.0 to 330.0	4.1
2.1	1.8	________	________	________	270.0 to 330.0	4.1
5.0	5.3	________	________	________	270.0 to 330.0	4.1
8.3	8.6	________	________	________	270.0 to 330.0	4.1
8.5	8.8	________	________	________	270.0 to 330.0	4.1
14.0	14.3	________	________	________	270.0 to 330.0	4.1
19.9	20.2	________	________	________	270.0 to 330.0	4.1
20.1	20.4	________	________	________	270.0 to 330.0	4.1
25.0	25.3	________	________	________	270.0 to 330.0	4.1
30.0	30.3	________	________	________	270.0 to 330.0	4.1
40.0	39.7	________	________	________	270.0 to 330.0	4.1
40.3	40.0	________	________	________	270.0 to 330.0	4.1

FM Accuracy, Locked Low-Noise Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading N (kHz)	Modulation Analyzer Reading S + N (kHz)	Actual Frequency Deviation S_{Actual} (kHz)	Limits (kHz RMS)	Measurement Uncertainty (±kHz)
1.0	1.3	________	________	________	270.0 to 330.0	4.1
2.1	1.8	________	________	________	270.0 to 330.0	4.1
5.0	5.3	________	________	________	270.0 to 330.0	4.1
8.3	8.6	________	________	________	270.0 to 330.0	4.1
8.5	8.8	________	________	________	270.0 to 330.0	4.1
14.0	14.3	________	________	________	270.0 to 330.0	4.1
19.9	20.2	________	________	________	270.0 to 330.0	4.1
20.1	20.4	________	________	________	270.0 to 330.0	4.1
25.0	25.3	________	________	________	270.0 to 330.0	4.1
30.0	30.3	________	________	________	270.0 to 330.0	4.1
40.0	39.7	________	________	________	270.0 to 330.0	4.1
40.3	40.0	________	________	________	270.0 to 330.0	4.1

3-11 Alternate Frequency Modulation Accuracy Test: All MG369XA Models with Option 23 or 25 (2 of 3)

FM Accuracy, Unlocked Narrow Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading N (kHz)	Modulation Analyzer Reading S + N (kHz)	Actual Frequency Deviation S_{Actual} (kHz)	Limits (kHz)	Measurement Uncertainty (±kHz)
1.0	1.3	___________	___________	___________	270.0 to 330.0	4.1
2.1	1.8	___________	___________	___________	270.0 to 330.0	4.1
5.0	5.3	___________	___________	___________	270.0 to 330.0	4.1
8.3	8.6	___________	___________	___________	270.0 to 330.0	4.1
8.5	8.8	___________	___________	___________	270.0 to 330.0	4.1
14.0	14.3	___________	___________	___________	270.0 to 330.0	4.1
19.9	20.2	___________	___________	___________	270.0 to 330.0	4.1
20.1	20.4	___________	___________	___________	270.0 to 330.0	4.1
25.0	25.3	___________	___________	___________	270.0 to 330.0	4.1
30.0	30.3	___________	___________	___________	270.0 to 330.0	4.1
40.0	39.7	___________	___________	___________	270.0 to 330.0	4.1
40.3	40.0	___________	___________	___________	270.0 to 330.0	4.1

3-11 Alternate Phase Modulation Accuracy Test: All MG369XA Models with Option 23 or 25 (3 of 3)

ΦM Accuracy, Unlocked Narrow Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading N (rad)	Modulation Analyzer Reading S + N (rad)	Actual Phase Deviation S_{Actual} (rad)	Limits (rad)	Measurement Uncertainty (±rad)
1.0	1.3	________	________	________	2.7 to 3.3	0.11
2.1	1.8	________	________	________	2.7 to 3.3	0.11
5.0	5.3	________	________	________	2.7 to 3.3	0.11
8.3	8.6	________	________	________	2.7 to 3.3	0.11
8.5	8.8	________	________	________	2.7 to 3.3	0.11
14.0	14.3	________	________	________	2.7 to 3.3	0.11
19.9	20.2	________	________	________	2.7 to 3.3	0.11
20.1	20.4	________	________	________	2.7 to 3.3	0.11
25.0	25.3	________	________	________	2.7 to 3.3	0.11
30.0	30.3	________	________	________	2.7 to 3.3	0.11
40.0	39.7	________	________	________	2.7 to 3.3	0.11
40.3	40.0	________	________	________	2.7 to 3.3	0.11

ΦM Accuracy, Unlocked Wide Mode On

DUT Frequency (GHz)	LO Frequency (GHz)	Modulation Analyzer Reading N (rad)	Modulation Analyzer Reading S + N (rad)	Actual Phase Deviation S_{Actual} (rad)	Limits (rad)	Measurement Uncertainty (±rad)
1.0	1.3	________	________	________	2.7 to 3.3	0.11
2.1	1.8	________	________	________	2.7 to 3.3	0.11
5.0	5.3	________	________	________	2.7 to 3.3	0.11
8.3	8.6	________	________	________	2.7 to 3.3	0.11
8.5	8.8	________	________	________	2.7 to 3.3	0.11
14.0	14.3	________	________	________	2.7 to 3.3	0.11
19.9	20.2	________	________	________	2.7 to 3.3	0.11
20.1	20.4	________	________	________	2.7 to 3.3	0.11
25.0	25.3	________	________	________	2.7 to 3.3	0.11
30.0	30.3	________	________	________	2.7 to 3.3	0.11
40.0	39.7	________	________	________	2.7 to 3.3	0.11
40.3	40.0	________	________	________	2.7 to 3.3	0.11

3-12 Amplitude Modulation Test: All MG369XA Models with Option 14 or 25 (1 of 3)

External AM Accuracy vs. Frequency at 50% Modulation

DUT Frequency (GHz)	LO Frequency (GHz)	M (%)	Specification (%)	Measurement Uncertainty (±%)
1.0	1.5	___________	45 to 55	1.0 ±1 Digit
1.4	1.9	___________	45 to 55	1.0 ±1 Digit
2.2	2.7	___________	45 to 55	1.0 ±1 Digit
2.3	2.8	___________	45 to 55	1.0 ±1 Digit
5.0	5.5	___________	45 to 55	1.0 ±1 Digit
8.3	8.8	___________	45 to 55	1.0 ±1 Digit
8.4	8.9	___________	45 to 55	1.0 ±1 Digit
14.0	14.5	___________	45 to 55	1.0 ±1 Digit
20.0	20.5	___________	45 to 55	1.0 ±1 Digit
23.0	22.5	___________	45 to 55	1.0 ±1 Digit
26.5	26.0	___________	45 to 55	1.0 ±1 Digit
30.0	29.5	___________	45 to 55	1.0 ±1 Digit
33.0	32.5	___________	45 to 55	1.0 ±1 Digit
36.0	35.5	___________	45 to 55	1.0 ±1 Digit
40.0	39.5	___________	45 to 55	1.0 ±1 Digit

Internal AM Accuracy vs. Frequency at 50% Modulation

DUT Frequency (GHz)	LO Frequency (GHz)	M (%)	Specification (%)	Measurement Uncertainty (±%)
1.0	1.5	___________	45 to 55	1.0 ±1 Digit
1.4	1.9	___________	45 to 55	1.0 ±1 Digit
2.2	2.7	___________	45 to 55	1.0 ±1 Digit
2.3	2.8	___________	45 to 55	1.0 ±1 Digit
5.0	5.5	___________	45 to 55	1.0 ±1 Digit
8.3	8.8	___________	45 to 55	1.0 ±1 Digit
8.4	8.9	___________	45 to 55	1.0 ±1 Digit
14.0	14.5	___________	45 to 55	1.0 ±1 Digit
20.0	20.5	___________	45 to 55	1.0 ±1 Digit
23.0	22.5	___________	45 to 55	1.0 ±1 Digit
26.5	26.0	___________	45 to 55	1.0 ±1 Digit
30.0	29.5	___________	45 to 55	1.0 ±1 Digit
33.0	32.5	___________	45 to 55	1.0 ±1 Digit
36.0	35.5	___________	45 to 55	1.0 ±1 Digit
40.0	39.5	___________	45 to 55	1.0 ±1 Digit

3-12 Amplitude Modulation Test: All MG369XA Models with Option 14 or 25 (2 of 3)

AM Roll Off at 50 kHz Bandwidth

DUT Frequency (GHz)	LO Frequency (GHz)	V_1 Multimeter Reading (Volts)	V_{50} Multimeter Reading (Volts)	Calculated AM_{ro} (dB)	Specification (dB)	Measurement Uncertainty (dB)
1.0	1.5	________	________	________	< 3	0.02
1.4	1.9	________	________	________	< 3	0.02
2.2	2.7	________	________	________	< 3	0.02
2.3	2.8	________	________	________	< 3	0.02
5.0	5.5	________	________	________	< 3	0.02
8.3	8.8	________	________	________	< 3	0.02
8.4	8.9	________	________	________	< 3	0.02
14.0	14.5	________	________	________	< 3	0.02
20.0	20.5	________	________	________	< 3	0.02
23.0	22.5	________	________	________	< 3	0.02
26.5	26.0	________	________	________	< 3	0.02
30.0	29.5	________	________	________	< 3	0.02
33.0	32.5	________	________	________	< 3	0.02
36.0	35.5	________	________	________	< 3	0.02
40.0	39.5	________	________	________	< 3	0.02

3-12 Amplitude Modulation Test: All MG369XA Models with Option 14 or 25 (3 of 3)

