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89411A Service Guide

Manufacturing Part Number: 89411-90001
Printed in USA
July 1994

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Notice

Hewlett-Packard to Agilent Technologies Transition

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. To reduce potential confusion, the only change to product numbers and names has been in the company name prefix: where a product name/number was HP XXXX the current name/number is now Agilent XXXX. For example, model number HP8648 is now model number Agilent 8648.

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`http://www.agilent.com/find/assist`

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United States
(tel) 1 800 452 4844
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Canada
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Europe
(tel) (31 20) 547 2323
(fax) (31 20) 547 2390

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(tel) (305) 269 7500
(fax) (305) 269 7599

Japan
(tel) (81) 426 56 7832
(fax) (81) 426 56 7840

Australia
(tel) 1 800 629 485
(fax) (61 3) 9210 5947

New Zealand
(tel) 0 800 738 378
(fax) 64 4 495 8950

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(tel) (852) 3197 7777
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Agilent Technologies

Printed in USA July 2004

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Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Safety Summary

The following general safety precautions must be observed during all phases of operation service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements. This is a Safety Class 1 instrument.

Ground the Instrument

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

Do Not Operate in an Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Keep Away from Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

Do Not Service or Adjust Alone

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

Do Not Substitute Parts or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure the safety features are maintained.

Dangerous Procedure Warnings

Warnings accompany potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

Cleaning

To prevent electrical shock, disconnect this product from mains before cleaning. Only use a dry cloth or one slightly dampened with water to clean external parts. DO NOT attempt to clean internally.

Safety Symbols

The following safety symbols are used throughout this manual and in the instrument. Familiarize yourself with each symbol and its meaning before operating this instrument.

General Definitions of Safety Symbols Used on Equipment or in Manuals



Instruction manual symbol. The product is marked with this symbol when it is necessary for the user to refer to the instruction manual to protect against damage to the instrument.



Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked).



Protective ground (earth) terminal. Used to identify any terminal which is intended for connection to an external protective conductor for protection against electrical shock in case of a fault, or to the terminal of a protective ground (earth) electrode.



Low-noise or noiseless, clean ground (earth) terminal. Used for a signal common, as well as providing protection against electrical shock in case of a fault. A terminal marked with this symbol must be connected to ground in the manner described in the installation (operating) manual, and before operating the equipment.



Frame or chassis terminal. A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures.



Alternating current (power line).



Direct current (power line).



Alternating or direct current (power line).

Warning

The warning sign denotes a hazard. It calls attention to a procedure, practice, condition or the like, which if not correctly performed or adhered to, could result in injury or death to personnel.

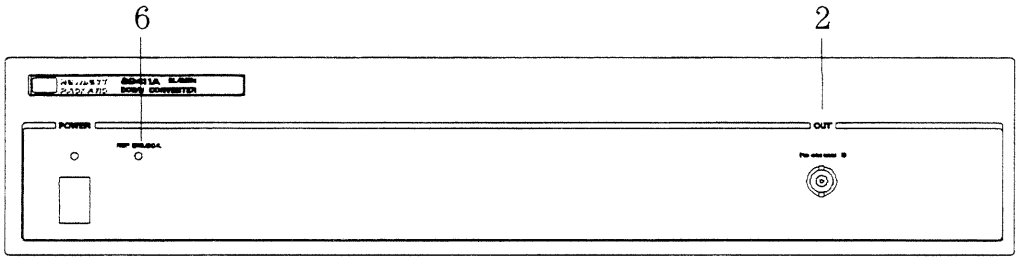
Caution

The caution sign denotes a hazard. It calls attention to an operating procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product or the user's data.

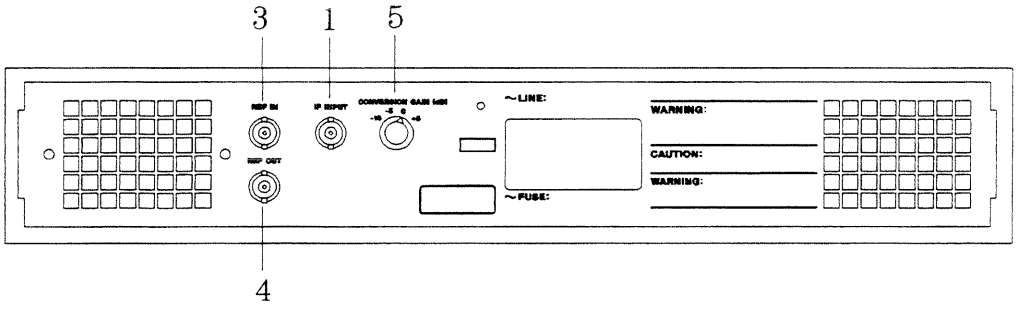
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Everett, Washington 98205-1298

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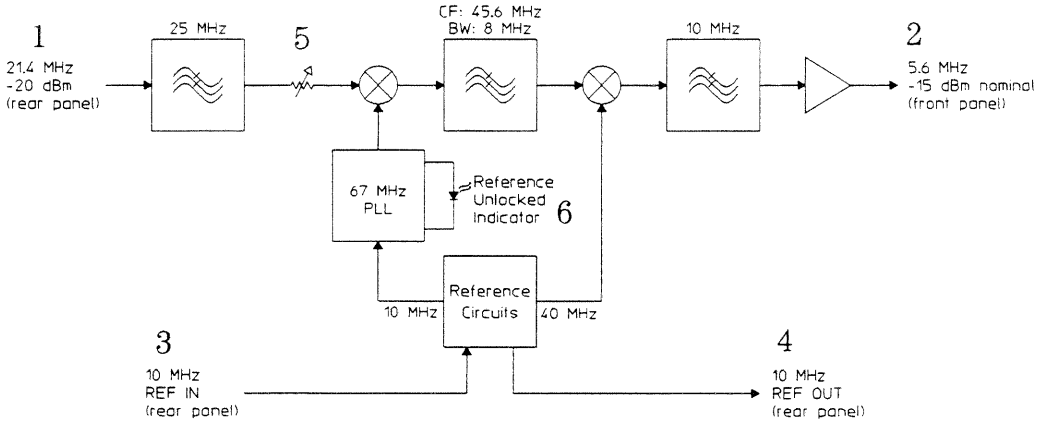
HP 89411A at a Glance



HP 89411A front panel



HP 89411A rear panel



HP 89411A block diagram

Descriptions

The HP 89411A 21.4 MHz Down Converter translates the 21.4 MHz IF output of a spectrum analyzer to a 5.6 MHz baseband input for the HP 89410A, HP 89440A, or HP 89441A Vector Signal Analyzer. This allows the advanced analysis features of the HP 89410A, HP 89440A, or HP 89441A to be applied to signals above the frequency limit of the HP 89441A (2.6 GHz).

The HP 89411A is a fixed downconverter that translates the 21.4 MHz IF output on several Hewlett-Packard RF or microwave spectrum analyzers to a baseband frequency within the range of the HP 89410A, HP 89440A, or HP 89441A. The HP 89411A translates the entire IF bandwidth to a baseband frequency centered at 5.6 MHz. The conversion gain of the HP 89411A can be varied to be compatible with several different spectrum analyzers.

For operating information, see "Extending the Frequency Range" in either the *HP 89410A Operator's Guide* or the *HP 89440A/HP 89441A Operator's Guide.*

The following describes elements appearing in the front and rear panel illustrations and the block diagram.

1 (rear) The IF INPUT connector provides the input for the 21.4 MHz signal from the rear panel of an RF or microwave spectrum analyzer. The input signal level should be approximately –20 dBm to achieve optimum performance from the HP 89411A. A BNC cable connects the 21.4 MHz IF output of an RF or microwave spectrum analyzer to the IF INPUT connector.

2 (front) The OUT connector provides the 5.6 MHz baseband input for the HP 89410A, HP 89440A, or HP 89441A. This signal should be approximately –15 dBm. The CONVERSION GAIN switch may be adjusted to change the gain. A BNC cable connects the OUT connector to the CHANNEL 1 connector on the HP 89410A, HP 89440A, or HP 89441A.

3 (rear) The REF IN connector provides the input for the frequency reference from an RF or microwave analyzer. A BNC cable connects the frequency reference from an RF or microwave analyzer to the REF IN connecor.

4 (rear) The REF OUT connector provides the frequency reference for the HP 89410A, HP 89440A, or HP 89441A. A BNC cable connects the REF OUT connector to the EXT REF IN connector on the HP 89410A, HP 89440A, HP 89441A.

5 (rear) The CONVERSION GAIN switch adjusts the conversion gain of the downconverter. The gain can be set to –10 dB, –5 dB, 0 dB, or +5 dB. If the IF input level is –20 dB, set the switch to +5 dB to yield the desired output level of –15 dB.

6 (front) The REF UNLOCK indicates if the external reference is locked or unlocked. This indicator lights when the 10 MHz external reference is <0 dBm or when there is a malfunction in the HP 89411A's local oscillator.

Options and Accessories

The following options are available to upgrade your HP 89411A. Order HP 89411A, quantity 0, followed by the option number below:

Option Description	Option Number
Front Handle Kit	AX3
Rack Flange Kit	AX4
Flange and Handle Kit	AX5

The accessories listed in the following table are supplied with the HP 89411A.

Supplied Accessories	Part Number
Line Power Cable	See page 2-3
HP 89411A Service Guide	HP 89411-90001
4 BNC Cables- 61 cm (24 inch)	HP 8120-1839

The accessories listed in the following table are available for the HP 89411A.

Available Accessories	Part Number
HP 89410A Operator's Guide	HP 89410-90047
HP 89440A/HP 89441A Operator's Guide	HP 89441-90000
BNC Cable - 30 cm (12 inch)	HP 8120-1838
BNC(m)-to-right angle SMB(f) Cable	HP 8120-6269

In This Book

This guide provides instructions for installing and verifying the performance of the HP 89411A 21.4 MHz Down Converter.

Chapter 1, "Specifications," lists the specifications for the HP 89411A and the specifications for the required test equipment.

Chapter 2, "Preparing the Down Converter for Use," provides step-by-step instructions for getting the down converter ready to use and instructions on storing and transporting.

Chapter 3, "Verifying Specifications," provides step-by-step instructions for installing and running the semiautomated performance test software. This chapter also provides illustrations that show the equipment set up for each test and a copy of the test records.

Chapter 4, "Troubleshooting the Down Converter," provides step-by-step instructions for isolating most failures in the faulty assembly.

Chapter 5, "Adjusting the Down Converter," provides step-by-step instructions for adjusting the down converter.

Chapter 6, "Replacing Assemblies," provides step-by-step instructions to follow before and after replacing an assembly. This chapter also provides step-by-step instructions for disassembling the instrument.

Chapter 7, "Replaceable Parts," provides ordering information and lists the replaceable parts.

Chapter 8, "Circuit Descriptions," provides the overall instrument description and individual assembly descriptions.

Chapter 9, "Voltages and Signals," shows where the signals and voltages are used in the instrument and describes each signal.

Chapter 10, "Backdating," provides information necessary to modify this manual for instruments that differ from those currently being produced.

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Declaration of Conformity

Need Assistance

1

Specifications

Specifications

This chapter contains the specifications for the HP 89411A 21.4 MHz Down Converter and the critical specifications for the equipment required to test the HP 89411A.

Specifications describe warranted performance over the temperature range of 0° to 55°C (except where noted) and include a 30-minute warm-up from ambient conditions unless otherwise noted.

Definitions

CF = Center frequency.

dBc = dB relative to input signal level.

dBfs = dB relative to full scale amplitude.

FS or fs = Full scale; synonymous with input range.

RH = Relative humidity.

Input

Input impedance (nominal)	50 ohm
Input center frequency	21.4 MHz
Input frequency span	± 3.6 MHz
Full scale input amplitude (no attenuation)	– 20 dBm
Input attenuation (switch selectable)	0, 5, 10, or 15 dB

Output

Output impedance (nominal)	50 ohm
Output center frequency	5.6 MHz
Conversion gain (with 0 dB attenuation, at 5.6 MHz)	5 dB
Conversion gain accuracy (including attenuator) over limited temperature range of 20° to 30°C	± 0.75 dB
Output bandwidth (nominal)	8 MHz
Output flatness (Relative to gain at 5.6 MHz for inputs within ± 3.6 MHz of center frequency)	± 1.5 dB

Dynamic range

Third-order intermodulation distortion (with two signals at – 6 dBfs)	≤– 70 dBc
Spurious responses with in band input signal at full scale	≤– 80 dBc
Residual responses relative to full scale. Applies over output frequency range of 2 to 9.6 MHz.	≤– 80 dBfs
Out-of-band residual responses relative to full scale	≤– 60 dBfs
Noise floor	≤– 115 dBfs/Hz

Phase noise

100 Hz offset	≤– 110 dBc/Hz
>1 kHz offset	≤– 115 dBc/Hz

10 MHz reference

Required input level	> 0 dBm, <+5 dBm
Output level	≥ 0 dBm

General

Safety standards	CSA Certified for Electronic Test and Measurement Equipment per CSA C22.2, No. 231
This product is designed for compliance to	UL1244 IEC348, 1978
EMI/RFI Standards	CISPR 11, ISM1-A
Acoustics (fan)	LpA <50 dB
Environmental operating restrictions	
Class A2 survival vibration and shock Class B2 otherwise	
Ambient temperature (Unless otherwise noted)	0° to 55°C
Maximum humidity at 0° to 40°C	95% RH at 40°C noncondensing
Maximum altitude	2300 meters (7,500 feet)
Storage and transport restrictions	
Ambient temperature	– 40° to 75°C
Maximum humidity	95% RH at 40°C noncondensing
Maximum altitude	4600 meters (15,000 feet)
AC power	
110/120 VAC operation	90 - 132 Vrms, 47 - 440 Hz
220/240 VAC operation	198 - 264 Vrms, 47 - 63 Hz
Maximum power dissipation	100 VA maximum
Fuse	
110/120 VAC operation	1 amp normal blow
220/240 VAC operation	500 milliamp normal blow
Warm-up time	30 minutes
Weight	9.1 kg (20 lb) net 11.8 kg (26 lb) shipping
Dimensions	
Height	90 mm (3.5 in)
Width	426 mm (16.75 in)
Depth	520 mm (20.5 in)

Recommended Test Equipment

The following table lists the recommended equipment needed to test the performance of the HP 89411A 21.4 MHz Down Converter. The table on page 1-6 lists additional equipment needed to adjust and troubleshoot the down converter. Other equipment may be substituted for the recommended model if it meets or exceeds the listed critical specifications. When substitutions are made, you may have to modify the procedures to accommodate the different operating characteristics.

Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model
Controller	HP Instrument BASIC compatible	HP 89410A or HP 89440A
Spectrum Analyzer	Frequency range 90 Hz to 10 MHz Amplitude range –95 to –10 dBm Dynamic range < –82 dBc Impedance 50 Ω External reference input and output	HP 3585B† Alternate HP 3585A†
Digital Multimeter	dc volts accuracy ±0.5%	HP 3458A† Alternate HP 3455A† HP 3456A† HP 3478A†
Frequency Synthesizer	Frequency range 17 to 23 MHz Amplitude range –25 to –15 dBm Impedance 50 Ω External reference input	HP 3335A †
Power Meter	Accuracy ±0.125 dB 2 inputs	HP 438A† Alternate HP 436A (2)†
Power Sensor (2)	Frequency range 1 to 25 MHz Compatible with power meter	HP 8482A
Mixer	50 Ω impedance Frequency range 15 to 25 MHz	ZP10514‡ Alternate HP 10514A

† Program controlled test equipment.
‡ Mini Circuits, P.O. Box 350166, Brooklyn, NY 11235-0003 U.S.A.

Recommended Test Equipment (continued)

Instrument	Critical Specifications	Recommended Model
Signal Generator	Frequency range 16 MHz to 26 MHz Frequency resolution 0.1 Hz Amplitude range –20 to + 10 dBm Impedance 50 Ω Spurious < –82 dBc External reference output	HP 8663A† Alternate HP 8662A†
Power Splitter	SWR ≤1.10 Impedance 50 Ω Two output ports	HP 11667A
Low Pass Filter	Rejection > 20 dB Impedance 50 Ω Cutoff frequency 10 to 500 kHz	TTE # J87-500K-50-613B‡
50 Ω Feedthrough Termination	Accuracy ±0.2%	HP 11048C
Directional Bridge	50 Ω impedance	HP 35677-63501
3 dB Attenuator	50 Ω impedance	HP 8491A opt 003
Cables	50 Ω BNC (8) 50 Ω Type-N	HP 8120-1840 HP 15000C (24 inch) or HP 15000D (60 inch)
Adapters	BNC Tee (2) N(m)-to-BNC(f) (2) N(f)-to-BNC(f) BNC(f)-to-Dual Bannana Plug(m) N(m)-to-BNC(m) (2) BNC(m)-to-BNC(m) N(f)-to-BNC(m) SMA(m)-to-BNC(f) (2)	HP 1250-0781 HP 1250-0780 HP 1250-1536 HP 1251-2277 HP 1250-1473 HP 1250-0216 HP 1250-1477 HP 1250-1200

† Program controlled test equipment.
‡ TEE Inc., 2251 Barry Ave, Los Angeles, CA 90064-1400 U.S.A. (310) 478-8224 FAX (310) 445-2791

Additional Recommended Test Equipment

Instrument	Critical Specifications	Recommended Model
Network Analyzer	Range 10 kHz to 60 MHz Resolution 10 Hz Input impedance 50 Ω Amplitude range –42 dBm to +10 dBm resolution 0.25 dB dynamic accuracy 0.15 dBp-p, 0.5 degree at –10 dB from 10 kHz to 50 MHz	HP 3577B Alternate HP 4195A HP 3589A with HP 35689A
RF Spectrum Analyzer	Frequency range 2 MHz to 70 MHz Amplitude range –60 to +15 dBm Dynamic range < –67 dBc Impedance 50 Ω External reference input Amplitude accuracy ± 1dB	HP 8566B Alternate HP 8566A
Digital Multimeter	Accuracy ±0.5%	HP 3458A Alternate HP 3455A HP 3456A HP 3478A
Logic Probe	TTL/CMOS	HP 545A Alternate HP 5006A HP 5005A/B
Non-conductive Box	Width 7 ± 1 in Length 8 ± 2 in Height 1 ±1/2 in	soft cover book
Cables	Test clips-to-double banana plug SMB(f)-to-SMB(f) extender (2) SMB(f)-to-BNC(m)	HP 11002A HP 03585-61601 † HP 03585-61616 †
Adapter	SMB(m)-to-SMB(m) adapter (2)	HP 1250-0669 †
Adjustment Tools	Non-conductive Flat-edge	HP 8710-0033 HP 8710-1928 †
A82 Extender Board		HP 89430-66595 ‡

† This equipment is included in the HP 89410A Service Kit.
‡ This equipment is included in the HP 89440A Service Kit.

2

Preparing the Down Converter for Use

Preparing the Down Converter for Use

This chapter contains instructions for inspecting and installing the HP 89411A 21.4 MHz Down Converter. This chapter also includes instructions for transporting and storing the analyzer.

Power Requirements

The analyzer can operate from a single-phase ac power source supplying voltages as shown in the table. With all options installed, power consumption is less than 100 VA.

AC Line Voltage

Range	Frequency
90-132 Vrms	47-440 Hz
198-264 Vrms	47-63 Hz

The line-voltage selector switch is set at the factory to match the most commonly used line voltage in the country of destination; the appropriate fuse is also installed. To check or change either the line-voltage selector switch or the fuse, see "To change the line-voltage switch" or "To change the fuse."

Warning **Only a qualified service person, aware of the hazards involved, should measure the line voltage.**

Caution Before applying ac line power to the instrument, ensure the line-voltage selector switch is set for the proper line voltage and the correct line fuse is installed in the fuse holder.

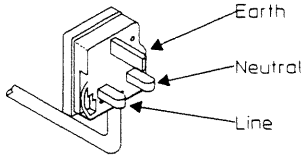
Power Cable and Grounding Requirements

The instrument frame, chassis, covers, all exposed metal surfaces including the BNC connectors' outer shell are connected to chassis ground.

Warning **DO NOT interrupt the protective earth ground or "float" the HP 89411A 21.4 MHz Down Converter. This action could expose the operator to potentially hazardous voltages.**

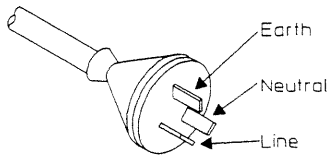
The instrument is equipped with a three-conductor power cord which grounds the instrument when plugged into an appropriate receptacle. The type of power cable plug shipped with each instrument depends on the country of destination. The following figure shows available power cables and plug configurations.

United Kingdom
Option 900



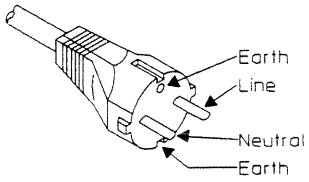
PLUG*: BS 1363A
CABLE*: HP 8120-1351
220V-5A OPERATION

Australia/New Zealand
Option 901



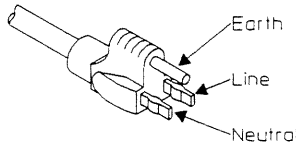
PLUG*: NZSS 198/AS C112
CABLE*: HP 8120-1369
220V-6A OPERATION

Continental Europe
Option 902



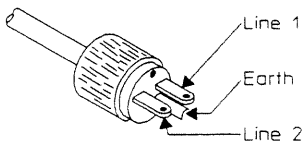
PLUG*: CEE7-V11
CABLE*: HP 8120-1689
220V-6A OPERATION

North America
Option 903



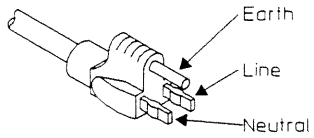
PLUG*: NEMA 5-15P
CABLE*: HP 8120-1378
125V-10A** OPERATION

North America
Option 904



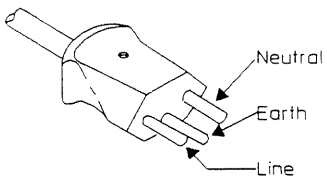
PLUG*: NEMA-6-15P
CABLE*: HP 8120-0698
250V-6A** OPERATION

Japan
Option 918



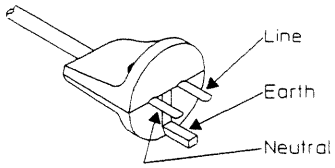
PLUG*: MITI 41-9692
CABLE*: HP 8120-4753
125V-12A OPERATION

Switzerland
Option 906



PLUG*: SEV 1011.1959-24507
TYPE 12
CABLE*: HP 8120-2104
220V-6A OPERATION

Denmark
Option 912



PLUG*: DHCR 107
CABLE*: HP 8120-2956
220V-6A OPERATION

*The number shown for the plug is the industry identifier for the plug only, the number shown for the cable is an HP part number for a complete cable including the plug.

**UL listed for use in the United States of America.

Warning

The power cable plug must be inserted into an outlet provided with a protective earth terminal. Defeating the protection of the grounded instrument cabinet can subject the operator to lethal voltages.

To do the incoming inspection

The HP 89411A 21.4 MHz Down Converter was carefully inspected both mechanically and electrically before shipment. It should be free of marks or scratches, and it should meet its published specifications upon receipt.

1 Inspect the instrument for physical damage incurred in transit. If the instrument was damaged in transit, do the following:

- Save all packing materials.
- File a claim with the carrier.
- Call your Hewlett-Packard sales and service office.

Warning **If the instrument is mechanically damaged, the integrity of the protective earth ground may be interrupted. Do not connect the instrument to power if it is damaged.**

2 Check that the line-voltage selector switch on the instrument's rear panel is set for the local line voltage.

The line-voltage selector switch is set at the factory to match the most commonly used line voltage in the country of destination. To change the line-voltage selector switch, see "To change the line-voltage switch."

3 Check that the correct line fuse is installed in the fuse holder.

The fuse is installed at the factory for the most commonly used line voltage in the country of destination. This instrument requires a 1 amp, 250 volt, normal blow fuse for 100/120 volt operation and a 500 milliamp, 250 volt, normal blow fuse for 220/240 volt operation. For instructions on removing the fuse or fuse part numbers, see "To change the fuse."

4 Using the supplied power cord, plug the instrument into an appropriate receptacle.

The instrument is shipped with a three-conductor power cord that grounds the instrument when plugged into an appropriate receptacle. The type of power cable plug shipped with each instrument depends on the country of destination. The type of power cable shipped with each instrument depends on the power requirements of the instrument.

5 Set the instrument's power switch to on.

Press the "I" symbol end of the rocker-switch located on the instrument's lower left-hand corner.

6 Test the electrical performance of the instrument using the operation verification or the performance tests in chapter 3, "Verifying Specifications."

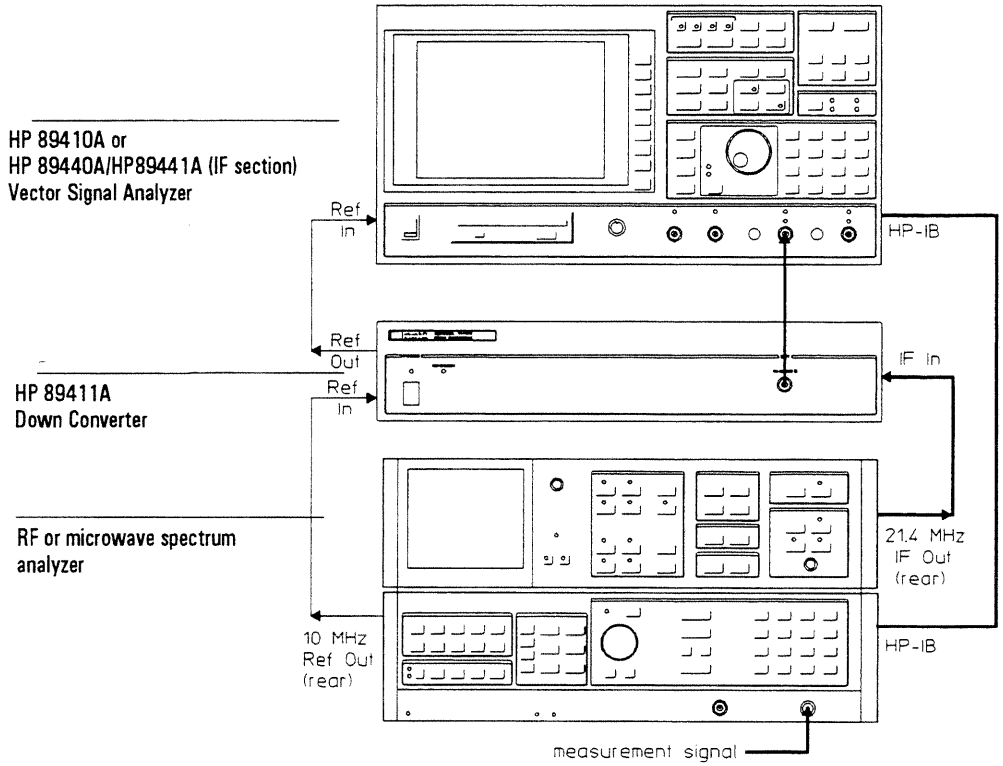
The operation verification tests verify the basic operating integrity of the instrument; these tests take about one hour to complete and are a subset of the performance tests. The performance tests verify that the instrument meets all the performance specifications; these tests take about two hours to complete.

