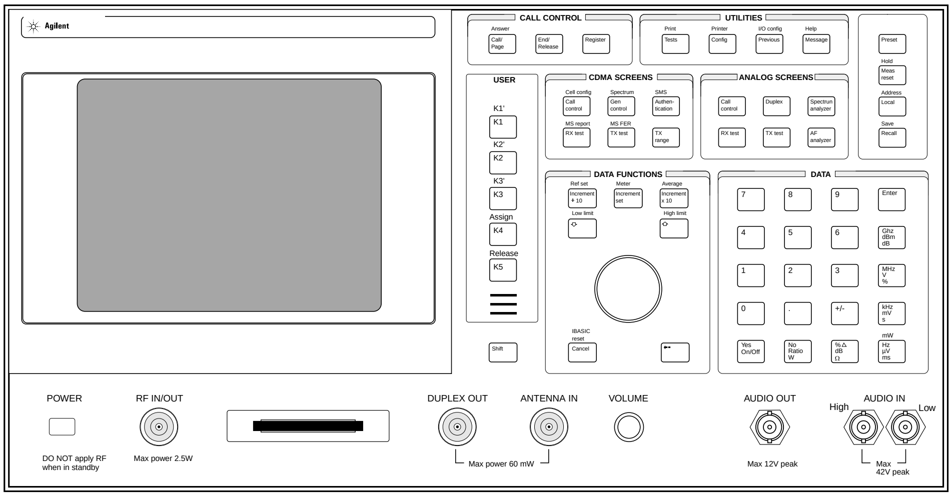
Agilent Technologies E8285A CDMA Mobile Station Test Set

Assembly Level Repair

Firmware Version: A.01.29 and above



Agilent Part Number E8285-90033

Revision A

Printed in U.S.A.

October 1999

Agilent Technologies
Innovating the HP Way

Notice

Manufacturer's Declaration

This statement is provided to comply with the requirements of the German Sound Emission Directive, from 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB(A).

- Sound Pressure Lp < 70 dB(A).
- At Operator Position.
- Normal Operation.
- According to ISO 7779:1988/EN 27779:1991 (Type Test).

Herstellerbescheinigung

Diese Information steht im Zusammenhang mit den Anforderungen der Maschinenlärminformationsverordnung vom 18 Januar 1991.

- Schalldruckpegel Lp < 70 dB(A).
- Am Arbeitsplatz.
- Normaler Betrieb.
- Nach ISO 7779:1988/EN 27779:1991 (Typprüfung).

Safety Considerations

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product has been designed and tested in accordance with IEC Publication 1010, "Safety Requirements for Electronic Measuring Apparatus," and has been supplied in a safe condition. This instruction documentation contains information and warnings which must be followed by the user to ensure safe operation and to maintain the product in a safe condition.

SAFETY EARTH GROUND

A uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set.

CHASSIS GROUND TERMINAL

To prevent a potential shock hazard, always connect the rear-panel chassis ground terminal to earth ground when operating this instrument from a dc power source.

SAFETY SYMBOLS

Indicates instrument damage can occur if indicated operating limits are exceeded. Refer to the instructions in this guide.

Indicates hazardous voltages.

Indicates earth (ground) terminal

WARNING

A WARNING note denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

A CAUTION note denotes a hazard. It calls attention to an operation procedure, practice, 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. Do not proceed beyond an CAUTION note until the indicated conditions are fully understood and met.

Safety Considerations for this Instrument

WARNING

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

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an autotransformer (for voltage reduction), make sure the common terminal is connected to the earth terminal of the power source.

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

No operator serviceable parts in this product. Refer servicing to qualified personnel. To prevent electrical shock, do not remove covers.

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

The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the product from all voltage sources while it is being opened.

Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

The power cord is connected to internal capacitors that my remain live for 5 seconds after disconnecting the plug from its power supply.

For Continued protection against fire hazard, replace the line fuse(s) only with 250 V fuse(s) or the same current rating and type (for example, normal blow or time delay). Do not use repaired fuses or short circuited fuseholders.

CAUTION

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

This product is designed for use in Installation Category II and Pollution Degree 2 per IEC 1010 and IEC 664 respectively. For indoor use only.

This product has autoranging line voltage input, be sure the supply voltage is within the specified range.

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

Product Markings

CE - the CE mark is a registered trademark of the European Community. A CE mark accompanied by a year indicated the year the design was proven.

CSA - the CSA mark is a registered trademark of the Canadian Standards Association.

Agilent Technologies Warranty Statement for Commercial Products

E8285A CDMA Mobile Station Test Set

Duration of Warranty: One Year

1. Agilent warrants Agilent hardware, accessories and supplies against defects in materials and workmanship for the period specified above. If Agilent receives notice of such defects during the warranty period, Agilent will, at its option, either repair or replace products which prove to be defective. Replacement products may be either new or like-new.
2. Agilent warrants that Agilent software will not fail to execute its programming instructions, for the period specified above, due to defects in material and workmanship when properly installed and used. If Agilent receives notice of such defects during the warranty period, Agilent will replace software media which does not execute its programming instructions due to such defects.
3. Agilent does not warrant that the operation of Agilent products will be uninterrupted or error free. If Agilent is unable, within a reasonable time, to repair or replace any product to a condition as warranted, customer will be entitled to a refund of the purchase price upon prompt return of the product.
4. Agilent products may contain remanufactured parts equivalent to new in performance or may have been subject to incidental use.
5. The warranty period begins on the date of delivery or on the date of installation if installed by Agilent. If customer schedules or delays Agilent installation more than 30 days after delivery, warranty begins on the 31st day from delivery.
6. Warranty does not apply to defects resulting from (a) improper or inadequate maintenance or calibration, (b) software, interfacing, parts or supplies not supplied by Agilent, (c) unauthorized modification or misuse, (d) operation outside of the published environmental specifications for the product, or (e) improper site preparation or maintenance.
7. TO THE EXTENT ALLOWED BY LOCAL LAW, THE ABOVE WARRANTIES ARE EXCLUSIVE AND NO OTHER WARRANTYOR CONDITION, WHETHER WRITTEN OR ORAL IS EXPRESSED OR IMPLIED AND AGILENT SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OR CONDITIONS OR MERCHANTABILITY, SATISFACTORY QUALITY, AND FITNESS FOR A PARTICULAR PURPOSE.

8. Agilent will be liable for damage to tangible property per incident up to the greater of $300,000 or the actual amount paid for the product that is the subject of the claim, and for damages for bodily injury or death, to the extent that all such damages are determined by a court of competent jurisdiction to have been directly caused by a defective Agilent product.

9. TO THE EXTENT ALLOWED BY LOCAL LAW, THE REMEDIES IN THIS WARRANTY STATEMENT ARE CUSTOMER'S SOLE AND EXCLUSIVE REMEDIES. EXCEPT AS INDICATED ABOVE, IN NO EVENT WILL AGILENT OR ITS SUPPLIERS BE LIABLE FOR LOSS OF DATA OR FOR DIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL (INCLUDING LOST PROFIT OR DATA), OR OTHER DAMAGE, WHETHER BASED IN CONTRACT, TORT, OR OTHERWISE.

   FOR CONSUMER TRANSACTIONS IN AUSTRALIA AND NEW ZEALAND: THE WARRANTY TERMS CONTAINED IN THIS STATEMENT, EXCEPT TO THE EXTENT LAWFULLY PERMITTED, DO NOT EXCLUDE RESTRICT OR MODIFY AND ARE IN ADDITION TO THE MANDATORY STATUTORY RIGHTS APPLICABLE TO THE SALE OF THIS PRODUCT TO YOU.

DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: **Agilent Technologies**

Manufacturer's Address:

Spokane Division
24001 E. Mission Avenue
Liberty Lake, Washington 99019-9599
USA

declares that the product

Product Name: CDMA Mobile Station Test Set

Model Number: Agilent Technologies E8285A

Product Options: All

conforms to the following Product specifications:

Safety: IEC 61010-1:1990+A1+A2 / EN 61010-1:1993+A2

EMC: CISPR 11:1990/EN 55011:1991- Group 1, Class A
IEC 61000-3-2:1995 / EN 61000-3-2: 1995
EN 50082-1:1992
IEC 801-3:1984 3V/m
IEC 801-4:1988 0.5 kV Sig. Lines, 1 kV Power Lines

Supplementary Information:

This product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE-marking accordingly.

Spokane, Washington USA November 20,1998

Vince Roland
Reliability & Regulatory
Engineering Manager

European Contact: Your local Agilent Technologies and Service Office or Agilent Technologies GmbH Department ZQ/Standards Europe, Herrenberger Strasse 130, D-71034 Böblinger, Germany (FAX+49-7031-14-3143)

Table 1

United States of America: Agilent Technologies Test and Measurement Call Center P.O. Box 4026 Englewood, CO 80155-4026 (tel) 1 800 452 4844	Canada: Agilent Technoligies Canada Inc. 5159 Spectrum Way Mississaua, Ontario L4W 5G1 (tel) 1 877 894 4414	Europe: Agilent Technologies European Marketing Organisation P.O. Box 999 1180 AZ Amstelveen The Netherlands (tel) (3120) 547 9999
Japan: Agilent Technologies Japan Ltd. Measurement Assistance Center 9-1 Takakura-Cho, Hachioji-Shi, Tokyo 192-8510, Japan (tel) (81) 456-56-7832 (fax) (81) 426-56-7840	Latin America: Agilent Technologies Latin America Region Headquarters 5200 blue Lagoon Drive, Suite #950 Miami, Florida 33126 U.S. A. (tel) (305) 267 4245 (fax) (305) 267 4286	Australia/New Zealand: Agilent Technologies Australia Pty Ltd 347 Burwood Hightway Forest Hill, Wictoria 3131 (tel) 1 800 629 485 (Austrailia) (fax) (61 3) 9272 0749 (tel) 0 800 738 378 (New Zeland) (fax) (64 4) 802 6881
Asia Pacific: Agilent Technologies 19/F, Cityplaza One, 111 Kings Road, Taikoo shing, Hong Kong, SAR (tel) (852) 2599 7899 (fax) (852) 2506 9233		

Agilent Technologies E8285A Support Contacts

The documentation supplied with your Test Set is an excellent source of reference, application, and service information. Please use these manuals if you are experiencing technical problems:

Table 2 **Table Documentation**

User's Guide
Application Guide
Reference Guide
Quick Reference Guide
Assembly Level Repair
CD-ROM

If you have used the manuals and still have *application* questions, contact your local Agilent Technologies Sales Representative.

Repair assistance is available for the Agilent Technologies E8285A CDMA Mobile Station Test Set from the factory by phone and e-mail. Internal Agilent users can contact the factory via email. Parts information is also available from Agilent.

When calling or writing for repair assistance, please have the following information ready:

- Instrument model number (E8285A)
- Instrument Serial Number (tag located on the rear panel).
- Installed options - if any (tag located on the rear panel).
- Instrument firmware revision (displayed at the top of the screen when the Test Set is powered up, and is also displayed on the CONFIGURE screen).

Support Telephone Numbers:

1 800 827 3848 RF Comms Service Assistance, U.S. only)

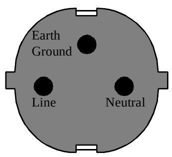
1 509 921 3848 (RF Comms Service Assistance, International)

1 800 227 8164 (Agilent Direct Parts Ordering, U.S. only)

1 916 783 0804 (Agilent Service Parts Identification, U.S. & Intl.)

Power Cables

Table 3

Plug type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Descriptions
	Straight/Straight Straight/90°	8120-1689 8120-1692	79 inches, mint gray 79 inches, mint gray

Used in the following locations:
Bangladesh, Belgium, Benin, Bolivia,Boznia-Herzegovina, Bulgaria, Burkina Faso, Burma, Burundi,Byelarus
Cameroon, Canary Islands, Central AfricanRepublic, Chad, Chile, Comoros, Congo, Croatia, Czech Republic,Czechoslovakia
Denmark, Djibouti
East Germany, Egypt, Estonia, Ethiopia
Finland, France, French Guiana, French Indian Ocean Areas
Gabon, Gaza Strip, Georgia, Germany, Gozo, Greece
Hungary
Iceland, Indonesia, Iran, Iraq, Israel, Italy, Ivory Coast
Jordan
Kazakhstan, Korea, Kyrgystan
Latvia, Lebanon, Libya, Lithuania, Luxembourg
Macedonia, Madeira Islands, Malagasy Republic, Mali, Malta, Mauritania, Miquelon, Moldova, Mongolia, Morocco, Mozambique
Nepal, Netherlands, Netherlands Antilles, Niger, Norway
Oman
Pakistan, Paraguay, Poland, Portugal
Rep. South Africa, Romania, Russia, Rwanda
Saudi Arabia (220V), Senegal, Slovak Republic, Slovenia, Somalia, Spain, Spanish Africa, Sri Lanka, St. Pierce Islands

Plug type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Descriptions
Sweden, Syria			
Tajikistan, Thailand, Togo, Tunisa, Turkey, Turkmenistan			
USSR, Ukraine, Uzbekistan			
Western Africa, Western Sahara			
Yugoslavia			
Zaire			

Table 4

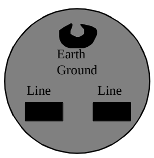
Plug Type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Descriptions
	Straight/Straight Straight/90°	8120-0698	90 inches, black
Used in the following locations:			
Peru			

Table 5

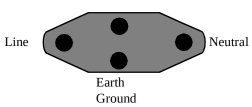
Plug Type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Descriptions
	Straight/Straight Straight/90°	8120-2104 8120-2296	79 inches, gray 79 inches, gray
Used in the following locations:			
Switzerland			

Table 6

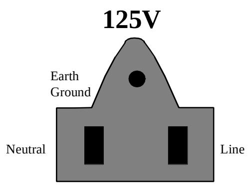
Plug Type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Descriptions
	Straight/Straight Straight/90° Straight/Straight	8120-1378 8120-1521 8120-1751	90 inches, jade gray 90 inches, jade gray 90 inches, jade gray
Used in the following locations:			
American Samoa			
Bahamas, Barbados, Belize, Bermuda, Brazil			
Caicos, Cambodia, Canada, Cayman Islands, Columbia, Costa Rica, Cuba			
Dominican Republic			
Ecuador, El Salvador			
French West Indies			
Guam, Guatemala, Guyana			
Haiti, Honduras			
Jamaica			
Korea			
Laos, Leeward and Windward Islands, Liberia			
Mexico, Midway Islands			
Nicaragua			
Other Pacific Islands			
Panama, Philippines, Puerto Rico			
Saudi Arabia (115V, 127V), Suriname			
Taiwan, Tobago, Trinidad, Trust Territories of Pacific Islands			
Turks Island			
United States			
Venezuela, Vietnam, Virgin Islands of the U.S.			
Wake Island			

Table 7

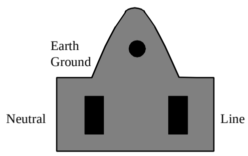
Plug Type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Descriptions
JIS C 8303, 100 V 	Straight/Straight Straight/90°	8120-4753 8120-4754	90 inches, dark gray 90 inches, dark gray
Used in the following locations:			
Japan			

Table 8

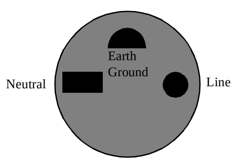
Plug Type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Descriptions
	90°/Straight 90°/90° Straight/Straight	8120-2956 8120-2957 8120-3997	79 inches, gray 79 inches, gray 79 inches, gray
Used in the following locations:			
Denmark			
Greenland			