AM Flatness

DUT F1 (GHz)	LO F1 (GHz)	V_0 (V)	V_1 (V)	V_2 (V)	V_3 (V)	V_4 (V)	V_5 (V)	V_6 (V)	V_7 (V)	V_8 (V)	V_9 (V)	V_{10} (V)	AM_{flat} (dB)	Spec. (dB)	MU (dB)
1.0	1.5	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
1.4	1.9	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
2.2	2.7	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
2.3	2.8	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
5.0	5.5	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
8.3	8.8	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
8.4	8.9	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
14.0	14.5	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
20.0	20.5	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
23.0	22.5	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
26.5	26.0	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
30.0	29.5	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
33.0	32.5	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
36.0	35.5	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02
40.0	39.5	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	0.6	0.02

3-13 Pulse Modulation Test: All MG369XA Models with Option 13 or 24 (1 of 3)

Pulse Rise and Fall Times

DUT Frequency (GHz)	Rise Time (ns)	Fall Time (ns)	Specification (ns)	Measurement Uncertainty (± ns)
0.5	________	________	15	0.023
1.2	________	________	15 (Option 4) 10 (Option 5)	0.023
1.9	________	________	15 (Option 4) 10 (Option 5)	0.023
5.0	________	________	10	0.023
14.0	________	________	10	0.023
22.0	________	________	10	0.023
28.0	________	________	10	0.023
34.0	________	________	10	0.023
41.0	________	________	10	0.023

Pulse Overshoot

DUT Frequency (GHz)	Overshoot (%)	Specification (%)	Measurement Uncertainty (%)
0.5	________	10	5
1.2	________	10	5
1.9	________	10	5
5.0	________	10	5
14.0	________	10	5
22.0	________	10	5
28.3	________	10	5
34.4	________	10	5
41.0	________	10	5

3-13 Pulse Modulation Test: All MG369XA Models with Option 13 or 24 (2 of 3)

Pulse Power Accuracy (Pulse Width ≥1 μs)

DUT Frequency (GHz)	V_{ref} (Volts)	V_{pulse} (Volts)	$P_{accuracy}$ (dB)	Specification (dB)	Measurement Uncertainty (dB)
0.05	__________	__________	__________	±0.5	0.1
1.2	__________	__________	__________	±0.5	0.1
1.9	__________	__________	__________	±0.5	0.1
5.0	__________	__________	__________	±0.5	0.1
14.0	__________	__________	__________	±0.5	0.1
22.0	__________	__________	__________	±0.5	0.1
28.0	__________	__________	__________	±0.5	0.1
34.0	__________	__________	__________	±0.5	0.1
41.0	__________	__________	__________	±0.5	0.1

Pulse Power Accuracy (Pulse Width <1 μs)

DUT Frequency (GHz)	V_{ref} (Volts)	V_{pulse} (Volts)	$P_{accuracy}$ (dB)	Specification (dB)	Measurement Uncertainty (dB)
2.2	__________	__________	__________	±1.0	0.1
5.0	__________	__________	__________	±1.0	0.1
14.0	__________	__________	__________	±1.0	0.1
22.0	__________	__________	__________	±1.0	0.1
28.0	__________	__________	__________	±1.0	0.1
34.0	__________	__________	__________	±1.0	0.1
41.0	__________	__________	__________	±1.0	0.1

3-13 Pulse Modulation Test:
All MG369XA Models with Option 13 or 24 (3 of 3)

Pulse On/Off Ratio

DUT Frequency (GHz)	P_{depth} (dB)	Specification (dB)	Measurement Uncertainty (dB)
0.01	________	–80	0.9
1.0	________	–80	0.9
1.4	________	–80	0.9
2.0	________	–80	0.9
2.2	________	–80	1.0
2.3	________	–80	1.0
5.0	________	–80	1.7
8.3	________	–80	2.6
8.4	________	–80	2.6
14.0	________	–80	2.5
20.0	________	–80	2.5
23.0	________	–80	3.3
26.5	________	–80	3.3
30.0	________	–80	3.1
33.0	________	–80	3.2
36.0	________	–80	3.2
40.0	________	–80	3.2
50.0	________	–80	3.2

Anritsu Model MG369_A **Date:** ______________________

Serial Number ________________ **Tested By:** ______________________

4-7 Preliminary Calibration

Procedure Step	**Step Completion**
1. Internal DVM Calibration (calterm119)	________
2. Coarse Loop Pretune DAC Calibration (calterm 137)	________
3. Sweep Time DAC Calibration (calterm 132)	________
4. YIG Frequency Linearizer DACs Calibration (calterm 127)	________
5. 100 MHz Reference Oscillator Calibration (calterm 130)	________
6. Ramp Center DAC Calibration (calterm 129)	________
7. Sweep Width DAC Calibration (calterm 133)	________
8. Center Frequency DAC Calibration (calterm 114)	________
9. Store the Calibration Data	________

4-8 Switched Filter Shaper Calibration

Log Amplifier Zero Calibration	Step Completion
1. Log Amplifier Zero Calibration (calterm 115)	______________
Limiter DAC Adjustment (MG369_A with Option 15)	
2. Limiter DAC Adjustment (calterm 145)	______________
Shaper DAC Adjustment	
3. Shaper DAC Adjustment (calterm 138)	______________
4. Store the Calibration Data	______________

4-9 RF Level Calibration

This calibration is performed using an automatic test system. Contact Anritsu Customer Service for further information.

4-10 ALC Bandwidth Calibration

Procedure Step	Step Completion
1. ALC Bandwidth Calibration (Calterm 110)	______________
2. Store the Calibration Data	______________

Appendix B
Performance Specifications

B-1 MG369XA Technical Data Sheet

MG369XA Data Sheet, part number 11410-00327.

Technical Datasheet

MG3690A

RF/Microwave Signal Generators

0.1 Hz to 65 GHz/110 GHz

MG3690A the ideal signal generator

Anritsu

Specifications

Frequency Coverage:

Model/Option No.	Frequency Coverage	Output Type
MG3691A	2 to 8.4 GHz	K(f)
MG3692A	2 to 20 GHz	K(f)
MG3693A	2 to 30 GHz	K(f)
MG3694A	2 to 40 GHz	K(f)
MG3695A	2 to 50 GHz	V(f)
MG3696A	2 to 65 GHz	V(f)
Option 4	10 MHz to 2.2 GHz	Model No. Dependent
Option 5	10 MHz to 2 GHz	Model No. Dependent
Option 22	0.1 Hz to 10 MHz	Model No. Dependent

Options 4 and 5: Frequency extension down to 10 MHz
Two options are available to extend the 2 GHz low end frequency limit of the base models down to 10 MHz. Option 4 uses a digital down-converter (DDC) with successive divide-by-two circuitry. It offers the best phase noise performance of the two choices, at the expense of some analog performance <500 MHz. In that range, analog sweep mode is not available, and pulse modulation performance is specified as typical. In addition, frequency and phase modulation mod index is scaled by the division ratio of each band of the DDC. Option 5 maintains all analog performance by using a heterodyne mixing down-converter.

Option 22: Frequency extension down to DC
If frequency coverage down to 0.1 Hz is desired, Option 22 can be added with either Option 4 or 5. Option 22 uses Direct Digital Synthesis (DDS) for CW and Step Sweep modes of operation. Modulation and analog sweep are not available in the DDS band. Frequency resolution <10 MHz is 0.02 Hz. Output power across the complete instrument frequency range is degraded by 2 dB.

CW Mode

Output: Twenty independent, presettable CW frequencies (F0 – F9 and M0 –M9).

Accuracy: Same as internal or external 10 MHz time base.

Internal Time Base Stability:
With Aging: <2 x 10^{-9}/day (<5 x 10^{-10}/day with Option 16)
With Temperature: <2 x 10^{-8}/deg C over 0˚C to 55˚C
(<2 x 10^{-10}/deg C with Option 16)

Resolution: 0.01 Hz

External 10 MHz Reference Input: Accepts external 10 MHz ±50 Hz (typical), 0 to +20 dBm time base signal. Automatically disconnects the internal high-stability time-base option, if installed. BNC, rear panel, 50Ω impedance.

10 MHz Reference Output: 1 Vp-p into 50Ω, AC coupled.
Rear panel BNC; 50Ω impedance.

Switching Time (typical maximum): <40 ms to be within 1 kHz of final frequency.

Phase Offset: Adjustable in 0.1 degree steps.

Electronic Frequency Control (EFC) Input: –5V to +5V input range; 5 x 10^{-7}.Fout Hz/V sensitivity (typical); ≤250 Hz Modulation BW; Rear panel BNC; High Impedance

Phase-Locked Step Sweep Mode

Sweep Width: Independently selected, 0.01 Hz to full range. Every frequency step in sweep range is phase-locked.

Accuracy: Same as internal or external 10 MHz time base.

Resolution (Minimum Step Size): 0.01 Hz

Linear/Log Sweep: User-selectable linear or log sweep.
In log sweep, step size logarithmically increases with frequency.

Steps: User-selectable number of steps or the step size.

Number of Steps: Variable from 1 to 10,000

Step Size: 0.01 Hz to the full frequency range of the instrument. (If the step size does not divide into the selected frequency range, the last step is truncated.)

Dwell Time Per Step: Variable from 1 ms to 99 seconds

Fixed Rate Sweep: Allows the user to set the total time of the sweep, including lock time. Variable from 20 ms to 99 seconds.

Switching Time (typical maximum): <15 ms + 1 ms/GHz step size or <40 ms, whichever is less, to be within 1 kHz of final frequency.