To connect the down converter and analyzers

The HP 89411A 21.4 MHz Down Converter converts the 21.4 MHz IF output of a spectrum analyzer to a 5.6 MHz baseband input for the HP 89410A Vector Signal Analyzer or for the IF section of the HP 89440A/HP 89441A Vector Signal Analyzer. For connection details, see "Extending the Frequency Range" in either the *HP 89410A* or *HP 89440A/HP 89441A Operator's Guide*.

1. Connect the spectrum analyzer's 10 MHz external reference to the down converter's REF IN connector using a BNC-to-BNC cable.
2. Connect the down converter's REF OUT connector to the vector signal analyzer's EXT REF IN connector using a BNC-to-BNC cable.
3. Connect the spectrum analyzer's 21.4 MHz IF output to the down converter's IF INPUT connector using a BNC-to-BNC cable.
4. Connect the down converter's OUT (to channel 1) connector to the vector signal analyzer's CHANNEL 1 connector using a BNC-to-BNC cable.
5. Optionally, connect the spectrum analyzer's HP-IB connector to the vector signal analyzer's HP-IB connector using an HP-IB cable.

   Vector signal analyzers with option UFG have an HP-IB connector labeled SYSTEM INTERCONNECT specifically for this connection.



To install the down converter

The HP 89411A 21.4 MHz Down Converter is shipped with plastic feet in place, ready for use as a portable bench instrument. The plastic feet are shaped to make full-width modular instruments self-align when they are stacked.

- **Install the analyzer to allow free circulation of cooling air.**
  Cooling air enters and exhausts through the rear panel.

Warning

To prevent potential fire or shock hazard, do not expose the instrument to rain or other excessive moisture.

- **Protect the instrument from moisture and temperatures or temperature changes that cause condensation within the analyzer.**
  The operating environment specifications for the instrument are listed in chapter 1, "Specifications."
- **To install the instrument in an equipment cabinet, follow the instructions shipped with the rack mount kits.**

To change the line-voltage switch

The line-voltage selector switch is set at the factory to match the most commonly used line voltage in the country of destination.

1. Unplug the power cord from the instrument.
2. Using a small screw driver, pry open the power selector cover.
3. Remove the cylindrical line voltage selector.
4. Position the cylindrical line voltage selector so the required voltage will be facing out of the power selector, then reinstall.

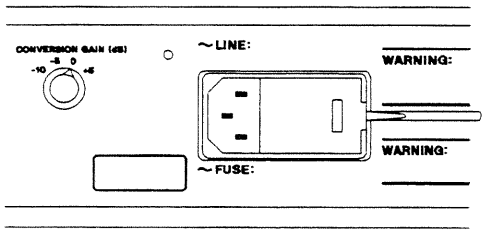
AC Line Voltage

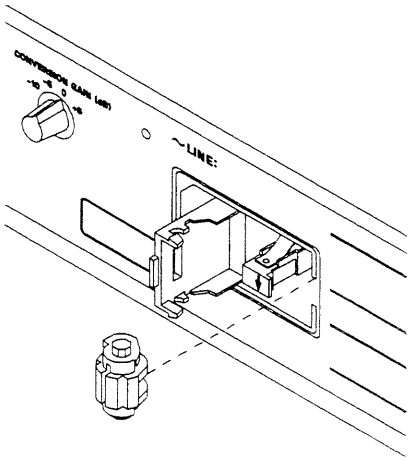
Range	Frequency	Selector Switch
90-110 Vrms	47-440 Hz	100
103-132 Vrms	47-440 Hz	120
198-242 Vrms	47-63 Hz	220
216-264 Vrms	47-63 Hz	240

Warning

Only a qualified service person, aware of the hazards involved, should measure the line voltage.

5. Check to see that the proper fuse is installed. See "To change the fuse."
6. Close the power selector by pushing firmly on the power selector cover.
7. Check that the correct line voltage appears through the power selector cover.





To change the fuse

The fuse is installed at the factory to match the most commonly used line voltage in the country of destination.

1 Unplug the power cord from the instrument.

2 Using a small screw driver, pry open the power selector cover.

3 Pull the white fuse holder out of the power selector and remove the fuse from the fuse holder.

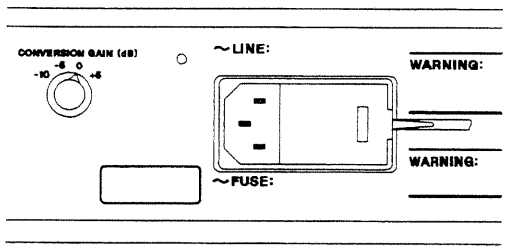
4 Select the proper fuse and place in the fuse holder.

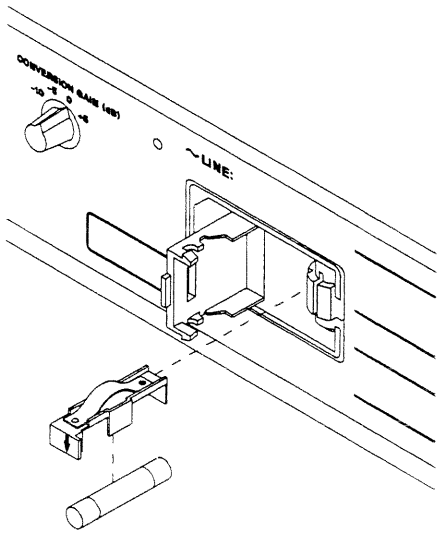
AC Line Voltage		Selector Switch	Fuse	
Range	Frequency		HP Part Number	Type
90-110 Vrms	47-440 Hz	100	2110-0001	1 A 250 V Normal Blow
103-132 Vrms	47-440 Hz	120	2110-0001	1 A 250 V Normal Blow
198-242 Vrms	47-63 Hz	220	2110-0012	500 mA 250 V Normal Blow
216-264 Vrms	47-63 Hz	240	2110-0012	500 mA 250 V Normal Blow

5 Align the white arrow on top of the fuse holder with the white arrow on the power selector cover. All three arrows should point in the same direction. Push the fuse holder into the bottom slot of the power selector.

6 Close the power selector by pushing firmly on the power selector cover.

7 Check that the correct line voltage appears through the power selector cover.





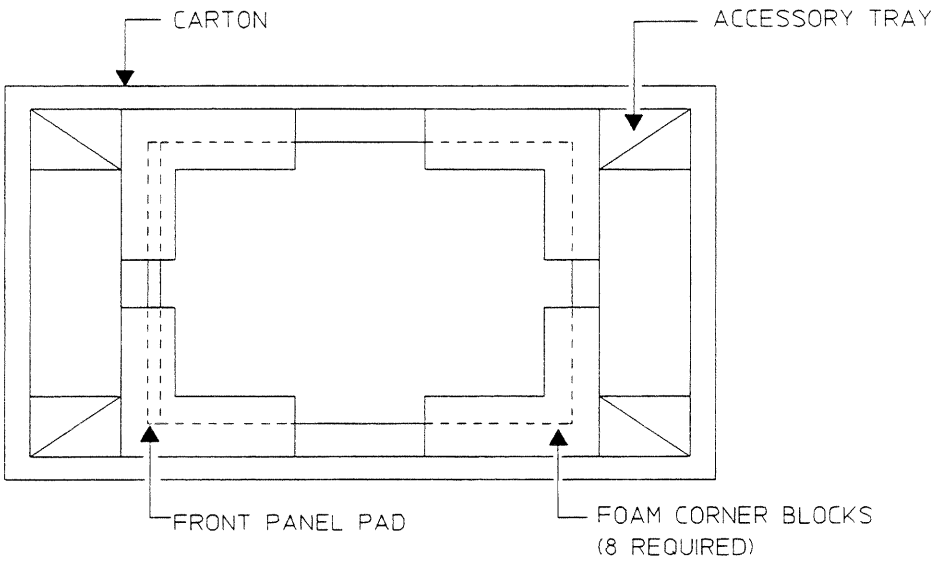
To store the down converter

- Store the instrument in a clean, dry, and static free environment.
  For other requirements, see storage and transport restrictions in chapter 1, "Specifications."

To transport the down converter

- Package the instrument using the original factory packaging or packaging identical to the factory packaging.
  Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices.
- If returning the instrument to Hewlett-Packard for service, attach a tag describing the following:
  - Type of service required
  - Return address
  - Model number
  - Full serial number

  In any correspondence, refer to the instrument by model number and full serial number.
- Mark the container FRAGILE to ensure careful handling.
- If necessary to package the instrument in a container other than original packaging, observe the following (use of other packaging is not recommended):
  - Wrap the instrument in heavy paper or anti-static plastic.
  - Protect the front panel with cardboard.
  - Use a double-wall carton made of at least 350-pound test material.
  - Cushion the instrument to prevent damage.



Caution Do not use styrene pellets in any shape as packing material for the instrument. The pellets do not adequately cushion the instrument and do not prevent the instrument from shifting in the carton. In addition, the pellets create static electricity which can damage electronic components.

If the green LED is not lit

The down converter has a green LED on its front panel that is lit when the down converter is on.

- ❑ Check that the power cord is connected to the down converter and to a live power source.
- ❑ Check that the front-panel switch is on (I).
- ❑ Check that the voltage selector switch is set properly.
  See "To change the line-voltage switch" on page 2-7.
- ❑ Check that the fuse is good.
  See "To change the fuse" on page 2-8.
- ❑ Obtain HP service, if necessary. See "Need Assistance?" at the end of this guide.

3

Verifying Specifications

Verifying Specifications

This chapter tells you how to use the *HP 89411A Semiautomated Performance Test Disk.* The performance test disk contains a program that semiautomates the operation verification tests and performance tests.

After you review this chapter, follow the directions in "To load the program" then continue with one of the following:

- "To run the program in semiautomated mode"
- "To run the program without a printer"
- "To run the program in manual mode"

Caution

Before applying line power to the down converter or testing its electrical performance, see chapter 2, "Preparing the Down Converter for Use."

Overview

The *Semiautomated Performance Test Disk* contains a program (ITM_89411A) and two procedure files (OP_VERIFY and PERFORMAN). ITM_89411A is the test manager program. OP_VERIFY is the operation verification procedure file and PERFORMAN is the performance test procedure file. The procedure files contain an ordered list of tests, and each test contains one or more measurements. The program can be run on an HP 89410A, HP 89440A, or HP 89441A Vector Signal Analyzer. Since ITM_89411A reads the procedure files, the disk must remain in the analyzer's disk drive during testing.

If you do not have a keyboard connected to the analyzer, use the numeric key pad and the alpha keys when the program prompts you to type in information. See the analyzer's help text for a description of the alpha keys.

If a test fails, contact your local Hewlett-Packard sales and service office or have a qualified service technician see chapter 4, "Troubleshooting the Down Converter."

Features of the Program

- The program can automatically create a printout similar to the test records at the back of this chapter.
- The program can beep when equipment connections need to be changed.
- The program can start the test sequence at any test in the operation verification or performance test list.
- The program can stop after each measurement or alternatively, only if a failure occurs.
- The program can be run in manual mode.

Test Duration

The operation verification tests require approximately one hour to complete in semiautomated mode. The performance tests require approximately two hours to complete in semiautomated mode.

Calibration Cycle

To verify the HP 89411A Down Converter is meeting its published specifications, do the performance tests every 12 months.

Recommended Test Equipment

The equipment needed for operation verification and performance tests is listed on page 1-4. Other equipment may be substituted for the recommended model if it meets or exceeds the listed critical specifications. The table also identifies the test equipment that is controlled by this program. If you use a test instrument that is not controlled by the program, the program prompts you to set the instrument state during testing.

Also, if you want the test record to be automatically printed, you need an HP-IB printer. If you want the printer to automatically leave top and bottom margins on every page, enable perforation skip mode (see your printer's manual for directions). If you do not have an HP-IB printer you must record the results of each test in the test records. These test records may be reproduced without written permission of Hewlett-Packard.

Measurement Uncertainty

A table starting on page 3-22 lists the measurement uncertainty and ratio for each performance test using the recommended test equipment. Except for the Conversion Gain and Intermodulation Distortion tests, the ratios listed for the recommended test equipment meet or exceed the measurement uncertainty ratio required by U.S. MIL-STD-45662A. The table also provides a place to record the measurement uncertainty and ratio for each performance test using equipment other than the recommended test equipment. The table may be reproduced without written permission of Hewlett-Packard.

Operation Verification and Performance Tests

The operation verification tests give a high confidence level (>90%) that the HP 89411A Down Converter is operating properly and within specifications. The operation verification tests are a subset of the performance tests. The operation verification tests should be used for incoming and after-repair inspections. The performance tests provide the highest level of confidence and are used to verify that the HP 89411A Down Converter conforms to its published specifications. Some repairs require a performance test to be done after the repair (see chapter 6, "Replacing Assemblies" for this information). The following table lists the operation verification and performance tests.

Operation Verification	Performance Tests
Conversion Gain	Conversion Gain
Flatness	Flatness
Residuals	Intermodulation Distortion
Noise Floor	Phase noise
	Residuals
	Noise Floor
	Spurious

Specifications and Performance Tests

The following table lists specifications and the performance test or tests that verify each specification.

Specification	Performance Test
Output	
Conversion gain accuracy	Conversion Gain
Output flatness	Flatness
Spur	
Third-order intermodulation responses	Intermodulation
Spurious responses	Spurious
Residual responses	Residuals
Noise	
Phase noise	Phase Noise
Noise floor	Noise Floor

To load the program

For information about the program's softkeys, see the menu descriptions starting on page 3-17.

1 Set the HP 89410A or HP 89440A/HP 89441A Vector Signal Analyzer's power switch to off (o), then connect the analyzer, test instruments, and printer using HP-IB cables.

2 If you have the optional PC Style Keyboard, connect the keyboard to the analyzer using the keyboard cable.
See "To connect the optional keyboard" in chapter 2 of the *HP 89410A, HP 89440A,* or *HP 89441A Installation and Verification Guide*.

3 Insert the *HP 89411A Semiautomated Performance Test Disk* into the analyzer's disk drive, then set the power switch to on (I).

4 After the analyzer finishes its power-up calibration routine, press the following keys:

[**Instrument Mode**]
    [receiver]
    [external]
[**Local/Setup**]
    [system controller]
[**System Utility**]
    [more]
    [diagnostics]
    [performance test]

5 Now go to one of the following procedures to continue:

- "To run the program in semiautomated mode"
- "To run the program without a printer"
- "To run the program in manual mode"

To run the program in semiautomated mode

You must have an HP-IB printer connected to your system to run the program in semiautomated mode. If you do not have a printer, see "To run the program without a printer" later in this chapter.

1 **Press the following keys and when the program prompts you, type in the information for the title page of the test record and press** [enter]:

[TITLE PAGE]
[TEST FACILITY]
[FACILITY ADDRESS]
[TESTED BY]
[REPORT NUMBER]
[CUSTOMER]
[MORE]
[SERIAL NUMBER]
[TEMP]
[HUMIDITY]
[LINE FREQUENCY]
[RETURN]

2 **Press the following keys and when the program prompts you, type in the equipment configuration information:**

[EQUIP CONFIG]
[SIGNAL GEN]
[SYNTHESIZER] (not required for operation verification)
[ANALYZER]
[MULTIMETER] (not required for operation verification)
[MORE]
[POWER METER #1]
[POWER METER #2] (not required if power meter #1 is an HP 438A)
[POWER SENSOR #1]
[POWER SENSOR #2]
[RETURN]

The HP-IB address is 100 × (interface select code) + (primary address). The interface select code for the test equipment and printer is 7 (for example, if the primary address is 8, the HP-IB address is 708).

When entering the calibration due date, only four characters are displayed on the screen. However, you can enter up to nine characters and they will be printed.

3 Press the following keys and type in the printer address when the program prompts you:

[TEST CONFIG]
[PRINTER ADDRESS]
[PROCEDURE]
[OP_VERIFY] or [PERFORMAN]
[STOP AFTER]
[LIMIT FAILURE] or [NONE]
[RETURN]

4 Press the following keys to start the test:

[START TESTING]
[START BEGINNING]

When you select [START BEGINNING], the data is written to a file on the disk and printed only after all tests are done. When you select [START MIDDLE] or [ONE TEST], the data is printed immediately after each measurement.

5 Follow the directions on the display.

The directions on the display briefly tell you how to connect test equipment. For detailed illustrations of equipment setup, see the setup illustrations starting on page 3-10.

If you want to pause the program and return the analyzer to front panel control, press [**BASIC**]. To continue the program, press [**BASIC**] [continue]. If you changed any instrument setup states, press [RESTART TEST] to ensure accurate measurement results.

To run the program without a printer

Use this procedure if you do not have an HP-IB printer connected to your system.

1 **Write in the information needed on the title page of the "Performance Test Record" or the "Operation Verification Test Record" (located near the back of this chapter).**

2 **Press the following keys and when the program prompts you, type in the model number and HP-IB address:**

[EQUIP CONFIG]
[SIGNAL GEN]
[SYNTHESIZER] (not required for operation verification)
[ANALYZER]
[MULTIMETER] (not required for operation verification)
[MORE]
[POWER METER #1]
[POWER METER #2] (not required if power meter #1 is an HP 438A)
[POWER SENSOR #1]
[POWER SENSOR #2]
[RETURN]

The HP-IB address equals 100 × (interface select code) + (primary address). The interface select code for the test equipment and printer is 7 (for example, if the primary address is 8, the HP-IB address is 708).

3 **Press the following keys:**

[TEST CONFIG]
[PROCEDURE]
[OP_VERIFY] or [PERFORMAN]
[STOP AFTER]
[EACH MEASUREMENT]
[RETURN]

4 **Press the following keys to start the test:**

[START TESTING]
[START BEGINNING]

5 **Now follow the directions on the display and record every measurement result in the "Performance Test Record" or the "Operation Verification Test Record."**

The directions on the display briefly tell you how to connect test equipment. For detailed illustrations of equipment setup, see the setup illustrations starting on page 3-10.

If you want to pause the program and return the analyzer to front panel control, press [**BASIC**]. To continue the program, press [**BASIC**] [continue]. If you changed any instrument setup states, press [RESTART TEST] to ensure accurate measurement results.

To run the program in manual mode

Use this procedure if you want to run the program in manual mode. You will be prompted to setup all test equipment and you can check the analyzer's setup state after each measurement.

1 Write in the information needed on the title page of the "Performance Test Record" or the "Operation Verification Test Record" (located near the back of this chapter).

2 Press the following keys and when the program prompts you, set all HP-IB addresses to 0:

[EQUIP CONFIG]
[SIGNAL GEN]
[SYNTHESIZER] (not required for operation verification)
[ANALYZER]
[MULTIMETER] (not required for operation verification)
[MORE]
[POWER METER #1]
[POWER METER #2] (not required if power meter #1 is an HP 438A)
[POWER SENSOR #1]
[POWER SENSOR #2]
[RETURN]

3 Press the following keys:

[TEST CONFIG]
[PROCEDURE]
[OP_VERIFY] or [PERFORMAN]
[STOP AFTER]
[EACH MEASUREMENT]
[RETURN]

4 Press the following keys to start the test:

[START TESTING]
[START BEGINNING]

5 Now follow the directions on the display and record the measurement result in the selected test record after every measurement.

The directions on the display briefly tell you how to connect test equipment. For detailed illustrations of equipment setup, see the setup illustrations starting on the next page.

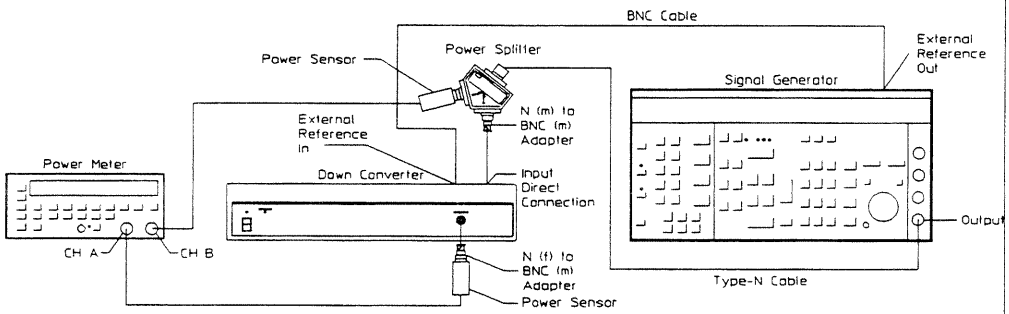
If you want to pause the program and return the analyzer to front panel control, press [**BASIC**]. To continue the program, press [**BASIC**] [continue]. If you changed any instrument setup states, press [RESTART TEST] to ensure accurate measurement results.

To set up the conversion gain test

Performance Test and Operation Verification

This test must be performed within the temperature range of 20° to 30 °C.

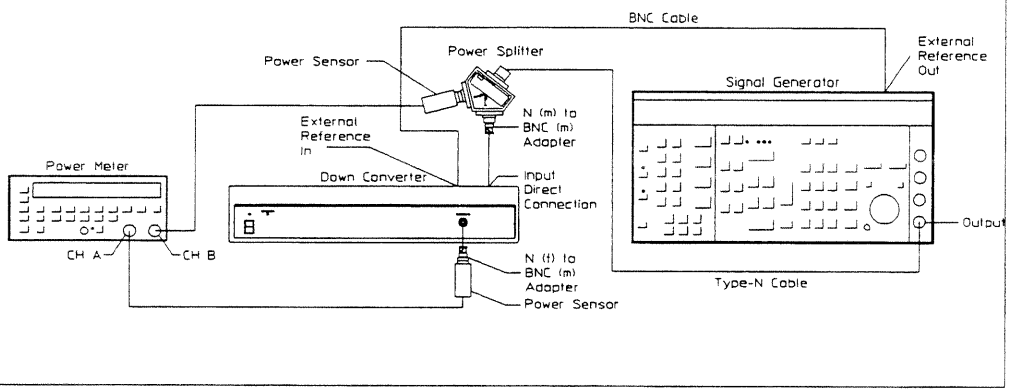
This test verifies that the HP 89411A meets its output specification for conversion gain. In this test, the signal generator outputs a signal to the power splitter. One output of the power splitter is measured by the power meter and the other output is connected to the HP 89411A's IF input. The HP 89411A converts the signal and the power meter measures the converted signal. This test checks the down converter's gain at +5, 0, –5, and –10 dB.



To set up the flatness test

Performance Test and Operation Verification

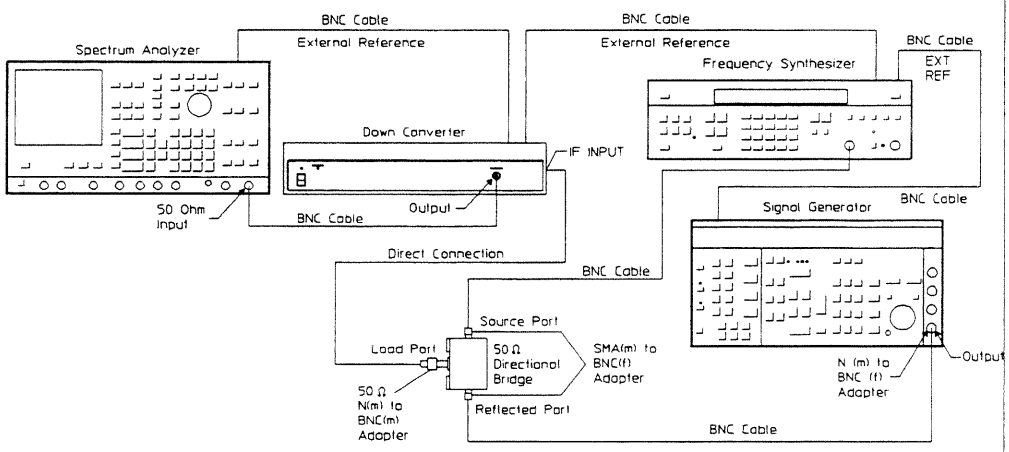
This test verifies that the HP 89411A meets its output specification for flatness. In this test, the signal generator outputs a signal to the power splitter. One output of the power splitter is measured by the power meter and the other output is connected to the HP 89411A's IF input. The HP 89411A converts the signal and the power meter measures the converted signal. This test checks flatness from 2 MHz to 9.2 MHz in 400 kHz steps with the down converter's gain set to +5, 0, –5, and –10 dB.



To set up the intermodulation distortion test

Performance Test only

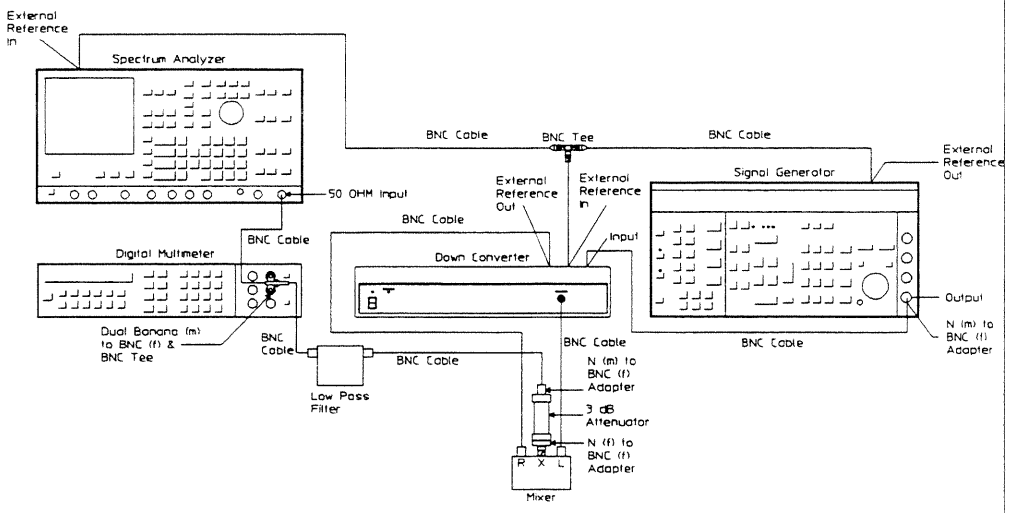
This test verifies that the HP 89411A meets its spur specification for third-order intermodulation responses. In this test, the signal generator and frequency synthesizer both output a signal (the "Performance Test Record" at the end of this chapter lists the frequencies). The two signals are mixed to provide the HP 89411A with a modulated signal. Anytime two signals are mixed, the resultant signal includes the two fundamental frequencies plus their sum and difference frequencies (the sum and difference frequencies are the intermodulation products). The HP 89411A converts the signals and the spectrum analyzer measures the amplitude of each third-order intermodulation product.