Table 9

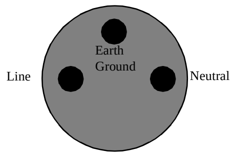
Plug Type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Description
	Straight/Straight Straight/90°	8120-4211 8120-4600	79 inches, mint gray 79 inches, mint gray
Used in the following locations:			
Botswana			
India			
Lesotho			
Malawi			
South-West Africa (Namibia), Switzerland			
Zambia, Zimbabwe			

Table 10

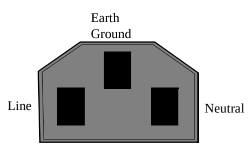
Plug Type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Descriptions
	Straight/Straight Straight/Straight Straight/90° Straight/90°	8120-1860 8120-1575 8120-2191 8120-4379	60 inches, jade gray 30 inches, jade gray 60 inches, jade gray 15.5 inches, jade gray
Used in the following locations:			
System Cabinets			

Table 11

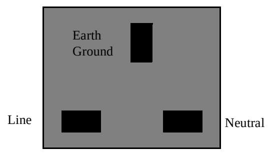
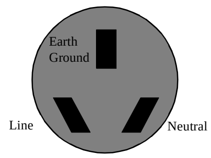
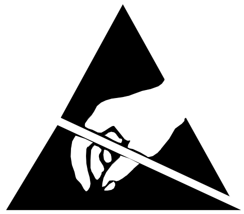
Plug Type (Male)	Plug Descriptions male/female	Agilent Part # (cable and plug)	Cable Descriptions
	90°/Straight 90°/90°	8120-1351 8120-1703	90 inches, mint gray 90 inches, mint gray
Used in the following locations:			
Bahrain, British Indian Ocean Terr., Brunei			
Canton, Cyprus			
Enderbury Island, Equatorial Guinea			
Falkland Islands, French Pacific Islands			
Gambia, Ghana, Gibraltar, Guinea			
Hong Kong			
Ireland			
Kenya, Kuwait			
Macao, Malaysia, Mauritius			
Nigeria			
Qatar			
Seychelles, Sierra Leone, Singapore, Southern Asia, Southern Pacific Islands, St. Helena, Sudan			
Tanzania			
Uganda, United Arab Emirates, United Kingdom			
Yeman (Aden & Sana)			

Table 12

Plug Type	Plug Descriptions male/female	Agilent Part # (cable & plug)	Cable Descriptions
	Straight/Straight Straight/90°	8120-1369 8120-0696	79 inches, gray 80 inches, gray
Used in the following locations:			
Argentina, Australia			
China (People's Republic)			
New Zealand			
Papua New Guinea			
Urugray			
Western Samoa			



ATTENTION
Static Sensitive Devices

This instrument was constructed in an ESD (electro-static discharge) protected environment. This is because most of the semi conductor devices used in this instrument are susceptible to damage by static discharge.

Depending on the magnitude of the charge, device substrates can be punctured or destroyed by contact or mere proximity of a static charge. The result can cause degradation of device performance, early failure, or immediate destruction.

These charges are generated in numerous ways such as simple contact, separation of materials, and normal motions of persons working with static sensitive devices.

When handling or servicing equipment containing static sensitive devices, adequate precautions must be taken to prevent device damage or destruction.

Only those who are thoroughly familiar with industry accepted techniques for handling static sensitive devices should attempt to service circuitry with these devices.

In all instances, measures must be taken to prevent static charge build-up on work surfaces and persons handling the devices.

Contents

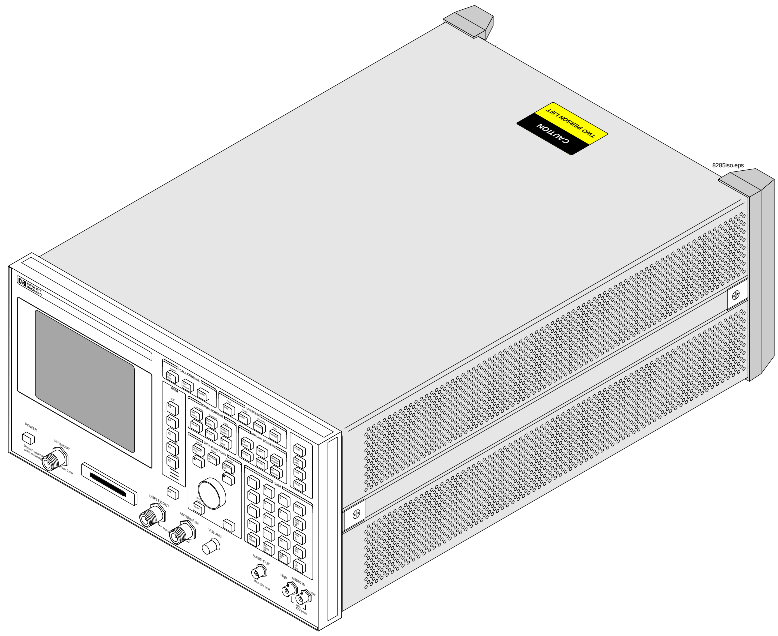
1 Introduction

This manual explains how to repair and calibrate the Agilent Technologies E8285A CDMA/PCS Mobile Station Test Set; called “the Test Set” throughout this manual.

Test Set Description

Several analog and digital test instruments are integrated into the E8285A CDMA Mobile Station Test Set to test Code Division Multiple Access (CDMA) digital cellular, PCS, and several types of analog mobile phones such as AMPS, NAMPS, and TACS.

Figure 1-1 The E8285A CDMA Mobile Station Test Set



Some of the instrument functions in the Test Set include:

- Synthesized AM, FM, and IQ modulation signal generator
- AM, FM, and IQ modulation analyzer
- Duplex offset generator
- SSB demodulator
- RF and audio power meters
- Audio and RF frequency counter and RF frequency error meter
- AC and DC voltmeter
- Distortion, SINAD, and signal-to-noise-ratio meters
- Two variable audio sources
- Oscilloscope
- Spectrum analyzer and tracking generator (optional)
- Signaling encoder and decoder
- DC current meter

Some of these functions are directly replaceable assemblies (such as the spectrum analyzer); some functions are digitally derived from other assemblies (such as the oscilloscope). Most of the replaceable assemblies are plug-in components.

Most instrument functions can be controlled by front-panel (local) controls and by remote commands (using a connected controller). Power on/off, volume, and squelch controls cannot be accessed remotely. Controls are grouped together on display screens that are usually associated with a specific task (such as making a call to a CDMA mobile phone).

An Instrument BASIC (IBASIC) controller is also built into the Test Set to allow automated operation without using an external controller. This computer also has the ability to be a system controller to other test system instruments. Refer to the Test Set’s user’s guide for information on using the IBASIC computer (also referred to as the IBASIC controller).

Product Description

The E8285A CDMA Mobile Test Set is designed to meet the needs of Cellular Provider Point of Sale Retailers. Manufacturing customers, and other customers who require CDMA Mobile Phone test capability. The Test Set is very similar to it's predecessor, the Agilent Technologies 8924C with the addition of newly designed RF I/O module. Upconverter and Downconverter assemblies. These assemblies extend the Test Set frequency range to cover the 1800-1900 PCS Cellular band as well as providing standard 800 MHz cellular band coverage.

Internal Operating System

A Motorola® 68020 – 33 MHz microprocessor acts as the host processor of the Test Set. It receives commands from the front-panel controls and communicates directly with almost every assembly inside the Test Set. The host is also in constant communication with several other microprocessors located in assemblies throughout the Test Set.

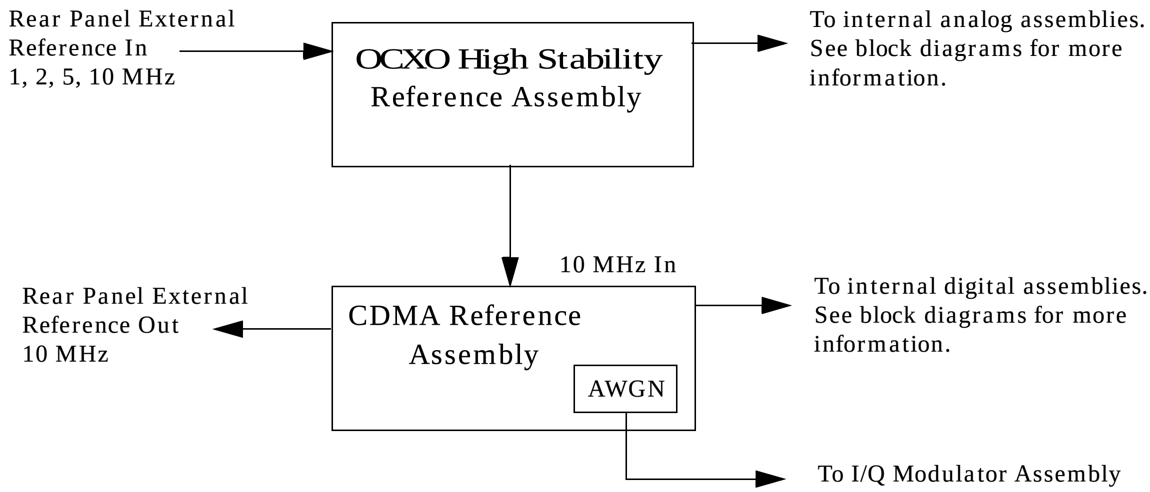
Communications to the GPIB, serial, and parallel ports are through the control interface assembly to the host processor.

This processor is also the core for the internal IBASIC computer. The IBASIC computer is used to load and run various software packages for automated radio tests. It is also responsible for executing the internal diagnostic routines used to troubleshoot a failing instrument.

Instrument Frequency References

The Test Set reference timebase path consists of two assemblies, the ovensized high stability reference assembly and the CDMA reference assembly. These two assemblies provide all frequency, phase, and timing signals used to accurately synthesize all of the Test Sets Source and Analysis signals. A master reference signal can originate from either an external source at the 10 MHz input on the rear panel, or from the internal 10 MHz phase locked loop located on the high stability reference assembly. The high stability reference assembly provides timebase references for the analog assemblies and a 10 MHz reference signal to the CDMA reference assembly. The CDMA reference assembly uses this signal to generate clock and timing signals for internal CDMA assemblies, provide the 10 MHz output signal to the rear panel, and generate the AWGN (Additive White Gaussian Noise) I & Q noise source signals.

Figure 1-2 Reference Signal Generation



RF Analysis

RF signals connected to the front panel RF IN/OUT connector or ANTENNA IN connector go to the RF I/O module. The signal level and RF frequency are measured, and the level is adjusted using fixed step and variable attenuators in the separate downconverter module.

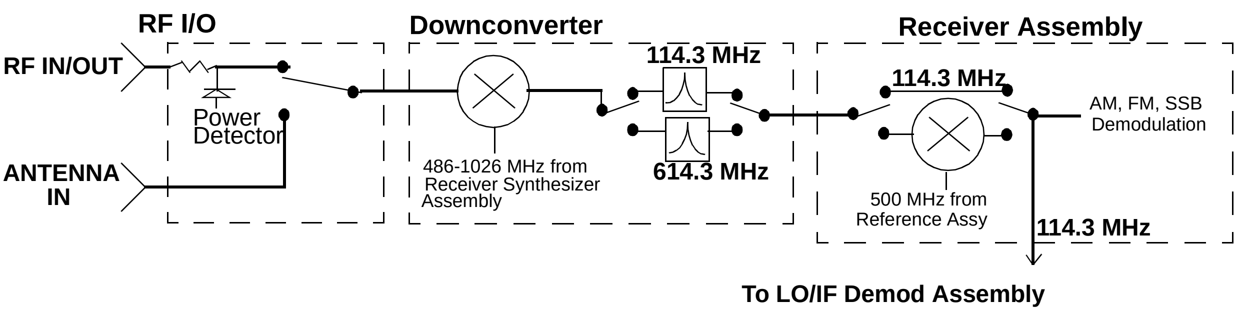
CAUTION **Over-Power Damage**

The ANTENNA IN connector is only used for very low level signals (60 mW or less), and cannot be used for Transmitter (TX) Power measurements. Exceeding this limit may destroy this assembly. The RF IN/OUT connector is used to measure direct mobile transmitter power up to 2.5 Watts continuous.

The downconverter then mixes the input signal with a local oscillator signal from the Receiver Synthesizer assembly to produce a 114.3 MHz or 614.3 MHz IF signal (depending on the frequency of the received signal). The signal goes through a bandpass filter and then to the Receiver assembly.

If the IF is 614.3 MHz, the Receiver assembly then mixes the signal with a 500 MHz local oscillator (LO) signal from the Reference assembly to get the 114.3 MHz IF. If the receiver synthesizer is already 114.3 MHz, the signal bypasses this downconversion. The 114.3 MHz signal divides into two paths.

Figure 1-3 Received Signal Downconversion



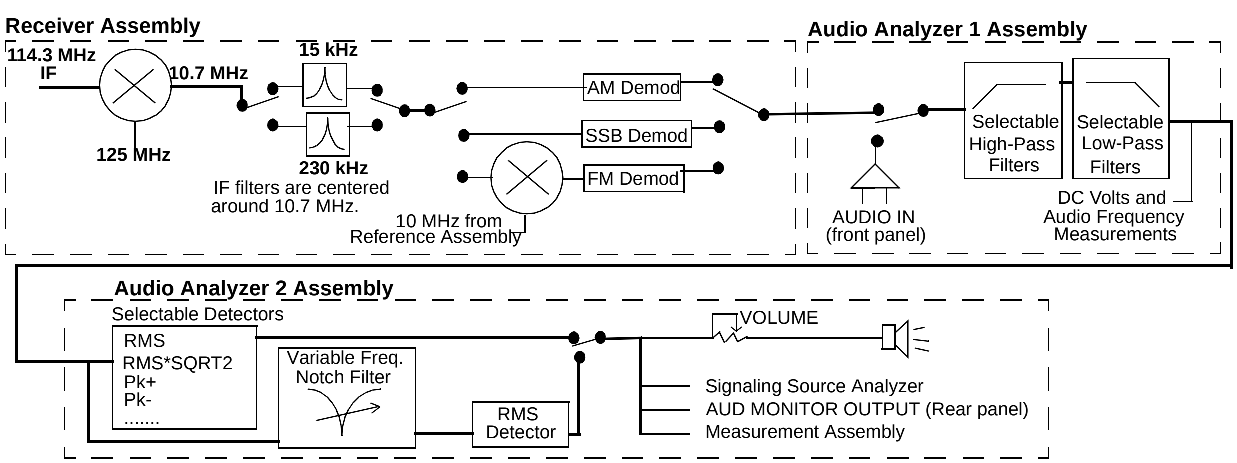
AM, FM, or SSB Modulation Analysis

For AM, FM, or SSB signals, the 114.3 MHz signal is downconverted to 10.7 MHz and routed through a user-selected IF bandpass filter (15 kHz or 230 kHz) that is centered around the 10.7 MHz IF. AM and SSB signals are demodulated at this point; FM signals are downconverted to a 700 kHz IF before demodulation. The demodulated signal is routed to the Audio Analyzer 1 assembly for audio frequency filtering. This assembly is also connected to the front-panel AUDIO IN connector for direct audio measurements. Several low pass and high pass filters can be selected, as well as a C-Message or optional CCITT filter. Frequency and voltage measurements are then made on this signal by the Measurement assembly. The signal is then routed to the Audio Analyzer 2 assembly.