Analog Sweep Mode (Option 6)

Sweep Width: Independently selected from 1 MHz to full frequency range. With Option 4, Digital Down Converter, Analog sweep is only available ≥500 MHz. Analog sweep is not available <10 MHz with Option 22.

Accuracy: The lesser of ± 30 MHz or (± 2 MHz + 0.25% of sweep width) for Sweep Speeds of ≤50 MHz/ms. (typical)

Sweep Time Range: 30 ms to 99 seconds

Alternate Sweep Mode

Sweeps alternately in step sweep between any two sweep ranges. Each sweep range may be associated with a power level.

Manual Sweep Mode

Provides stepped, phase-locked adjustment of frequency between sweep limits. User-selectable number of steps or step size.

List Sweep Mode

Under GPIB control or via the front panel, up to 4 tables with 2000 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. One table of 2000 points is stored in non-volatile memory, all other tables are stored in volatile memory.

Switching Time (typical maximum): <25 ms to be within 1 kHz of final frequency.

Programmable Frequency Agility

Under GPIB control, up to 3202 non-sequential frequency/power sets can be stored and then addressed as a phase-locked step sweep. Data stored in volatile memory.

Switching Time (typical maximum): <25 ms to be within 1 kHz of final frequency.

Markers

Up to 20 independent, settable markers (F0 – F9 and M0 – M9).

Video Markers: +5V or –5V marker output, selectable from system menus. AUX I/O connector, rear panel.

Intensity Markers: Produces an intensity dot on analog display traces, obtained by a momentary dwell in RF sweep, in analog sweeps of <1s.

Marker Accuracy: Same as sweep frequency accuracy.

Marker Resolution:
Analog Sweep: 1 MHz or Sweep Width/4096 which ever is greater.
Step Sweep: 0.01Hz.

Sweep Triggering

Sweep triggering is provided for Analog Frequency Sweep, Step Frequency Sweep, List Frequency Sweep, and CW Power Sweep.

Auto: Triggers sweep automatically.

External: Triggers a sweep on the low to high transition of an external TTL signal. AUX I/O connector, rear panel.

Single: Triggers, aborts, and resets a single sweep. Reset sweep may be selected to be at the top or bottom of the sweep.

General

Stored Setups: Stores front panel settings and nine additional front-panel setups in a non-volatile RAM. A system menu allows saving and recalling of instrument setups. Whenever the instrument is turned on, control settings come on at the same functions and values existing when the instrument was turned off.

Memory Sequencing Input: Accepts a TTL low-level signal to sequence through ten stored setups. AUX I/O connector, rear panel.

Self-Test: Instrument self-test is performed when Self-Test soft-key is selected. If an error is detected, an error message is displayed in a window on the LCD identifying the probable cause and remedy.

Secure Mode: Disables all frequency and power level state displays. Stored setups saved in secure mode remain secured when recalled. Mode selectable from a system menu and via GPIB.

Parameter Entry: Instrument-controlled parameters can be entered in three ways: keypad, rotary data knob, or the ^ and v touch pads of the cursor-control key. The keypad is used to enter new parameter values; the rotary data knob and the cursor-control key are used to edit existing parameter values. The ^ and v touch pads of the cursor-control key move the cursor left and right one digit under the open parameter. The rotary data knob or the ^ and v touch pads will increment or decrement the digit position over the cursor. Controlled parameters are frequency, power level, sweep time, dwell time, and number of steps. Keypad entries are terminated by pressing the appropriate soft key. Edits are terminated by exiting the edit menu.

Reset: Returns all instrument parameters to predefined default states or values. Any pending GPIB I/O is aborted. Selectable from the system menu.

Master/Slave Operation: Allows two output signals to be swept with a user-selected frequency offset. One instrument controls the other via AUX I/O and SERIAL I/O connections. Requires a Master/Slave Interface Cable Set (Part No. ND36329).

User Level Flatness Correction: Allows user to calibrate out path loss due to external switching and cables via entered power table from a GPIB power meter or calculated data. When user level correction is activated, entered power levels are delivered at the point where calibration was performed. Supported power meters are Anritsu ML2437A, ML2438A, and ML4803A and HP 437B, 438A, and 70100A. Five user tables are available with up to 801 points/table.

Warm Up Time:
From Standby: 30 minutes.
From Cold Start (0 deg C): 120 hours to achieve specified frequency stability with aging.
Instruments disconnected from AC line power for more than 72 hours require 30 days to return to specified frequency stability with aging.

Power: 85-264 Vac, 48-440 Hz, 250 VA maximum

Standby: With ac line power connected, unit is placed in standby when front panel power switch is released from the OPERATE position.

Weight: 18 kg maximum

Dimensions: 133 H x 429 W x 450 D mm

Warranty: 3 years from ship date

Remote Operation

All instrument functions, settings, and operating modes (except for power on/standby) are controllable using commands sent from an external computer via the GPIB (IEEE-488 interface bus).

GPIB Address: Selectable from a system menu

IEEE-488 Interface Function Subset:
- **Source Handshake:** SH1
- **Acceptor Handshake:** AH1
- **Talker:** T6
- **Listener:** L4
- **Service Request:** SR1
- **Remote/Local:** RL1
- **Parallel Poll:** PP1
- **Device Clear:** DC1
- **Device Trigger:** DT1
- **Controller Capability:** C0, C1, C2, C3, C28
- **Tri-State Driver:** E2

GPIB Status Annunciators: When the instrument is operating in Remote, the GPIB status annunciators (listed below) will appear in a window on the front panel LCD.

Remote: Operating on the GPIB (all instrument front panel keys except for the SYSTEM key and the RETURN TO LOCAL soft-key will be ignored).

LLO (Local Lockout): Disables the RETURN TO LOCAL soft-key. Instrument can be placed in local mode only via GPIB or by cycling line power.

Emulations: The instrument responds to the published GPIB commands and responses of the Anritsu Models 6600, 6700, and 6XX00-series signal sources. When emulating another signal source, the instrument will be limited to the capabilities, mnemonics, and parameter resolutions of the emulated instrument.

Environmental (MIL-PRF-28800F, class 3)

Storage Temperature Range: –40 to +75°C

Operating Temperature Range: 0 to +50°C

Relative Humidity: 5% to 95% at 40°C

Altitude: 4,600 meters, 43.9 cm Hg

EMI: Meets the emission and immunity requirements of
- EN61326: 1998
- EN55011: 1991/CISPR-11:1990 Group 1 Class A
- EN61000-4-2: 1995 – 4 kV CD, 8 kV AD
- EN61000-4-3: 1997 – 3 V/m
- EN61000-4-4: 1995 – 0.5 kV SL, 1 kV PL
- EN61000-4-5: 1995 – 1 kV – 2 kV L-E
- EN61000-4-6: 1996 – 3 Vrms
- EN61000-4-11: 1994 – 100% for 20 ms

Shock: 30G for 11 ms, $^1/_2$ sine

Spectral Purity

All specifications apply at the lesser of +10 dBm output or maximum specified leveled output power, unless otherwise noted.

Spurious Signals

Harmonic and Harmonic Related:

Frequency Range	Standard
0.1 Hz to 10 MHz (Option 22)	<–30 dBc
10 MHz to ≤100 MHz (Option 4)	<–40 dBc
>100 MHz to ≤2.2 GHz (Option 4)	<–50 dBc
10 MHz to ≤50 MHz (Option 5)	<–30 dBc
>50 MHz to ≤2 GHz (Option 5)	<–40 dBc
>2 GHz (2.2 GHz w/Option 4) to ≤20 GHz	<–60 dBc
>20 GHz to ≤40 GHz	<–40 dBc
>40 GHz to ≤50 GHz (MG3695A)	<–40 dBc
>40 GHz to ≤65 GHz (MG3696A)	<–25 dBc

Harmonic and Harmonic Related (for models with Option 15, at maximum specified leveled output power):

Frequency Range	Standard
0.1 Hz to 10 MHz (Option 22)	<–30 dBc
10 MHz to ≤100 MHz (Option 4)	<–40 dBc
>100 MHz to ≤2.2 GHz (Option 4)	<–50 dBc
10 MHz to ≤50 MHz (Option 5)	<–30 dBc
>50 MHz to ≤2 GHz (Option 5)	<–40 dBc
>2 GHz (2.2 GHz w/Option 4) to ≤20 GHz	<–50 dBc
>20 GHz to ≤40 GHz	<–30 dBc*

*Typical (<21 GHz: <–20 dBc typical)

Nonharmonics:

Frequency Range	Standard
0.1 Hz to 10 MHz (Option 22)	<–30 dBc
10 MHz to ≤2.2 GHz (Option 4)	<–60 dBc
10 MHz to ≤2 GHz (Option 5)	<–40 dBc
>2 GHz (2.2 GHz w/Option 4) to ≤65 GHz	<–60 dBc

Power Line and Fan Rotation Spurious Emissions (dBc):

	Offset from Carrier		
Frequency Range	<300 Hz	300 Hz to 1 kHz	>1 kHz
≥10 to ≤500 MHz (Option 4)	<–68	<–72	<–72
>500 to ≤1050 MHz (Option 4)	<–62	<–72	<–72
>1050 to ≤2200 MHz (Option 4)	<–56	<–66	<–66
≥0.01 to ≤8.4 GHz	<–50	<–60	<–60
>8.4 to ≤20 GHz	<–46	<–56	<–60
>20 to ≤40 GHz	<–40	<–50	<–54
>40 to ≤65 GHz	<–34	<–44	<–48

Residual FM (CW and Step Sweep modes, 50 Hz - 15 kHz BW):