To set up the phase noise test

Performance Test only

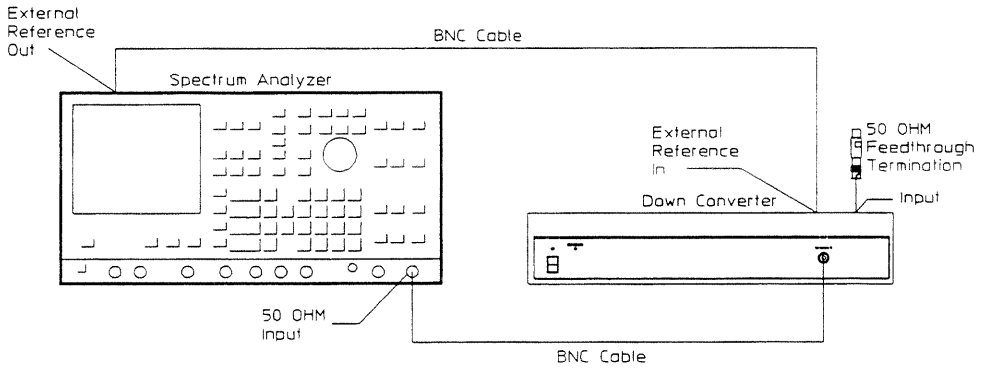
This test verifies that the HP 89411A meets its noise specification for phase noise. In this test, the signal generator outputs a clean 17.0003 MHz, –10 dBm signal to the HP 89411A's IF input connector. The HP 89411A converts the signal to 9.9997 MHz. The 9.9997 MHz signal is mixed with the 10 MHz external reference. The spectrum analyzer makes a reference measurement. Then the signal generator is set for 17 MHz which the HP 89411A converts to 10 MHz. The digital multimeter monitors the dc output of the mixer. The signal generator's frequency is adjusted until the output of the mixer is at 0 Vdc which indicates that the two signals signals are 90 degrees apart in phase. The spectrum analyzer then measures the phase noise relative to the reference measurement.



To set up the residuals test

Performance Test and Operation Verification

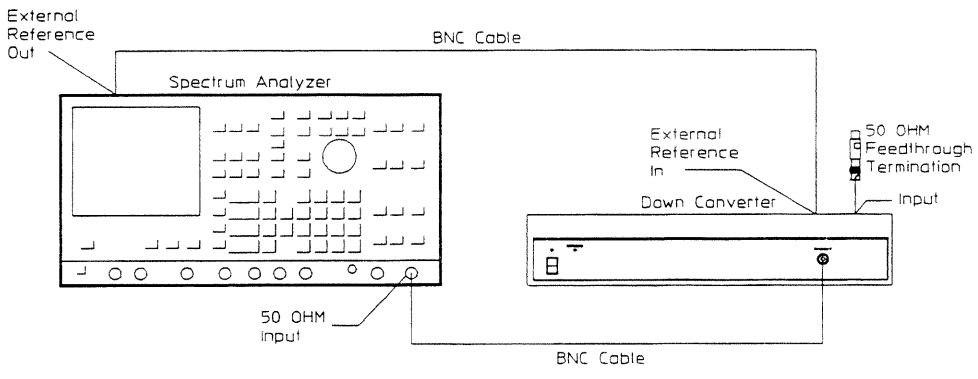
This test verifies that the HP 89411A meets its spur specification for residual responses. In this test, the spectrum analyzer measures the residual responses at 2, 3, 4, 5, 6, 7, 8, 9, and 10 MHz.



To set up the noise floor test

Performance Test and Operation Verification

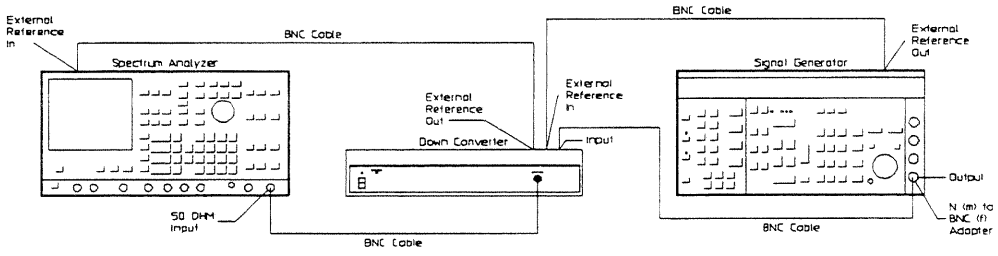
This test verifies that the HP 89411A meets its noise specification for noise floor. In this test, the spectrum analyzer measures the noise floor at 2.6, 3.6, 4.6, 5.6, 6.6, 7.6, 8.6, and 9.6 MHz.



To set up the spurious test

Performance Test only

This test verifies that the HP 89411A meets its spur specification for spurious responses. In this test, a signal generator supplies a clean –20 dBm signal. The HP 89411A converts the signal and the spectrum analyzer measures the signal at various frequencies (the "Performance Test Record" at the end of this chapter lists the frequencies).



ITM_89411A Main Menu Descriptions

If you do not have a keyboard connected to the analyzer, use the numeric key pad and the alpha keys to enter names or numbers. See the analyzer's help text for a description of the alpha keys.

Load and run the ITM_89411A program to display the following softkeys:

[START TESTING]

Displays a menu that allows you to start testing with any test or to select just one test in the list. Before pressing this softkey, use [TEST CONFIG] and [EQUIP CONFIG]. See "Start Testing Menu Descriptions" for additional information.

[TEST CONFIG]

Displays the test configuration and a menu that allows you to enter the procedure, stop conditions, beeper prompt, and HP-IB address for the printer. See "Test Configuration Menu Descriptions" for additional information.

[EQUIP CONFIG]

Displays the test equipment configuration and a menu that allows you to enter the model number, calibration due date, serial number, and HP-IB address for each test instrument. See "Equipment Configuration Menu Descriptions" for additional information.

[TITLE PAGE]

Displays the test record title page information and a menu that allows you to enter information for the down converter. See "Title Page Menu Descriptions" for additional information.

[STOP ITM]

Stops the ITM_89411A program.

Start Testing Menu Descriptions

Press [START TESTING] to display the following softkeys:

[START BEGINNING]

Prints the test record title page information and starts the selected test procedure at the beginning. The measurement results are written to a file on the disk and printed only after all tests are done.

[START MIDDLE]

Displays a list of all the tests in the selected procedure. Testing starts with the test you select and continues through the remainder of the tests in the list. The measurement results are printed immediately after each measurement.

[ONE TEST]

Displays all the tests in the selected procedure. The test you select is the only test performed. The measurement results are printed immediately after each measurement.

[RETURN]

Returns to the ITM_89411A main menu.

Start a test to display the following softkeys:

[STOP TESTING]

Stops the test and returns to the ITM_89411A main menu.

[RESTART TEST]

Starts the current test over. Any connection prompts are repeated.

[RESTART MEAS]

Starts the current measurement over.

The following softkeys also appear when the program is waiting for you to press [CONTINUE]:

[STOP BEEPING]

Turns off the beeper prompt for the remainder of this measurement.

[CONTINUE]

Continues the test. Press this key after following the directions on the display.

Test Configuration Menu Descriptions

Press [TEST CONFIG] to display the test configuration and the following softkeys:

[PRINTER ADDRESS]

Prompts you to enter the HP-IB address for the printer. To disable the printer, set the printer address to 0.

The HP-IB address equals 100 × (interface select code) + (primary address). The interface select code for the printer and test equipment is 7 (for example, if the primary address is 8, the HP-IB address is 708).

[PROCEDURE]

Prompts you to select the operation verification procedure (OP_VERIFY) or the performance test procedure (PERFORMAN).

[STOP AFTER]

Prompts you to select stop after limit failure, stop after each measurement, or do not stop after a limit failure or measurement. If [Limit Failure] is selected, the program stops after the failing measurement is displayed but before it is printed. At this point you can continue on and print the failing measurement or restart the measurement.

[BEEPER]

Toggles the beeper on and off. When the beeper is on, the program beeps approximately every 2 minutes while waiting for you to follow the directions on the display and press [CONTINUE].

[RETURN]

Returns to the ITM_89411A main menu.

Equipment Configuration Menu Descriptions

Press [EQUIP CONFIG] to display the test equipment configuration and the following softkeys:

[SIGNAL GENERATOR]

Prompts you to enter the model, serial number, HP-IB address, and calibration due date for the signal generator.

If you select [OTHER] for model, the program prompts you to type in a model, serial number, and calibration due date but not an HP-IB address.

When entering the calibration due date, only four characters are displayed on the screen. However, you can enter up to nine characters and they will be printed.

[SYNTHESIZER]

Prompts you to enter the model, serial number, HP-IB address, and calibration due date for the frequency synthersizer.

[ANALYZER]

Prompts you to enter the model, serial number, HP-IB address, and calibration due date for the spectrum analyzer.

[MULTIMETER]

Prompts you to enter the model, serial number, HP-IB address, and calibration due date for the digital multimeter.

[more]

Displays the first page.

[POWER METER #1]

Prompts you to enter the model, serial number, and calibration due date for the power meter.

[POWER METER #2]

Prompts you to enter the model, serial number, and calibration due date for the power meter.

[POWER SENSOR #1]

Prompts you to enter the model, serial number, calibration due date, and calibration data for the power sensor.

[POWER SENSOR #2]

Prompts you to enter the model, serial number, calibration due date, and calibration data for the power sensor.

[SAVE SETUP]

Saves the current equipment configuration to a file for future recall.

[RECALL SETUP]

Recalls an equipment configuration that was previously saved using [SAVE SETUP].

[RETURN]

Returns to the ITM_89411A main menu.

Title Page Menu Descriptions

Press [TITLE PAGE] to display the title page information and the following softkeys:

[TEST FACILITY]

Prompts you to enter the name or number of the testing entity.

[FACILITY ADDRESS]

Prompts you to enter the address of the testing entity.

[TESTED BY]

Prompts you to enter the name or number of the person performing the test.

[REPORT NUMBER]

Prompts you to enter the down converter's report number.

[CUSTOMER]

Prompts you to enter the name or number of the person requesting the test.

[SERIAL NUMBER]

Prompts you to enter the down converter's serial number.

[MORE]

Displays the next page.

[RETURN]

Returns to the ITM_89411A main menu.

[OPTIONS]

Prompts you to enter the down converter's options.

[DATE]

Prompts you to enter the test date.

[TEMP]

Prompts you to enter the temperature of the environment during the test.

[HUMIDITY]

Prompts you to enter the humidity of the environment during the test.

[LINE FREQUENCY]

Prompts you to enter the power line frequency.

[MORE]

Displays the first page.

[RETURN]

Returns to the ITM_89411A main menu.

The title page information is printed at the beginning of the test procedure.

Measurement Uncertainty

The following table lists the measurement uncertainty and ratio for each performance test using the recommended test equipment. Except for the Conversion Gain and Intermodulation Distortion test, the ratios listed for the recommended test equipment meet or exceed the measurement uncertainty ratio required by U.S. MIL-STD-45662A.

- If you are using equipment other than the recommended test equipment, you may calculate and record the measurement uncertainty and ratio for each performance test.

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Performance Test	Using Recommended Test Equipment		Using Other Test Equipment	
	Measurement Uncertainty	Ratio	Measurement Uncertainty	Ratio
Conversion Gain	±0.256 dB	2.6:1 †		
Flatness	±0.256 dB	4.8:1		
Intermodulation Distortion	±2.39 dB	3.2:1 ‡		
Phase Noise	±1.0 dB	8.2:1		
Residuals	±1.0 dB	8.2:1		
Noise Floor	±1.4 dB	5.7:1		
Spurious	±1.0 dB	8.2:1		

† If measured value is within ±0.25 dB of specification, verify test system accuracy.
‡ If measured value is within ±2 dB of specification, verify test system accuracy.

Performance Test Record

Test Facility _____

Facility Address _____

Tested By _____

Report Number _____

Customer Name _____

Serial Number _____

Installed Options _____

Date _____

Temperature _____

Humidity _____

Power Line Frequency _____

Test Instruments Used

Instrument	Model	ID or Serial Number	Calibration Due
Signal Generator			
Synthesizer			
Analyzer			
Multimeter			
Power Meter #1			
Power Meter #2			
Power Sensor #1			
Power Sensor #2			

Serial Number:_____Report Number:_____
Test Date:___/___/___

Conversion Gain

Measurement	Lower Limit (dB)	Upper Limit (dB)	Measured Value (dB)	Pass/Fail
+5 dB Gain	4.25	5.75		
0 dB Gain	–0.75	0.75		
–5 dB Gain	–5.75	–4.25		
–10 dB Gain	–10.75	–9.25		

Flatness

Measurement	Lower Limit (dB)	Upper Limit (dB)	Measured Value (dB)	Pass/Fail
+5 dB Gain Flatness	–1.5	1.5		
0 dB Gain Flatness	–1.5	1.5		
–5 dB Gain Flatness	–1.5	1.5		
–10 dB Gain Flatness	–1.5	1.5		

Intermodulation Distortion

Measurement	Lower Limit	Upper Limit (dBc)	Measured Value (dBc)	Pass/Fail
2A-B, Input = 18 MHz & 18.001 MHz		–70		
2B-A, Input = 18 MHz & 18.001 MHz		–70		
2A-B, Input = 22 MHz & 22.001 MHz		–70		
2B-A, Input = 22 MHz & 22.001 MHz		–70		

Serial Number:_____Report Number:_____
Test Date:___/___/___

Phase Noise

Measurement	Lower Limit	Upper Limit (dBc/Hz)	Measured Value (dBc/Hz)	Pass/Fail
90 Hz Offset		–110		
1 kHz Offset		–115		

Residuals

Measurement	Lower Limit	Upper Limit (dBfs)	Measured Value (dBfs)	Pass/Fail
2 MHz		–80		
3 MHz		–80		
4 MHz		–80		
5 MHz		–80		
6 MHz		–80		
7 MHz		–80		
8 MHz		–80		
9 MHz		–80		
10 MHz		–60		

Serial Number:_____Report Number:_____
Test Date:___/___/___

Noise Floor

Measurement	Lower Limit	Upper Limit (dBfs/Hz)	Measured Value (dBfs/Hz)	Pass/Fail
2.6 MHz		–115		
3.6 MHz		–115		
4.6 MHz		–115		
5.6 MHz		–115		
6.6 MHz		–115		
7.6 MHz		–115		
8.6 MHz		–115		
9.6 MHz		–115		

Spurious

Measurement	Lower Limit	Upper Limit (dBc)	Measured Value (dBc)	Pass/Fail
2.6 MHz spur, 18.4 MHz input		–80		
3.6 MHz spur, 18.4 MHz input		–80		
4.6 MHz spur, 18.4 MHz input		–80		
5.6 MHz spur, 18.4 MHz input		–80		
6.6 MHz spur, 18.4 MHz input		–80		
7.6 MHz spur, 18.4 MHz input		–80		
9.6 MHz spur, 18.4 MHz input		–80		
2.6 MHz spur, 19.4 MHz input		–80		
3.6 MHz spur, 19.4 MHz input		–80		
4.6 MHz spur, 19.4 MHz input		–80		
5.6 MHz spur, 19.4 MHz input		–80		

Serial Number:_____Report Number:_____
Test Date:___/___/___

Spurious (continued)

Measurement	Lower Limit	Upper Limit (dBc)	Measured Value (dBc)	Pass/Fail
8.6 MHz spur, 22.4 MHz input		–80		
9.6 MHz spur, 22.4 MHz input		–80		
2.6 MHz spur, 23.4 MHz input		–80		
4.6 MHz spur, 23.4 MHz input		–80		
5.6 MHz spur, 23.4 MHz input		–80		
6.6 MHz spur, 23.4 MHz input		–80		
7.6 MHz spur, 23.4 MHz input		–80		
8.6 MHz spur, 23.4 MHz input		–80		
9.6 MHz spur, 23.4 MHz input		–80		
3.6 MHz spur, 24.4 MHz input		–80		
4.6 MHz spur, 24.4 MHz input		–80		
5.6 MHz spur, 24.4 MHz input		–80		
6.6 MHz spur, 24.4 MHz input		–80		
7.6 MHz spur, 24.4 MHz input		–80		
8.6 MHz spur, 24.4 MHz input		–80		
9.6 MHz spur, 24.4 MHz input		–80		
6.6 MHz spur, 19.4 MHz input		–80		
8.6 MHz spur, 19.4 MHz input		–80		
9.6 MHz spur, 19.4 MHz input		–80		
2.6 MHz spur, 20.4 MHz input		–80		
3.6 MHz spur, 20.4 MHz input		–80		
4.6 MHz spur, 20.4 MHz input		–80		

Serial Number:_____Report Number:_____
Test Date:___/___/___

Spurious (continued)

Measurement	Lower Limit	Upper Limit (dBc)	Measured Value (dBc)	Pass/Fail
5.6 MHz spur, 20.4 MHz input		–80		
7.6 MHz spur, 20.4 MHz input		–80		
8.6 MHz spur, 20.4 MHz input		–80		
9.6 MHz spur, 20.4 MHz input		–80		
2.6 MHz spur, 21.4 MHz input		–80		
3.6 MHz spur, 21.4 MHz input		–80		
4.6 MHz spur, 21.4 MHz input		–80		
6.6 MHz spur, 21.4 MHz input		–80		
7.6 MHz spur, 21.4 MHz input		–80		
8.6 MHz spur, 21.4 MHz input		–80		
9.6 MHz spur, 21.4 MHz input		–80		
2.6 MHz spur, 22.4 MHz input		–80		
3.6 MHz spur, 22.4 MHz input		–80		
5.6 MHz spur, 22.4 MHz input		–80		
6.6 MHz spur, 22.4 MHz input		–80		
7.6 MHz spur, 22.4 MHz input		–80		

Operation Verification Test Record

Test Facility _____

Facility Address _____

Tested By _____

Report Number _____

Customer Name _____

Serial Number _____

Installed Options _____

Date _____

Temperature _____

Humidity _____

Power Line Frequency _____

Test Instruments Used

Instrument	Model	ID or Serial Number	Calibration Due
Signal Generator			
Analyzer			
Power Meter #1			
Power Meter #2			
Power Sensor #1			
Power Sensor #2			

Serial Number:_____Report Number:_____
Test Date:___/___/___

Conversion Gain

Measurement	Lower Limit (dB)	Upper Limit (dB)	Measured Value (dB)	Pass/Fail
+5 dB Gain	4.25	5.75		
0 dB Gain	–0.75	0.75		
–5 dB Gain	–5.75	–4.25		
–10 dB Gain	–10.75	–9.25		

Flatness

Measurement	Lower Limit (dB)	Upper Limit (dB)	Measured Value (dB)	Pass/Fail
+5 dB Gain Flatness	–1.5	1.5		
0 dB Gain Flatness	–1.5	1.5		
–5 dB Gain Flatness	–1.5	1.5		
–10 dB Gain Flatness	–1.5	1.5		

Serial Number:_____Report Number:_____
Test Date:___/___/___

Residuals

Measurement	Lower Limit	Upper Limit (dBfs)	Measured Value (dBfs)	Pass/Fail
2 MHz		–80		
3 MHz		–80		
4 MHz		–80		
5 MHz		–80		
6 MHz		–80		
7 MHz		–80		
8 MHz		–80		
9 MHz		–80		
10 MHz		–60		

Noise Floor

Measurement	Lower Limit	Upper Limit (dBfs/Hz)	Measured Value (dBfs/Hz)	Pass/Fail
2.6 MHz		–115		
3.6 MHz		–115		
4.6 MHz		–115		
5.6 MHz		–115		
6.6 MHz		–115		
7.6 MHz		–115		
8.6 MHz		–115		
9.6 MHz		–115		

4

Troubleshooting the Down Converter

Troubleshooting the Down Converter

This chapter contains troubleshooting tests that can isolate most failures to the faulty assembly. The section "How to troubleshoot the down converter" tells you which test to start with based on the failure. The test you start with will either isolate the faulty assembly or send you to another test to continue troubleshooting.

Safety Considerations

The HP 89411A Down Converter is a Safety Class 1 instrument (provided with a protective earth terminal). Although the instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings that must be followed to ensure safe operation and retain the instrument in safe operating condition.

Warning

Service must be performed by trained service personnel who are aware of the hazards involved (such as fire and electrical shock).

Any interruption of the protective (grounding) conductor inside or outside the instrument, or disconnection of the protective earth terminal can expose operators to potentially dangerous voltages.

Under no circumstances should an operator remove any covers, screws, shields or in any other way access the interior of the HP 89411A Down Converter. There are no operator controls inside the instrument.

Only fuses with the required current rating and of the specified type should be used for replacement. The use of repaired fuses or short circuiting the fuse holder is not permitted. Whenever it is likely that the protection offered by the fuse has been impaired, the instrument must be made inoperative and secured against any unintended operation.

Equipment Required

See "Recommended Test Equipment" starting on page 1-4 for tables listing recommended equipment. Any equipment which meets the critical specifications given in the tables may be substituted for the recommended model.

Troubleshooting Hints

- Most troubleshooting procedures do not check the power supply voltages to the assembly. If you suspect incorrect supply voltages to an assembly, use the table on page 9-4 and an extender board to check the voltages at the assembly.
- The troubleshooting procedures do not isolate failures to cables or connectors. If you suspect a cable or connector failure, check the device for continuity.
- Cables can cause intermittent hardware failures.
- Noise or spikes in the power supply can cause the down converter to fail.
- Measurements in this chapter are only approximate (usually ±1 dB or 10%) unless stated otherwise.
- Use chassis ground for all measurements in this chapter unless stated otherwise.
- Logic levels in this chapter are either TTL-level high or TTL-level low unless stated otherwise. Toggling signal levels continually change from one TTL level to the other.
- Configure a logic probe with an external bias supply for testing digital signals. This down converter does not have easily accessible +5 V supplies.
- The troubleshooting tests in this chapter assume only one independent failure. Multiple failures can cause false results.

How to troubleshoot the down converter

1 Review "Safety Considerations" and "Troubleshooting Hints."

Warning

Service must be performed by trained service personnel who are aware of the hazards involved (such as fire and electrical shock).

2 See chapter 6, "Replacing Assemblies," to determine how to disassemble and assemble the down converter.

3 Determine which test to start with by comparing the down converter's symptoms to the symptoms in the following table.

Symptom	Troubleshooting Test
Front panel "POWER" LED not lit Fan not turning Front panel "REF UNLOCK" LED lit No output or incorrect output	Initial verification, page 4-5
Performance test fails	Performance test, page 4-12

4 Follow the recommended troubleshooting test until you locate the faulty assembly.

5 Replace the faulty assembly and follow the directions in "What to do after replacing an assembly" in chapter 6, "Replacing Assemblies."

To perform initial verification

Use this test to check voltages and signals that are vital to the operation of the down converter.

Warning

This procedure is performed with protective covers removed and power applied. Energy available at may points can, if contacted, result in personal injury.

Even with power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level approximately five minutes after the power cord is disconnected.

❑ Step 1. Check the voltage selector switch and fuse.

1 Check that the voltage selector switch on the rear panel is set for the local line voltage.

2 Check that the correct line fuse is installed in the rear panel fuse holder.

For information on the voltage selector switch and line fuse, see "To change the line-voltage switch" and "To change the fuse" in chapter 2.

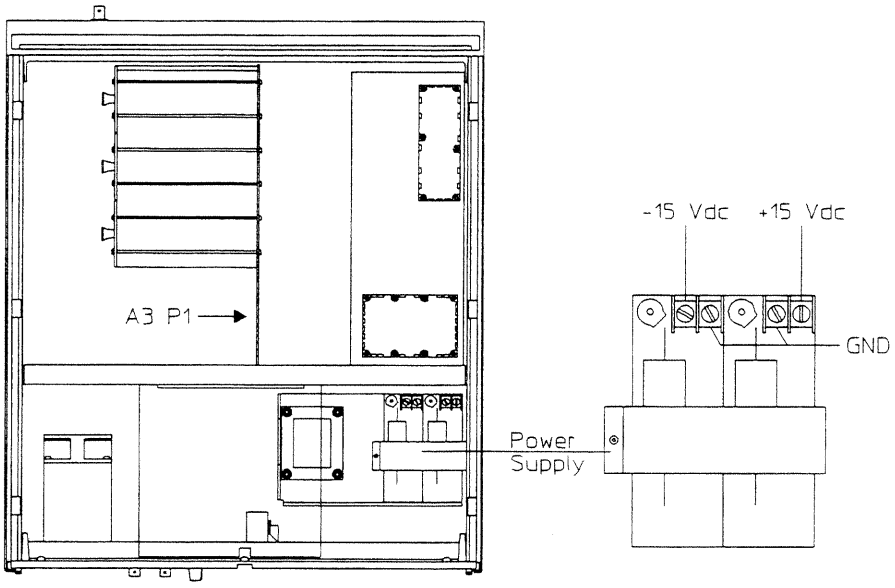
❑ Step 2. Check the A6 Power Supply assembly's voltages.

1 Connect the power cord and set the power switch to on (|).

2 Using a multimeter, check +15 Vdc and –15 Vdc.

3 If the voltages are present but not within ±0.01 V, do the power supply adjustment on page 5-4 before replacing the A6 Power Supply assembly.

The voltage levels are for fully loaded supplies. If you suspect loading, remove one assembly at a time until the assembly loading the power supply is located. Use the table on page 9-4 to help isolate the failing assembly.



❑ Step 3. If the fan is not turning, check the FAN power.