The Audio Analyzer 2 assembly routes the signal through a user-selectable detector. A variable frequency notch filter may also be selected for SINAD and distortion measurements. The detector’s signal is then sent to several other assemblies:

- The Measurement assembly measures and displays the modulation level (such as FM deviation) and provide the input to the oscilloscope.
- The Signaling Source Analyzer assembly for signaling decoding.
- The rear-panel AUD MONITOR OUTPUT connector for external use of the demodulated signal.
- The front-panel VOLUME control and internal speaker to listen to the demodulated signal.

Figure 1-4 AM, FM, and SSB Signal Demodulation and Filtering



CDMA Signal Analysis

The 114.3 MHz IF also goes to the CDMA LO/IF Demodulation assembly. This assembly provides a through path to the spectrum analyzer (option 102) for all RF signals, and also provides down conversion for CDMA signals, measurements and call processing.

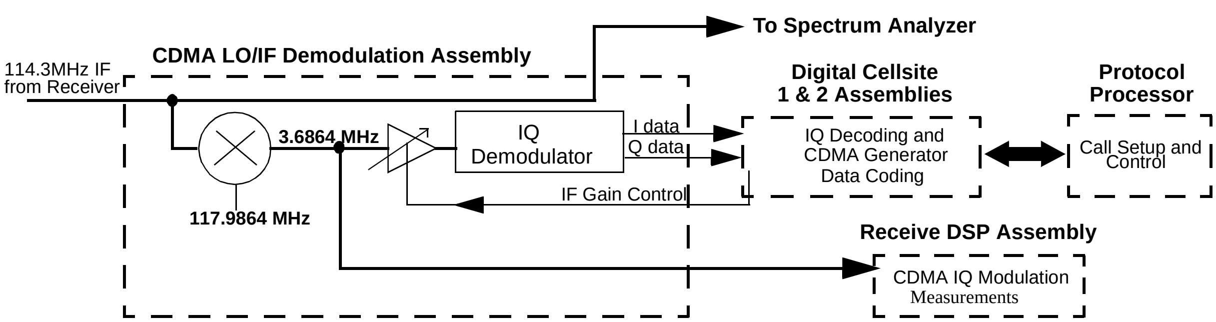
To downconvert the CDMA signal, the 114.3 MHz IF is mixed with a 117.9864 MHz local oscillator (LO) signal to produce a 3.6864 MHz IF. (The LO signal is from an oscillator that is phase locked to a 10 MHz signal from the CDMA Reference module.)

The 3.6864 MHz signal is split and goes to the Receiver DSP assembly, and also through a variable-gain IF amplifier before IQ demodulation. The demodulated I and Q baseband signals are then routed to the Digital Cellsite assemblies with the mobile phone.

Under control from the Protocol Processor assembly, the Digital Cellsite assemblies use the demodulated IQ information to set up and maintain calls to CDMA phones. The Digital Cellsite 1 assembly also furnishes feedback to the CDMA LO/IF Demodulation assembly to control the level of the variable-gain IF amplifier into the demodulator.

The Receive DSP assembly further converts, digitizes, and provides final analysis on the 3.6864 MHz signal to make measurements, such as rho, timing accuracy, carrier feedthrough, and phase error.

Figure 1-5 Analyzing CDMA Signals



RF Signal Generation

The Signal Generator Synthesizer assembly creates a 500 to 1000 MHz signal. The reference signal for the synthesizer is supplied by the High Stability Reference assembly. The synthesizer's frequency is varied using a divider network in the feedback circuit of the phase locked loop. Any FM modulation signal (from the Modulation Distribution assembly), and the frequency sweep signal for the spectrum analyzer and tracking generator, are integrated into this feedback loop. If a CDMA signal is not being generated, the 500-1000 MHz signal is passed through the I/Q Modulator assembly, bypassing the I/Q modulator.

IQ Modulation

If a CDMA signal is being generated, the signal is I/Q modulated in the I/Q Modulator assembly, using data from the Analog Cellsite assembly. The Analog Cellsite assembly gets its data from the two Digital Cellsite assemblies, which are controlled by the Protocol Processor assembly. Up to eight code channels of CDMA modulation data and noise may be summed into the IQ modulator at one time. These channels provide phone paging, synchronization, voice (traffic) transmission, and other CDMA system functions.

Final Frequency Conversion and Leveling

The RF Output assembly performs three tasks:

- Mixes or divides the 500 to 1000 MHz signal to produce signals below 500 MHz (down to 30 MHz). A 1 GHz LO from the Reference assembly is used for mixing.
- Provides AM modulation (when selected).
- Controls the signal level out of the assembly using an Automatic Level Control (ALC) loop.

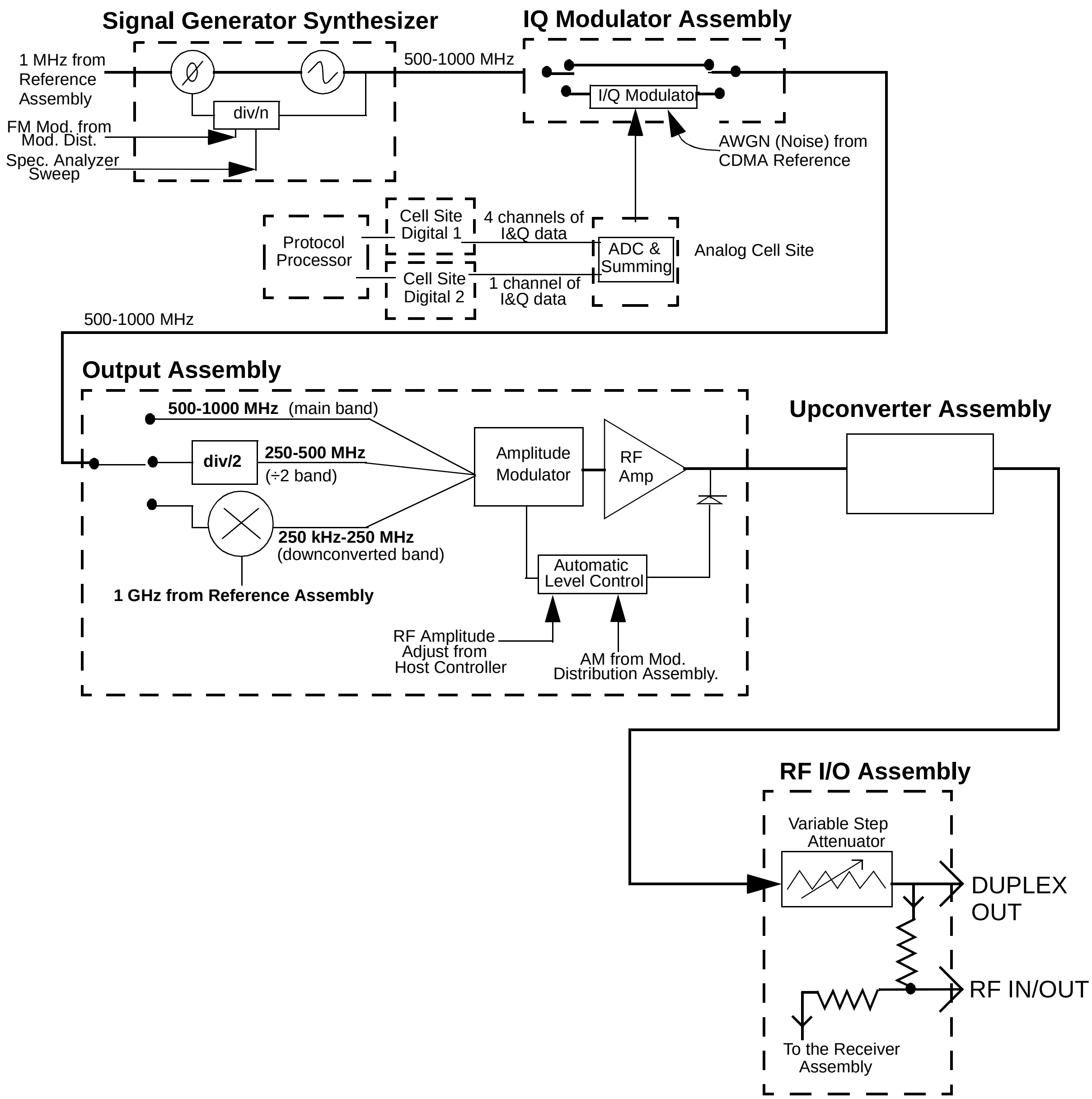
The signal out of the RF Output assembly is sent to one of two paths in the Upconverter assembly. RF frequencies from 30 MHz to 1 GHz route through the bypass path. PCS frequencies are upconverted to supply frequencies from 1700 to 2000 MHz. The user-selected frequency contains desired modulation that was selected (AM, FM, or CDMA), or is a continuous wave (CW) signal. The level has been adjusted to provide the required level (after going through RF I/O assembly).

RF and Duplex Outputs

The RF I/O assembly receives the signal from the Upconverter assembly and routes it to the selected output connector: RF IN/OUT or DUPLEX OUT. The signal first goes to a variable attenuator for level control.

If the DUPLEX OUT connector is selected, the signal then goes directly to that connector without additional attenuation. If the RF IN/OUT connector is used as an output, the signal passes through additional attenuation before reaching the connector. This is why a greater signal level can be output through the DUPLEX OUT connector than through the RF IN/OUT connector.

Figure 1-6 RF Generation Path Overview



Troubleshooting Strategy

You can repair the Test Set yourself or send it to your local Agilent Technologies Customer Service Center. Before starting a repair, you should become familiar with basic Test Set operation using the user's guide.

Troubleshooting relies on built-in diagnostics. Because some diagnostic results may be ambiguous, further interpretation and testing may be required. There are several diagnostic routines built into the Test Set:

- Power-up self-test diagnostics to test controller functioning. These are automatically run when the instrument is turned on, and can also be run after the instrument has been on.
- RF (Radio Frequency) assembly diagnostics.
- AF (Audio Frequency) assembly diagnostics.
- Digital assembly diagnostics for CDMA signals.

Troubleshooting hints in this manual include:

- Instructions on how to begin troubleshooting (see chapter 2, "Troubleshooting").
- Block diagrams and theory of operation (this chapter and chapter 8, "Block Diagrams").
- Detailed information about the built-in diagnostics (see chapter 2, "Troubleshooting").
- Error message explanations (see chapter 10, "Error Messages").

Repair Process

Repairing the Test Set consists of:

- Identifying the faulty assembly – see chapter 2, "Troubleshooting")
- Ordering a replacement assembly – see chapter 3, "Disassembly and Replaceable Parts"
- Replacing the faulty assembly – see chapter 3, "Disassembly and Replaceable Parts"
- Downloading calibration data – see chapter 2, "Troubleshooting"
- Performing periodic calibration – see chapter 5, "Periodic Adjustments/Calibration"
- Functional Verification – see chapter 4 , "Functional Verification"

Calibration and Performance Verification

The Test Set periodically requires some maintenance to verify that it meets its published specifications. Periodic Adjustments (calibration) consists of running several built-in calibration programs, and should be performed at least every year. An external frequency counter and dc voltmeter are required. (See *Chapter 5, "Periodic Adjustments/Calibration" on page 5*).

The performance tests in Chapter 6, “Performance Tests,” on page 137, verify that the Test Set performs as indicated in the Specifications. These tests should be performed if the Test Set’s operation is suspect, even though it passes all internal diagnostic checks, and on a regular two year cycle. This identifies whether a problem actually exists in the Test Set, or if an application problem exists outside of the Test Set.

Several assemblies, when replaced, require running specific periodic calibration procedures to create calibration factors for that assembly. In other cases, the calibration data will be included with the replacement assembly on a memory card. Instructions that come with the replacement assembly explain how to download the calibration data. (This is not considered part of periodic calibration.)

NOTE When troubleshooting the Test Set, it is sometimes desirable to swap a known-good assembly (perhaps from another Test Set) for a suspected-faulty assembly. If the swapped assembly requires calibration data, most assemblies will operate well enough with the original assembly’s calibration data to troubleshoot and run the diagnostics. However, do not expect the Test Set to meet its specifications. Also, some assemblies may appear to fail because of the incorrect calibration data.

E8285A Support Contacts

The documentation supplied with your Test Set is an excellent source of reference, applications, and service information. Please use these manuals if you are experiencing technical problems:

- Application information is located in the E8285 Application Guide (p/n E8285-90019) and the GPIB Condensed Programming Reference Guide (p/n E8285-90020).
- Operation and reference information are included in the E8285A CDMA Mobile Station Test Set User's Guide (p/n E8285-90018).
- Calibration and repair information in this manual.

If you have used the manuals and still have application questions, contact your local representative.

Repair assistance is available from the factory by phone and email. Internal Agilent Technologies users can contact the factory through email. Parts information is also available from Agilent Technologies. When calling or writing for repair assistance, please have the following information ready:

- Instrument model number
- Instrument serial number; tag located on the rear panel.
- Installed options - if any; tag located on the rear panel.
- Instrument firmware revision; displayed at the top of the screen when the Test Set is powered up, and is also displayed on the CONFIGURE screen.

Support Telephone Numbers and Email Address

- Call Center 1-800-922-8920
- RF Comms Service Assistance,
  International 1-509-921-3848

  RF Comms Service Assistance,
  U.S. only 1-800-827-3848
- Service Parts Identification,
  U.S. & International 1-916-783-0804

  Direct Parts Ordering,
  U.S. only (for manuals) 1-800-227-8164
- Email .... Spokane_Service@agilent.com

Hardware and Firmware Enhancements

The hardware and firmware of the Test Set are enhanced on a continuous basis. If an assembly is replaced, it is recommended that the firmware be upgraded at the same time. This is important if an assembly-level repair is performed because exchange assemblies, which may be of a later revision than the one being replaced, may require a later revision of the firmware to function correctly.

Ordering New Manuals

The Test Set is designed to allow future upgrades to hardware and firmware which may obsolete some of the material in this manual. For the latest document revisions and information, call the Direct Parts Ordering office (U.S. only), 1-800-227-8164.

For local and remote operating information, including descriptions of all controls, connectors, and programming syntax, refer to the E8285 User's Guide, part number E8285-90018.

For application information refer to the E8285 Application Guide, p/n E8285-90019. Also, all manuals are available on CD-ROM, p/n E8285-10003.

2 Troubleshooting

This chapter explains how to isolate a problem to the defective assembly. Troubleshooting uses the Test Set's built-in diagnostics. If diagnostics can't identify the faulty assembly, supplementary information in the form of manual troubleshooting procedures is provided.

How to Troubleshoot the Test Set

Document the result of each step in case you need to contact Agilent Technologies for service assistance. General troubleshooting steps are illustrated in figure 2-2 on page 45.

NOTE

Periodic Adjustment Interval

The calibration programs Periodic Calibration, IQ Calibration and IQ Demod Path Calibration should be performed after the replacement of any assembly referred to in table 5-1, "Assembly Calibration Information" on page 121, or at least every 24 months. See Chapter 5, "Periodic Adjustments/Calibration" on page 119 for details.

On power-up, the Test Set runs the Self-Test Diagnostic. Most of the Test Set’s digital control functions are tested. The outcome of the test appears on the display (if operating) and on four (DIAG) LEDs 0,1,2, 3, and 4 viewable digital controller unit, see figure 2-1 (you must remove the external and top-internal covers to view the LEDs).