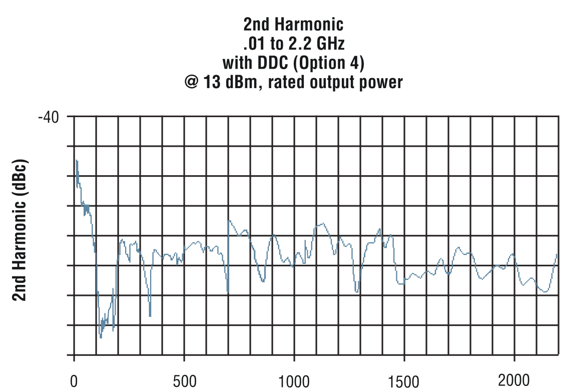
	Residual FM (Hz RMS)	
Frequency Range	Option 3	Standard
≤8.4 GHz	<40	<120
>8.4 to 20 GHz	<40	<220
>20 to ≤40 GHz	<80	<440
>40 to ≤65 GHz	<160	<880

Residual FM (Analog Sweep and Unlocked FM modes, 50 Hz - 15 kHz BW):

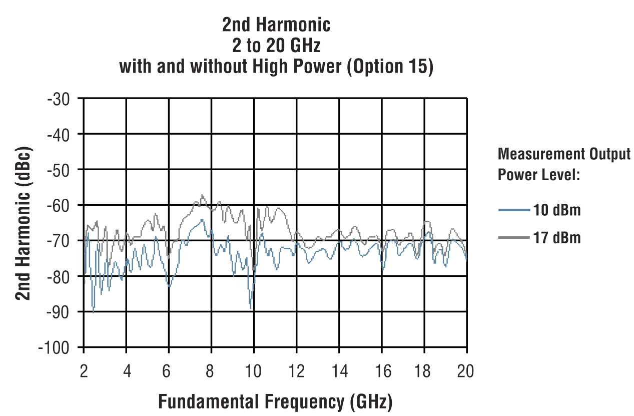
	Residual FM (kHz RMS)	
Frequency Range	Unlocked Narrow FM mode	Unlocked Wide FM mode or Analog Sweep (typ)
≥0.01 to ≤20 GHz	<5	<25
>20 GHz to ≤40 GHz	<10	<50
>40 GHz to ≤65 GHz	<20	<100

AM Noise Floor:

Typically <-145 dBm/Hz at 0 dBm output and offsets >5 MHz from carrier.



RF band harmonics with DDC option



Increase your output power without compromising your spectral purity

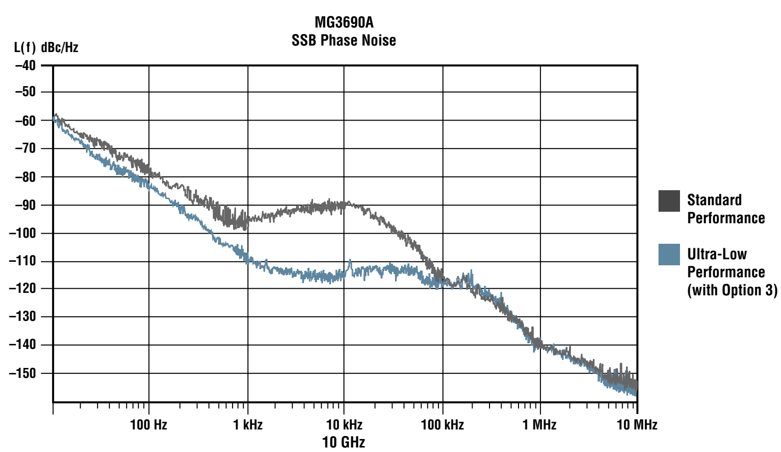
Single-Sideband Phase Noise

Single-Sideband Phase Noise (dBc/Hz):

	Offset from Carrier			
Frequency Range	**100 Hz**	**1 kHz**	**10 kHz**	**100 kHz**
≥0.1 Hz to <10 MHz (Option 22)	–90	–120	–130	–130
≥10 MHz to <500 MHz (Option 4)	–94	–106	–104	–120
≥500 MHz to <2.2 GHz (Option 4)	–82	–94	–92	–108
≥10 MHz to <2 GHz (Option 5)	–77	–88	–85	–100
≥2 GHz to ≤6 GHz	–77	–88	–86	–102
>6 GHz to ≤10 GHz	–73	–86	–83	–102
>10 GHz to ≤20 GHz	–66	–78	–77	–100
>20 GHz to ≤40 GHz	–60	–75	–72	–94
>40 GHz to ≤65 GHz	–54	–69	–64	–88

Single-Sideband Phase Noise (dBc/Hz) – Option 3:

	Offset from Carrier					
Frequency Range	**10 Hz**	**100 Hz**	**1 kHz**	**10 kHz**	**100 kHz**	**1 MHz**
≥0.1 Hz to <10 MHz (Option 22)	–60	–90	–120	–130	–130	–130
≥10 MHz to ≤15.625 MHz (Option 4)	–105	–126	–139	–142	–141	–145
>15.625 MHz to ≤31.25 MHz (Option 4)	–99	–120	–134	–137	–137	–145
>31.25 MHz to ≤62.5 MHz (Option 4)	–90	–114	–129	–136	–136	–144
>62.5 MHz to ≤125 MHz (Option 4)	–84	–108	–127	–135	–133	–144
>125 MHz to ≤250 MHz (Option 4)	–88	–102	–125	–132	–130	–143
>250 MHz to ≤500 MHz (Option 4)	–77	–99	–123	–125	–124	–142
>500 MHz to ≤1050 MHz (Option 4)	–71	–93	–118	–121	–119	–138
>1050 MHz to ≤2200 MHz (Option 4)	–66	–86	–112	–115	–113	–135
≥10 MHz to <2 GHz (Option 5)	–64	–83	–100	–102	–102	–111
≥2 GHz to ≤6 GHz	–54	–77	–104	–108	–107	–130
>6 GHz to ≤10 GHz	–52	–73	–100	–107	–107	–128
>10 GHz to ≤20 GHz	–45	–68	–94	–102	–102	–125
>20 GHz to ≤40 GHz	–45	–63	–92	–98	–98	–119
>40 GHz to ≤65 GHz	–37	–57	–86	–92	–90	–113



Typical MG3690A single sideband phase noise at 10 GHz carrier.
Standard and Ultra-Low performance with Option 3.

RF Output

Power level specifications apply at 25 ±10°C.

Maximum Leveled Output Power:**

Model Number	Configuration	Frequency Range (GHz)	Output Power (dBm)	Output Power With Step Attenuator (dBm)	Output Power With Electronic Step Attenuator (dBm)
MG3691A	w/opt 4 w/opt 5 STD	≤2.2 GHz ≤2 GHz ≥2 to ≤8.4 GHz	+17.0 +17.0 +13.0	+15.0 +15.0 +11.0	+13.0 +13.0 +9.0
MG3692A	w/opt 4 w/opt 5 STD	≤2.2 GHz ≤2 GHz ≥2 to ≤20 GHz	+17.0 +17.0 +13.0	+15.0 +15.0 +11.0	Not Available
MG3693A	w/opt 4 w/opt 5 STD STD	≤2.2 GHz ≤2 GHz ≥2 to ≤20 GHz >20 to ≤30 GHz	+13.0 +13.0 +9.0 +6.0	+11.0 +11.0 +7.0 +3.0	Not Available
MG3694A	w/opt 4 w/opt 5 STD STD	≤2.2 GHz ≤2 GHz ≥2 to ≤20 GHz >20 to ≤40 GHz	+13.0 +13.0 +9.0 +6.0	+11.0 +11.0 +7.0 +3.0	Not Available
MG3695A	w/opt 4 w/opt 5 STD STD	≤2.2 GHz ≤2 GHz ≥2 to ≤20 GHz >20 to ≤50 GHz	+12.0 +12.0 +10.0 +3.0	+10.0 +10.0 +8.0 +0.0	Not Available
MG3696A	w/opt 4 w/opt 5 STD STD	≤2.2 GHz ≤2 GHz ≥2 to ≤20 GHz >20 to ≤65 GHz	+12.0 +12.0 +10.0 +3.0	+10.0 +10.0 +8.0 +0.0*	Not Available

*Typical 60 to 65 GHz
**For output power with Option 22, 0.1 Hz to 10 MHz, derate all specifications by 2 dB

Maximum Leveled Output Power With Option 15 (High Power) Installed:**

Model Number	Configuration	Frequency Range (GHz)	Output Power (dBm)	Output Power With Step Attenuator (dBm)	Output Power With Electronic Step Attenuator (dBm)
MG3691A	w/opt 4 w/opt 5 STD	≤2.2 GHz ≤2 GHz ≥2 to ≤8.4 GHz	+19.0 +19.0 +19.0	+18.0 +18.0 +18.0	+15.0 +15.0 +13.0
MG3692A	w/opt 4 w/opt 5 STD STD	≤2.2 GHz ≤2 GHz ≥2 to ≤10 GHz >10 to ≤20 GHz	+19.0 +19.0 +19.0 +17.0	+18.0 +18.0 +18.0 +15.0	Not Available
MG3693A	w/opt 4 w/opt 5 STD STD STD	≤2.2 GHz ≤2 GHz ≥2 to ≤10 GHz >10 to ≤20 GHz >20 to ≤30 GHz	+15.0 +15.0 +15.0 +12.0 +14.0	+14.0 +14.0 +14.0 +10.0 +12.0	Not Available
MG3694A	w/opt 4 w/opt 5 STD STD STD	≤2.2 GHz ≤2 GHz ≥2 to ≤10 GHz >10 to ≤20 GHz >20 to ≤40 GHz	+15.0 +15.0 +15.0 +12.0 +14.0	+14.0 +14.0 +14.0 +10.0 +12.0	Not Available

**For output power with Option 22, 0.1 Hz to 10 MHz, derate all specifications by 2 dB

Leveled Output Power Range

Standard Units:

Without an Attenuator: Maximum leveled output power to –15 dBm (–20 dBm typical).
With an Attenuator: Maximum leveled output power to –120 dBm (MG3691A, MG3692A, MG3693A, MG3694A), to –105 dBm (MG3695A, MG3696A).
With an Electronic Attenuator: Maximum leveled output power to –140 dBm.