1 Using a multimeter, check A3 P6 pin 2 for –11.5 V ±1 V.
2 If the voltage is correct, the fan is probably faulty.
3 Set the power switch to off (O).
4 Disconnect the fan cable from A3 P6.
5 Connect a –12 Vdc supply to the fan cable's pin 2 and ground to pin 1.
6 If the fan turns, the A3 Motherboard is probably faulty.
7 If the fan does not turn, the fan is probably faulty.

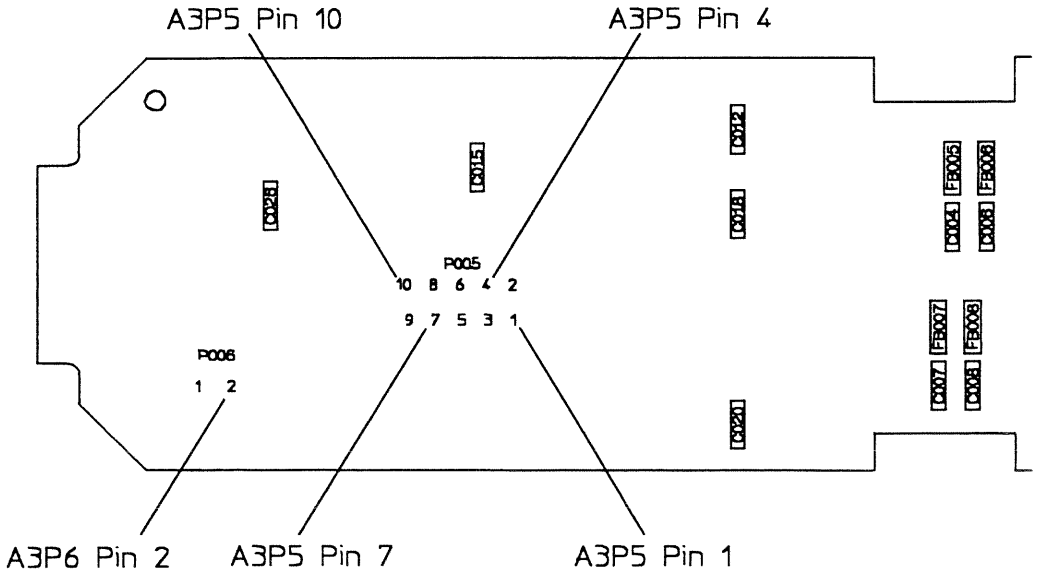
❑ Step 4. Check the voltages regulated by the A3 Motherboard.

1 Check the following voltages.

The voltage levels are for fully loaded supplies. If assemblies are removed, the voltage levels will vary.

Test Location	Nominal Voltage	Minimum Voltage	Maximum Voltage
A3 P5 pin 1	+5 V	+4.75 V	+5.25 V
A3 P5 pin 4	–5 V	–5.25 V	–4.75 V
A3 P5 pin 7	+15 V	+14.25	+15.75 V
A3 P5 pin 10	–15 V	–15.75 V	–14.25 V

2 If any voltage is incorrect, the A3 Motherboard is probably faulty.



A3 Motherboard Component Locator, Back View

❑ Step 5. If the POWER LED is not lit, check the POWER signal.

1 Set the power switch to off (O).
2 Disconnect the cable from A5 P2.
3 Set the power switch to on (I).
4 Check that A5 P2 pin 3 is +15 V and pin 2 is a TTL low.
5 If the signals are correct, the A7 LED assembly is probably faulty.
6 If the signals are not correct, the A5 First Converter assembly is probably faulty.

❑ Step 6. Check that a 0 to +5 dBm, 10 MHz signal is connected to the rear panel REF IN connector.

❑ Step 7. Check the 40 MHZ RCVR signal (A4 J4) and 10 MHZ REF signal (A4 J2).

1 Set the spectrum analyzer as follows:

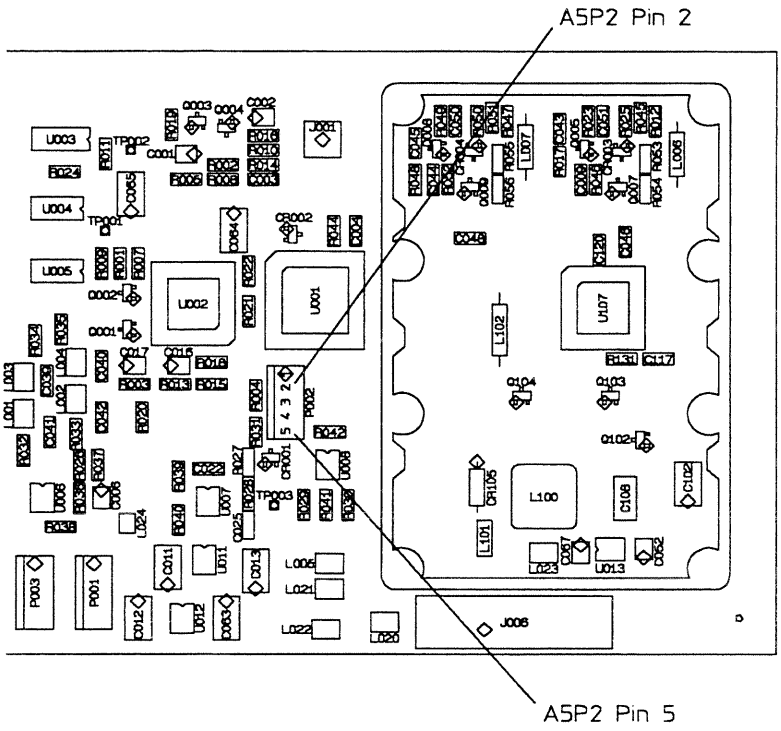
Input	
Input impedance	**50 Ω**
Coupling	**ac**
Range	**+10 dBm**
Frequency	
Center	**10 MHz**
Span	**10 MHz**

2 Check that A4 J2 is 10 MHz, 3 ±3 dBm.
3 If the signal is incorrect, the A4 Reference assembly is probably faulty.
4 Change the spectrum analyzer's center frequency to 40 MHz.
5 Check that A4 J4 is 40 MHz, 3 ±3 dBm.
6 If the signal is incorrect, the A4 Reference assembly is probably faulty.

❑ Step 8. If the REF UNLOCK LED is lit, check the REF UNLOCK signal (A5 P2 pin 5).

1 Set the power switch to off (O).
2 Disconnect the cable from A5 P2.
3 Set the power switch to on (I).
4 Check that A5 P2 pin 5 is 0 Vdc.
5 Disconnect the 10 MHz signal from the rear panel REF IN connector.
6 Check that A5 P2 pin 5 is -0.7 Vdc.
7 If the signal responded correctly, the A7 LED assembly is probably faulty.
8 If the signal did not respond correctly, the A5 First Converter assembly is probably faulty.

To continue troubleshooting, go to page 4-10 "To troubleshoot conversion failures."


A5P2 Pin 2
A5P2 Pin 5

To troubleshoot conversion failures

After you perform initial verification, use this test to isolate conversion failures to one of the following assemblies:

- A5 First Converter
- A24 Stage 1 First IF Filter
- A23 Stage 2 First IF Filter
- A22 Stage 3 First IF Filter
- A25 2nd Mixer Amplifier

❑ Step 1. Check the output signal.

1 Set the rear panel CONVERSION GAIN knob to +5 dB.

2 Set the synthesizer to 21 MHz, –20 dBm.

3 Connect the synthesizer to the rear panel IF INPUT connector using a BNC(m)-to-BNC(m) cable.

4 Set the spectrum analyzer as follows:

Input	
Input impedance	**50 Ω**
Coupling	**ac**
Range	**0 dB**
Frequency	
Center	**6 MHz**
Span	**1 MHz**
Resolution BW	**10 kHz**
Display format	**log magnitude**
Scale	
Reference level	**–10 dBm**
dB/division	**10 dB/div**

5 Connect the spectrum analyzer to the front panel OUT connector.

6 Check that the signal is 6 MHz, –15 dBm ±1 dB.

7 If the signal is incorrect, go to Step 2.

8 Using the CONVERSION GAIN knob, check that the signal level decreases 5 ±1 dB for each decrease in conversion gain.

9 If the signal level did not respond correctly but you heard the relays click at each change in conversion gain, the A5 First Converter assembly is probably faulty.

10 If the signal level did not respond correctly and you did not hear the relays click, go to Step 3.

11 If the signal level responded correctly, go to "To troubleshoot performance test failures" on page 4-12 to continue troubleshooting.

❑ Step 2. Check the first IF signal path.

1 Change the spectrum analyzer's center frequency to 46 MHz.

2 Using the spectrum analyzer, check the following signals in the order listed. If the signal is correct, reconnect the SMB cable and check the next signal. If the signal is incorrect, do the recommended next step or replace the probable faulty assembly.

Test Location	Frequency	Amplitude (±3 dB)	Next Step or Probable Faulty Assembly
A5 J3	46 MHz	–33 dBm	Step 3
A24 J2	46 MHz	–34 dBm	A24 Stage 1 First IF Filter †
A23 J2	46 MHz	–35 dBm	A23 Stage 2 First IF Filter †
A22 J2	46 MHz	–36 dBm	A22 Stage 3 First IF Filter †

†Before replacing, do the adjustments for the assembly followed by the receiver gain adjustment.

3 If the signals are all correct, the A25 2nd Mixer Amplifier assembly is probably faulty. Before replacing, do the receiver gain adjustment.

❑ Step 3. Check the conversion gain switch.

1 Check that A5 P1 pin 1 is +5 V.

2 If the voltage is not correct, the A5 First Converter assembly is probably faulty.

3 Set the CONVERSION GAIN knob to the failing gain setting and check the corresponding TTL levels in the table. The cable from the conversion gain switch (W2) must be connected to A5 P1 when checking the TTL levels.

CONVERSION GAIN	A5 P1 pin 3	A5 P1 pin 4	A5 P1 pin 5
–10 dB	TTL low	TTL low	TTL low
–5 dB	**TTL high**	TTL low	TTL low
0 dB	TTL low	**TTL high**	TTL low
+5 dB	TTL low	TTL low	**TTL high**

4 If the TTL levels are correct, A5 First Converter assembly is probably faulty.

5 If the TTL levels are incorrect, the conversion gain switch (W2) is probably faulty.

To troubleshoot performance test failures

Use this test when one or more performance tests fail.

❑ Step 1. Determine if an adjustment is causing the down converter to fail a performance test.

1 Do the adjustments in chapter 5, "Adjusting the Down Converter."
2 Repeat the failing performance test.

❑ Step 2. Determine the next step or test by comparing the performance test results to the following table.

If more than one performance test fails, use the entry closest to the beginning of the table. The table lists the assemblies most likely to cause the failure and the next step or test. Probable faulty assemblies are listed in order of probability.

Failing Performance Test	Probable Faulty Assembly (in order of probability)	Next Step/Test
Conversion Gain	A25 2nd Mixer Amplifier A5 First Converter A24 Stage 1 First IF Filter A23 Stage 2 First IF Filter A22 Stage 3 First IF Filter	Conversion gain and flatness, page 4-14
Flatness	A25 2nd Mixer Amplifier A5 First Converter A24 Stage 1 First IF Filter A23 Stage 2 First IF Filter A22 Stage 3 First IF Filter	Conversion gain and flatness, page 4-14
Intermodulation Distortion	A25 2nd Mixer Amplifier A5 First Converter A24 Stage 1 First IF Filter A23 Stage 2 First IF Filter A22 Stage 3 First IF Filter	Intermodulation distortion, 4-16
Spurious	A5 First Converter	
Noise Floor	A25 2nd Mixer Amplifier A5 First Converter A24 Stage 1 First IF Filter A23 Stage 2 First IF Filter A22 Stage 3 First IF Filter	Noise floor, page 4-19
Residuals	A5 First Converter A25 2nd Mixer Amplifier A4 Reference	Residuals, page 4-18
Phase Noise	A5 First Converter A4 Reference A25 2nd Mixer Amplifier	Step 3

❑ Step 3. Substitute the 10 MHZ REF signal and run the Phase Noise performance test.

1 Set up the Phase Noise performance test (see page 3-13).
2 Connect a 0 to +5 dBm, 10 MHz external reference to the rear panel REF IN connector and to A5 J1 using a BNC tee and a BNC-to-SMB cable.
3 Run the Phase Noise performance test.
4 If the test now passes, the A4 Reference assembly is probably faulty.
5 If the test still fails, the A5 First Converter assembly is probably faulty, but the problem could still be caused by the A4 Reference assembly or the A25 2nd Mixer Amplifier assembly.

To troubleshoot conversion gain and flatness failures

Use this test to determine which of the following assemblies is causing the Conversion Gain or Flatness performance test to fail.

- A5 First Converter
- A24 Stage 1 First IF Filter
- A23 Stage 2 First IF Filter
- A22 Stage 3 First IF Filter
- A25 2nd Mixer Amplifier

❑ Step 1. Set up the equipment for the failing frequency and gain setting.

1 Check that a 0 to +5 dBm, 10 MHz reference is connected to the rear panel REF IN connector.

2 Set the rear panel CONVERSION GAIN knob to the failing gain setting.

3 Set the synthesizer's amplitude to –20 dBm.

4 Set the synthesizer's frequency to the IF Input Frequency in the following table that corresponds to the Failing Output Frequency.

Failing Output Frequency (MHz)	IF Input Frequency (MHz)	IF Frequency (MHz)
2.0	25.0	42.0
2.4	24.6	42.4
2.8	24.2	42.8
3.2	23.8	43.2
3.6	23.4	43.6
4.0	23.0	44.0
4.4	22.6	44.4
4.8	22.2	44.8
5.2	21.8	45.2
5.6	21.4	45.6
6.0	21.0	46.0
6.4	20.6	46.4
6.8	20.2	46.8
7.2	19.8	47.2
7.6	19.4	47.6
8.0	19.0	48.0
8.4	18.6	48.4
8.8	18.2	48.8
9.2	17.8	49.2

5 Connect the synthesizer to the rear panel IF INPUT connector using a BNC(m)-to-BNC(m) cable.

6 Set the spectrum analyzer as follows:

Input	
Input impedance	50 Ω
Coupling	ac
Range	0 dB
Frequency	
Center	(to IF Frequency in previous table)
Span	1 MHz
Resolution BW	10 kHz
Display format	log magnitude
Scale	
Reference level	–10 dBm
dB/division	10 dB/div

❑ Step 2. Check the first IF signal path.

1 Check the following signals in the order listed. If the signal is correct, reconnect the SMB cable and check the next signal. If the signal is incorrect, do the recommended next step or replace the probable faulty assembly.

Test Location	Amplitude (±3 dB) for Gain Setting				Next Step or Probable Faulty Assembly
	+5 dB	0 dB	–5 dB	–10 dB	
A5 J3	–33 dBm	–38 dBm	–43 dBm	–48 dBm	Step 3, page 4-11
A24 J2	–34 dBm	–39 dBm	–44 dBm	–49 dBm	A24 Stage 1 First IF Filter
A23 J2	–35 dBm	–40 dBm	–45 dBm	–50 dBm	A23 Stage 2 First IF Filter
A22 J2	–36 dBm	–41 dBm	–46 dBm	–51 dBm	A22 Stage 3 First IF Filter

2 If the signals are all correct, the A25 2nd Mixer Amplifier assembly is probably faulty.

To troubleshoot intermodulation distortion failures

Use this test to determine which of the following assemblies is causing the Intermodulation Distortion performance test to fail.

- A5 First Converter
- A24 Stage 1 First IF Filter
- A23 Stage 2 First IF Filter
- A22 Stage 3 First IF Filter
- A25 2nd Mixer Amplifier

❑ Step 1. Check the A5 First Converter assembly.

1 Load the performance test program (see page 3-5).

2 Press the following keys and when the program prompts you, set all HP-IB addresses to 0:

[EQUIP CONFIG]
[SIGNAL GEN]
[SYNTHESIZER]
[ANALYZER]
[RETURN]

3 Press the following keys:

[TEST CONFIG]
[PROCEDURE]
[PERFORMAN]
[STOP AFTER]
[EACH MEASUREMENT]
[RETURN]
[START TESTING]
[ONE TEST]
[INTERMODULATION DISTORTION]

4 Now follow the directions on the display except connect the spectrum analyzer to A5 J3 instead of the front panel (see page 3-12 for normal setup) and set the spectrum analyzer's frequency 40 MHz higher than instructed.

For example, when the program tells you to set the spectrum analyzer's start frequency to 8.9995 MHz, set the spectrum analyzer's start frequency to 48.9995 MHz.

5 If the test fails, the A5 First Converter assembly is probably faulty.

❑ Step 2. If the test passes, check the A24 Stage 1 First IF Filter assembly.

1 Reconnect the cable to A5 J3 and connect the spectrum analyzer to A24 J2.
2 Press [RESTART TEST].
3 Follow the directions on the display except leave the spectrum analyzer connected to A24 J2 and set the spectrum analyzer's frequency 40 MHz higher than instructed.
4 If the test fails, the A24 Stage 1 First IF Filter assembly is probably faulty.

❑ Step 3. If the test passes, check the A23 Stage 2 First IF Filter assembly.

1 Reconnect the cable to A24 J2 and connect the spectrum analyzer to A23 J2.
2 Press [RESTART TEST].
3 Follow the directions on the display except leave the spectrum analyzer connected to A23 J2 and set the spectrum analyzer's frequency 40 MHz higher than instructed.
4 If the test fails, the A23 Stage 2 First IF Filter assembly is probably faulty.

❑ Step 4. If the test passes, check the A22 Stage 3 First IF Filter assembly.

1 Reconnect the cable to A23 J2 and connect the spectrum analyzer to A22 J2.
2 Press [RESTART TEST].
3 Follow the directions on the display except leave the spectrum analyzer connected to A22 J2 and set the spectrum analyzer's frequency 40 MHz higher than instructed.
4 If the test fails, the A22 Stage 3 First IF Filter assembly is probably faulty.
5 If the test passes, the A25 2nd Mixer Amplifier assembly is probably faulty.

To troubleshoot residual failures

Use this test to determine which of the following assemblies is causing the residuals performance test to fail.

- A5 First Converter
- A25 2nd Mixer Amplifier
- A4 Reference

❑ Step 1. Set up the equipment.

1 Set the spectrum analyzer as follows:

Input	
Input impedance	**50 Ω**
Coupling	**ac**
Range	**–25 dBm**
Frequency	
Start	**2 MHz**
Stop	**10 MHz**
Resolution BW	**3 Hz**
Display format	**log magnitude**
Scale	
Reference level	**–50 dBm**
dB/division	**10 dB/div**

2 Connect the spectrum analyzer's external reference output to the down converter's rear panel REF IN connector.

3 Connect the spectrum analyzer's input to the down converter's front panel OUT connector.

4 Set the spectrum analyzer to manual sweep at the failing frequency.

❑ Step 2. Check the spur level.

1 Disconnect the cable from A25 J1 and A5 J1.

2 If the reading dropped more than approximately 4 dB, the A4 Reference assembly is probably faulty.

3 Disconnect the cable from A24 J1.

4 If the reading dropped more than approximately 4 dB, the A5 First Converter assembly is probably faulty.

5 If the reading dropped less than approximately 4 dB, the A25 2nd Mixer Amplifier assembly is probably faulty.

To troubleshoot noise floor failures

Use this test to determine which of the following assemblies is causing the noise floor performance test to fail.

- A25 2nd Mixer Amplifier
- A5 First Converter
- A24 Stage 1 First IF Filter
- A23 Stage 2 First IF Filter
- A22 Stage 3 First IF Filter

❑ Step 1. Set up the equipment.

1 Set the spectrum analyzer as follows:

Input	
Input impedance	**50 Ω**
Coupling	**ac**
Range	**–25 dBm**
Frequency	
Start	**2 MHz**
Stop	**10 MHz**
Resolution BW	**3 Hz**
Display format	**log magnitude**
Scale	
Reference level	**–50 dBm**
dB/division	**10 dB/div**

2 Connect the spectrum analyzer's external reference output to the down converter's rear panel REF IN connector.

3 Connect the spectrum analyzer's input to the down converter's front panel OUT connector.

4 Set the spectrum analyzer to manual sweep at the failing frequency.

❑ Step 2. Check the noise generated by each assembly.

1 Disconnect the cable from A24 J1.
2 If the reading dropped more than approximately 4 dB, the A5 First Converter assembly is probably faulty.
3 Disconnect the cable from A23 J1.
4 If the reading dropped more than approximately 4 dB, the A24 Stage 1 First IF Filter assembly is probably faulty.
5 Disconnect the cable from A22 J1.
6 If the reading dropped more than approximately 4 dB, the A23 Stage 2 First IF Filter assembly is probably faulty.
7 Disconnect the cable from A25 J2.
8 If the reading dropped more than approximately 4 dB, the A22 Stage 3 First IF Filter assembly is probably faulty.
9 If the reading dropped less than approximately 4 dB, the A25 2nd Mixer Amplifier assembly is probably faulty.

5

Adjusting the Down Converter

Adjusting the Down Converter

This chapter contains the adjustment procedures for the HP 89411A 21.4 MHz Down Converter. Follow these procedures if the down converter does not meet its specifications or if instructed in chapter 4, "Troubleshooting the Down Converter," or chapter 6, "Replacing Assemblies," to perform these adjustments. These adjustments are not required for routine maintenance.

Before starting the adjustments, allow the HP 89411A to warm up for at least an hour.

The following table shows the assembly and components adjusted during each adjustment procedure.

Adjustment	Assembly	Component
Power supply	A6 Power Supply	R8 +15, R8 –15
IF filter	A22 Stage 3 First IF Filter A23 Stage 2 First IF Filter A24 Stage 1 First IF Filter	C20, C30, C21, C31, C23, C29, C22 C20, C30, C21, C31, C23, C29, C22 C20, C30, C21, C31, C23, C29, C22
Local oscillator	A5 First Converter	L100
Receiver gain	A25 2nd Mixer Amplifier	R36

Safety Considerations

Although the HP 89411A 21.4 MHz Down Converter is designed in accordance with international safety standards, this guide contains information, cautions, and warnings that must be followed to ensure safe operation and to keep the unit in safe condition. Adjustments in this chapter are performed with power applied and protective covers removed. These adjustments must be performed by trained service personnel who are aware of the hazards involved (such as fire and electrical shock).

Warning

Any interruption of the protective (grounding) conductor inside or outside the unit, or disconnection of the protective earth terminal can expose operators to potentially dangerous voltages.

Under no circumstances should an operator remove any covers, screws, shields or in any other way access the interior of the HP 89411A down converter. There are no operator controls inside the down converter.

Equipment Required

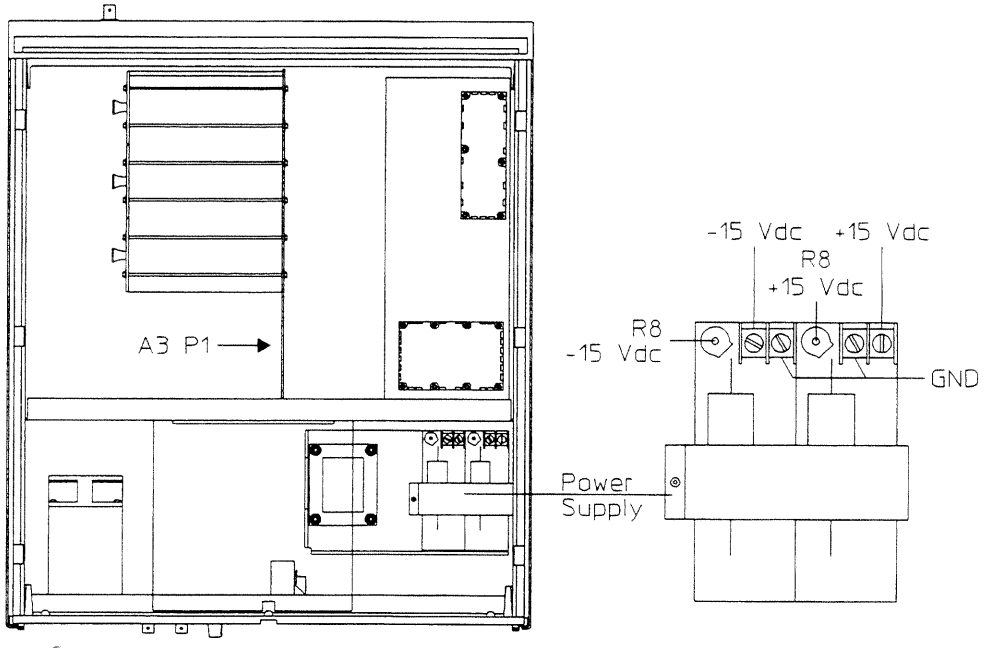
See chapter 1, "Specifications," for tables listing recommended test equipment. Any equipment which meets the critical specifications given in the tables may be substituted for the recommended model.

To adjust power supply

This procedure adjusts the A6 Power Supply assembly's +15 Vdc and –15 Vdc supply.

Equipment Required: Digital multimeter
Flat-edge adjustment tool, HP 8710-1928

1 Set the power switch to on (I).
2 Connect the digital multimeter to the +15 Vdc output.
3 Adjust R8 +15 Vdc for +15 ±0.01 Vdc.



4 Connect the digital multimeter to the –15 Vdc output.
5 Adjust R8 –15 Vdc for –15 ±0.01 Vdc.

This completes the A6 Power Supply assembly adjustments.

To adjust IF filter

This procedure adjusts the 42 to 50 MHz bandpass filter on the IF filter assemblies. The HP 89411A has three IF filter assemblies: A22 Stage 3 First IF Filter assembly, A23 Stage 2 First IF Filter assembly, and A24 Stage 1 First IF Filter assembly. All the IF filter assemblies are adjusted the same. The following steps are for one IF filter assembly. If more than one IF filter assembly needs to be adjusted, repeat Steps 2 through 12 for each assembly.

Equipment Required: Network analyzer
Extender board, HP 89430-66595
Book (or other non-conductive object)
(2) SMB(f)-to-BNC(m) cable
SMB(m)-to-SMB(m) adapter
(2) N(m)-to-BNC(f) adapter
Flat-edge adjustment tool, HP 8710-1928

❑ Step 1. Normalize the SMB(f)-to-BNC(m) cables.