Figure 2-1 LEDs

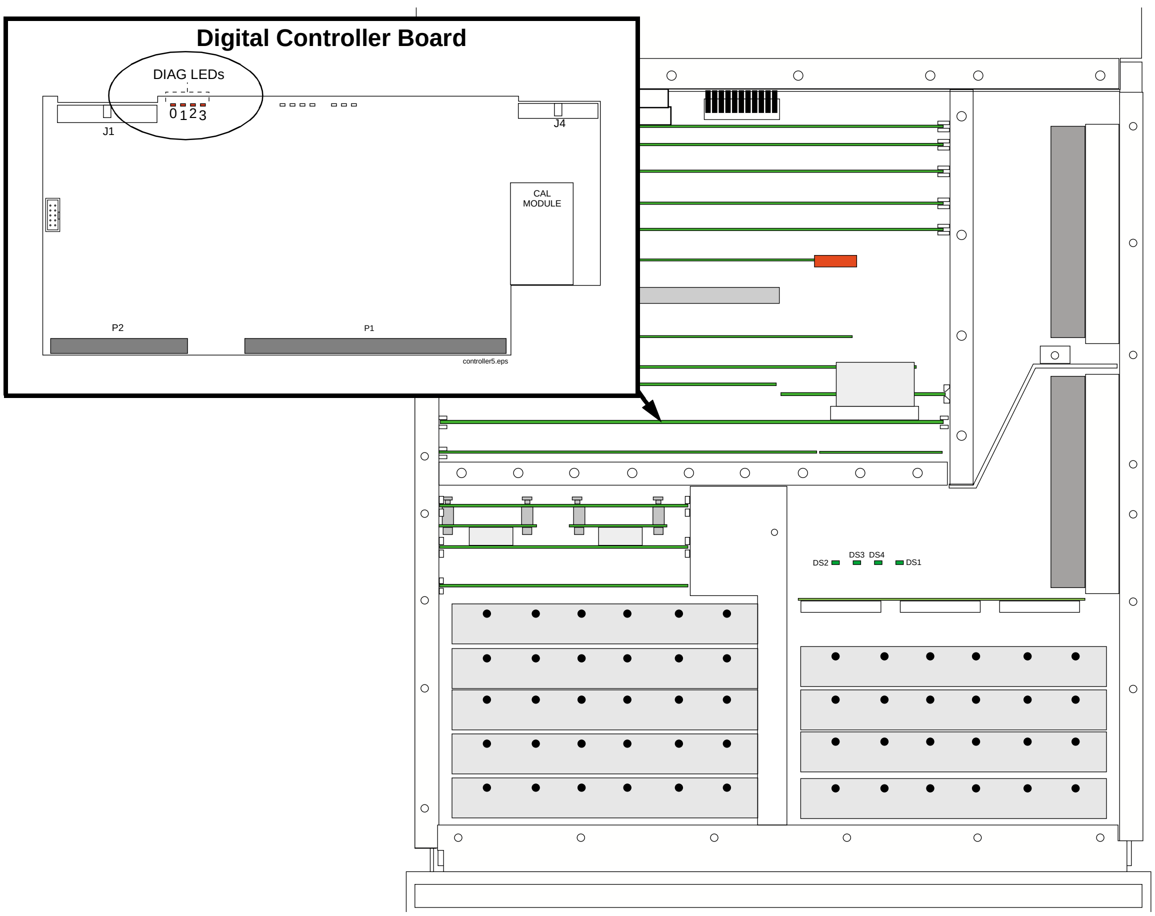
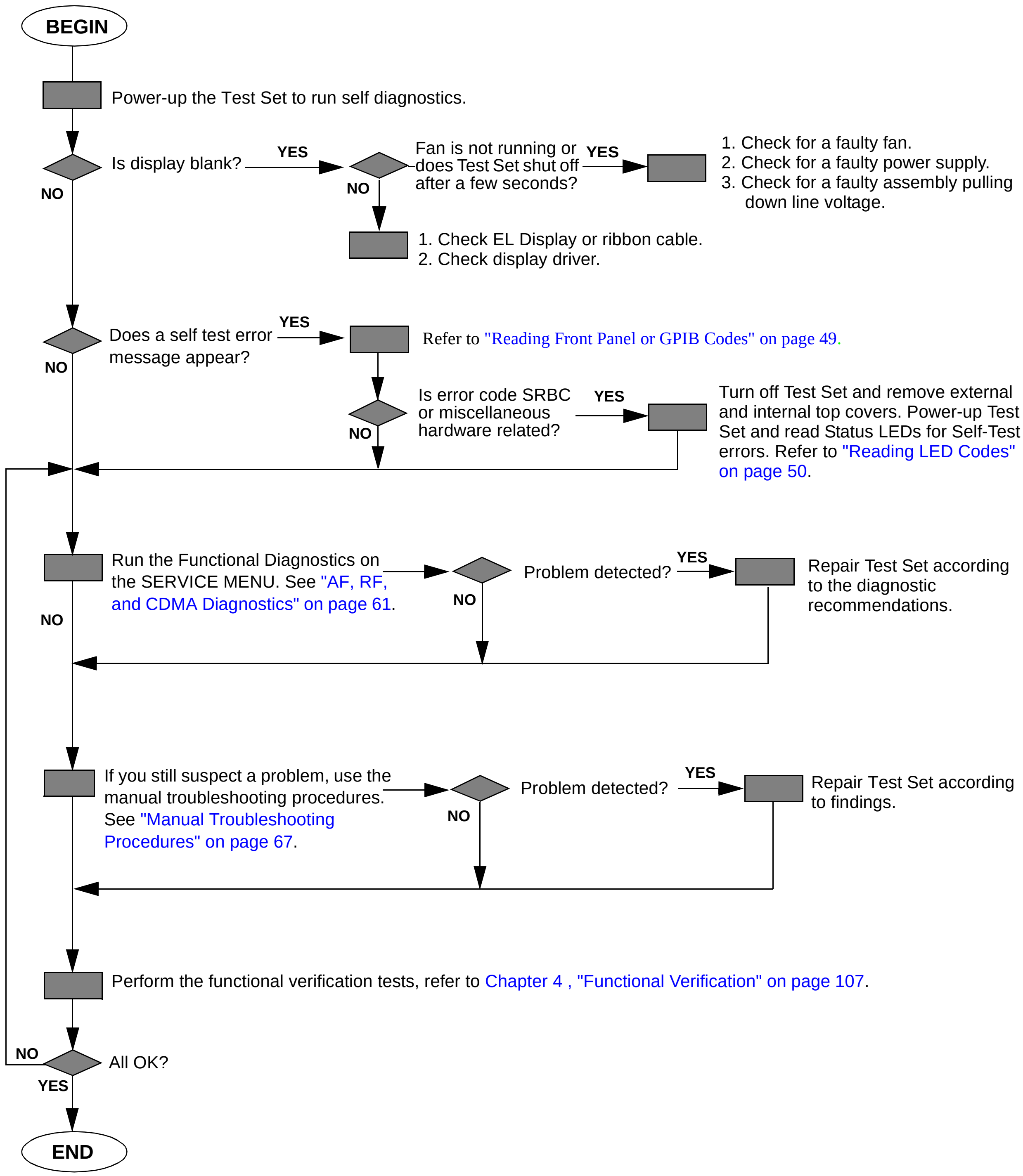


Figure 2-2 Agilent E8285A Test Set Troubleshooting Flowchart



Self-Test Diagnostics

On power-up the Test Set runs a self-test diagnostic test. Most of the Test Set's digital functions are tested. The outcome of the test appears on the display (if operating) and on four LEDs viewable and the digital controller board (you must remove the external and top-internal covers to view the LEDs).

The self-test diagnostic can be run three ways:

1. The test runs automatically when the Test Set is turned on. After the Test Set powers up, a message appears at the top of the display. If one or more tests fail, the message reports the failure with a hexadecimal code.

   During the test, coded failure information is displayed on four LEDs on the top of the controller board, see figure 2-1 on page 44. The Test Set's cover must be removed to view these LEDs. See Chapter 3, "Disassembly and Replaceable Parts," on page 81 for disassembly and replacement instructions.

2. The test runs when the Test Set receives the query ***TST?** over GPIB. The resultant decimal code can be read over the bus.

3. The test runs when the `Self Test` menu item of the Functional Diagnostics menu is selected.

To Start Troubleshooting

1. Turn on the Test Set to automatically run the self test diagnostics.
   - If the Test Set does not power up, see "If the Test Set Fails to Power-up" on page 47.
   - If all self-test diagnostics pass, and the front-panel keys and knob work, you can assume that the digital control assemblies work.

2. After power-up, the top line of the Test Set's display should show copyright information and the firmware revision code. The second line should display `All self tests passed`.
   - If the Test Set powers-up with **"One or more self-tests failed. Error code:<hexadecimal error code>:"**, see "Reading Front Panel or GPIB Codes" on page 49.
   - See "Frequently Encountered Diagnostic Messages" on page 65 for other error messages that might appear on the second line of the display.

3. The CDMA CALL CONTROL screen should be displayed. Two conditions cause a different screen to be displayed on power-up:

   o A SAVE/RECALL register named POWERON was saved to automatically power-up the Test Set in a different state. Press the Preset key before proceeding; this will restore the Test Set to the factory power-up condition.

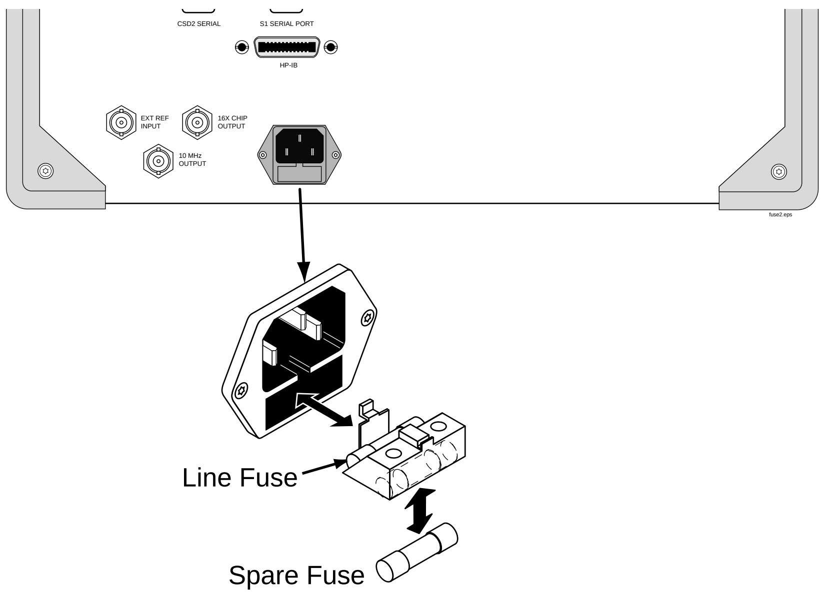
- The **`Autostart Test Procedure on Power-Up:`** field (of the “TESTS [Execution Conditions]” screen) is set to **`On`** to automatically run a loaded program. Press the Shift key, then press the Cancel key to stop the program. Press the Preset key to restore the Test Set to the factory power-up condition.

  To turn the autostart function off, press the **Tests** key, then select **`Execution Cond`** (under the **`SET UP TEST SET:`** heading). The autostart function is at the bottom of the screen; turn it **`Off`**.

If the Test Set Fails to Power-up

1. Is the Test Set plugged in? Listen for fan operation. If you don’t hear it, check the line fuse, see figure 2-3.

Figure 2-3 Fuse



2. If there is no image on the display, remove the Test Set’s covers and check the power supply LEDs: +5V, –12V, +12V (see figure 2-5 on page 48). If one is out, the power supply or regulator board is faulty. If no LEDs are lit, confirm that the Test Set is connected to the main power source. (Also, see step 5.)
3. Check the LEDs on the Controller assembly, see figure 2-5 on page 48. The LEDs should all light up immediately on power-up, and then go off several seconds after a beep is heard. If the LEDs do not light when the Test Set is powered-up, either the Controller or the Memory/SBRC assembly is faulty.
4. If the Test Set does not power-up properly, but the fan operates and the power supply voltages are correct on the Power Supply Regulator outputs, the Controller may be failing. Check TP2 on the Controller for +5V. If +5V is present, the Controller assembly is faulty.

5. If there is no display, but VIDEO OUT port on the rear panel has the signal shown in figure 2-4, then the Display assembly is faulty. If the signal is not present, then Display Drive assembly is faulty.

Figure 2-4 VIDEO OUT Signal

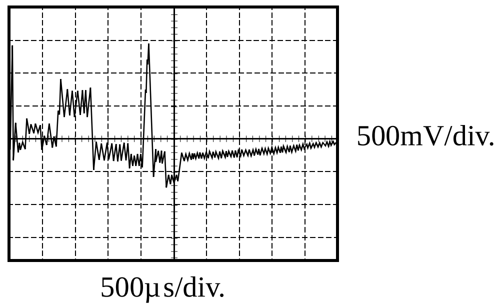
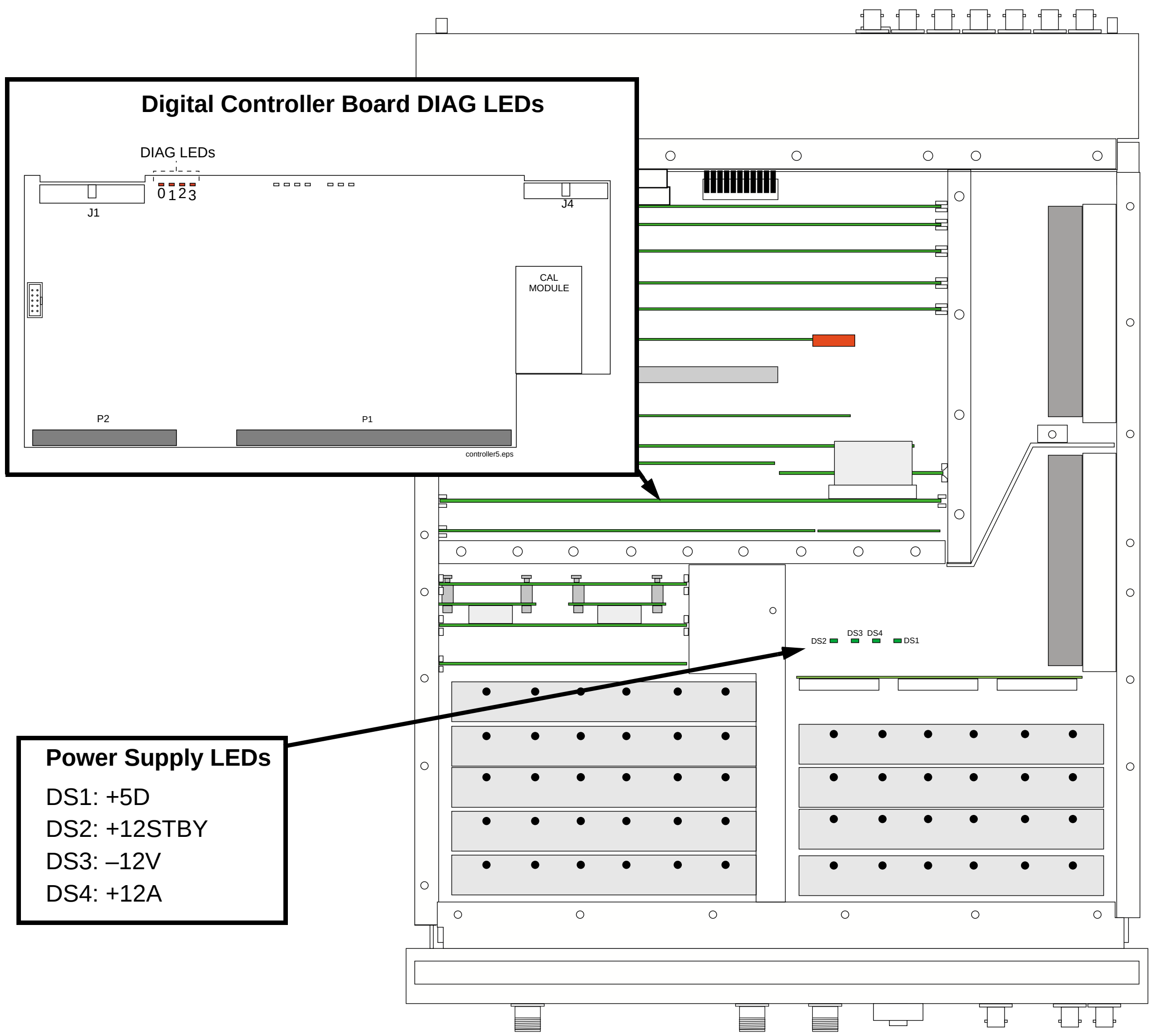


Figure 2-5 Diagnostic and Power Supply LEDs



Reading Front Panel or GPIB Codes

Failure codes are listed in the table below. If more than one failure occurs, the failure code will be the sum of the individual failure codes. The nature of the failure and the assembly most-likely at fault is also listed.