Units with Option 15, High Power:

Without an Attenuator: Maximum leveled output power to –5 dBm (–10 dBm typical).
With an Attenuator: Maximum leveled output power to –105 dBm.
With an Electronic Attenuator: Maximum leveled output power to –115 dBm.

Unleveled Output Power Range (typical)

Without an Attenuator: >40 dB below max power.

With an Attenuator: >130 dB below max power.

Power Level Switching Time (to within specified accuracy)

Without Change in Step Attenuator: <3 ms typical

With Change in Step Attenuator: <20 ms typical
With Change in Electronic Step Attenuator: <3 ms typical. Power level changes across –70 dB step will result in 20 ms delay.

Step Attenuator (Option 2)

Adds a 10 dB/step attenuator, with 110 dB range on models ≤40 GHz, and 90 dB range on models >40 GHz. Option 2E adds an electronic version with 120 dB range, only available on an MG3691A.

Accuracy and Flatness

Accuracy specifies the total worst case accuracy. Flatness is included within the accuracy specification.

Step Sweep and CW Modes:

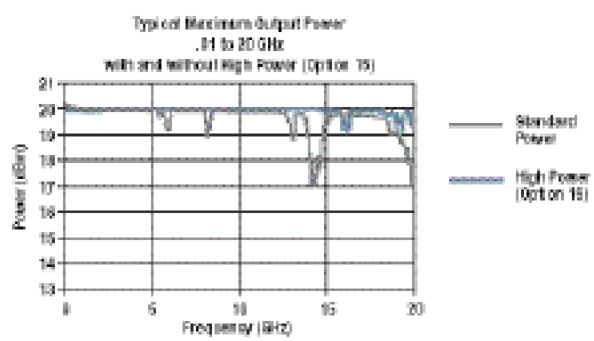
Attenuation Below Max Power	Frequency (GHz)			
	≤40	40-50	50-60	60-65
Accuracy:[1]				
0-25 dB	±1.0 dB	±1.5 dB	±1.5 dB	±1.5 dB
25-60 dB	±1.0 dB	±1.5 dB	±3.5 dB[2]	N/A
60-100 dB	±1.0 dB	±1.5 dB[2]	±3.5 dB[2]	N/A
Flatness:[1]				
0-25 dB	±0.8 dB	±1.1 dB	±1.1 dB	±1.1 dB
25-60 dB	±0.8 dB	±1.1 dB	±3.1 dB[2]	N/A
60-100 dB	±0.8 dB	±2.1 dB[2]	±3.1 dB[2]	N/A

① 0 to 25 dB or to minimum rated power, whichever is higher

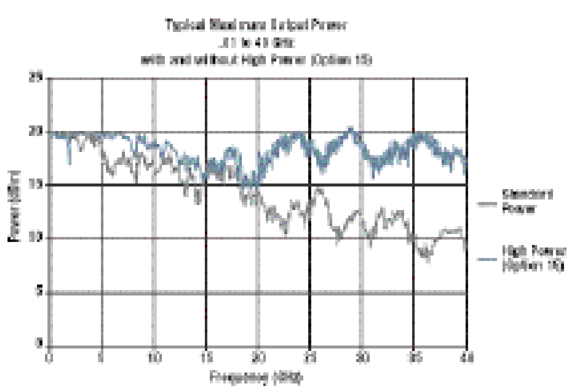
② Typical

Analog Sweep Mode (typical):

Attenuation Below Max Power	Frequency (GHz)			
	0.01-0.05	0.05-20	20-40	40-65
Accuracy:				
0-12 dB	±2.0 dB	±2.0 dB	±2.0 dB	±3.0 dB
12-30 dB	±3.5 dB	±3.5 dB	±4.6 dB	±5.6 dB
30-60 dB	±4.0 dB	±4.0 dB	±5.2 dB	±6.2 dB
60-122 dB	±5.0 dB	±5.0 dB	±6.2 dB	±7.2 dB
Flatness:				
0-12 dB	±2.0 dB	±2.0 dB	±2.0 dB	±2.5 dB
12-30 dB	±3.5 dB	±3.5 dB	±4.1 dB	±5.1 dB
30-60 dB	±4.0 dB	±4.0 dB	±4.6 dB	±5.6 dB
60-122 dB	±5.0 dB	±5.0 dB	±5.2 dB	±6.2 dB



Typical maximum MG3692A available output power



Typical maximum MG3694A available output power

Other Output Power Specifications

Output Units: Output units selectable as either dBm or mV. Selection of mV assumes 50Ω load. All data entry and display are in the selected units.

Output Power Resolution: 0.01 dB or 0.001 mV

Source Impedance: 50Ω nominal

Source SWR (Internal Leveling): <2.0 typical

Power Level Stability with Temperature: 0.04 dB/deg C typical

Level Offset: Offsets the displayed power level to establish a new reference level.

Output On/Off: Toggles the RF output between an Off and On state. During the Off state, the RF oscillator is turned off. The On or Off state is indicated by two LEDs located below the OUTPUT ON/OFF key on the front panel.

RF On/Off Between Frequency Steps: System menu selection of RF On or RF Off during frequency switching in CW, Step Sweep, and List Sweep modes.

RF On/Off During Retrace: System menu selection of RF On or RF Off during retrace.

Internal Leveling: Power is leveled at the output connector in all modes.

External Leveling:

External Detector: Levels output power at a remote detector location. Accepts a positive or negative 0.5 mV to 500 mV input signal from the remote detector. EXT ALC ADJ adjusts the input signal range to an optimum value. BNC connector, rear panel.

External Power Meter: Levels output power at a remote power meter location. Accepts a ±1V full scale input signal from the remote power meter. EXT ALC ADJ adjusts the input signal range to an optimum value. BNC connector, rear panel.

External Leveling Bandwidth: 30 kHz typical in Detector mode. 0.7 Hz typical in Power Meter mode.

User Level Flatness Correction:

Number of points: 2 to 801 points per table

Number of tables: 5 available

Entry modes: GPIB power meter or computed data

CW Power Sweep

Range: Sweeps between any two power levels at a single CW frequency.

Resolution: 0.01 dB/step (Log) or 0.001 mV (Linear)

Accuracy: Same as CW power accuracy.

Log/Linear Sweep: Power sweep selectable as either log or linear. Log sweep is in dB; linear sweep is in mV.

Step Size: User-controlled, 0.01 dB (Log) or 0.001 mV (Linear) to the full power range of the instrument.

Step Dwell Time: Variable from 1 ms to 99 seconds. If the sweep crosses a step attenuator setting, there will be a sweep dwell of approximately 20 ms to allow setting of the step attenuator.

Sweep Frequency/Step Power

A power level step occurs after each frequency sweep. Power level remains constant for the length of time required to complete each sweep.

Internal Power Monitor (Option 8)

Sensors: Compatible with Anritsu 560-7, 5400-71, or 6400-71 series detectors. Rear panel input.

Range: +16 dBm to –35 dBm

Accuracy: ±1 dBm, (+16 to –10 dBm)
±2 dBm, (–10 to –35 dBm)

Resolution: 0.1 dBm minimum

Modulation

Frequency/Phase Modulation (Option 12)

Option 12 adds frequency and phase modulation, driven externally via a rear panel BNC connector, 50Ω. For internal modulation, add LF Generator Option 23. Frequency/Phase Modulation is not available <10 MHz with Option 22.

For most accurate FM, ΦM measurements, Bessel Null methods are used.

Frequency Generator Multiplication/Division Ratios:

Frequency Range	Divide Ratio, n
<10 MHz (Option 22)	modulation not available
≥10 to ≤15.625 MHz (Option 4)	256
>15.625 to ≤31.25 MHz (Option 4)	128
>31.25 to ≤62.5 MHz (Option 4)	64
>62.5 to ≤125 MHz (Option 4)	32
>125 to ≤250 MHz (Option 4)	16
>250 to ≤500 MHz (Option 4)	8
>500 to ≤1050 MHz (Option 4)	4
>1050 to ≤2200 MHz (Option 4)	2
>10 to ≤2000 MHz (Option 5)	1
>2 to ≤20 GHz	1
>20 to ≤40 GHz	1/2
>40 to ≤65 GHz	1/4

Maximum Input: ±1V

Frequency Modulation:

Parameter	Modes	Conditions	Specifications	Conditions	Specifications
		for all Frequencies other than <2.2 GHz with option 4		for Frequencies <2.2 GHz with option 4	
Deviation	Locked	Rate= 1 kHz to 8 MHz	±[Lesser of 10 MHz or 300 * (mod rate)]/n	Rate= 1 kHz to (Lesser of 8 MHz or 0.03 * Fcarrier)	±[Lesser of 10 MHz or 300 * (mod rate)]/n
	Locked Low-noise	Rate= 50 kHz to 8 MHz	±[Lesser of 10 MHz or 3 * (mod rate)]/n	Rate= 50 kHz to (Lesser of 8 MHz or 0.03 * Fcarrier)	±[Lesser of 10 MHz or 3 * (mod rate)]/n
	Unlocked Narrow	Rate= DC to 8 MHz	±10 MHz/n	Rate= DC to (Lesser of 8 MHz or 0.03 * Fcarrier)	±(10 MHz)/n
	Unlocked Wide	Rate= DC to 100 Hz	±100 MHz/n	Rate= DC to 100 Hz	±(100 MHz)/n
Bandwidth (3 dB)	Locked	100 kHz rate	1 kHz to 10 MHz	100 kHz rate	1 kHz to (Lesser of 10 MHz or 0.03 * Fcarrier)
	Locked Low-noise	100 kHz rate	30 kHz to 10 MHz	100 kHz rate	30 kHz to (Lesser of 8 MHz or 0.03 * Fcarrier)
	Unlocked Narrow	100 kHz rate	DC to 10 MHz	100 kHz rate	DC to (Lesser of 10 MHz or 0.03 * Fcarrier)
	Unlocked Wide	DC rate	DC to 100 Hz	DC rate	DC to 100 Hz
Flatness	Locked	Rate= 10 kHz to 1 MHz	±1 dB relative to 100 kHz	Rate= 10 kHz to (Lesser of 1 MHz or 0.01 * Fcarrier)	±1 dB relative to 100 kHz
Accuracy	Locked and Low-noise Unlocked Narrow	Rate= 100 kHz, Sinewave Int. or 1Vpk Ext.	10% (5% typical)	Rate= 100 kHz, Sinewave Int. or 1Vpk Ext.	10% (5% typical)
Incidental AM	Locked and Low-noise Unlocked Narrow	1 MHz Rate, ±1 MHz Dev.	<2% typical	Rate and Dev.= Lesser of 1 MHz or 0.01 * Fcarrier	<2% typical
Harmonic Distortion	Locked	10 MHz Rate, ±1 MHz Dev.	<1%	Rate= 10 kHz, Dev.= ±(1 MHz)/n	<1%
External Sensitivity	Locked Locked Low-noise Unlocked Narrow Unlocked Wide		±(10 kHz/V to 20 MHz/V)/n ±(100 kHz/V to 100 MHz/V)/n		±(10 kHz/V to 20 MHz/V)/n ±(100 kHz/V to 100 MHz/V)/n

Phase Modulation:

Parameter	Modes	Conditions	Specifications	Conditions	Specifications
		for all Frequencies other than <2.2 GHz with option 4		for Frequencies <2.2 GHz with option 4	
Deviation	Narrow	Rate= DC to 8 MHz	±[Lesser of 3 rad or (5 MHz)/(mod rate)]/n	Rate= DC to (Lesser of 8 MHz or 0.03 * Fcarrier)	±[Lesser of 3 rad or (5 MHz)/(mod rate)]/n
	Wide	Rate= DC to 1 MHz	±[Lesser of 400 rad or (10 MHz)/(mod rate)]/n	Rate= DC to (Lesser of 1 MHz or 0.03 * Fcarrier)	±[Lesser of 400 rad or (10 MHz)/(mod rate)]/n
Bandwidth (3 dB)	Narrow	100 kHz rate	DC to 10 MHz	100 kHz rate	DC to (Lesser of 10 MHz or 0.03 * Fcarrier)
	Wide	100 kHz rate	DC to 1 MHz	100 kHz rate	DC to (Lesser of 1 MHz or 0.03 * Fcarrier)
Flatness	Narrow	Rate= DC to 1 MHz	±1 dB relative to 100 kHz rate	Rate= DC to (Lesser of 1 MHz or 0.01 * Fcarrier)	±1 dB relative to 100 kHz rate
	Wide	Rate= DC to 500 kHz	±1 dB relative to 100 kHz rate	Rate= DC to (Lesser of 500 kHz or 0.01 * Fcarrier)	±1 dB relative to 100 kHz rate
Accuracy	Narrow & Wide	100 kHz, Int. or 1Vpk Ext., sine	10%	100 kHz, Int. or 1Vpk Ext., sine	10%
External Sensitivity	Narrow Wide		±(0.0025 rad/V to 5 rad/V)/n ±(0.25 rad/V to 500 rad/V)/n		±(0.0025 rad/V to 5 rad/V)/n ±(0.25 rad/V to 500 rad/V)/n

Amplitude Modulation (Option 14)

All amplitude modulation specifications apply at 50% depth, 1 kHz rate, with RF level set 6 dB below maximum specified leveled output power, unless otherwise noted. Amplitude Modulation is not available <10 MHz with Option 22.

AM Depth (typical): 0-90% linear; 20 dB log

AM Bandwidth (3 dB):
DC to 50 kHz minimum
DC to 100 kHz typical

Flatness (DC to 10 kHz rates): ±0.3 dB

Accuracy: ±5%

Distortion: <5% typical

Incidental Phase Modulation (30% depth, 10 kHz rate):
<0.2 radians typical

External AM Input: Log AM or Linear AM input, rear-panel BNC, 50Ω input impedance. For internal modulation, add LF Generator Option 23.
Sensitivity:
Log AM: Continuously variable from 0 dB per volt to 25 dB per volt.
Linear AM: Continuously variable from 0% per volt to 100% per volt.
Maximum Input: ±1V

LF Generator (Option 23)

Two internal waveform generators are added, one providing a frequency or phase modulating signal and the other an amplitude modulating signal. This Low Frequency (LF) Generator option can only be ordered in combination with either FM/ΦM or AM options, 12 and 14 respectively.

Waveforms: Sinusoid, square-wave, triangle, positive ramp, negative ramp, Gaussian noise, uniform noise. (Check Option 10 for User-Defined)

Rate:
0.1 Hz to 1 MHz sinusoidal
0.1 Hz to 100 kHz square-wave, triangle, ramps

Resolution: 0.1 Hz

Accuracy: Same as instrument timebase

Output: Two BNC connectors on the rear panel, FM/ΦM OUT and AM OUT

External Pulse Modulation (Option 13)

Pulse modulation specifications apply at maximum rated power, unless otherwise noted. Pulse modulation is not available <10 MHz with Option 22.

On/Off Ratio: >80 dB

Minimum Leveled Pulse Width:
100 ns, ≥2 GHz[1]
1 µs, <2 GHz[1]

Minimum Unleveled Pulse Width: <10 ns

Level Accuracy Relative to CW (100 Hz to 1 MHz PRF):
±0.5 dB, ≥1 µs pulse width
±1.0 dB, <1 µs pulse width

Pulse Delay (typical): 50 ns in External Mode

PRF Range:
DC to 10 MHz, unleveled
100 Hz to 5 MHz, leveled

Frequency Range	Rise & Fall Time (10% to 90%)	Overshoot	Pulse Width Compression	Video Feedthrough
≥10 to <31.25 MHz (Opt. 4)	400 ns*	33%*	40 ns*	±70 mV*
≥31.25 to <125 MHz (Opt. 4)	90 ns*	22%*	12 ns*	±130 mV*
≥125 to <500 MHz (Opt. 4)	33 ns*	11%*	12 ns*	±70 mV*
≥500 to <2200 MHz (Opt. 4)	15 ns	10%	12 ns*	±15 mV*
≥10 to <1000 MHz (Opt. 5)	15 ns 10 ns*	10%	8 ns*	±15 mV*
≥1 to <2 GHz (Opt. 5)	10 ns 5 ns*	10%	8 ns*	±15 mV*
≥2 to ≤65 GHz	10 ns 5 ns*	10%[2]	8 ns*	±10 mV*

External Input: Rear-panel BNC. For internal modulation, add Pulse Generator Option 24.

Drive Level: TTL compatible input

Input Logic: Positive-true or negative-true, selectable from modulation menu.

Pulse Generator (Option 24)

Modes: Free-run, triggered, gated, delayed, singlet, doublet, triplet, quadruplet.

Parameter	Selectable Clock Rate 40 MHz	Selectable Clock Rate 10 MHz
Pulse Width	25 ns to 419 ms	100 ns to 1.6 s
Pulse Period[3]	250 ns to 419 ms	600 ns to 1.6s
Variable Delay		
Singlet	0 to 419 ms	0 to 1.6 s
Doublet	100 ns to 419 ms	300 ns to 1.6 s
Triplet	100 ns to 419 ms	300 ns to 1.6 s
Quadruplet	100 ns to 419 ms	300 ns to 1.6 s
Resolution	25 ns	100 ns

Accuracy: 10 ns (5 ns typical)

Inputs/Outputs: Video pulse and sync out, rear-panel BNC connectors

Pulse Generator option is not available without Pulse Modulation Option 13.

[1] 2.2 GHz with Option 4, DDC.
[2] For 50 and 65 GHz units, overshoot >40 GHz is 20% typical at rated power.
[3] Period must be longer than the sum of delay and width by 5 clock cycles minimum.
* Typical

IF Up-Conversion (Option 7)

Option 7 adds an internal mixer that can be used for the generic up-conversion of an IF signal. The mixer's RF, LO, and IF ports are made available at the rear panel of the MG3690A, via three female K-Connectors. The typical application will feed the MG3690A microwave output, which can be moved to the rear panel via option 9K, to the mixer's LO port. An external IF signal will be fed to the mixer's IF port. The new up-converted signal will be available at the mixer's RF port.