1 Set the network analyzer as follows:

Receiver	**reference channel**
Attenuation	**20 dB**
Resolution BW	**1 kHz**
Source	
Sweep	**continuous**
Sweep time	**0.3 s**
Sweep type	**linear frequency sweep**
Amplitude	**−10 dBm**
Center frequency	**46 MHz**
Frequency span	**20 MHz**
Display format	**log magnitude**
Scale	
Reference level	**−1 dBm**
dB/division	**0.1 dB/div**

2 Connect SMB(f)-to-BNC(m) cables to the network analyzer's source output and receiver using the N(m)-to-BNC(f) adapters.

3 Connect the SMB(f)-to-BNC(m) cables together using the SMB(m)-to-SMB(m) adapter.

4 Store the trace data in a storage register.

5 Set the network analyzer to divide the input channel by the storage register.

❑ Step 2. Check the IF filter adjustment.

1 Set the power switch to on (|).

2 Connect the network analyzer's external reference out to the HP 89411A REF IN on the rear panel. The 10 MHz reference must be 0 to 5 dBm.

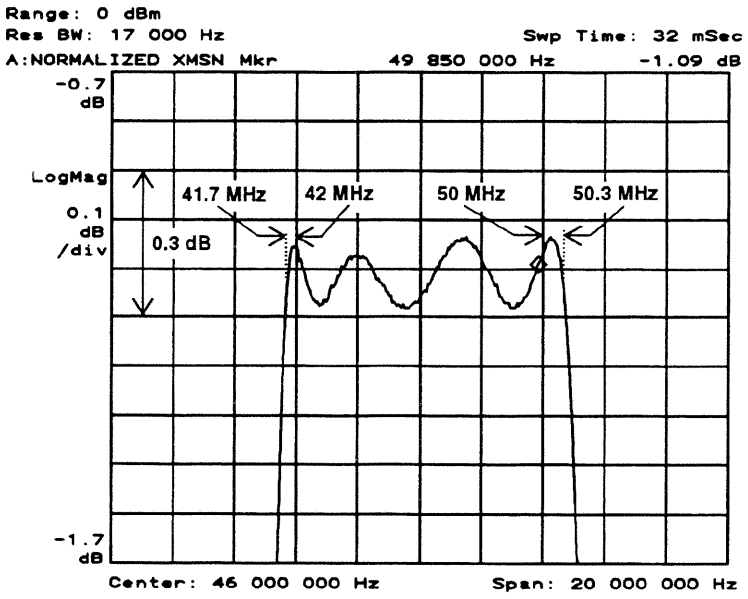
3 Connect the network analyzer's source to J1 using the normalized SMB(f)-to-BNC(m) cable.

4 Connect the network analyzer's input channel to J2 using the normalized SMB(f)-to-BNC(m) cable.

5 Adjust the network analyzer's reference level to view the filter's response.

6 Compare the filter's response to the following specifications:

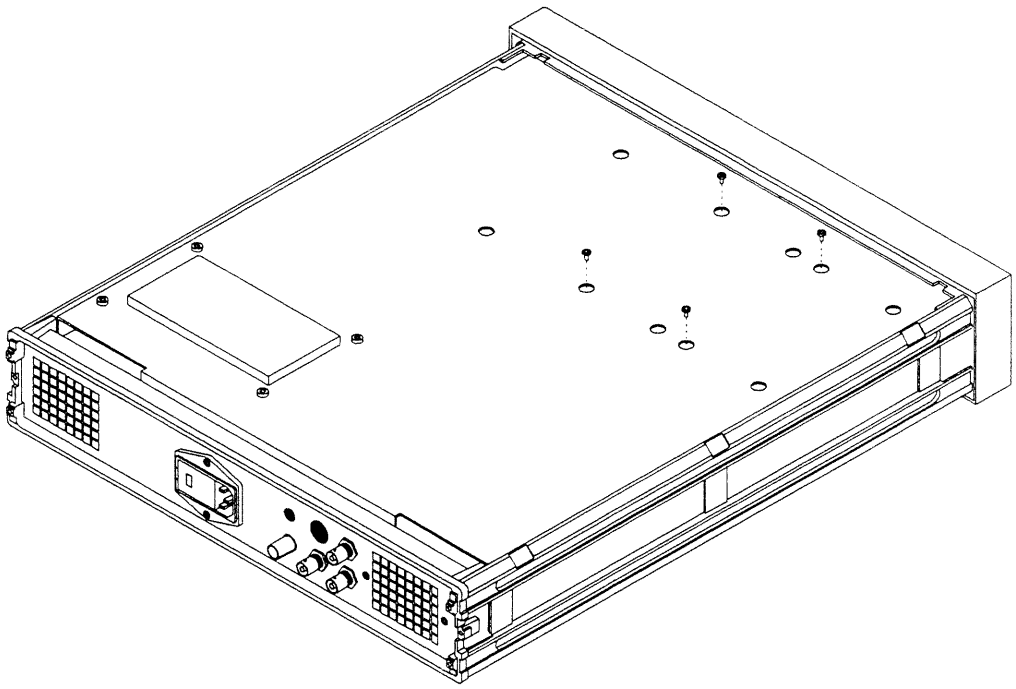
Bandpass level	**–1 ±1 dB**
Bandpass frequency	
Start	**between 41.7 and 42 MHz**
Stop	**between 50 and 50.3 MHz**
Ripple	**< 0.3 dB**



7 If the assembly's IF filter is within its adjustment specifications, do not adjust. Reconnect the cables (see Step 12).

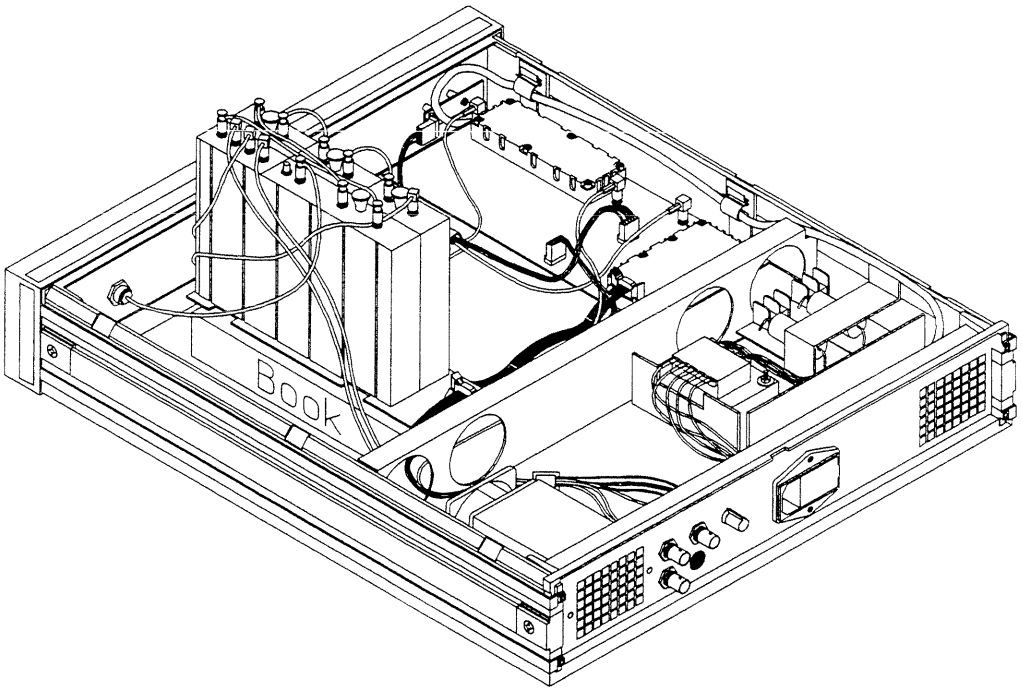
❑ Step 3. Set up IF filter assembly.

1 Set the power switch to off (O) and disconnect the power cord from the rear panel.
2 Place a book (or other non-conductive object) on top of the card nest.
3 While holding the book in place, turn the down converter over and set on top of the book.
4 Remove the bottom cover.
5 Unscrew the four screws holding the card nest to the chassis. Lift the screws out of holes using a needle nose pliers.



6 Turn the down converter back over while supporting the card nest with the book.

7 Place the book inside the chassis and set the card nest upright on the book. Do not short the bottom of the A3 Motherboard.

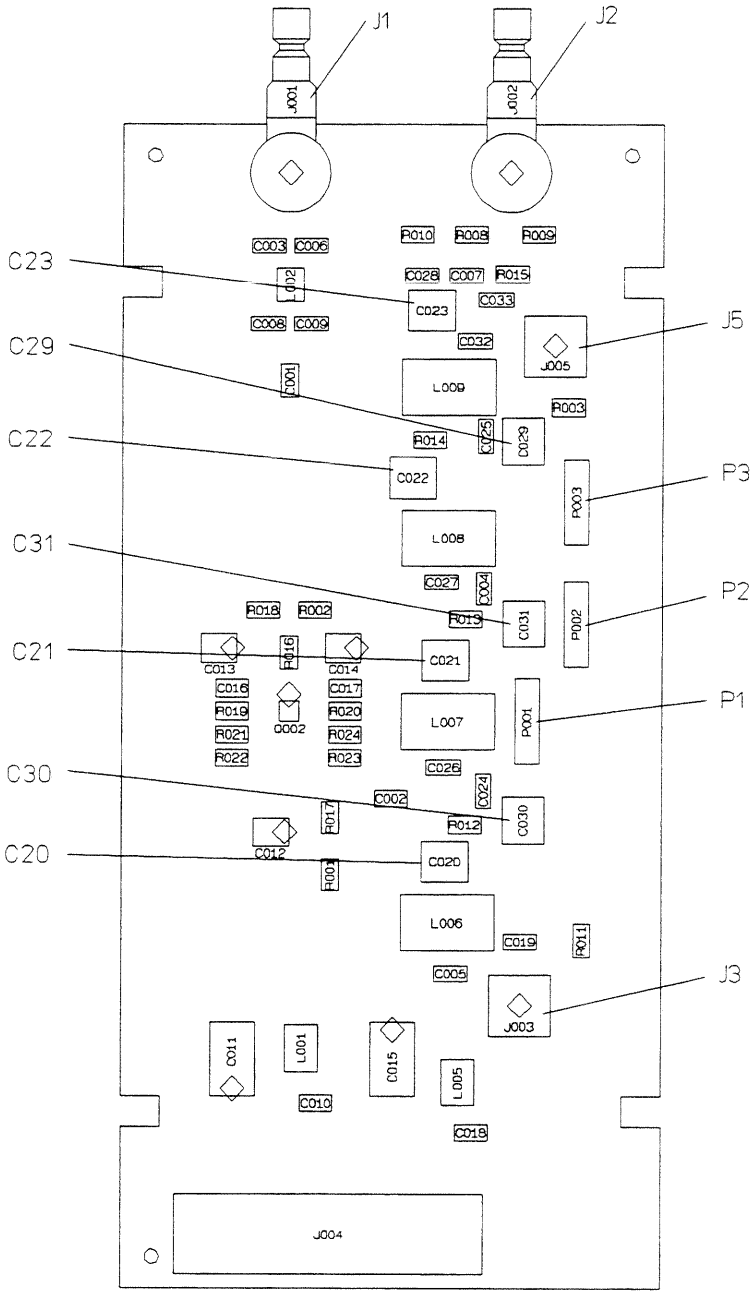


8 Remove screws holding the IF filter assembly in the card nest.

9 Place the assembly on an extender board.

10 Remove test jumpers P1, P2, and P3.

11 Connect the power cord and set the power switch to on (|).


J1
J2
J001
J002
C23
C29
C22
C31
C21
C30
C20
J5
P3
P2
P1
J3
C003
C006
R010
R008
R009
C028
C007
R015
C033
C023
C008
C009
C032
J005
L009
R003
C025
C029
R014
C022
P003
L008
C027
C004
R018
R002
R013
C031
P002
C013
R016
C014
C021
C016
C017
R019
R020
R021
R024
R022
R023
C002
L007
P001
C026
C024
C002
R017
R012
C030
C012
C020
R001
L006
C019
R011
C005
J003
C011
L001
C015
L005
C010
C018
J004

❑ Step 4. Adjust C20.

1 Connect the network analyzer's source to J1 using the normalized SMB(f)-to-BNC(m) cable.

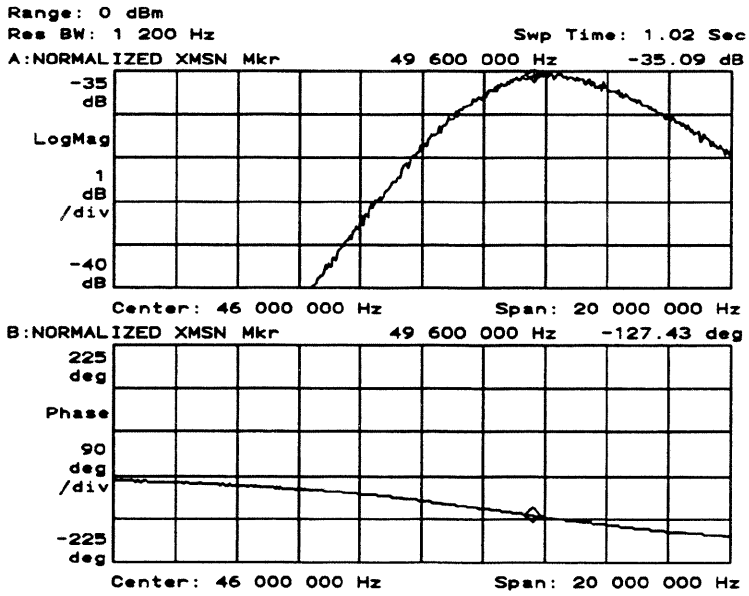
2 Connect the network analyzer's input channel to J3 using the normalized SMB(f)-to-BNC(m) cable.

3 Set the network analyzer as follows:

Source	
Sweep time	**1 s**
Display format	**phase**
Scale	
Reference level	**0 deg**
dB/division	**90 deg**

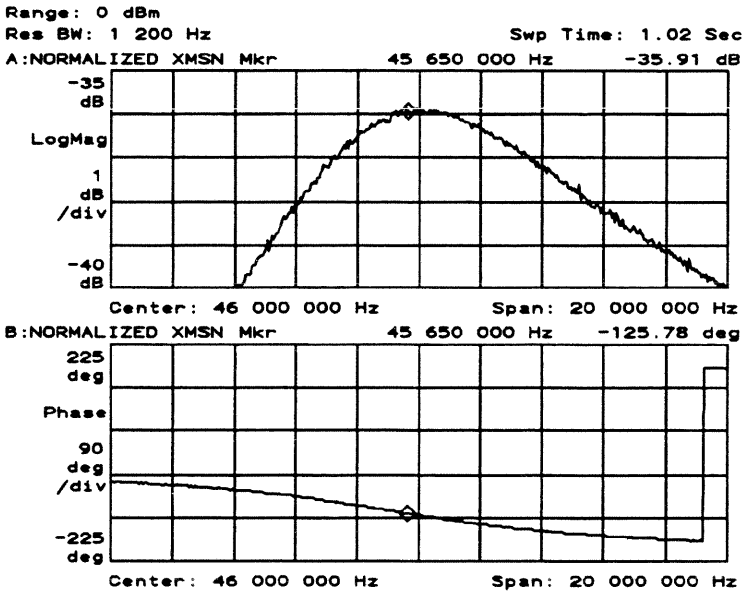
4 Move the marker to 49.6 MHz.

5 Adjust C20 for –127 ±1 deg at 49.6 MHz.



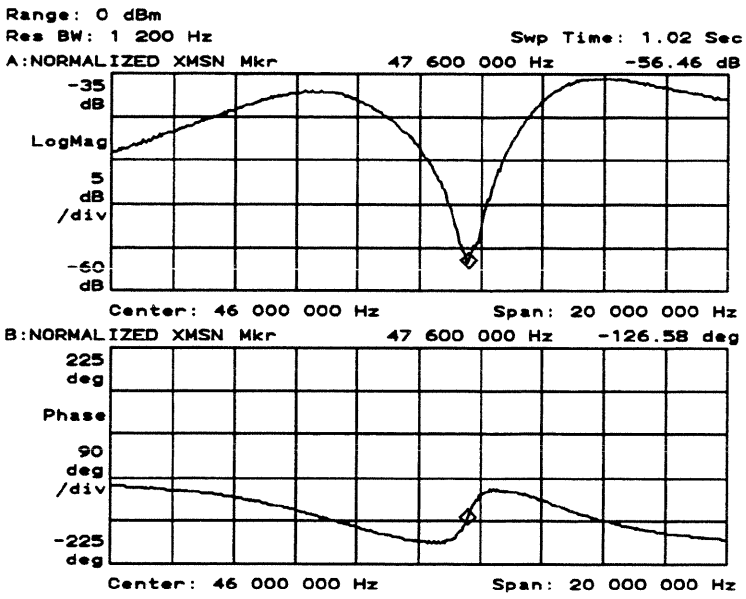
❑ Step 5. Adjust C30.

1 Install P1 into its test position.
2 Move the marker to 45.65 MHz.
3 Adjust C30 for –126 ±2 deg at 45.65 MHz.



❑ Step 6. Adjust C21.

1 Return P1 to its normal position.
2 Move the marker to 47.6 MHz.
3 Adjust C21 for –126 ±5 deg at 47.6 MHz.

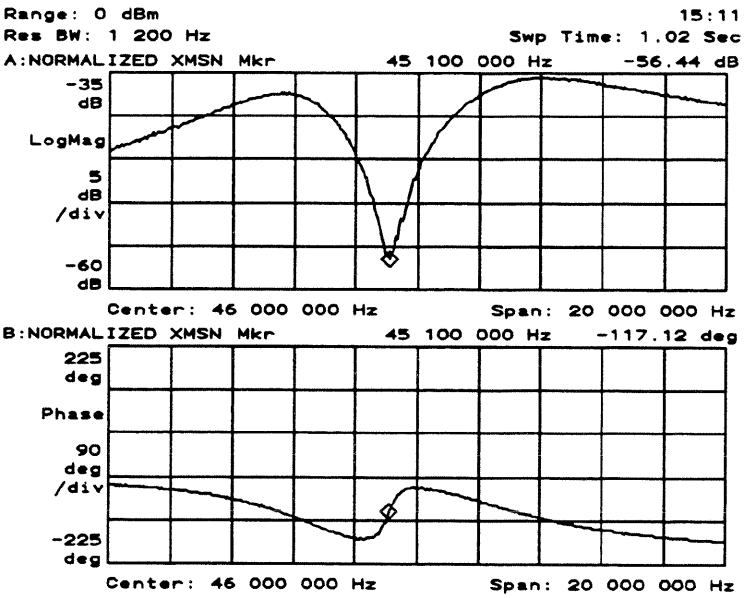


❑ Step 7. Adjust C31.

1 Install P2 into its test position.

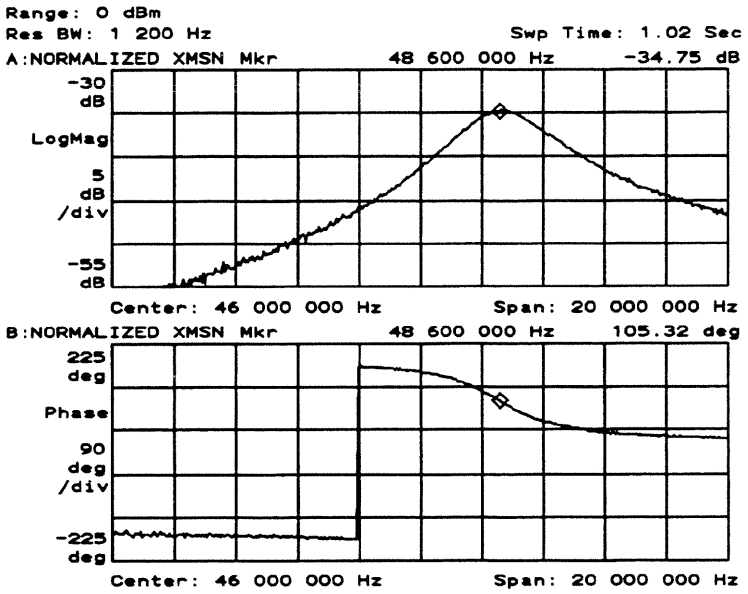
2 Move the network analyzer's marker to 45.1 MHz.

3 Adjust C31 for –114 ±5 deg 45.1 MHz.



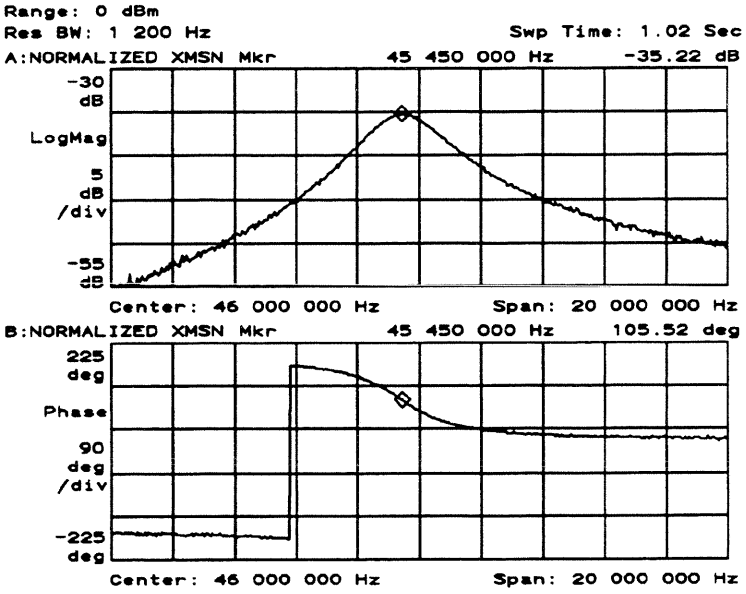
❑ Step 8. Adjust C23.

1 Connect the network analyzer's source to J2 using the normalized SMB(f)-to-BNC(m) cable.
2 Connect the network analyzer's input channel to J5 using the normalized SMB(f)-to-BNC(m) cable.
3 Set the network analyzer's reference level to 15 deg.
4 Move the network analyzer's marker to 48.6 MHz.
5 Adjust C23 for 105 ±2 deg at 48.6 MHz.



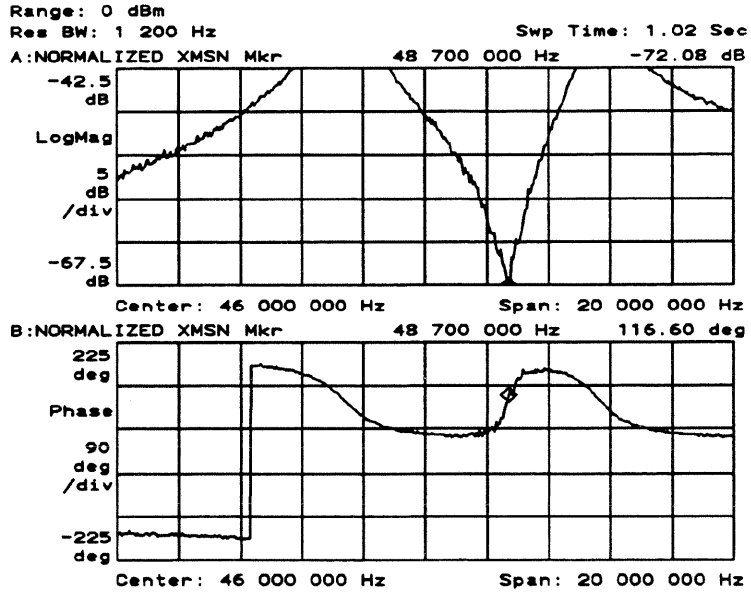
❑ Step 9. Adjust C29.

1 Install P3 into its test position.
2 Move the network analyzer's marker to 45.45 MHz.
3 Adjust C29 for 105 ±2 deg at 45.45 MHz.



❑ Step 10. Adjust C22.

1 Return P3 to its normal position.
2 Set the network analyzer's reference level to –42.5 dB and to 5 dB/division.
3 Move the network analyzer's marker to 48.7 MHz.
4 Adjust C22 for minimum value at 48.7 MHz.



❑ Step 11. Check the IF filter adjustment.

1 Return P2 to its normal position.

All the test jumpers should now be in their normal position.

2 Connect the network analyzer's source to J1 using the normalized SMB(f)-to-BNC(m) cable.

3 Connect the network analyzer's input channel to J2 using the normalized SMB(f)-to-BNC(m) cable.

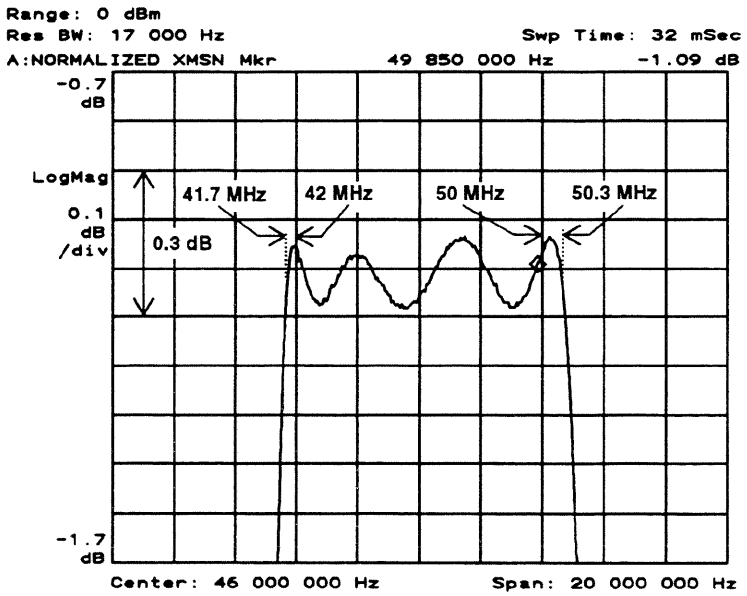
4 Set the network analyzer as follows:

Source	
Sweep time	**0.3 s**
Display format	**log magnitude**
Scale	
Reference level	**−1 dB**
dB/division	**0.1 dB/div**

5 Adjust the network analyzer's reference level to view the filter's response.

6 Compare the filter's response to the following specifications:

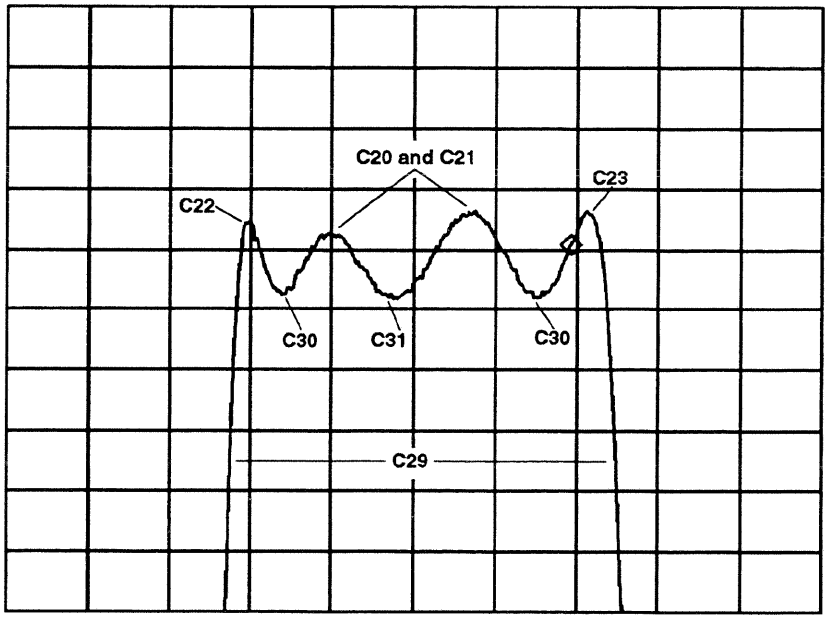
Bandpass level	**−1 ±1 dB**
Bandpass frequency	
Start	**between 41.7 and 42 MHz**
Stop	**between 50 and 50.3 MHz**
Ripple	**< 0.3 dB**



7 To fine tune the filter response, leave the jumpers in their normal position and readjust the capacitors.

Since these adjustments are interactive, adjust each capacitor only a small amount until the filter response can not be improved and it meets or exceeds its specifications.