Table 2-1 Return Values for Self-Test Diagnostic Failures

Detected Failure	Failed Assembly	Returned Error Code: Hexadecimal (displayed)	Returned Error Code: Decimal (GPIB)
Microprocessor	Digital Controller	0002	2
ROM	Digital Controller	0004	4
RAM	Memory/SBRC	0008	8
RAM	Memory/SBRC	0010	16
Timer	Controller	0020	32
Real-Time Clock	Memory	0040	64
Keyboard (stuck key)	Keypad[a]	0080	128
RS-232 I/O	Memory/SBRC	0100	256
Serial Bus Communication	Any Non-Optional assembly [b]	0200	512
Signaling Board Self-Test	Signaling Source/Analyzer	0400	1024
Display Drive Self-Test	Display Drive	0800	2048
Miscellaneous Hardware	Several Possible Assemblies [c]	1000	4096

a. Could also be the digital controller with a faulty key-down detector.
b. This checks the ability of the digital controller to communicate with any hardware on the bus.
c. This message occurs if expected hardware is absent or not responding to the digital controller.

Reading LED Codes

When the self-test diagnostic reports a failure, more information about the failure may be available inside the Test Set. This additional information is output to the four LEDs on the top of the digital controller assembly. The failure codes are sent out as code sequences. Figure 2-6, "Reading the Self-Test Diagnostic. The Internal LEDs," on page 51 and the tables following it document some of the more useful code sequences. You may need to run the Self-Test Diagnostic several times to decode a particular LED sequence.

NOTE The LEDs output self-test diagnostic codes only when the Test Set is powering up. The LEDs remain off when the self-test diagnostic is initiated through programming or when running the functional diagnostics. To read the LED codes, the Test Set's cover must be removed.

If the Test Set has no faults that can be detected by the Self-Test Diagnostic, the four LEDs on the Controller assembly will light and remain on for about ten seconds. During that period, a short beep will be heard. Then the LEDs will extinguish and remain off.

If a fault is detected during the test:

1. The four LEDs will go on for about four seconds.
2. The LEDs will blink a failure code which corresponds to the error listed in table 2-1, "Return Values for Self-Test Diagnostic Failures" on page 49. Figure 2-7, "First LED Patterns," on page 52 shows the blinking LED codes.
3. Two non-blinking LED codes will follow. The interpretation of these codes depends on the preceding blinking code. Two sets of the non-blinking codes are listed: see figure 2-8, "Non-blinking LED Codes For Serial Bus Communication Failure," on page 53 and figure 2-9, "Non-Blinking LED Codes for Miscellaneous Hardware Failure," on page 54.
4. If there is more than one failure, the test will loop back to step 2 and repeat until the last failure is reported.

The pattern generated by the LEDs can be interpreted as a binary-weighting code. The LED (labeled 0) is the least-significant bit (see figure 2-6 on page 51).

For example if the LEDs blinking pattern is Off, On, On, On (reading left-to-right or LEDs "3 2 1 0"), the binary number is 0111 or decimal 7. The error codes shown in table 2-1, "Return Values for Self-Test Diagnostic Failures" on page 49 are weighted by the binary value. The weighted value for this example is decimal 27 = 128 or hexadecimal 80. (This failure is easy to simulate; simply power-up the Test Set while holding down a key.)

Figure 2-6 Reading the Self-Test Diagnostic. The Internal LEDs

1. Remove the Test Set's external cover.
2. Turn power on.
3. Read the LED sequence on the digital controller board (see below) and compare with the patterns below.

NOTE

For multiple failures, the failure patterns described below will repeat for all failures detected.

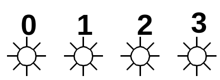
LED Legend

● = off
= rapid blink
= steady on or slow blink

LED Sequences

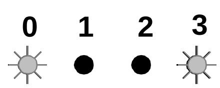
No Failures...

- The LEDs will light for approximately 10 seconds, then all will turn off.



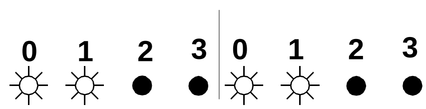
Failures... three patterns are displayed:

- The first blinks rapidly and indicates the type of failure.



See the following tables. (This example indicates a Serial Bus Communication problem.)

- The second and third patterns blink slowly and indicate failure details.



(This example indicates a faulty Audio Analyzer 1 assembly.)

Digital Controller Board

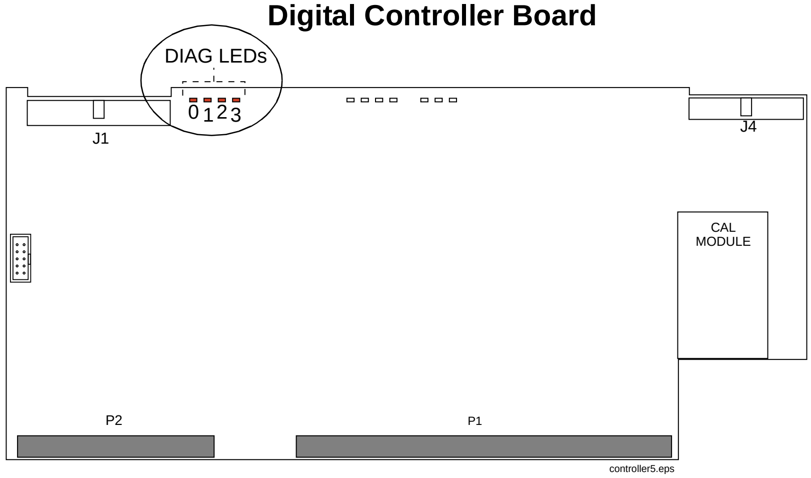


Figure 2-7 First LED Patterns

If the first LED pattern displayed is...				Then the failure is...
0	1	2	3	
✳	●	●	●	Microprocessor
●	✳	●	●	ROM Checksum (See note 1.)
✳	✳	●	●	RAM (See note 2.)
●	●	✳	●	RAM (See note 3.)
✳	●	✳	●	Timer
●	✳	✳	●	Real-Time Clock
✳	✳	✳	●	Keyboard (stuck key or faulty key-down detector)
●	●	●	✳	Control Interface (See note 4.)
✳	●	●	✳	Serial Bus Communication (see figure 2-8 on page 53)
●	✳	●	✳	Signaling Board Self Test
✳	✳	●	✳	Display Drive Self Test
●	●	✳	✳	Miscellaneous Hardware (see figure 2-9 on page 54)

LED Legend
● = off
✳ = rapid blink
☼ = steady on or slow blink

NOTES

1. Second and third LED failure patterns:
   0001 and 0001 for any main ROM failure
   0001 and 0002 for boot ROM failure

2. Second and third LED failure patterns:
   0001 and 0001 for Memory/SBRC board RAM failure
   0001 and 0002 for Controller board RAM failure

3. Second and third LED failure patterns:
   0001 and 0001 for Memory/SBRC board RAM failure
   0001 and 0010 for Memory/SBRC board RAM failure

4. Second and third LED failure patterns for Control Interface:
   0001 and 0001 for Serial Port 9 failure
   0001 and 0010 for Serial Port 10 failure
   0001 and 0011 for Serial Port 11 failure
   0001 and 0100 for Serial Port 14 failure
   0001 and 1101 for Parallel Port 15 failure
   0001 and 1110 for Parallel Port 16 failure

Figure 2-8 Non-blinking LED Codes For Serial Bus Communication Failure

If the second and third LED patterns displayed are....								Then the failure is...
0	1	2	3	0	1	2	3	
☼	●	●	●	☼	●	●	●	Modulation Distribution
●	☼	●	●	●	☼	●	●	Output Section
☼	☼	●	●	☼	☼	●	●	Audio Analyzer 1
●	●	☼	●	●	●	☼	●	Audio Analyzer 2
☼	●	☼	●	☼	●	☼	●	Reference
●	☼	☼	●	●	☼	☼	●	RF Input/Output
☼	☼	☼	●	☼	☼	☼	●	Downconverter
●	●	●	☼	●	●	●	☼	Receiver
☼	●	●	☼	☼	●	●	☼	Spectrum Analyzer
●	☼	●	☼	●	☼	●	☼	Signal Generator Synthesizer
☼	☼	●	☼	☼	☼	●	☼	Receiver Synthesizer
●	●	☼	☼	●	●	☼	☼	Upconverter
☼	●	●	●	●	☼	☼	☼	LO IF/IQ Modulator
☼	●	●	●	☼	●	☼	☼	CDMA Generator Reference
☼	●	●	●	●	●	☼	☼	Digital Cellsite

LED Legend

● = off
☼ (grey) = rapid blink
☼ = steady on or slow blink

Figure 2-9 **Non-Blinking LED Codes for Miscellaneous Hardware Failure**

If the second and third LED patterns displayed are....								Then the failure is...
0	1	2	3	0	1	2	3	
☼	●	●	●	☼	●	●	●	Reference
☼	●	●	●	●	☼	●	●	Audio Filter 1 - C-Message Filter
☼	●	●	●	☼	☼	●	●	Audio Filter 2 - 6 kHz BPF
●	☼	●	●	⊗	⊗	⊗	⊗	Receive DSP
☼	●	●	●	●	☼	☼	☼	Digital Cellsite 1 and 2

LED Legend

● = off
☀ = rapid blink
☼ = steady on or slow blink
⊗ = don’t care

Functional Diagnostics

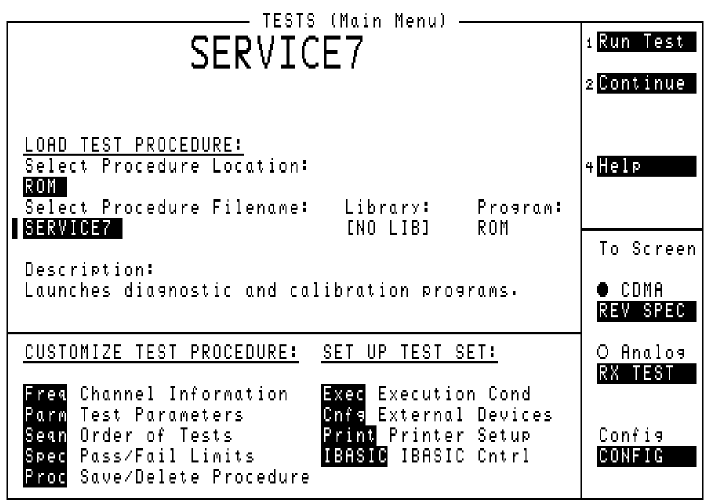
The Diagnostics (of the SERVICE7 MENU, shown in figure 2-13 on page 58) check whether or not major portions of the Test Set are functioning. They may pinpoint faults in the circuitry to the faulty assembly, or they may direct the use of any or all of the AF, RF, CDMA diagnostics to more extensively test the circuitry.

Accessing the Diagnostic Tests

CAUTION A fifteen minute warm up is required. The measurement limits of the SERVICE7 diagnostic tests are valid only at room temperature; that is, 20º to 25ºC (65º to 75ºF).

1. Press the Preset key.
2. Press the Tests key. The TEST (Main Menu) screen appears, see figure 2-10 on page 55.
3. Set the **Select Procedure Location:** field to **ROM**.
4. Set the **Select Procedure Filename:** field to **SERVICE7**.

Figure 2-10 TESTS (Main Menu) Screen



5. To define test conditions, see "Define Test Conditions" on page 56. To configure the Test Set for a printer, see "Configuring a Printer" on page 57.
6. On the Tests (Main Menu), select the **Run Test** field (or press K1), and wait for the SERVICE MENU to appear, see figure 2-13 on page 58.
7. Choose the diagnostic test (Functional, AF, RF, or CDMA) to run by turning the knob to move the pointer and then pressing the knob to select the test.
8. Follow the instructions on the screen.

As some of the tests run, you may be offered the options to alter test execution conditions by selecting:

- **`Loop`** to run the test continuously
- **`Pause`** to pause the tests
- **`Stp Fail`** (stop-failure) to stop on a failure
- **`Sgl Step`** (single-step) to pause the test after each measurement

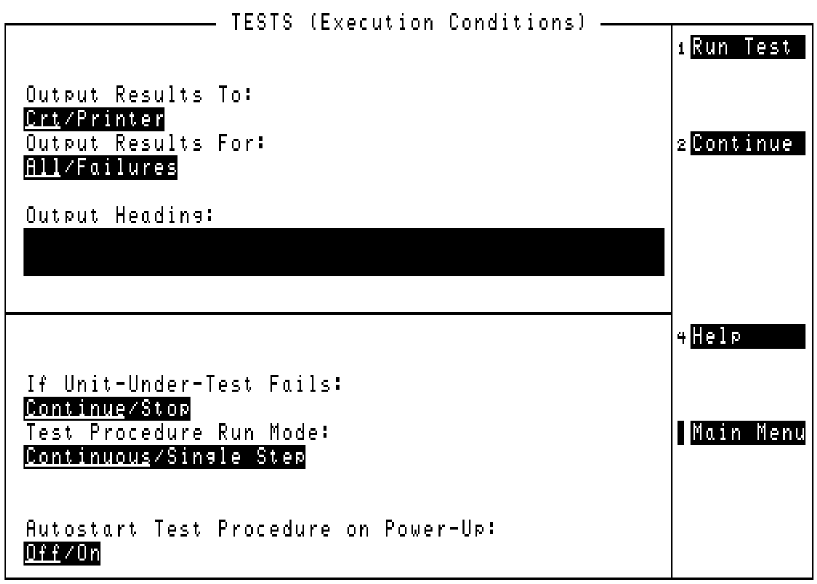
For descriptions of the diagnostic options, refer to:

- "Functional Diagnostics Menu" on page 59.
- "AF Diagnostics" on page 61
- "RF Diagnostics" on page 62
- "CDMA Diagnostics" on page 64

Define Test Conditions

1. On the TESTS (Main Menu) screen (see figure 2-13), select **Exec Execution Cond** to access the TESTS (Execution Conditions) screen.