Mixer Type	Double Balanced
RF, LO Range	1 to 40 GHz
IF Range	DC to 700 MHz
Conversion Loss	10 dB Typical
Max Power into any Port	30 dBm
Isolation, RF to LO	23 dB
LO Drive Level (recommended)	+10 to +13 dBm
Input P_{1dB}	+3 dBm Typical

The IF Up-Conversion option is particularly useful to create a microwave frequency IQ-modulated signal. Lower frequency IQ-modulated RF sources are readily available, such as the Anritsu MG3681A. Option 7's IF input can be used to feed in an IQ-modulated signal from an MG3681A, up-converting it to as high as 40 GHz with an MG3694A. A typical setup is shown below.

User-Defined Modulation Waveform Software (Option 10)

An external software package provides the ability to download user-defined waveforms into the internal LF Generator's (Option 23) memory. The MG3690A provides as standard with the LF Generator sinusoidal, square-wave, triangle, positive ramp, Gaussian noise, and uniform noise waveforms.

Two look-up tables of 65,536 points can be used to generate two pseudo-random waveforms, one for amplitude modulation and the other for frequency or phase modulation. The download files are simple space-delimited text files containing integer numbers between 0 and 4095, where 0 corresponds to the minimum modulation level and 4095 the maximum.

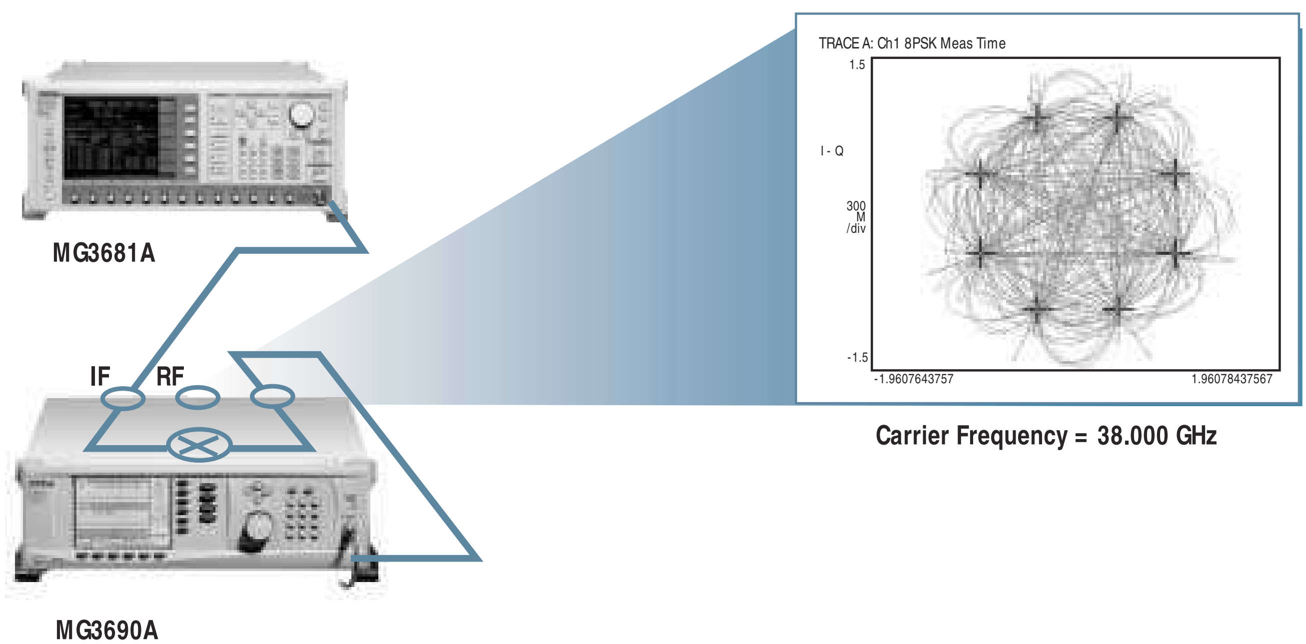
In addition to the capability of downloading custom waveforms, the software offers a virtual instrument modulation panel. Custom modulation setups with user waveforms can be stored for future use. For IFF signal simulation, the internal generators can be synchronized. They can also be disconnected from the internal modulators, making the low frequency waveforms available at the rear panel for external purposes.

One application of this feature is storing an antenna pattern wave form in memory and using it to feed the external input to the scan modulator, Option 20.

Scan Modulation (Option 20)

Option 20 adds a microwave linearly controlled alternator to provide deep AM capability. This modulator is inserted outside the leveling loop but before the optional step alternator. It is switched in and out of the RF path. Scan modulation is driven externally only.

Frequency Range	2 to 18 GHz
Attenuation Range	0 to 60 dB
Flatness	±2 dB, 0 to 40 dB
	±2 dB, 40 to 60 dB
Step Response	< 1 ms
Sensitivity	-10 dB/V
Insertion Loss	< 6 dB (when engaged)
Input	Rear Panel BNC connector High Impedance



IF Up-Conversion Application and Setup

mmW Frequency Coverage

Millimeter Wave Multipliers (54000 Series plus Option 18)

External multipliers can be added to the MG3690A to provide coverage as high as 110 GHz. Please call us for solutions beyond 110 GHz.

The 54000 series multipliers provide 50 to 75 GHz coverage in WR15 or 75 to 110 GHz in WR10. An MG3690A with Option 18, mmW bias, is required to drive these multipliers. The MG3692A provides the input frequencies which are below 20 GHz. Higher frequency MG3690A models could be used, but are not necessary. Option 18 adds a rear panel BNC Twinax connector that supplies the proper DC bias to power these external multipliers. (Option 18 is not available with Option 7.)

The 54000 series multipliers come in two versions, –4 and –5. Both versions include input and output isolators for improved source match. An external full-band “Through” (FL1) can be replaced with either one of two split-band supplied external filters (FL2, FL3) for better than –50 dBc spurious. The –5 version adds an internal output coupler and a detector to supply a detected voltage output. This output can be routed to the synthesizer’s external ALC input for a flatter response, using External ALC Leveling mode.

Modulation can be used up to 110 GHz with these multipliers. FM/ΦM’s deviation will be multiplied based on the multiplication factor of the 54000 used. Pulse Modulation is available, with sharper rise and fall times. AM is not recommended.
All performance is typical.

MG3690A with 54000 Series Millimeter Wave Multiplier

	54000-4WR15, 54000-5WR15	54000-4WR10, 54000-5WR10
Frequency	50-75 GHz	75-110 GHz
Waveguide Output	WR15	WR10
Flange	UG-387/U	UG-385/U
Source Match	<1.7 typical	<1.7 typical
Output Power	0.0 dBm (+4 dBm typical)	–5 dBm (+1 dBm typical)
Power Flatness, Unleveled	±3.0 dB typical	±3.0 dB typical
Power Flatness, Leveled (54000-5WRxx)	±1.0 dB typical	±1.0 dB typical
Power Leveling Range (54000-5WRxx)	10 dB typical	10 dB typical
Required Input Frequency	12.75 to 18.75 GHz	12.75 to 18.75 GHz
Multiplication Factor	x4	x6
Frequency Accuracy	Synthesizer Accuracy x4	Synthesizer Accuracy x6
Frequency Resolution	Synthesizer Resolution x4	Synthesizer Resolution x6
Filters		
FL1 (Through)	50 to 75 GHz	75 to 110 GHz
FL2	50 to 58 GHz	75 to 92 GHz
FL3	57 to 75 GHz	89 to 110 GHz
Spurious		
with FL2, FL3	–50 dBc	–50 dBc
with FL1 (Through)	–20 dBc typical	–20 dBc typical
Input	N(f)	N(f)

Inputs and Outputs

Nomenclature	Input/Output Connectors Type**	Location
EXT ALC IN	BNC	Rear Panel
RF OUTPUT* (Option 9)	K Connector (female) fmax ≤40 GHz V Connector (female) fmax ≥40 GHz	Standard-Front Panel Option 9-Rear Panel
10 MHz REF IN	BNC	Rear Panel
10 MHz REF OUT	BNC	Rear Panel
HORIZ OUT	BNC	Rear Panel
EFC IN	BNC	Rear Panel
AUX I/O	25 pin D-type	Rear Panel
SERIAL I/O	RJ45	Rear Panel
IEEE-488 GPIB	Type 57	Rear Panel
mmW/BIAS* (Option 18)	Twinax	Rear Panel
RF, LO, IF* (Option 7)	K Connector (female) 3x	Rear Panel
PULSE TRIG IN (Option 13)	BNC	Rear Panel
PULSE SYNC OUT (Option 24)	BNC	Rear Panel
PULSE VIDEO OUT (Option 24)	BNC	Rear Panel
AM IN (Option 14)	BNC	Rear Panel
FM/ΦM IN (Option 12)	BNC	Rear Panel
AM OUT (Option 23)	BNC	Rear Panel
FM/ΦM OUT (Option 23)	BNC	Rear Panel
SCAN MOD IN* (Option 20)	BNC	Rear Panel
POWER MONITOR IN* (Option 8)	Custom	Rear Panel

* Options (7 & 18), (7 & 20), (8 & 9) are mutually exclusive, as they share the same rear panel space.
** Connectors may be available but not active, if option is not ordered.

MG3690A Rear Panel

EXT ALC IN

Provides for leveling the RF output signal externally with either a detector or power meter. Signal requirements are shown in the RF Output specifications.

RF OUTPUT

Provides for RF output from 50Ω source impedance. K Connector, female. Option 9 moves the RF Output connector to the rear panel.

10 MHz REF IN

Accepts an external 10 MHz ±100 Hz, 0 to +20 dBm time-base signal. Automatically disconnects the internal high-stability time-base option, if installed. 50Ω impedance.