The following illustration shows the area each capacitor adjusts.



- C30 adjusts the null points up and down.
- C20 and C21 interactively equalize the peaks and valleys.
- C22 adjusts the 42 MHz point up and down.
- C23 adjusts the 50 MHz point up and down.
- C31 adjusts the 46 MHz point up and down.
- C29 adjusts the width of the entire response.

❑ Step 12. Reinstall the IF filter assembly.

1 Set the power switch to off (**O**).

2 Place the IF filter assembly in the card nest.

3 Reconnect the following using original cables:

For A22 assembly A22 J1 to A23 J2 (red cable)
A22 J2 to A25 J2 (orange cable)
For A23 assembly A23 J1 to A24 J2 (red cable)
A23 J2 to A22 J1 (red cable)
For A24 assembly A24 J1 to A5 J3 (gray cable)
A24 J2 to A23 J1 (red cable)

If another IF filter assembly needs to be checked, start at Step 2.

4 Reinstall the card nest and replace the bottom cover (see Step 3).

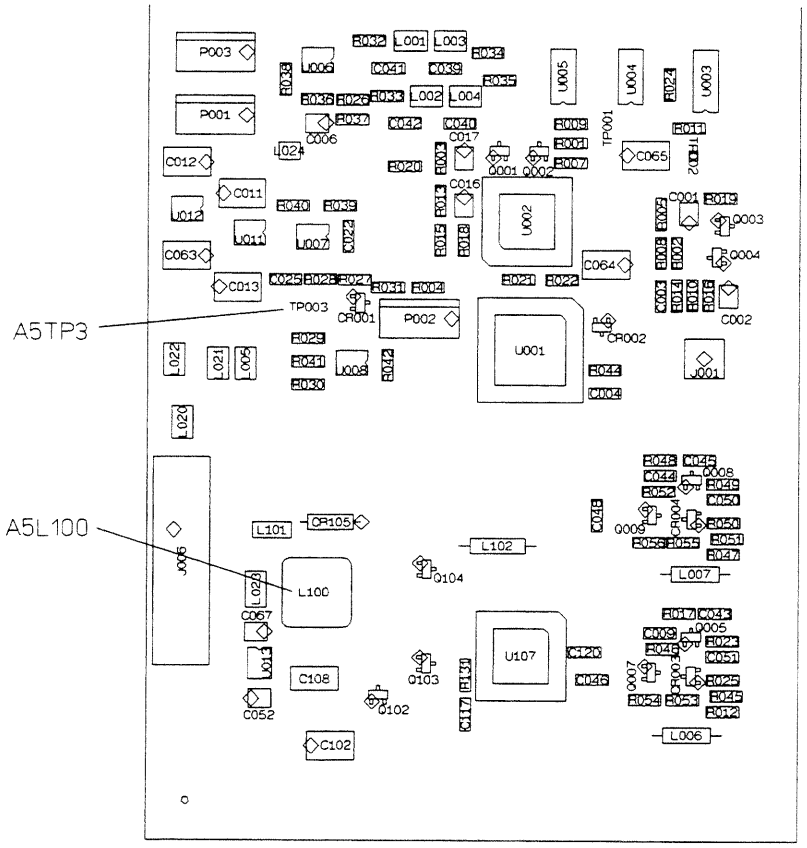
This completes the IF filter assembly adjustments.

To adjust local oscillator

This procedure adjusts the center frequency for the VCO. The Receiver Gain adjustment must be done after this adjustment.

Equipment Required: Digital multimeter
Signal generator
Non-conductive adjustment tool, HP 8710-0033

1 Connect the signal generator's external reference out to the HP 89411A's REF IN connector on the rear panel. The 10 MHz reference must be 0 to 5 dBm.
2 Connect the digital multimeter to A5 TP3 and chassis ground.



3 Adjust A5 L100 for +2 ±0.25 Vdc using the non-conductive adjustment tool.
4 Remove the adjustment tool from A5 L100 and check value at A5 TP3.
5 Readjust A5 L100 for +2 ±0.25 Vdc when the adjustment tool is removed.

This completes the A5 First Converter assembly adjustment.

To adjust receiver gain

This procedure adjusts gain of the A25 2nd Mixer Amplifier assembly.

Equipment Required: Power meter
(2) Power sensor
Signal generator
Power splitter
BNC cable
Type-N cable
N(f)-to-BNC(m) adapter
N(m)-to-BNC(m) adapter
Flat-edge adjustment tool, HP 8710-1928

❑ Step 1. Set up the HP 89411A.

1 Set the power switch to off (O).
2 Remove the side cover from the side that is closest to the OUT connector.
3 Set the power switch to on (I).
4 Set the rear panel conversion gain switch to +5.

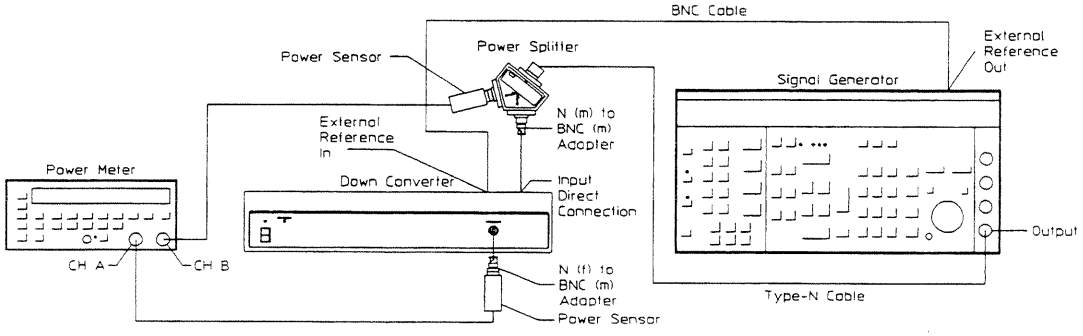
❑ Step 2. Set up the test equipment.

1 Connect the test equipment as shown below.

The signal generator's 10 MHz external reference must be 0 to 5 dBm.

2 Set the channel A power sensor's calibration factor for 21.4 MHz.
3 Set the channel B power sensor's calibration factor for 5.6 MHz.
4 Set the signal generator for 21.4 MHz, –14 dBm.

The signal generator's amplitude is –20 dBm plus the power splitter loss.



❑ Step 3. Adjust A25 R36.

1 Set the power meter to read channel B.
2 Set the signal generator's amplitude for a power meter reading of –20 dBm.
3 Set the power meter to read A/B.

If using two power meters, subtract the two dBm readings to determine the adjustment value.

4 Adjust A25 R36 for a marker reading of +5 ±0.2 dB using the flat-edge adjustment tool.

A25 R36 is labeled "GAIN" on the A25 assembly cover.

❑ Step 4. Replace the side cover.

1 Set the power switch to off (**O**).
2 Replace the side cover.

This completes the A25 2nd Mixer Amplifier assembly adjustment.

6

Replacing Assemblies

Replacing Assemblies

This chapter tells you what to do after you replace an assembly and shows you how to disassemble the HP 89411A 21.4 MHz Down Converter.

Warning

Disconnect the power cord from the rear panel before disassembly or assembly of the HP 89411A.

Even with power removed, there can be sufficient stored energy in some circuits to cause personal injury. These voltages will discharge to a relatively safe level approximately five minutes after the power cord is disconnected.

Caution

Do not connect or disconnect cables from circuit assemblies with the line power turned ON (|).

To protect circuits from static discharge, remove or replace assemblies only at static-protected work stations.

What to do after replacing an assembly

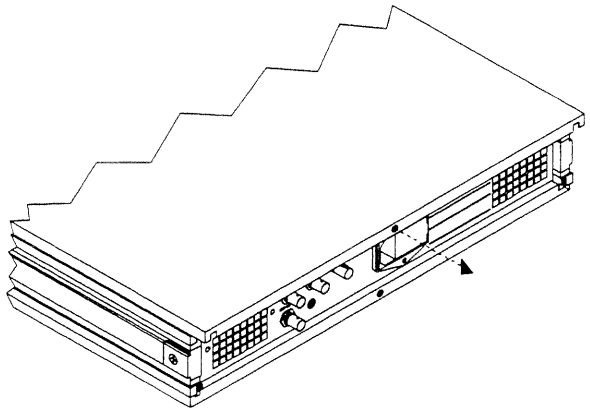
1. Do the required adjustments listed in the following table.
2. Reinstall all assemblies and cables that were removed during troubleshooting.
3. Do the required performance tests listed in the following table.

Required Adjustments and Performance Tests

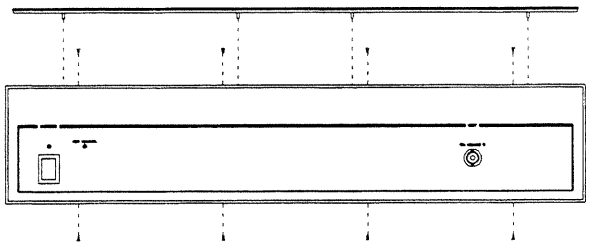
Assembly Replaced	Adjustment	Performance Test
A3 Motherboard		
A4 Reference		Phase noise, page 3-13 Spurious, page 3-16
A5 First Converter	Local oscillator, page 5-18 Receiver gain, page 5-19	Conversion gain, page 3-10 Flatness, page 3-11 Residuals, page 3-14 Noise floor, page 3-15 Spurious, page 3-16
A6 Power Supply	Power supply, page 5-4	Conversion gain, page 3-10 Flatness, page 3-11 Spurious, page 3-16
A7 LED		
A22 Stage 1 First IF Filter	IF filter, page 5-5 Receiver gain, page 5-19	Conversion gain, page 3-10 Flatness, page 3-11 Residuals, page 3-14 Noise floor, page 3-15 Spurious, page 3-16
A23 Stage 2 First IF Filter	IF filter, page 5-5 Receiver gain, page 5-19	Conversion gain, page 3-10 Flatness, page 3-11 Residuals, page 3-14 Noise floor, page 3-15 Spurious, page 3-16
A24 Stage 3 First IF Filter	IF filter, page 5-5 Receiver gain, page 5-19	Conversion gain, page 3-10 Flatness, page 3-11 Residuals, page 3-14 Noise floor, page 3-15 Spurious, page 3-16
A25 2nd Mixer Amplifier	Receiver gain, page 5-19	Conversion gain, page 3-10 Flatness, page 3-11 Residuals, page 3-14 Noise floor, page 3-15 Spurious, page 3-16

To remove front panel

1 Using a T-15 torx driver, remove the screw from the back of the top cover. Slide the cover off.



2 Remove trim strip from top of front frame. Using a T-10 torx driver, remove four screw from the top and four screws from the bottom of the front frame.

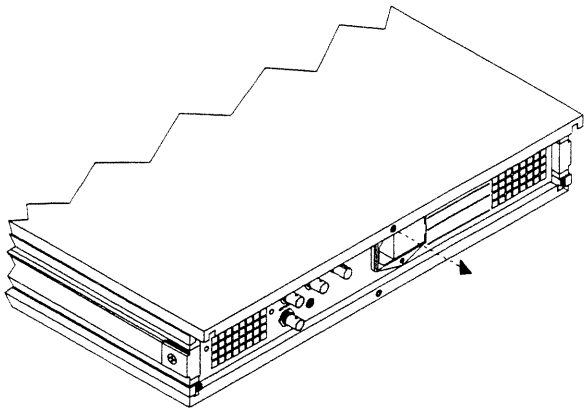


3 Pull the front panel out of the frame.

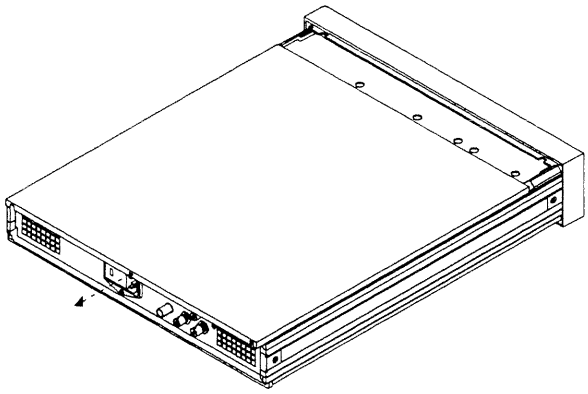
4 Disconnect the coaxial cable from A25 J3. Disconnect the cable from A7 J1. Disconnect the cables from the power switch (red and gray stripe = pin 1, gray stripe = pin 2, solid gray = pin 3, gray and brown stripe = pin 4).

To remove rear panel

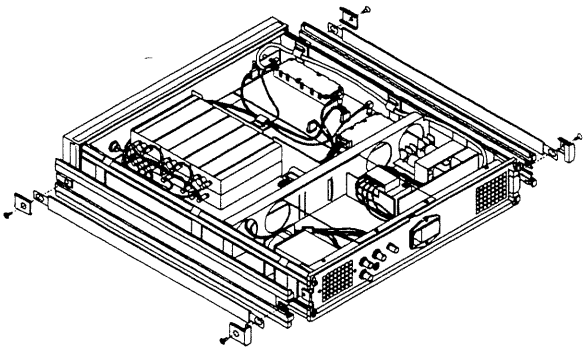
1 Using a T-15 torx driver, remove the screw from the back of the top cover. Slide the cover off.



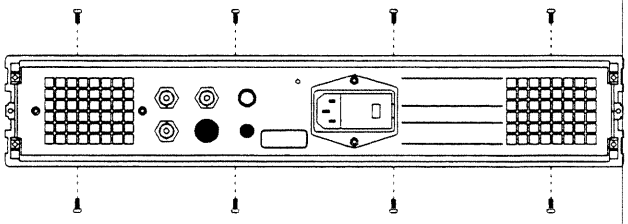
2 Using a T-15 torx driver, remove the screw from the back of the bottom cover. Slide the cover off.



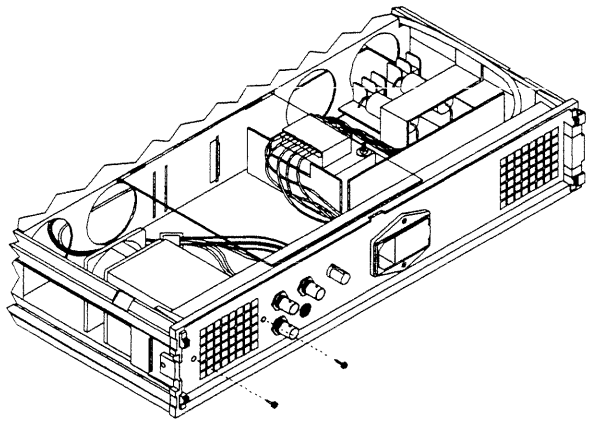
3 Using a 2 point pozidriv, remove the screw from both end caps of both strap handles. Remove the strap handles and side covers.



4 Using a T-10 torx driver, remove the four screws and plastic safety shield from the top of the rear frame and the four screws from the bottom of the rear frame.



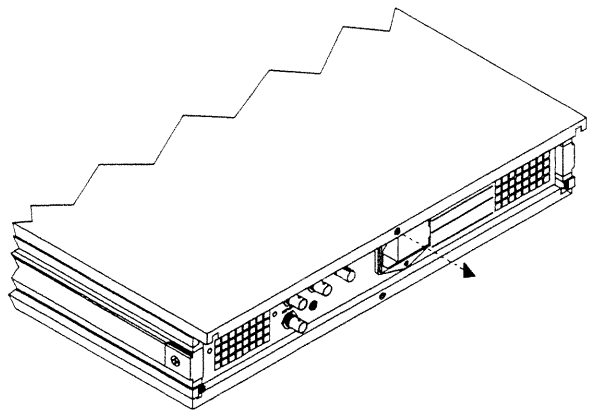
5 Using a T-10 torx driver, remove the two screws on the rear panel that attach the fan.



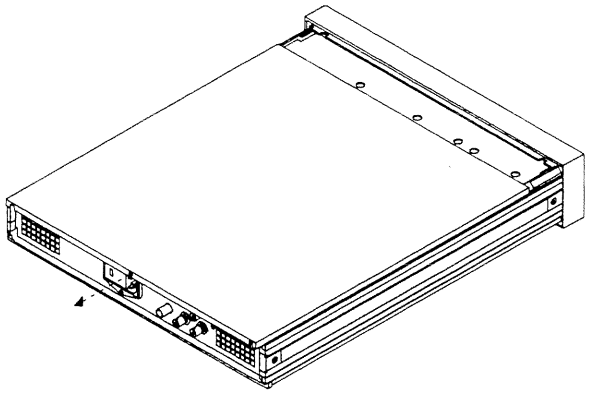
6 Slide the rear panel out of the frame and disconnect all cables.

To remove card nest

1 Using a T-15 torx driver, remove the screw from the back of the top cover. Slide the cover off.

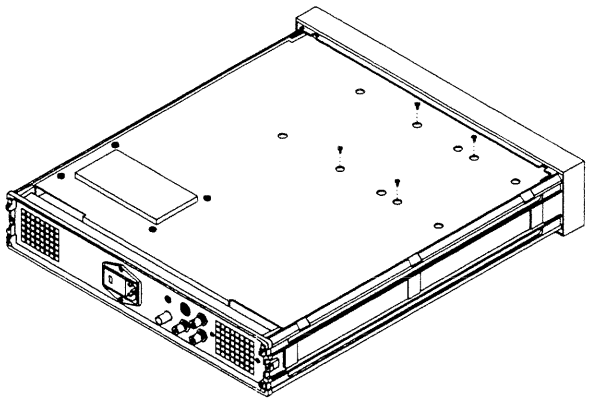


2 Using a T-15 torx driver, remove the screw from the back of the bottom cover. Slide the cover off.



3 Place a book (or other non-conductive object) on top of the card nest. While holding the book in place, turn the down converter over and set on top of the book.

4 Unscrew the four screws holding the card nest to the chassis. Lift the screws out of holes using a needle nose pliers.



5 Turn the down converter back over while supporting the card nest with the book.

6 Disconnect the cables from the assemblies in the card nest and from the A3 Motherboard.

7

Replaceable Parts

Replaceable Parts

This chapter contains information for ordering replacement parts for the HP 89411A Down Converter.

Ordering Information

Replacement parts are listed in the following nine tables:

- Assemblies
- Cables
- Instrument Covers and Handles
- Assembly Covers and Brackets
- Front Panel
- Rear Panel
- Chassis Parts
- Screws, Washers, and Nuts
- Miscellaneous

To order a part listed in one of the tables, quote the Hewlett-Packard part number (HP Part Number), the check digit (CD), indicate the quantity required, and address the order to the nearest Hewlett-Packard sales and service office (see the inside back cover of this guide). The check digit verifies that an order has been transmitted correctly, ensuring accurate and timely processing of the order. The first time a part is listed in the table, the quantity column (Qty) lists the total quantity of the part used in the down converter. For the corresponding name and address of the manufacturers' codes shown in the tables, see "Code Numbers."

Caution

Many of the parts listed in this chapter are static sensitive. Use the appropriate precautions when removing, handling, and installing all parts to avoid unnecessary damage.

Non-Listed Parts

To order a part that is NOT listed in the replaceable parts tables, indicate the instrument model number, instrument serial number, description and function of the part, and the quantity of the part required. Address the order to the nearest Hewlett-Packard sales and service office (see the inside back cover of this guide).

Direct Mail Order System

Within the U.S.A., Hewlett-Packard can supply parts through a direct mail order system. Advantages of the Direct Mail Order System are:

- Direct ordering and shipment from the HP Parts Center.
- No maximum or minimum on any mail order. There is a minimum order for parts ordered through a local HP sales and service office when the orders require billing and invoicing.
- Transportation charges are prepaid. A small handling charge is added to each order.
- No invoicing. A check or money order must accompany each order.
- Mail order forms and specific ordering information are available through your local Hewlett-Packard sales and service office. See the inside back cover of this guide for a list of Hewlett-Packard sales and service office locations and addresses.

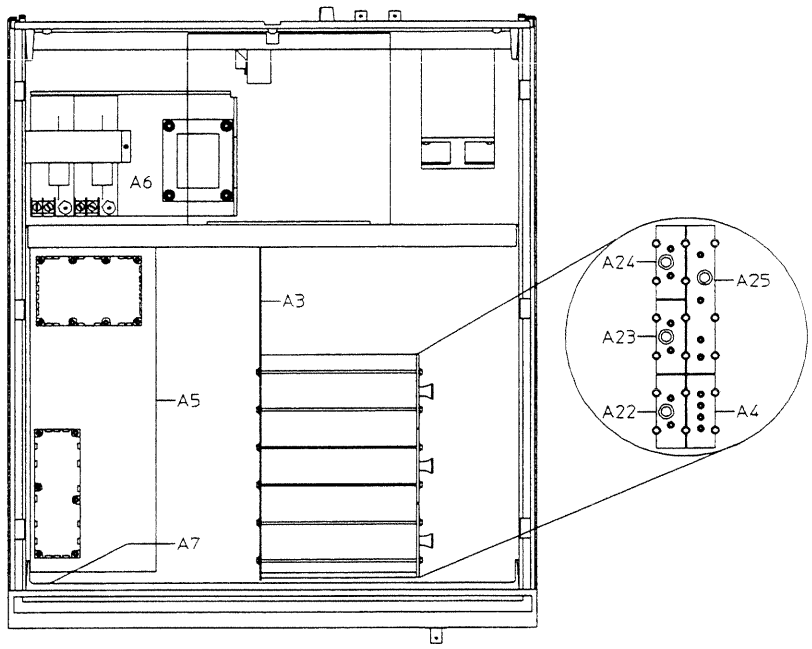
Code Numbers

The following table provides the name and address for the manufacturers' code numbers (Mfr Code) listed in the replaceable parts tables.

Mfr No.	Mfr Name	Address
02145	Raychem Corp.	Menlo Park, CA 94025 U.S.A.
03480	Heyco Molded Products	Kentworth, NJ 07033 U.S.A.
09328	Dreefs Switch Inc.	Waukegan, IL 60087 U.S.A.
12324	Catamount Manufacturing Inc.	Leominster, MA 01453 U.S.A.
12339	IMC Components Corp.	Chatsworth, CA 91311 U.S.A.
24931	Specialty Connector Co.	Franklin, IN 46131 U.S.A.
28480	Hewlett-Packard Company	Palo Alto, CA 94304 U.S.A.
30817	Instrument Specialties Co. Inc.	Placentia, CA 92670 U.S.A.
34785	Dek Inc.	St Charles, IL 60174 U.S.A.
56501	Thomas & Betts Corp.	Bridgewater, NJ 08807 U.S.A
57003	Chomerics Shielding Technology	Carson, CA 90745 U.S.A.
75915	Littelfuse Inc.	Des Plaines, IL 60016 U.S.A.
86928	Seastrom Mfg Co.	Glendale, CA 91201 U.S.A.
98291	ITT Sealectro	New Britain, CT 06051 U.S.A.

Assemblies

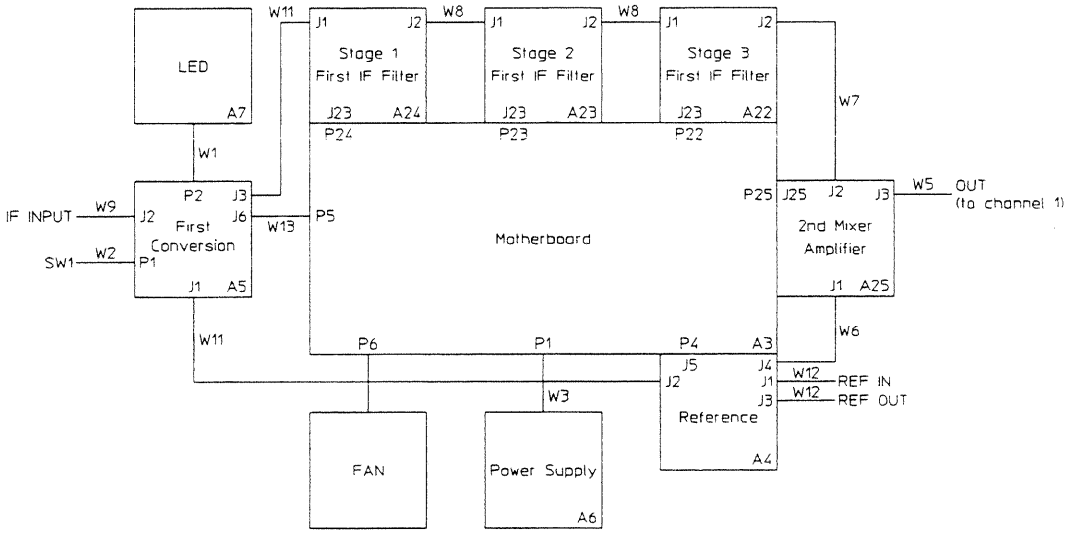
After replacing an assembly, see "What to do after replacing an assembly" in chapter 6 for required adjustments and performance tests.