Figure 2-11 TESTS (Execution Conditions)



2. Set up the **Output Results To**: field. Select:
   - **<u>Crt</u>** to view measurements only on the display.
   - Select **<u>Printer</u>** to print the test results as well as display them on the CRT.
3. Set the **Output Results For:** field to **<u>All</u>**
4. Set up the **If Unit-Under-Test Fails:** field.
   - Select **<u>Continue</u>** to continue to the next test point.
   - Select **<u>Stop</u>** to pause testing at that point.

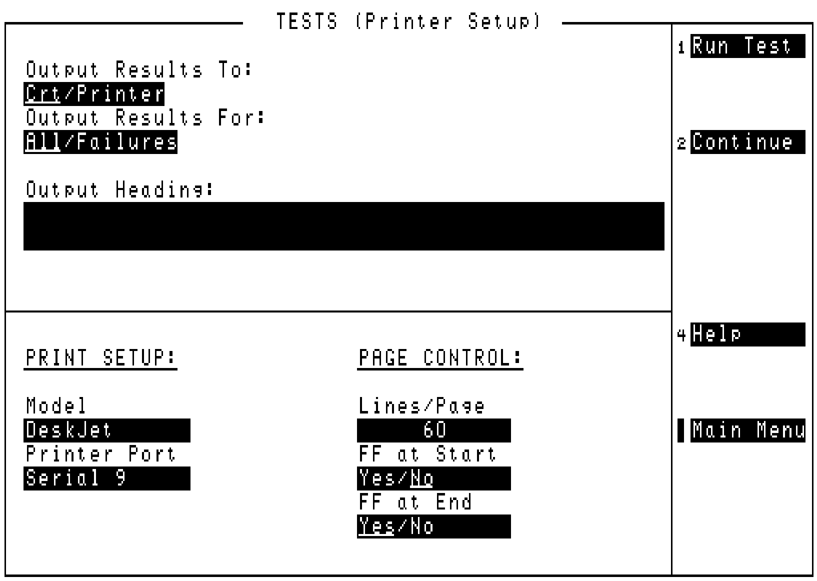
5. Set up the **Test Procedure Run Mode:** field.
   - Select **<u>Continuous</u>** to run the tests continuously.
   - Select **<u>Single Step</u>** to pause after each measurement.
6. Verify that the **Autostart Test Procedure on Power-Up:** setting is **<u>Off</u>**.

Configuring a Printer

Only perform the following steps if you want to print test results to a printer.

1. Press the Tests key.
2. On the TESTS (Main Menu) select **`Print Printer Setup`**. The TESTS (Printer Setup) screen appears.

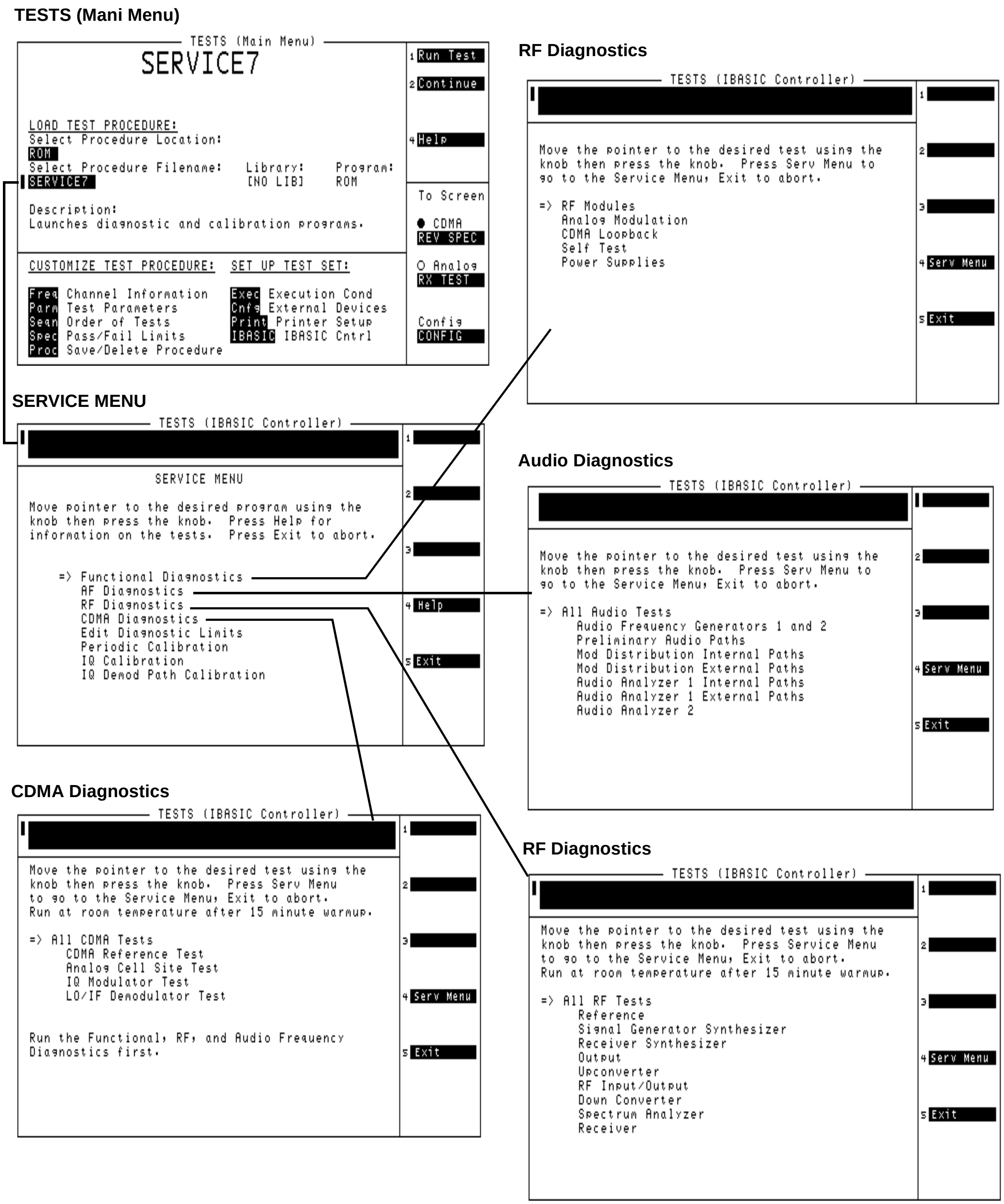
Figure 2-12 TESTS (Execution Conditions)



3. Under **PRINT SETUP:**, select **Model:** and the printer of your choice.
4. Set the **Printer Port:** for the side-panel connector your printer is connected to (Parallel 15, Serial 9, or GPIB).

   If an GPIB printer is used, you need to enter the printer’s two-digit bus address when the **Printer Adrs** field appears (Example; enter **1** or **01** for bus address 701). Also, press the **Shift** key, then the **INST CONFIG** key to access the I\O CONFIGURE screen, and set the **Mode** field to **Control**.
5. Under **PAGE CONTROL:**, set the **Lines/Page:** and Form Feed (**FF at Start:**, and **FF at End:**) parameters if necessary.

Figure 2-13 SERVICE7 Program Screens



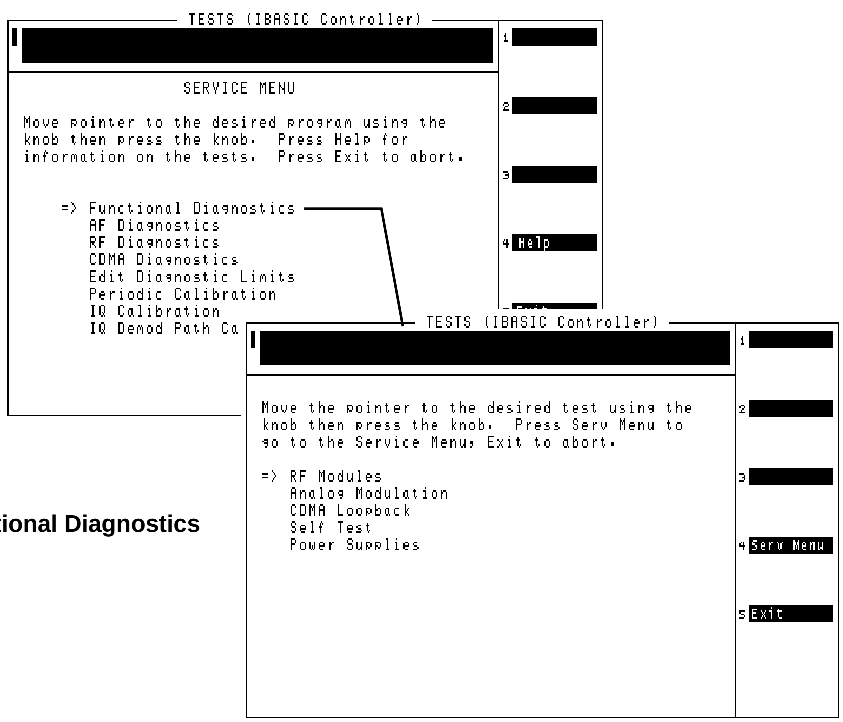
Functional Diagnostics Menu

To run the Functional Diagnostics, see "Accessing the Diagnostic Tests" on page 55.

NOTE The diagnostics are intended to help in locating the source of catastrophic failures. Occasionally, a test will fail with the test results being only slightly out of limits. Such failures do not necessarily indicate that the Test Set is operating outside of its published specifications or that it is otherwise faulty. Further testing (such as running the performance tests) will be required in such cases.

NOTE Many of the internal diagnostic and calibration procedures use low-level latch commands to control the instrument settings. Many latch settings persist even through a preset. They can only be reset by an instrument power down or by explicitly reseting each latch. This phenomenon is the reason the message "**`Direct latch write occurred. Cycle power when done servicing`**." is displayed the first time a latch is written to. Because latch settings persist, problems can arise in running these programs. For example, prematurely terminating a test in a diagnostic (using the Pause and Exit keys) and restarting another test may cause failures in that test because of improper latch settings. It is best to run tests to completion before starting another one. Also, be sure to cycle the power off and on when done servicing the Test Set.

Figure 2-14 Functional Diagnostics Screen



Functional Diagnostics

RF Modules
The Average and TX power meters, Channel Power Meter, RF analyzer, IF analyzer and spectrum analyzer are used to test the signal generator. Both the internal and external paths of the RF/IO assembly are used in the tests.

Analog Modulation
The demodulator in the RF analyzer, and the spectrum analyzer are used to check the accuracy, distortion, and residuals of the FM and AM frequencies. The counter is used to measure the audio frequency.

CDMA Loopback
CDMA Analyzer is used to measure Test Mode Rho on a signal from the CDMA Generator. This test is only a rough indicator of CDMA functionality.

Self Test
The power-up Self-Test Diagnostics are run. Refer to "Self-Test Diagnostics" on page 46.

Power Supplies
The different levels of the power supply are measured with the internal voltmeter.

AF, RF, and CDMA Diagnostics

NOTE

The diagnostics are intended to help in locating the source of catastrophic failures. Occasionally, a test will fail with the test results being only slightly out of limits. Such failures do not necessarily indicate that the Test Set is operating outside of its published specifications or that it is otherwise faulty. Further testing (such as running the performance tests) will be required in such cases.

NOTE

Many of the internal diagnostic and calibration procedures use low-level latch commands to control the instrument settings. Many latch settings persist even through a preset. They can only be reset by an instrument power down or by explicitly reseting each latch. This phenomenon is the reason the message "**`Direct latch write occurred. Cycle power when done servicing`**." is displayed the first time a latch is written to. Because latch settings persist, problems can arise in running these programs. For example, prematurely terminating a test in a diagnostic (using the Pause and Exit keys) and restarting another test may cause failures in that test because of improper latch settings. It is best to run tests to completion before starting another one. Also, be sure to cycle the power off and on when done servicing the Test Set.

AF Diagnostics

This program tests the audio functions of the following assemblies:

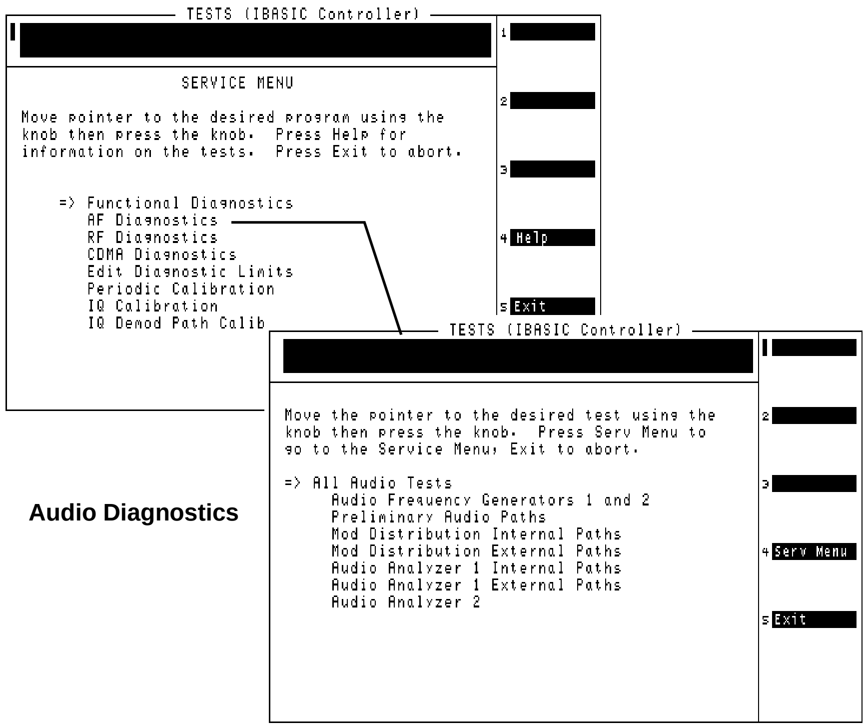
- Audio Analyzer 2
- Audio Analyzer 1
- Modulation Distribution
- Signaling Source/Analyzer (AF Generators 1 and 2 only)
- Measurement (only a few selected inputs)

After initial cabling, all tests can be run in a loop mode without further intervention. This makes it easier to catch intermittent failures. To run the AF diagnostics, see "Accessing the Diagnostic Tests" on page 55.

NOTE

A fifteen minute warm up is required. The measurement limits of the SERVICE7 diagnostic tests are valid only at room temperature; that is, 20º to 25ºC (65º to 75ºF).

Figure 2-15 AF Diagnostics Screen



When a test fails, a diagnosis is given in three parts:

- A diagnostic code.
- The name of the assembly or assemblies most likely to have failed.
- A rating of the confidence (high, medium, or low) of the diagnosis.