10 MHz REF OUT

Provides a 1 Vp-p, AC coupled, 10 MHz signal derived from the internal frequency standard. 50Ω impedance.

HORIZ OUT (Horizontal Sweep Output)

Provides 0V at beginning and +10V at end of sweep, regardless of sweep width. In CW mode, the voltage is proportional to frequency between 0V at low end and +10V at the high end of range. In CW mode, if CW RAMP is enabled, a repetitive, 0V to +10V ramp is provided.

EFC IN

Provides the capability to frequency modulate the internal crystal oscillator, allowing phase locking the synthesizer inside an external lock loop. Specifications on page 2.

AUX I/O (Auxiliary Input/Output)

Provides for most of the rear panel BNC connections through a single, 25-pin, D type connector. Supports master-slave operation with another synthesizer or allows for a single-cable interface with the Model 56100A Scalar Network Analyzer and other Anritsu instruments. (see figure below)

SERIAL I/O (Serial Input/Output)

Provides access to RS-232 terminal ports to support service and calibration functions and master-slave operations.

IEEE-488 GPIB

Provides input/output connections for the General Purpose Interface Bus (GPIB).

mmW BIAS

Provides the bias for the external waveguide multipliers for coverage up to 110 GHz.

RF, LO, IF

Provides access to an internal IF up-conversion mixer, Option 7.

PULSE TRIG IN

Accepts an external TTL compatible signal to pulse modulate the RF output signal or to trigger or to gate the optional internal pulse generator. Available with Option 13, Pulse Modulation.

PULSE SYNC OUT

Provides a TTL compatible signal, synchronized to the internal pulse modulation output, Option 24.

PULSE VIDEO OUT

Provides a video modulating signal from the internal pulse generator, Option 24.

AM IN

Accepts an external signal to amplitude modulate the RF output signal, Option 14. 50Ω impedance.

FM/ΦM IN

Accepts an external signal to frequency or phase modulate the RF output signal, Option 12. 50Ω impedance.

AM OUT

Provides the amplitude modulation waveform from the internal LF generator, Option 23.

FM/ΦM OUT

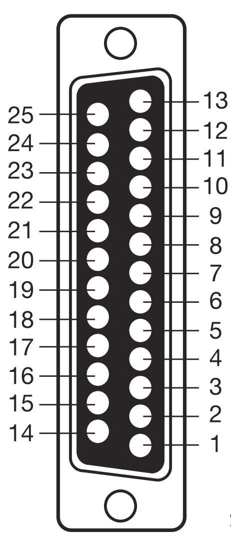
Provides the frequency or phase modulation waveform from the internal LF generator, Option 23.

SCAN MOD IN

Accepts an external signal to scan modulate the RF output signal, Option 20. High Impedance.

POWER MONITOR IN

Accepts an external detector for power monitoring, Option 8.



Aux I/O pins:

1. Horizontal Output
2. Chassis Ground
3. Sequential Sync Output
4. Low Alternate Enable Output
5. Marker Output
6. Retrace Blanking Output
7. Low Alternate Sweep Output
8. Chassis Ground
9. -
10. Sweep Dwell Output
11. Lock Status Output
12. Penlift
13. External Trigger Input
14. V/GHz Output
15. End-of-Sweep Input
16. End-of-Sweep Output
17. -
18. Sweep Dwell Input
19. -
20. Bandswitch Blanking Output
21. -
22. Horizontal Sweep Input
23. Horizontal Sweep Input Return
24. Chassis Ground
25. Memory Sequencing Input

25-pin, D type connector

Ordering Information

Models

MG3691A	2 – 8.4 GHz Signal Generator
MG3692A	2 – 20 GHz Signal Generator
MG3693A	2 – 30 GHz Signal Generator
MG3694A	2 – 40 GHz Signal Generator
MG3695A	2 – 50 GHz Signal Generator
MG3696A	2 – 65 GHz Signal Generator

Options and Accessories

MG3690A/1A	**Rack Mount with slides** – Rack mount kit containing a set of track slides (90 degree tilt capability), mounting ears, and front panel handles to let the instrument be mounted in a standard 19-inch equipment rack.
MG3690A/1B	**Rack Mount without slides** – Modifies rack mounting hardware to install unit in a console that has mounting shelves. Includes mounting ears and front panel handles.
MG3690A/2X	**Mechanical Step Attenuator** – Adds a 10 dB/step attenuator. Rated RF output power is reduced. (This option comes in different versions, based on instrument configuration.)
MG3690A/2E	**Electronic Step Attenuator** – Adds a 10 dB/step electronic attenuator with a 120 dB range for the MG3691A. Rated RF output power is reduced. (Not available with Option 20 or 22.)
MG3690A/3	**Ultra Low Phase Noise, main band** – Adds new modules to significantly reduce SSB phase noise.
MG3690A/4	**10 MHz to 2.2 GHz RF coverage**, Ultra-Low Phase Noise version – Uses a digital down converter to significantly reduce SSB phase noise.
MG3690A/5	**10 MHz to 2 GHz RF coverage** – Uses an analog down converter.
MG3690A/6	**Analog Sweep Capability** – (limited to ≥500 MHz when used with Option 4.)
MG3690A/7	**IF Up-Conversion** – Adds an internal 40 GHz mixer for up-converting an IF signal. (Not available with MG3695A, MG3696A, or with Options 18 or 20.)
MG3690A/8	**Power Monitor** – Adds internal power measurement capability. (Not available with Option 9.)
MG3690A/9X	**Rear Panel Output** – Moves the RF output connector to the rear panel. (This option comes in different versions, based on instrument configuration.) (Not available with Option 8.)
MG3690A/10	**User-Defined Modulation Waveform Software** – External software package provides the ability to download user-defined waveforms into the memory of the internal waveform generator, serially or via GPIB. External PC and an instrument with LF Generator, Option 23, are required.
MG3690A/12	**Frequency and Phase Modulation** – External, via a rear panel BNC connector. For internal modulation capability, requires additionally LF Generator, Option 23.
MG3690A/13X	**Pulse Modulation** – External, via a rear panel BNC connector. For internal modulation capability, requires additionally Pulse Generator, Option 24. (This option comes in different versions, based on instrument configuration.)
MG3690A/14	**Amplitude Modulation** – External, via a rear panel BNC connector. For internal modulation capability, requires additionally LF Generator, Option 23.
MG3690A/15X	**High Power** – Adds high-power RF components to the instrument to increase its output power level. (This option comes in different versions, based on instrument configuration.)
MG3690A/16	**High Stability Time Base** – Adds an ovenized, 10 MHz crystal oscillator as a high-stability time base.
MG3690A/17	**Delete Front Panel** – Deletes the front panel for use in remote control applications where a front panel display and keyboard control are not needed. (Only available with Options 1A or 1B)
MG3690A/18	**mmW Bias Output** – Adds a rear panel BNC Twinax connector required to bias the 5400-xWRxx millimeter wave source modules, sold separately. (Not available with Option 7.)
MG3690A/20	**Scan Modulation** – Adds an internal Scan modulator for simulating high-depth amplitude modulated signals. Requires an external modulating signal input capability. (Not available on models MG3693A, MG3694A, MG3695A, MG3696A, or with Options 2E, 7, or 22.)
MG3690A/22	**0.1 Hz to 10 MHz Audio coverage** – Uses a DDS for coverage down to approximately DC. When adding Option 22, the output power is derated by 2 dB. The frequency resolution below 10 MHz is 0.02 Hz. No modulation is available in the 0.1 Hz to 10 MHz band. (Not available without Option 4 or 5, or with Option 20 or 2E)
MG3690A/23	**LF Generator** – Provides modulation waveforms for internal AM, FM, or ΦM. (Not available without Option 12 or 14.)
MG3690A/24	**Pulse Generator** – Provides pulse waveforms for internal Pulse Modulation. (Not available without Option 13.)
MG3690A/25X	**Analog Modulation Suite** – For ease of ordering and package pricing, this option bundles Options 12, 13, 14, 23 and 24, offering internal and external AM, FM, ΦM, and Pulse Modulation. (This option comes in different versions, based on instrument configuration.)

Millimeter Wave Accessories
(Requires MG3690A Option 18)

54000-4WR15	50 to 75 GHz, V Band X4 Multiplier-Source Module (includes A36599 power cable and 3 filters).
54000-5WR15	50 to 75 GHz, V Band X4 Multiplier-Source Module with internal reference coupler/detector (includes A36599 power cable, 3 filters, and 560-10BX-2 detector adapter cable).
54000-4WR10	75-110 GHz, W Band X6 Multiplier-Source Module (includes A36599 power cable and 3 filters).
54000-5WR10	75-110 GHz, W Band X6 Multiplier-Source Module with internal reference coupler/detector (includes A36599 power cable, 3 filters, and 560-10BX-2 detector adapter cable).
N120-6	Semi-rigid cable, N(m) to N(m), 15 cm long, connects synthesizer's RF output to multiplier's RF input. (Also requires 34RKNF50 or 34RVNF50 Adapter).

Accessories

34RKNF50	DC to 20 GHz, Ruggedized Type N female adapter for units with a K connector output
ND36329	MASTER/SLAVE interface cable set
760-212A	Transit case
2300-469	IVI Driver, includes LabView® driver
806-97	Aux I/O Cable, 25 pin to BNC: Provides BNC access to Aux I/O Data Lines: Sequential Sync, Marker Out, Bandswitch Blanking, Retrace Blanking, Sweep Dwell In, V/GHz, Horizontal Out.

Upgrades

Economical upgrades are available to upgrade any model to any higher performing model. Consult Anritsu for details.

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