Ref Des	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A3	89411-66503	5	1	PC_ASSY MOTHER BOARD	28480	89411-66503
A4	89411-66504	6	1	PC_ASSY REFERENCE PC ASSEMBLY	28480	89411-66504
A5	89411-69505	3	1	PC_ASSY 1ST CONVERSION	28480	89411-69505
A6	35689-67501	6	1	PWR +5VDC/+15VDC	28480	35689-67501
A7	89411-66507	9	1	PC_ASSY LED PC BOARD	28480	89411-66507
A22	89430-66523	2	3	PC_ASSY 2ND IF FILTER †	28480	89430-66523
A23	89430-66523	2	3	PC_ASSY 2ND IF FILTER †	28480	89430-66523
A24	89430-66523	2	3	PC_ASSY 2ND IF FILTER †	28480	89430-66523
A25	89430-66525	4	1	PC_ASSY 3RD MIXER/DETECTOR AMP †	28480	89430-66525

† Cover not included.

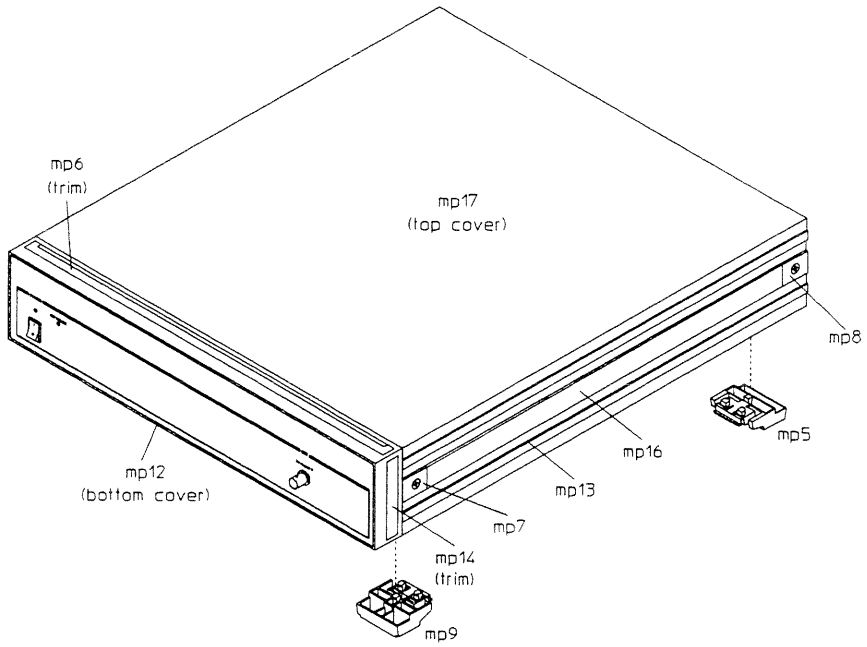
Cables



Ref Des	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
W1	89411-61601	4	1	CBL-ASM DSC	28480	89411-61601
W2	89411-61602	5	1	CBL-ASM DSC FHSG/SWT 630MM ML	28480	89411-61602
W3	89411-61603	6	1	CBL-ASM DSC FHSG/LVG 400MM ML	28480	89411-61603
W4	89411-61604	7	1	BL-ASM LINE MODULE	28480	89411-61604
W5	03562-61604	9	1	CBL-ASM CXL FSMB/FBNC 320MM VI	28480	03562-61604
W6	03577-61622	8	1	CBL-ASM CXL FSMB/FSMB 160MM YL	28480	03577-61622
W7	03577-61641	1	1	CBL-ASM CXL FSMB/FSMB 135MM OR	28480	03577-61641
W8	03585-61602	4	2	CBL-ASM CXL FSMB/FSMB 76MM RD	28480	03585-61602
W9	03585-61611	5	1	CBL-ASM CXL FSMB/FBNC 730MM GY	28480	03585-61611
W10	8120-1839	9	4	CABLE ASSY-COAX 50-OHM 24-IN-LG JGK	28480	8120-1839
W11	8120-5026	4	2	CBL-COAX	28480	8120-5026
W12	8120-5056	0	2	CBL-ASM COAX	28480	8120-5056
W13	8120-6198	3	1	CBL-ASM RBN 10 CND D.D.	28480	8120-6198

Instrument Covers and Handles

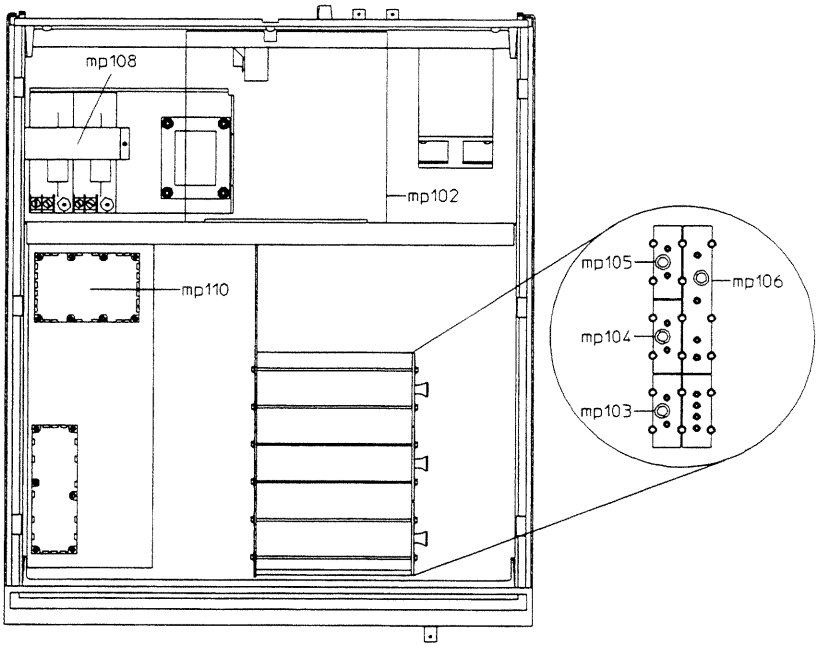
The reference designator for the screws that fasten MP7 and MP8 to the instrument is MP604.



Ref Des	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
MP5	5041-8801	8	2	MOLD FOOT II+	28480	5041-8801
MP6	5041-8802	9	1	MOLD TRM-TOP FM II+	28480	5041-8802
MP7	5041-8819	8	2	MOLD STRP HDL CAP FRT II+	28480	5041-8819
MP8	5041-8820	1	2	MOLD STRP HDL CAP RR II+	28480	5041-8820
MP9	5041-8822	3	2	MOLD FOOT-NON SKID II+	28480	5041-8822
MP12	5062-3747	5	1	SHTF CVR-BTM FM 497D II+ALV	28480	5062-3747
MP13	5062-3776	0	2	SHTF CVR-SD RS 88H497D II+ALV	28480	5062-3776
MP14	5001-0538	8	2	TRIM-FRT FRM SD 88.1H II+VYNL	28480	5001-0538
MP15	8160-0360	3	4	RFI ROUND STRIP STL MSH/SIL RBR SN-PL	57003	02-0101-0053-05
MP16	5062-3704	4	2	ASSY-SD HNDL 497D II+SSTP	28480	5062-3704
MP17	5062-3735	1	1	SHTF CVR-TOP FM 497D II+ALV	28480	5062-3735
MP18	8160-0689	9	2	STMP RFI GASKET.228LNG BECUZN	30817	0097-954-15
MP19	89430-01209	5	1	SHTF COVER-SHIELD MU	28480	89430-01209

Assembly Covers and Brackets

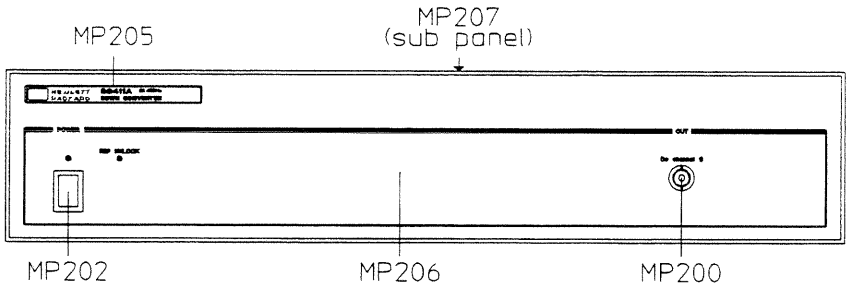
The reference designator for the screws that fasten MP106 to A25 is MP612. The reference designator for the screws that fasten MP103 to A22, MP104 to A23, MP105 to A24 is MP607. The reference designator for the nuts that fasten MP107 to the covers is MP609. The reference designators for the nuts and washers that attach to the gold connectors are MP615 and MP616. The reference designator for the screws that fasten the assemblies in the card nest is MP614. The reference designator for the screw that fastens MP108 to A6 is MP606 and to the side strut is MP602.



Ref Des	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
MP102	89411-64101	5	1	SHTF ASSY-SHIELD	28480	89411-64101
MP103	89411-04122	4	1	SHTF CVR-22 BD ALSK	28480	89411-04122
MP104	89411-04123	5	1	SHTF CVR-23 BD ALSK	28480	89411-04123
MP105	89411-04124	6	1	SHTF CVR-24 BD ALSK	28480	89411-04124
MP106	89411-04125	7	1	SHTF CVR-25 BD ALSK	28480	89411-04125
MP107	1400-0964	6	3	BRACKET-RTANG STL ZINC/CLEAR CHROMATE	28480	1400-0964
MP108	89411-01205	8	1	SHTF BKT-HOLDOWN AL	28480	89411-01205
MP110	89411-00602	7	1	SHTF SHIELD-05 BOARD AL	28480	89411-00602

Front Panel

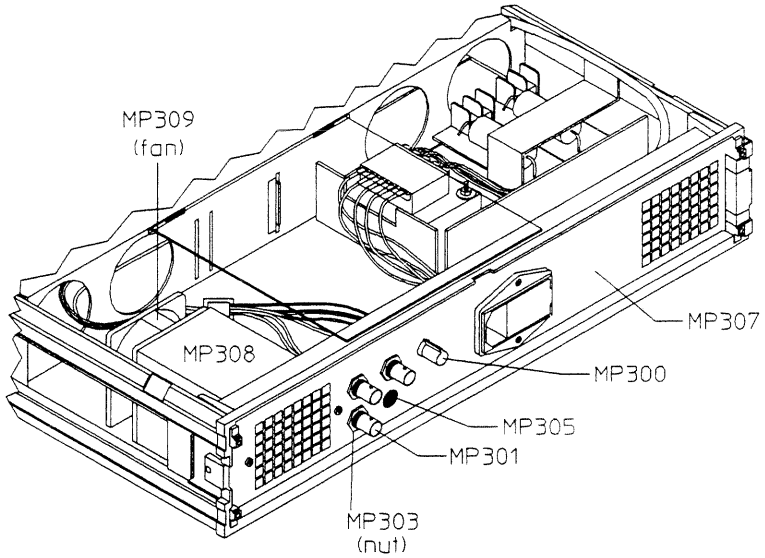
The reference designator for the nuts that fasten MP206 to MP207 is MP609. The reference designators for the washers used with MP201 to fasten the connector to MP206 and MP207 are MP610 and MP613. The reference designator for the screws that fasten A5 to MP207 is MP601. The reference designator for the screws that fasten MP207 to the frame is MP606.



Ref Des	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
MP200	1250-0102	5	1	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	24931	28JS109-1
MP201	2950-0054	1	1	NUT-HEX-DBL-CHAM 1/2-28-THD .125-IN-THK	28480	2950-0054
MP202	3101-3014	1	1	SW--RKR	09328	WI32/217MZ
MP205	89411-34301	4	1	PLT-NAME "89411" W/ADH,PNS,LOG	28480	89411-34301
MP206	89411-64301	7	1	PNL-FRT DRS"89411A" II+ALLM	28480	89411-64301
MP207	89411-00201	2	1	SHTF SUBPANEL AL	28480	89411-00201

Rear Panel

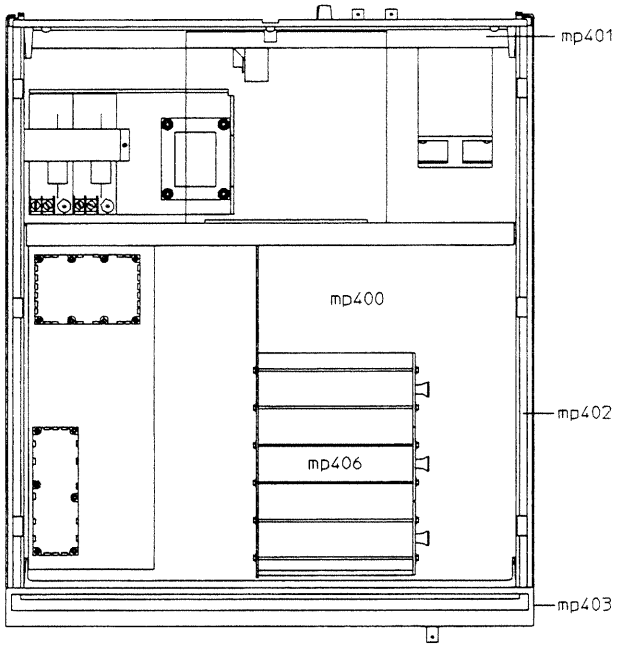
The reference designator for the screws that fasten MP307 to the frame is MP600. The reference designator for the washers used with MP303 is MP611. The reference designator for the nuts that fasten the line module (W4) to MP307 is MP609. The reference designator for the screws that fasten MP308 to MP309 and MP307 is MP600.



Ref Des	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
MP300	0370-1005	2	1	KNOB-BASE-PTR 3/8 JGK .125-IN-ID	28480	0370-1005
MP301	1250-0252	6	1	CONNECTOR-RF BNC FEM SGL-HOLE-RR 50-OHM	24931	28JS108-1
MP303	2950-0035	8	3	NUT-HEX-DBL-CHAM 15/32-32-THD	28480	2950-0035
MP305	6960-0041	1	1	PLUG-HOLE FL-HD FOR .5-D-HOLE NYL	03480	2643 (BLACK)
MP307	89411-00202	3	1	SHTF PANEL-REAR ALSK	28480	89411-00202
MP308	89411-60103	9	1	SHTF ASSY-FAN PLENUM AL	28480	89411-60103
MP309	3160-0833	0	1	FAN-ASM,W/LEADS & CON	12339	2410 NL 04W B40 P00

Chassis

The reference designator for the screws that fasten MP406 to A3 is MP605. The reference designator for the screws that fasten MP402 to MP401 and MP403 is MP608. The reference designator for the screws that fasten MP400 to MP402 is MP602. The reference designator for the screws that fasten A6 to MP400 is MP603. The reference designator for the screws that fasten MP406 to MP400 is MP617. The reference designator for the screws that fasten A7 to MP400 is MP601 .



Ref Des	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
MP400	89411-60101	7	1	SHTF ASSY-CHASSIS AL	28480	89411-60101
MP401	5021-5802	1	1	CSTG FRM-RR FM 88.1H II AL	28480	5021-5802
MP402	5021-5832	7	2	CSTG STRT-SD 88H 497D II AL	28480	5021-5832
MP403	5021-8401	2	1	CSTG FRM-FRT FM 88.1H II+ALPT	28480	5021-8401
MP404	02932-80078	7	1	GSKT FOAM-12.7MM	28480	02932-80078
MP405	0460-2362	7	2	TAPE-NSLSHN 1.0WX.12TK	28480	0460-2362
MP406	89411-60102	8	1	MCHD-XTRU CD NEST	28480	89411-60102

Screws, Washers, and Nuts

Ref Des	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
MP600	0515-0372	2	12	SCREW-MACHINE ASSEMPLY M3 X 0.5 8MM-LG	28480	0515-0372
MP601	0515-0430	3	8	SCREW-MACHINE ASSEMPLY M3 X 0.5 6MM-LG	28480	0515-0430
MP602	0515-0433	6	15	SCREW-MACHINE ASSEMPLY M4 X 0.7 8MM-LG	28480	0515-0433
MP603	0515-0686	1	4	SCREW-MACH M4 X 0.7 20MM-LG PAN-HD	28480	0515-0686
MP604	0515-1132	4	4	SCREW-MACH M5 X 0.8 10MM-LG	28480	0515-1132
MP605	0515-1821	8	18	SCR-TPG M3.0 11MMLG HH STZN	28480	0515-1821
MP606	0515-1946	8	9	SCR-MCH M3.0 6MMLG FHTX SST	28480	0515-1946
MP607	0515-2035	8	3	SCR-MCH M3.0 16MMLG FHTX SST *	28480	0515-2035
MP608	0515-2086	9	8	SCR-SPC M4.0 7MMLG FHTX SST	28480	0515-2086
MP609	0535-0031	2	5	NUT-HEX W/LKWR M3 X 0.5 2.4MM-THK	28480	0535-0031
MP610	2190-0068	5	1	WASHER-LK INTL T 1/2 IN .505-IN-ID	28480	2190-0068
MP611	2190-0099	2	3	WASHER-LK INTL T 7/16 IN .472-IN-ID	28480	2190-0099
MP612	0515-2411	4	5	SCR-MCH M2.5 5MMLG PHTX SST+	28480	0515-2411
MP613	3050-0604	0	1	WASHER-FL MTLC 7/16 IN .5-IN-ID	86928	5710-94-16
MP614	0624-0653	3	18	SCR-TPG 4-40 .50LG PHTX STZN	28480	0515-2411
MP615	2190-0124	4	5	WASHER-LK INTL T NO. 10 .195-IN-ID	98291	3002-26
MP616	2950-0078	9	5	NUT-HEX-DBL-CHAM 10-32-THD .067-IN-THK	98291	40001-18-030-156
MP617	0515-0375	5	3	SCREW-MACHINE ASSEMPLY M3 X 0.5 16MM-LG	28480	0515-0375

Miscellaneous

Ref Des	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
MP701	0400-0082	8	1	GROMMET-CHAN NCH .09-IN-GRV-WD	12324	GSNY-085-9
MP702	1400-0249	0	2	CABLE TIE .062-.625-DIA .091-WD NYL	56501	TY-23M-8
MP703	1400-1229	8	6	CLAMP-CABLE .375-DIA 1-WD NYL	34785	021-0375
MP704	0890-0100	8	0	TUBING-HS .093-D/.046-RCVD .02-WALL	02145P02	VERSAFIT-3/32-WHT
	2110-0001	8	1	FUSE 1A 250V NTD 1.25X.25 UL	75915	312 001
	2110-0012	1	1	FUSE 500 mA 250V NTD 1.25X.25 UL	75915	312.500

8

Circuit Descriptions

Circuit Descriptions

This chapter contains the overall instrument description and individual assembly descriptions for the HP 89411A 21.4 MHz Down Converter. The overall instrument description describes the instrument's overall block diagram. The assembly descriptions give additional information for each assembly. For signal descriptions and information on voltage and signal distribution, see chapter 9, "Voltages and Signals."

Overall Instrument Description

The HP 89411A 21.4 MHz Down Converter converts the 21.4 MHz IF output of a spectrum analyzer to a 5.6 MHz baseband input for the HP 89410A, HP 89440A, or HP 89441A Vector Signal Analyzer. This allows the vector signal analyzer to analyze signals in the frequency range of an RF or microwave-frequency spectrum analyzer. The down converter uses the spectrum analyzer's 10 MHz frequency reference to generate its internal frequency references and the external frequency reference for the vector signal analyzer.

Block Diagram

The following figure shows the overall block diagram for the HP 89411A 21.4 MHz Down Converter. Each block in the diagram represents a function performed in the instrument. The assembly that performs the function is listed in the block.

First Mixer — Mixes the spectrum analyzer's 21.4 MHz IF signal with 67 MHz. A filter attenuates the sum frequency and passes the 45.6 MHz difference frequency to the Stage 1 First IF Filter.

Stage 1, Stage 2, and Stage 3 First IF Filters — Filter the 45.6 MHz first IF signal.

2nd Mixer Amplifier — Mixes the 45.6 MHz first IF signal with 40 MHz. A filter attenuates the sum frequency and passes the 5.6 MHz second IF signal to the front-panel OUT connector. The OUT signal is the input signal for the vector signal analyzer.

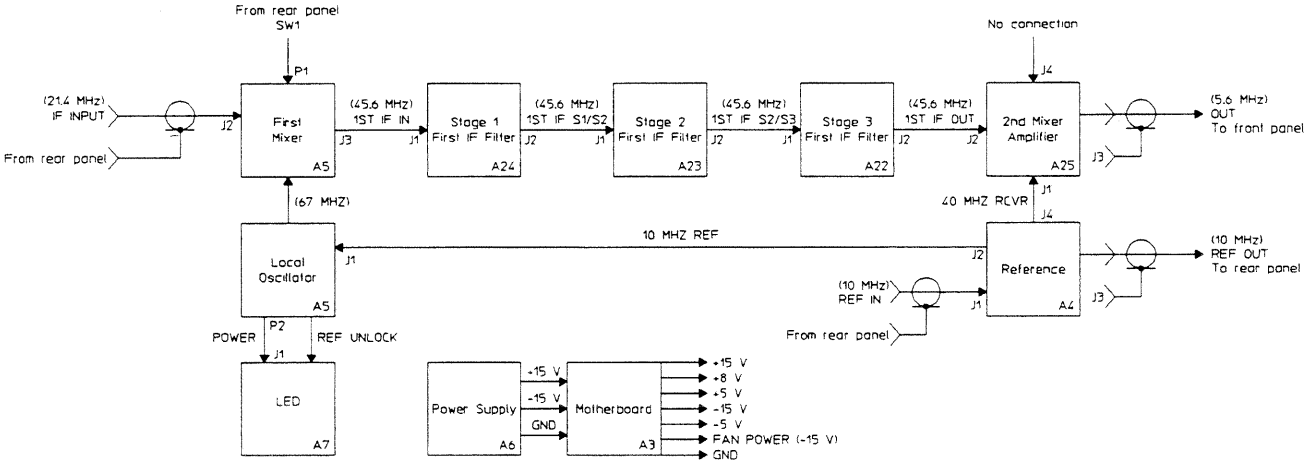
Reference — Generates the 40 MHz and 10 MHz reference signals using the spectrum analyzer's 10 MHz frequency reference. The REF OUT signal is the frequency reference for the vector signal analyzer.

Local Oscillator — Generates a 67 MHz signal that is phase locked to the 10 MHz external reference.

LED — Indicates when the power is on and the local oscillator is unlocked.

Power Supply — Provides +15 V and –15 V to the Motherboard.

Motherboard — Decouples and regulates the voltages providing the dc voltages shown in the diagram. See "A3 Motherboard" in chapter 9 for further information.



Overall Block Diagram

A3 Motherboard

The Motherboard decouples and regulates +15 V and –15 V from the A6 Power Supply assembly and provides a common point of contact for voltage distribution. The Motherboard provides +15 V, +8 V, +5 V, –15 V, FAN POWER (–15 V), and –5 V to various assemblies. See "A3 Motherboard" in chapter 9 for a list of the assemblies that use each voltage.

A4 Reference

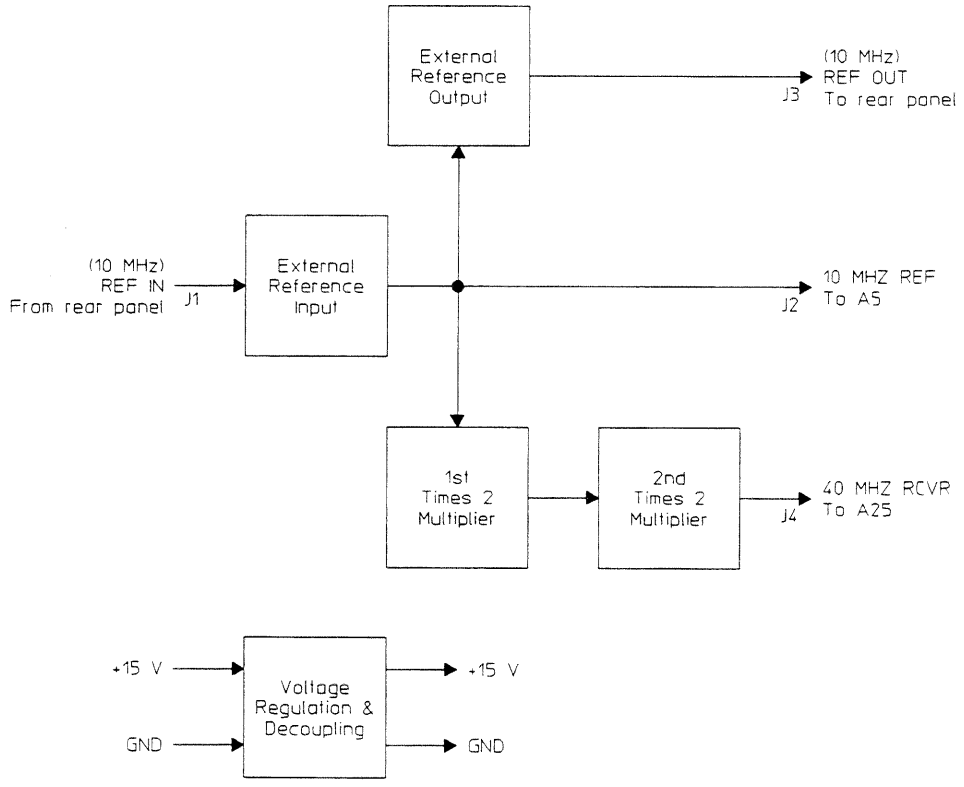
The Reference assembly provides the spectrum analyzer's 10 MHz frequency reference to the A5 First Conversion assembly and to the vector signal analyzer. The Reference assembly also uses the 10 MHz frequency reference to generate the 40 MHz signal for the A25 2nd Mixer Amplifier assembly.

External Reference Input Limits and conditions the 10 MHz external reference. The RF or microwave-frequency spectrum analyzer provides the 10 MHz external reference. A BNC cable connects the 10 MHz external reference to the down converter's REF IN connector.

External Reference Output Amplifies the 10 MHz external reference for the external reference output. A BNC cable connects the REF OUT connector to the vector signal analyzer's EXT REF IN connector.

1st Times 2 Multiplier Multiplies the 10 MHz external reference by 2.

2nd Times 2 Multiplier Multiplies the resulting 20 MHz signal by 2 providing 40 MHz to the A25 2nd Mixer Amplifier assembly.