RF Diagnostics

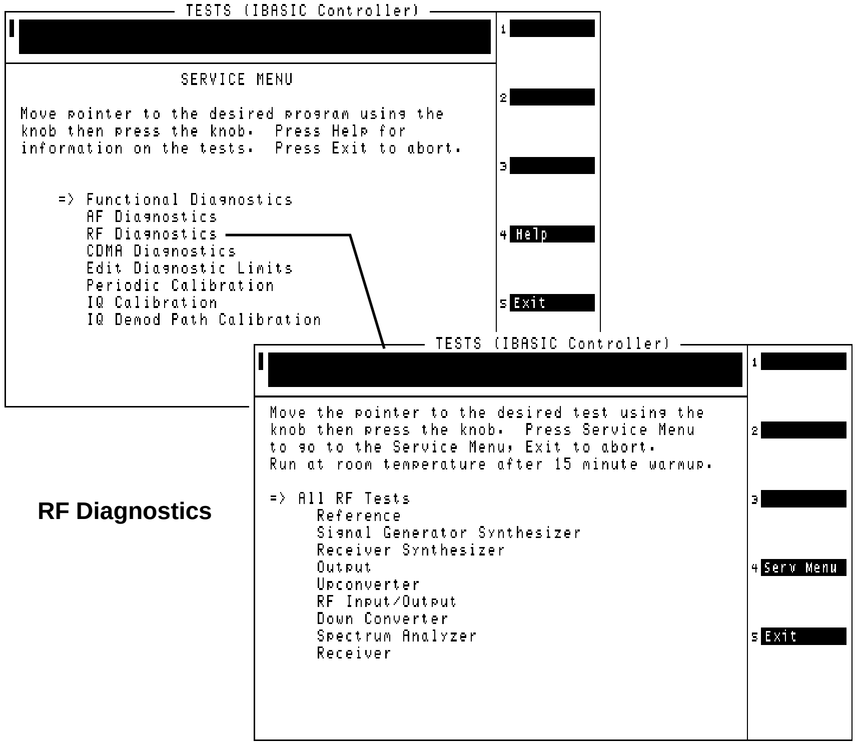
This program tests the RF functions of the following assemblies:

- Downconverter
- RF Output
- Signal Generator Synthesizer
- Reference
- Receiver
- Receiver Synthesizer
- Spectrum Analyzer (optional)
- RF I/O
- Upconverter

Some tests require cabling before the RF Diagnostics can be run; but all tests can be run in a loop mode without further intervention. Running in loop mode makes it easier to catch intermittent failures. To run these diagnostics, see "RF Diagnostics" on page 62.

NOTE A fifteen minute warm up is required. The measurement limits of the SERVICE4 diagnostic tests are valid only at room temperature; that is, 20º to 25ºC (65º to 75ºF).

Figure 2-16 RF Diagnostics Screen



When a test fails, a diagnosis is given as:

- Sometimes a diagnostic code.
- The name of the assembly or assemblies most likely to have failed.
- Sometimes a rating (high, medium, or low) of the confidence of the diagnosis.

CDMA Diagnostics

The Digital Diagnostics test the assemblies required for CDMA-formatted IQ modulation.

These assemblies include:

- CDMA Reference
- LO/IF Demod
- I/Q Modulator
- Cell Site Analog

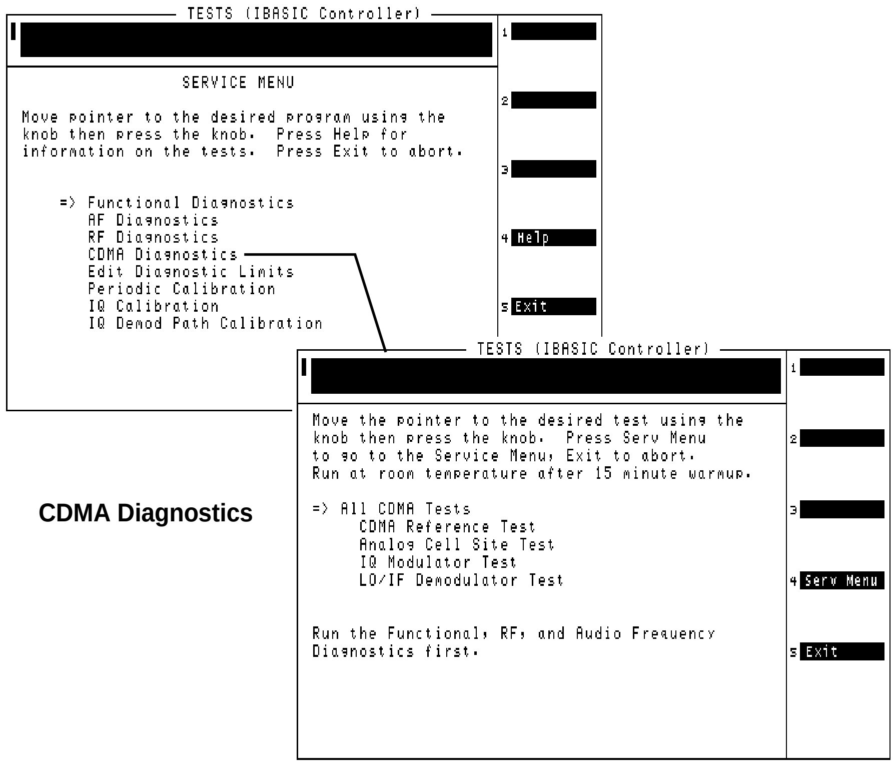
The CDMA Reference, LO/IF Demod, and I/Q Modulator are also used when generating or analyzing analog signals.

NOTE

Before ordering a replacement assembly...

Before ordering an assembly based on the results of the diagnostics, you should verify the diagnostics by other means if possible. This could include using manual troubleshooting procedures and descriptions of the AF, RF, and CDMA diagnostics in this chapter, and/or block diagrams in Chapter 8, “Block Diagrams,” on page 239. If you still lack confidence in troubleshooting or diagnosing the problem or faulty assembly, call the Agilent Call Center (1-800-922-8920) for troubleshooting assistance.

Figure 2-17 **CDMA Diagnostics Screen**



Frequently Encountered Diagnostic Messages

Warning/Error Messages

Error messages that appear on the second line of the Test Set's display frequently occur while any of the SERVICE7 program diagnostic tests are running. The most complete and general list of error messages is in the "Error Messages" chapter of the Test Set's *Reference Guide*. (Some messages relating specifically to troubleshooting can be found in Chapter 10, "Error Messages" on page 291.) Some of the messages you can expect to occur while running the SERVICE7 program diagnostic tests are as follows:

- **`Direct latch write occurred. Cycle power when done servicing.`** The SERVICE7 program commonly generates this message. This message appears the first time the diagnostic program directly addresses a latch. The message should be ignored and cleared when you make a normal (not a diagnostic) measurement with the Test Set. To clear this message the Test Set should be turned off and back on again.
- **`Change Ref Level, Input Port or Attenuator (if using "Hold").`** This message, and similar messages, can be generally ignored.
- **`Printer does not respond.`** This usually indicates that one or more settings on the TESTS (Printer Setup) screen are set incorrectly for your printer. Also, check that the printer's power is on and that it is correctly cabled. For Agilent-IB printers make sure the printer is correctly addressed. If a serial printer is used, you may have to change the serial communication settings on the I/O CONFIGURE screen (press **Shift** then **Inst Config** to get to this screen). The message times out after a few seconds, and the output destination is changed to CRT by the program.
- **`ERROR 173 IN XXXX Active/system controller req'd`** (where **`"XXXX"`** represents a line number). Indicates that the Test Set's internal IBASIC computer must be set as a system controller for some reason. This usually indicates that the **`Printer Port`** field of the TESTS (Printer Setup) screen was set to **`Agilent-IB`** but the **`Mode`** field on the I/O CONFIGURE screen is set to **`Talk&Lstn`** instead of **`Control`**. Change the mode setting to **`Control`** and run the diagnostic again.

Time-outs

Certain failures may cause a frequency or voltage reading to time out, that is, the time required for the measurement will be unreasonably long. If a timeout occurs, measurement execution will stop and an error message will be displayed.

- If frequency or voltage readings have been successfully made before the timeout, the assembly currently being tested or a multiplexer on the Measurement assembly may be at fault.
- If most measurements fail, the Reference assembly may be supplying faulty clock signals to the Measurement assembly.
- Re-run the test to see if the timeout is intermittent.

Manual Troubleshooting Procedures

If you are not sure a problem exists, you should attempt to duplicate the suspected problem. This is especially important if the Test Set is being used in a new application where misapplication, or incorrect operation of the Test Set may be involved.

An Agilent 8924C Mobile Station Test Set combined with an Agilent 83236B Cellular Adapter can be used to simulate a high performance CDMA base station and may be useful in attempting to duplicate the problem.

Refer to following table to determine which diagnostic tests, performance tests, and periodic self calibration adjustments apply to an assembly. Downloading calibration data is discussed in Chapter 6, "Performance Tests" on page 137.

Table 2-2 Relating Assemblies to Troubleshooting Aids

Assembly Name	SERVICE7 Program Diagnostic Test: Sub-Test	Performance Test to Perform[a]	Periodic Calibration[b] Program	Cal.-Data Needed[c]
Keypad	Functional Diagnostics: Self Test			No
Display				No
RF I/O	RF Diagnostics: RF Input/Output	RF Generator: Level Accuracy	PCMCIA Program System Power E6380-61811	Yes
Digital Cellsite 1 & 2	Functional Diagnostics: CDMA Loopback		SERVICE7: IQ Modulator	Yes
Upconverter	RF Diagnostics: Upconverter			Yes
RPG Assembly				No
Front Panel				No
Receive DSP	Functional Diagnostics: CDMA Loopback			No
PCMCIA				No
Signaling Source/Analyzer	AF Diagnostics: Audio Frequency Generators 1 and 2			No
Controller	Functional Diagnostics: Self Test			No
Memory/SBRC	Functional Diagnostics: Self Test			No
Downconverter	RF Diagnostics: Downconverter			Yes
Power Supply Regulator	Functional Diagnostics: Self Test			No
Fans				No
Display Drive	Functional Diagnostics: Self Test			No
Power Supply	Functional Diagnostics: Self Test			No

Assembly Name	SERVICE7 Program Diagnostic Test: Sub-Test	Performance Test to Perform[a]	Periodic Calibration[b] Program	Cal.-Data Needed[c]
Signal Generator Synthesizer	RF Diagnostics: Signal Generator Synthesizer	RF Generator: Harmonic and Spurious Spectral Purity		Yes
LO-IF/IQ Modulator	CDMA Diagnostics LO_IF/IQ Mod.		SERVICE7: IQ Modulator	Yes
RF Output	RF Diagnostics: Output			Yes
Reference	RF Diagnostics: Reference	RF Generator: Residual FM		Yes
Receiver Synthesizer	RF Diagnostics: Receiver Synthesizer	RF Analyzer: Residual FM		Yes
CDMA Generator Reference	CDMA Diagnostics: CDMA Gen. Ref.		SERVICE7: IQ Modulator	Yes
Receiver	RF Diagnostics: Receiver	RF Analyzer: FM Accuracy		Yes
Power Supply				No
Spectrum Analyzer (optional)	RF Diagnostics: Spectrum Analyzer	Spectrum Analyzer		Yes[d]
Control Interface	Functional Diagnostics: Self Test			No
Modulation Distribution	AF Diagnostics: Mod Distribution Internal Paths	AF Generator: AC Level Accuracy	SERVICE7: Periodic Calibration: AF Gen Gain, EXT Mod Path Gain	Yes
Audio Analyzer 1	AF Diagnostics: Audio Analyzer 1 Internal Paths		SERVICE7: Periodic Calibration: Audio Analyzer Offset	Yes
Audio Analyzer 2	AF Diagnostics: Audio Analyzer 2	AF Analyzer: AC Voltage Accuracy	SERVICE7: Periodic Calibration: VFN	Yes
Measurement [e]	Functional Diagnostics: Self Test	Oscilloscope	SERVICE7: Periodic Calibration: Voltmeter Reference	Yes[f]
Motherboard				No

a. See Chapter 6, "Performance Tests" on page 137.
b. See Chapter 5, "Periodic Adjustments/Calibration" on page 119.
c. See table 5-1, "Assembly Calibration Information" on page 121 of Chapter 5, “Periodic Adjustments/Calibration.”
d. PCMCIA smart card supplied with kit.
e. Measurement checked indirectly by all diagnostics.
f. PCMCIA smart card supplied with kit.

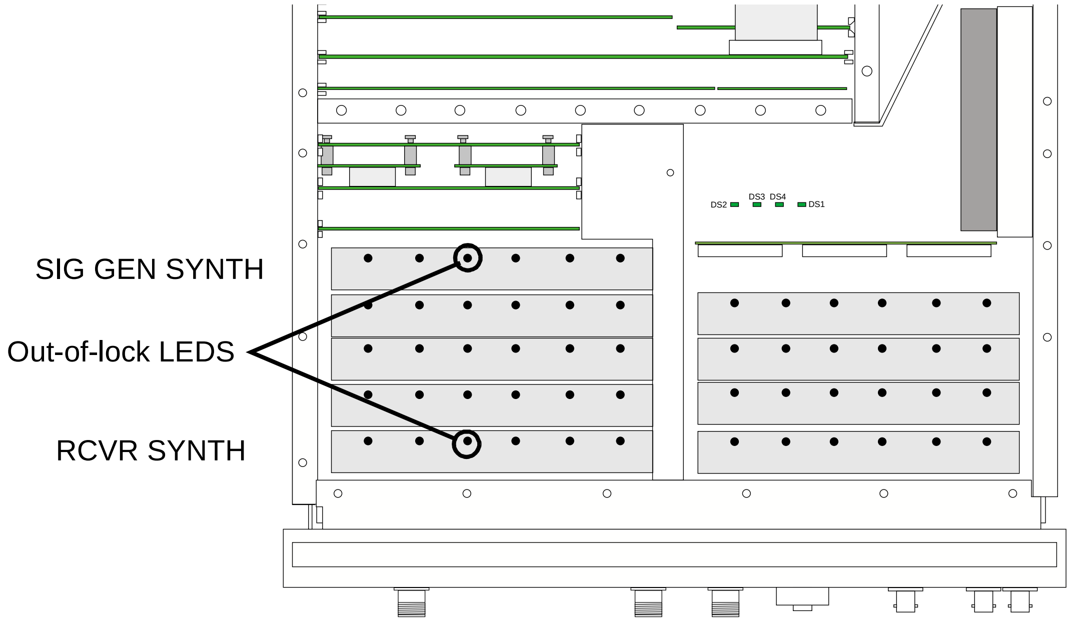
Verify Test Set’s Reference Path

Out-of-Lock (OOL) LEDs

Out-of-lock (OOL) LEDs light when a phase-locked loop inside an assembly is failing. The signal generator synthesizer and the receiver synthesizer assemblies have these LEDs mounted close to the top of the modules. The location of each LED is labeled on the assembly.

Verify that the CDMA generator reference and the reference are working before troubleshooting the receiver synthesizer and/or the signal generator synthesizer assemblies.

Figure 2-18 **Out-of-lock LEDs**



CDMA Generator Reference Assembly Verification

1. Turn the Test Set off and remove the external cover.
2. Remove the bottom cover and verify that the cable is connected between the EXT REF IN connector and J17 on the CDMA Generator Reference assembly.
3. Turn the Test Set on and verify that a 10 MHz signal is present on J15 of the CDMA Generator Reference assembly.

   If no signal or a poor signal appears at this connector, then the CDMA Generator Reference assembly is faulty.
4. Use screwdrivers to remove the Reference assembly.
5. Turn the Test Set on and verify that a 10 MHz signal is present on pin 20 of J63 and pin 19 of J18. This is the reference signal from the CDMA Generator Reference assembly.

If the 10 MHz signal is not present at all, then the CDMA Generator Reference assembly is faulty.

If the signal is present on pin 20 but not pin 19, then the Motherboard assembly is faulty (open or short).