A4 Reference Block Diagram

A5 First Converter

The First Converter assembly performs the first frequency conversion on the 21.4 MHz IF input signal. This assembly generates a 67 MHz signal and mixes it with the 21.4 MHz IF signal.

21.4 MHz Bandpass Filter Filters the 21.4 MHz IF signal from the RF or microwave-frequency spectrum analyzer. A BNC cable connects the spectrum analyzer's 21.4 MHz IF signal to the down converter's IF INPUT connector.

5 dB Step Attenuator Provides 0 to 15 dB of attenuation in 5 dB steps. A switch on the rear panel controls which path the 21.4 MHz IF signal is routed through. Setting the switch to +5 bypasses all attenuator pads, resulting in +5 dB overall gain for the down converter. Setting the switch to 0 routes the signal through a 5 dB attenuator pad, resulting in 0 dB overall gain for the down converter. Setting the switch to –5 routes the signal through a 10 dB attenuator pad, resulting in –5 dB overall gain for the down converter. Setting the switch to –10 routes the signal through both the 5 dB and 10 dB attenuator pad, resulting in –10 dB overall gain for the down converter.

First Mixer Mixes the 21.4 MHz IF signal with a 67 MHz signal. The result of this mixing is the 88.4 MHz sum frequency and the 45.6 MHz difference frequency.

Low Pass Filter Attenuates the 88.4 MHz sum frequency and other unwanted mixing products and passes the 45.6 MHz difference frequency to the A24 Stage 1 First IF Filter assembly.

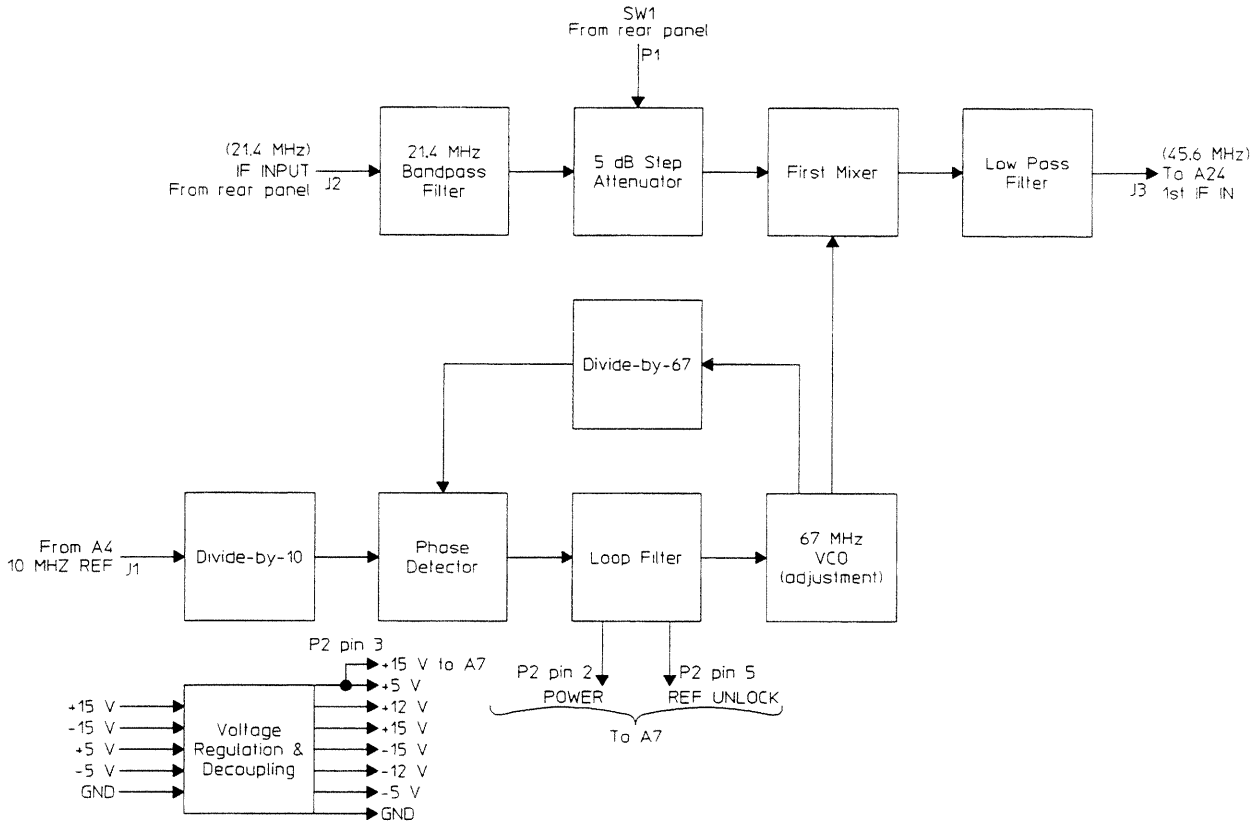
Divide-by-10 Divides the 10 MHz reference signal down to 1 MHz.

Phase Detector Compares the phase of the signal from the Divide-by-10 with the phase of the signal from the Divide-by-67 and generates a voltage relative to the phase difference.

Loop Filter Amplifies and integrates the phase difference voltage, creating the control voltage for the 67 MHz VCO. This circuit also provides the control lines for the A7 LED assembly.

67 MHz VCO Generates the 67 MHz signal. When an external frequency reference is present, feedback phase-locks the 67 MHz VCO to the external reference. This circuit also contains a center frequency adjustment for the VCO.

Divide-by-67 Divides the 67 MHz signal down to 1 MHz.



A5 First Converter Block Diagram

A6 Power Supply

The Power Supply assembly provides +15 and –15 volts to the Motherboard. The Motherboard decouples and regulates the voltages providing +15 V, +8 V, +5 V, –15 V, FAN POWER (–15 V), and –5 V to various assemblies. See "Voltages" in chapter 9 for a list of the assemblies that use each voltage.

A7 LED

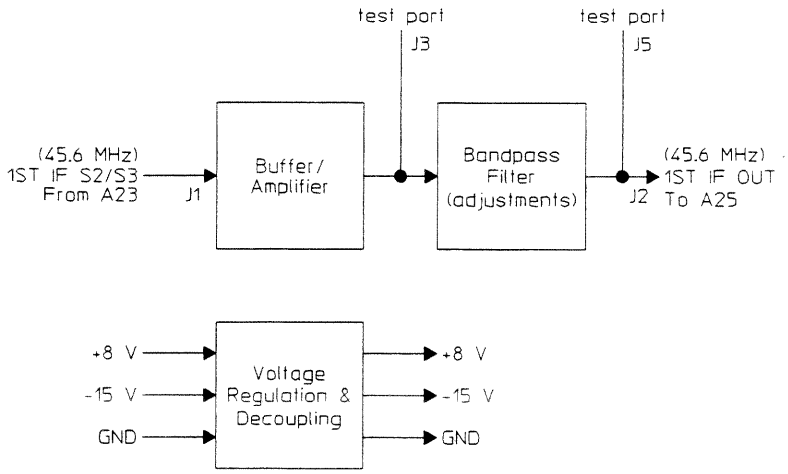
The LED assembly contains a green LED that is lit when the instrument is on and an amber LED that is lit when the local oscillator is unlocked. The A5 First Converter assembly provides +15 V and the control lines.

A22 Stage 3 First IF Filter

The Stage 3 First IF Filter assembly along with the Stage 1 and Stage 2 First IF Filter assemblies provide bandpass filtering for the 45.6 MHz first IF signal.

Buffer/Amplifier Provides impedance buffering and amplification.

Bandpass Filter Attenuates signals outside the 42 to 50 MHz passband. This circuit contains service adjustments.



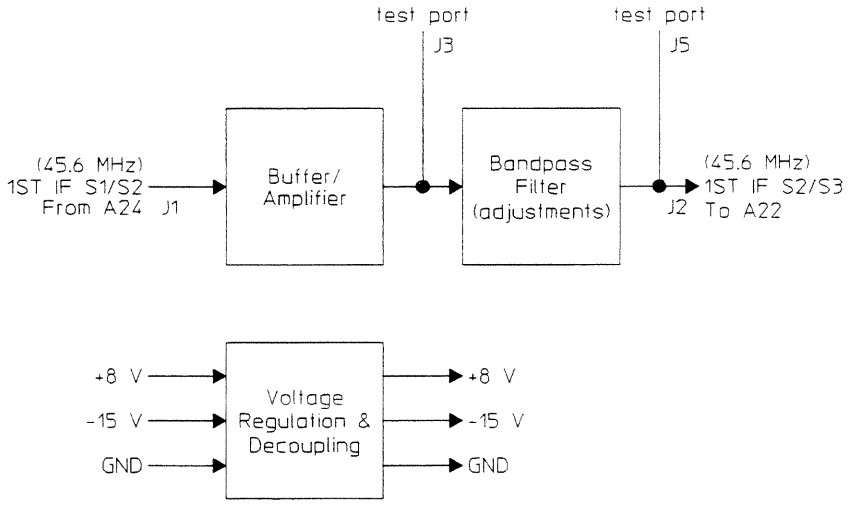
A22 Stage 3 Second IF Block Diagram

A23 Stage 2 First IF Filter

The Stage 2 First IF Filter assembly along with the Stage 1 and Stage 3 First IF Filter assemblies provide bandpass filtering for the 45.6 MHz first IF signal.

Buffer/Amplifier Provides impedance buffering and amplification.

Bandpass Filter Attenuates signals outside the 42 to 50 MHz passband. This circuit contains service adjustments.



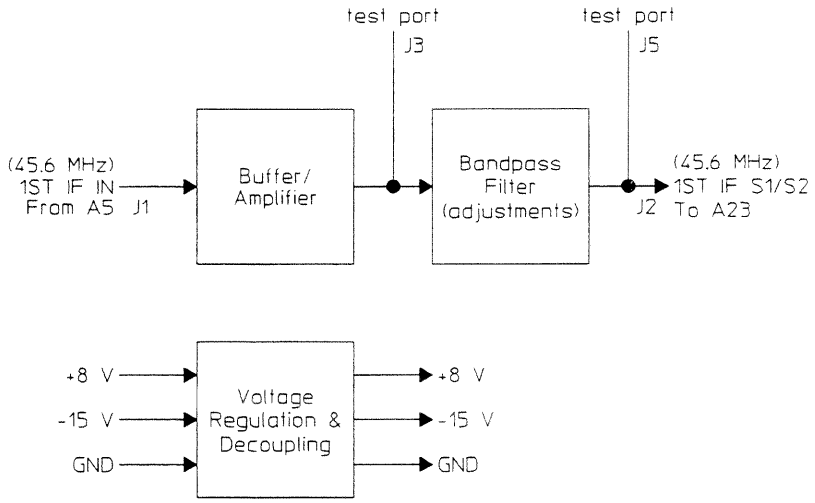
A23 Stage 2 Second IF Block Diagram

A24 Stage 1 First IF Filter

The Stage 1 First IF Filter assembly along with the Stage 2 and Stage 3 First IF Filter assemblies provide bandpass filtering for the 45.6 MHz first IF signal.

Buffer/Amplifier Provides impedance buffering and amplification.

Bandpass Filter Attenuates signals outside the 42 to 50 MHz passband. This circuit contains service adjustments.



A24 Stage 1 Second IF Block Diagram

A25 2nd Mixer Amplifier

The 2nd Mixer Amplifier assembly performs the final frequency conversion on the IF input signal. This assembly mixes the 45.6 MHz first IF with 40 MHz, generating the 5.6 MHz baseband input for the vector signal analyzer.

Buffer

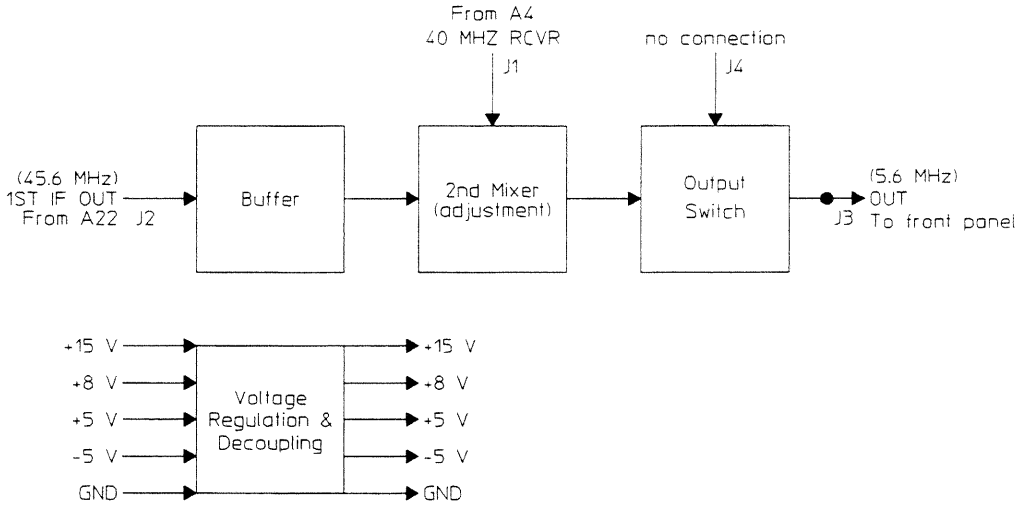
Buffers the 45.6 MHz first IF signal.

2nd Mixer

Mixes the 45.6 MHz first IF signal with 40 MHz. A low pass filter attenuates the 85.6 MHz sum frequency and passes the 5.6 MHz difference frequency to the Output Switch. This circuit also contains a service adjustment for receiver gain.

Output Switch

Routes the 5.6 MHz second IF signal to the front-panel OUT connector. A BNC cable connects the OUT connector to the CHANNEL 1 connector on the vector signal analyzer.



A25 2nd Mixer Amplifier Block Diagram

9

Voltages and Signals

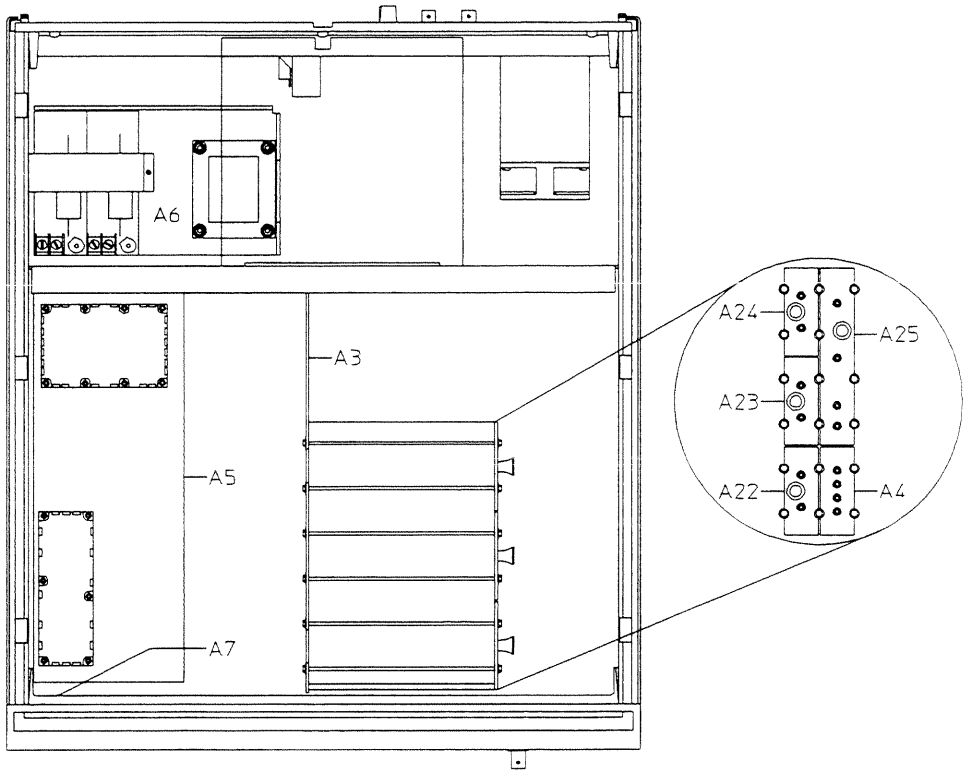
Voltages and Signals

This chapter shows where the signals and voltages are used in the HP 89411A 21.4 MHz Down Converter and describes each signal.

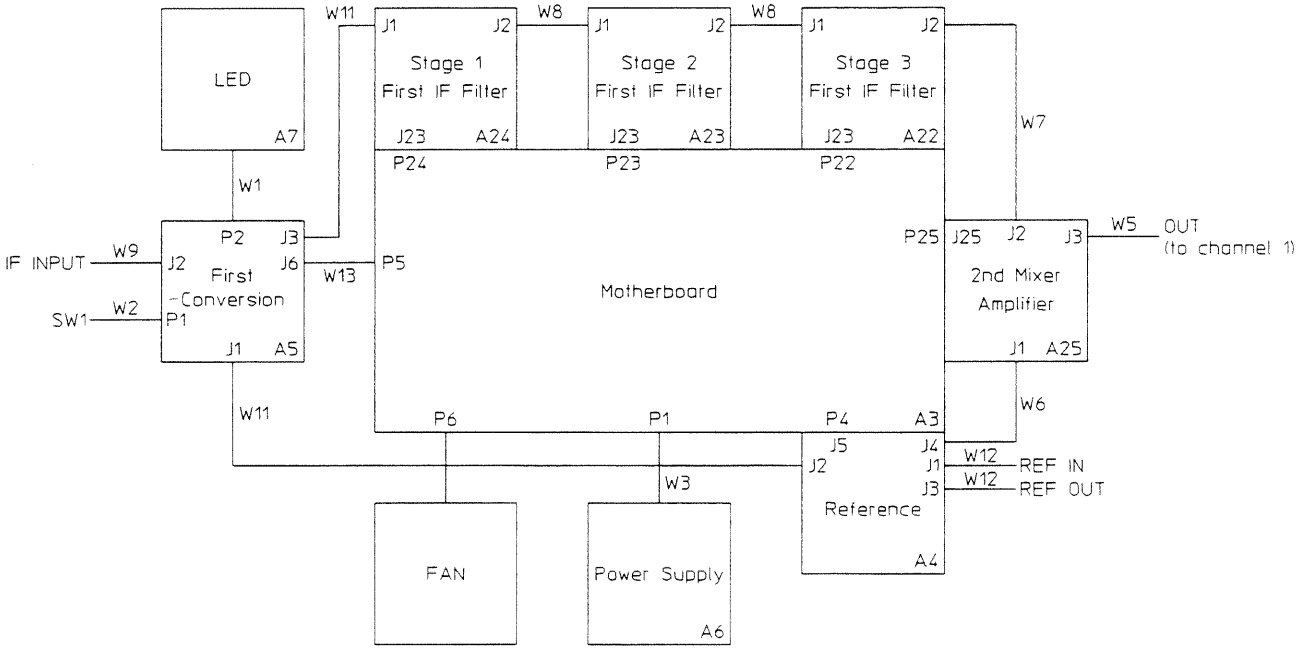
Assembly Locations and Connections

The following figures show the assembly locations and assembly connections.

A3 Motherboard
A4 Reference
A5 First Conversion
A6 Power Supply
A7 LED
A22 Stage 3 First IF Filter
A23 Stage 2 First IF Filter
A24 Stage 1 First IF Filter
A25 2nd Mixer Amplifier



Assembly Locations



Assembly Connections

Motherboard

The following table shows the voltages at each A3 Motherboard connector. The A6 Power Supply assembly supplies +15 V and –15 V to the Motherboard. The Motherboard decouples and regulates the voltages to +15 V, +8 V, +5 V, –15 V, FAN POWER (–15 V), and –5 V. The Motherboard then distributes these voltages to all the assemblies. Some assemblies use the voltages as supplied by the Motherboard. However, most assemblies contain voltage regulation and voltage decoupling circuits to provide additional regulation and decoupling for their own use.

	Assembly							
	A4	**A5**	**A6**	**A22**	**A23**	**A24**	**A25**	**Fan**
	Motherboard Connector							
	P4	**P5**	**P1**	**P22**	**P23**	**P24**	**P25**	**P6**
Voltage	**Connector Pin Number**							
+15 V	11-12	7	4				1-2	
–15 V	15-16	10	2	15-16	15-16	15-16	9-10	
FAN POWER (–15 V)								2
+8 V				19-20	19-20	19-20	5-6	
+5 V		1					17-18	
–5 V		4					13-14	
GND	1-2 4 6-10 13-14 17-20	3 5-6 8-9	1 3 5	1-14 17-18	1-14 17-18	1-14 17-18	3-4 7-8 11-12 15-16 20	1
No Connection	3 5	2					9-10 19	

Cables

Signals and voltages routed through cables are shown in the following table. The table shows signals routed to the connectors on the front and rear panels and signals routed from one assembly to another. The table shows where the cables are connected and uses bold face type to show where the signal is generated.

Measurements given in dBm are terminated in 50 ohms unless stated otherwise.

Signal Name	Assembly and Connector									Cable Color
	A4	A5	A7	A22	A23	A24	A25	Front Panel	Rear Panel	
+15 V		**P2 pin 3**	J1 pin 3							green
10 MHZ REF	**J2**	J1								gray
1ST IF IN		**J3**				J1				gray
1ST IF OUT				**J2**			J2			orange
1ST IF S1/S2					J1	**J2**				red
1ST IF S2/S3				J1	**J2**					red
40 MHZ RCVR	**J4**						J1			yellow
IF INPUT		J2							**IF INPUT**	gray
OUT							**J3**	OUT		purple
POWER		**P2 pin 2**	J1 pin 2							brown
REF IN	J1								**REF IN**	gray
REF OUT	**J3**								REF OUT	gray
REF UNLOCK		**P2 pin 5**	J1 pin 5							white
SW1		P1							**CONVERSION GAIN**	yellow/ purple/blue/ brown

+15 V

+15 volts — This line provides the power for the A7 LED assembly.

10 MHZ REF

10 MHz Reference — This is a 10 MHz reference for the A5 First Converter assembly's local oscillator circuits. This allows the local oscillator to phase lock to the external reference.

1ST IF IN — 1st IF Input — This is a 45.6 MHz signal with a nominal full-scale amplitude of –40 dBm. This is the input signal for the A24 Stage 1 First IF Filter assembly.

1ST IF OUT — 1st IF Output — This is a 45.6 MHz signal with a nominal full-scale amplitude of –40 dBm. This is the input signal for the A25 2nd Mixer Amplifier assembly.

1ST IF S1/S2 — 1st IF Stage1/Stage2 — This is a 45.6 MHz signal with a nominal full-scale amplitude of –40 dBm. This is the input signal for the A23 Stage 2 First IF Filter assembly.

1ST IF S2/S3 — 1st IF Stage2/Stage3 — This is a 45.6 MHz signal with a nominal full-scale amplitude of –40 dBm. This is the input signal for the A22 Stage 3 First IF Filter assembly.

40 MHZ RCVR — 40 MHz to Receiver — This is a 40 MHz, +3 dBm, ac-coupled sine wave. The A25 2nd Mixer Amplifier assembly mixes this signal with 1ST IF OUT.

IF INPUT — IF Input — This is the 21.4 MHz IF output of an RF or microwave spectrum analyzer. A BNC cable connects the spectrum analyzer's IF output to the down converter's IF INPUT connector.

OUT — Receiver Output — This is a 5.6 MHz signal. A BNC cable connects the down converter's OUT connector to the vector signal analyzer's CHANNEL 1 connector. The converted input signal is –25 dBm full scale (–40 dBm IF INPUT).

POWER — Power — This line turns on the green POWER LED. The POWER LED is on when the instrument is on (1).

REF IN — Reference Input — This is the 10 MHz external reference input for the down converter. A BNC cable connects the RF or microwave-frequency analyzer's external reference output to the down converter's REF IN connector.

REF OUT — Reference Output — This is the 10 MHz external reference input for the vector signal analyzer. A BNC cable connects the down converter's REF OUT connector to the vector signal analyzer's EXT REF IN connector.

REF UNLOCK — Reference Unlocked — This line turns on the amber REF UNLOCK LED. The REF UNLOCK LED is on when the A5 First Converter assembly's local oscillator is unlocked.

SW1 — Switch 1 — These lines select or bypass the 5 and 10 dB attenuator pads on the A5 First Converter assembly. When SW1 is set to –10 dB, pins 3, 4, and 5 are TTL low and the 21.4 MHz IF signal is routed through the 5 and 10 dB attenuator pads. When SW1 is set to –5 dB, pin 3 is a TTL high and the signal is routed through the 10 dB attenuator pad. When SW1 is set to 0 dB, pin 4 is a TTL high and the signal is routed through a 5 dB attenuator pad. When SW1 is set to +5 dB, pin 5 is a TTL high and the signal bypasses all attenuator pads.

10

Backdating

Backdating

This chapter provides information necessary to modify this manual for instruments that differ from those currently being produced. The information in this chapter documents earlier instrument configurations and associated servicing procedures.

With the information provided in this chapter, this manual can be corrected so that it applies to any earlier version or configuration of the instrument.

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Declaration of Conformity

According to ISO/IEC Guide 22 and EN 45014

Manufacturer's name:	Hewlett-Packard Company
Manufacturer's address:	Lake Stevens Instrument Division 8600 Soper Hill Road Everett, Washington 98205-1298

declares, that the product

Product Name:	Down Converter
Model Number:	HP 89411A

conforms to the following specifications:

Safety:	IEC 348/HD401
EMC:	CISPR 11: 1990/EN55011 (1991), Group1, Class A
	IEC 801-2: 1991/EN50082-1 (1992): 4 kV CD, 8 kV AD
	IEC 801-3: 1984/EN50082-1 (1992): 3 V/m (1)
	IEC 801-4: 1988/EN50082-1 (1992): 1 kV

Supplementary Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC

(1) In a 3 V/m field, some degradation of product performance occurs.

Everett, Washington - March 11, 1993

Larry Bennett, Product Services Manager

Need Assistance?

If you need assistance, contact your nearest Hewlett-Packard Sales and Service Office listed in the HP Catalog, or contact your nearest regional office listed at the back of this guide. If you are contacting Hewlett-Packard about a problem with your HP 89411A Down Converter, please provide the following information:

- ❑ Model number: HP 89411A
- ❑ Serial number:
- ❑ Date the problem was first encountered:
- ❑ Circumstances in which the problem was encountered:
- ❑ Can you reproduce the problem?
- ❑ What effect does this problem have on you?

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