Reference Verification

1. Turn the Test Set off and re-install the Reference assembly.
2. Use screwdrivers to remove the Receiver Synthesizer assembly.
3. Turn the Test Set on and verify that a 1 MHz signal of approximately −1 dBm is present on pin 3 of J21. This is the reference signal from the Reference assembly.
4. If the 1 MHz signal is not present, then the Reference assembly is probably faulty.

It is also possible that an open or shorted trace on the motherboard assembly exists. Check the motherboard for continuity between J21 pin 3 under the Receiver Synthesizer assembly and J18 pin 2 under the Reference assembly, and verify that the trace is not shorted to ground.

Receiver Synthesizer Unlocked

If the 1 MHz signal is present on pin 3 of J21, then the Receiver Synthesizer assembly is faulty.

Signal Generator Synthesizer Unlocked

1. Turn the Test Set off and use screwdrivers to remove the Signal Generator Synthesizer assembly.
2. If the signal is present, then the Signal Generator Synthesizer assembly is faulty.
3. Turn the Test Set on and verify that a 1 MHz signal of about −20 dBm is present on pin 3 of J12. This is the reference signal from the Reference assembly.

If the 1 MHz signal is not present, then the Reference assembly is probably faulty.

It is also possible that an open or shorted trace on the Motherboard assembly exists. Check the motherboard for continuity between J12 pin 3 (under the Signal Generator Synthesizer assembly) and J34 pin 1 (under the Reference assembly), and verify that the trace is not shorted to ground.

Swapping Known-Good Assemblies

Most swapped assemblies which use calibration data will operate well enough with the original assembly’s calibration data to troubleshoot and to run the diagnostics; do not expect the Test Set to meet its specifications. Some assemblies may appear to fail because of incorrect calibration data. It is also important to keep track of the original assemblies in the Test Set. If calibration data is lost, the assembly will have to be sent back to the factory.

Calibration data is generally stored in a daughter board’s socketed EEPROM on the digital controller assembly. If the controller is replaced or swapped, the original EEPROM must be put in the new Test Set’s controller. Should the EEPROM lose its data, the entire instrument will require factory restoration.

The assemblies that require downloaded calibration data from a memory card are:

- Spectrum Analyzer (optional)
- Measurement

Swapping these assemblies may cause some performance specification failures if the swapped in assembly's calibration data cannot be downloaded.

The assemblies that require on-board calibration loaded at the factory are:

- Downconverter
- Upconverter
- RF I/O
- Output Section
- Receiver
- Signal Generator Synthesizer
- Receiver Synthesizer
- Reference

Swapping these assemblies should not cause a performance problem, as their calibration data resides with the assembly.

The assemblies that require a periodic calibration procedure are:

- CDMA Reference
- RF Input/Output
- LO IF/IQ Modulator
- Audio Analyzer 1
- Audio Analyzer 2
- Measurement
- Modulation Distribution

Generally, these assemblies can be swapped without an immediate need of recalibration. In some cases though, a recalibration may be necessary to properly troubleshoot the instrument.

Further Isolating RF Failures

Isolating failures in the RF assemblies of the Test Set can be difficult. One problem occurs when the diagnostics use the built-in RF analyzer to test the built-in RF source, and vice versa. This is necessary to make the diagnostics self-contained, that is, they run without external equipment.

Some general-purpose, RF test equipment will be needed:

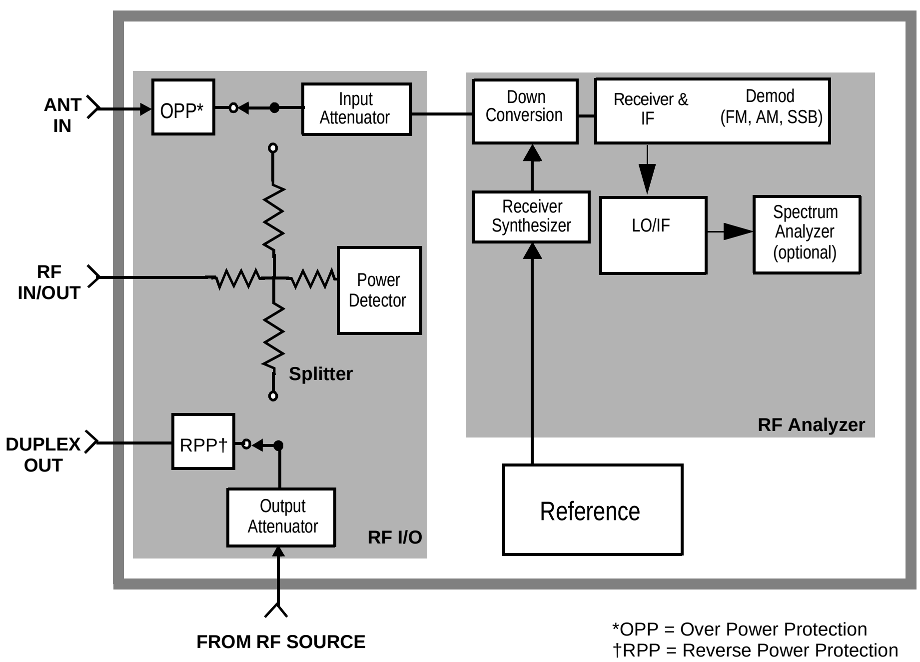
- RF signal generator
- RF modulation analyzer or spectrum analyzer.

Isolating the RF Analyzer

The RF Analyzer function uses the following assemblies. Refer to figure 2-19 and the block diagrams in chapter 8, "Block Diagrams".

- Downconverter
- Receiver
- Receiver Synthesizer
- Spectrum Analyzer (optional)

Figure 2-19 Isolating the RF Analyzer



To isolate an RF analyzer problem:

1. On the Test Set:

   a. Press **Preset**.

   b. Press the **Config** to access the CONFIGURE screen.

      - Set the `RF Display` field to `Freq`.
      - Set the `RF Offset` field to `Off`.

   c. Rotate the knob to the field under analog, press the knob and select RF ANL (to go to the analog RF ANALYZER screen).

      - Set the `Tune Freq` to `100 MHz`.
      - Set the `Input Port` to `RF IN`.

2. On the external RF signal generator:

   a. Set the frequency to 100 MHz CW.

   b. Set the amplitude to 0 dBm.

   c. Connect the output to the Test Set's RF IN/OUT connector.

3. Set the RF signal generator's frequency to 100, then 500, 900, and 1800 MHz. For each frequency reset the `Tune Freq` to that frequency. The Test Set's measurements should read as follows:

   a. `TX Power` should read approximately 0.001 W for each frequency.

   b. `Frequency` should read 100, 500, 900, and 1800 MHz respectively.

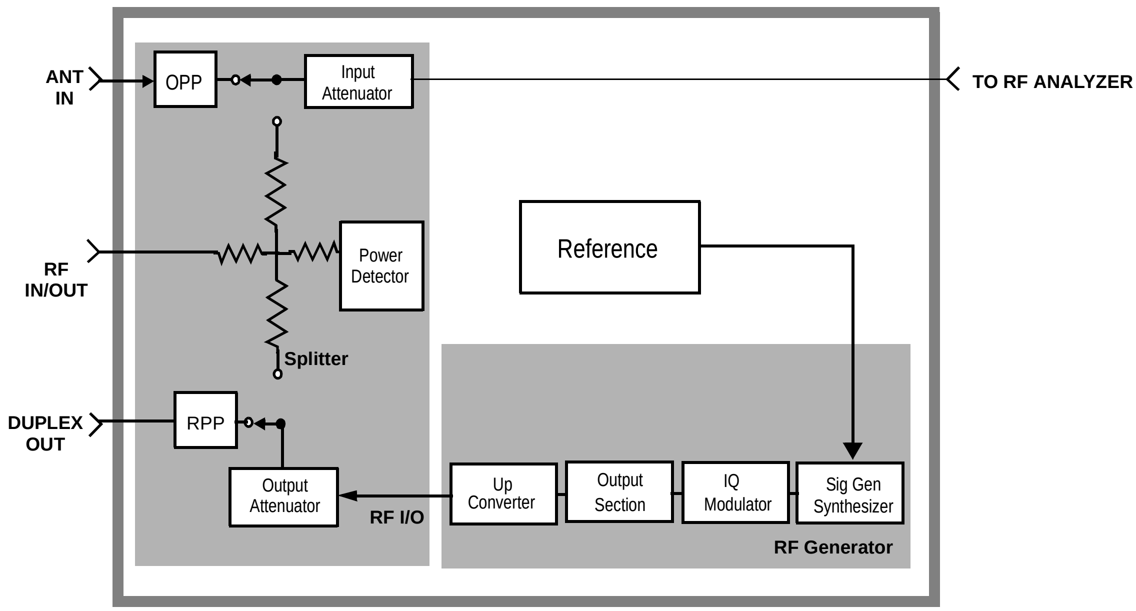
   c. If the Test Set has the optional spectrum analyzer, press the Spec Anl key to access the analog spectrum analyzer. Observe the level and frequency of the signal.

Isolating the RF Source

The RF generator function uses the following assemblies. Refer to figure 2-20 and the block diagrams in chapter 8, "Block Diagrams".

- LO IF/IQ Modulator
- Signal Generator Synthesizer
- Output Section
- Upconverter

Figure 2-20 Isolating the RF Source



To isolate the RF Source:

1. On the Test Set:

   a. Press **Preset**.

   b. Press the **Config** key to access the CONFIGURE screen.

      - Set the **RF Display** field to **Freq**.
      - Set the **RF Offset** field to **Off**.

   c. Press the **RF Gen** key (to go to the analog RF GENERATOR screen).

   d. Set **RF Gen Freq** to **1800 MHz**.

   e. Set **Amplitude** to **0 dBm**.

   f. Set **Output Port** to **Dupl**.

2. On the external RF modulation analyzer or spectrum analyzer:

   a. Set the tuning for the signal generated by the Test Set.

   b. Connect the analyzer’s input to the Test Set’s DUPLEX OUT connector.

3. Set the Test Set’s **RF Gen Freq** to 1800, then 600, 300, and 150 MHz. For each frequency, the external RF analyzer should read as follows:

   a. Power should read approximately 0.001 W for each frequency.

   b. Frequency should read 1800, 600, 300, and 150 MHz respectively.

Service Screen

A large number of latch and DAC settings used throughout the Test Set can also be read and/or set to alter standard operation. The SERVICE screen uses the internal voltmeter and frequency counter functions to monitor specific nodes in most assemblies. These functions are primarily intended to allow the automated internal diagnostic routines to verify proper instrument operation, and to allow the internal periodic adjustment routines to modify Test Set operation.

Use these functions for further troubleshooting when the diagnostics cannot isolate a failure to a specific assembly. To do this, you must understand how to operate the Test Set and, especially, understand how the assemblies in the Test Set work together.

To Access the SERVICE Screen

1. Press the Config key on the Test Set.
2. On the CONFIGURE screen, rotate the Test Set's selector knob and select **SERVICE**, see figure 2-21.

The SERVICE screen appears. For field descriptions, see "Field Names and Descriptions".

Field Names and Descriptions

Voltmeter Connection

This field selects the desired circuit node for voltage measurements. To change the voltmeter connection, use the knob to select the **Voltmeter Connection** field. A **Choices** menu will appear. Move the cursor to the desired circuit node in the list and push the cursor control knob. The reading is displayed in the **Voltage** measurement field at the top- left of the display.

Because the nodes being measured must be in the range of 0 to ±5 volts, the measurement of some points are scaled to that measurement range. For example; the +12 Volt reference (**MEAS_12V_REF**) should measure about +5volts. The –12 Volt reference (**MEAS_NEG_12V_REF**) should measure about –5 volts. Many of the voltage measurements are only valid after a number of instrument settings are changed.

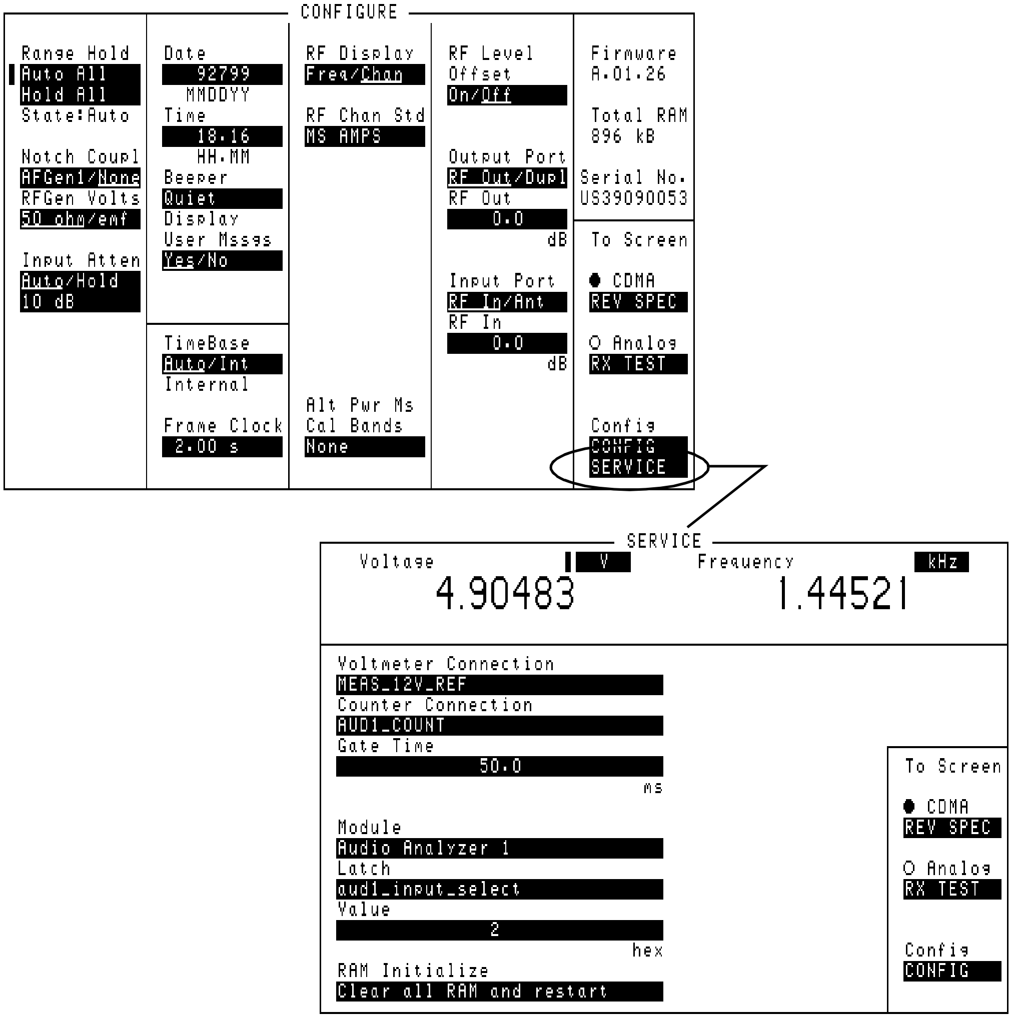
When run, the diagnostic routines make the necessary circuit changes and measurements automatically, comparing the measurements to known limits for each node.

Counter Connection

This field selects the desired circuit node to connect to the Test Set's internal frequency counter. The reading is displayed in the **Frequency** measurement field at the top right of the display.

To change the counter connection, use the knob to select the **Counter Connection** field. A **Choices** menu will appear. Select the desired circuit node.

Figure 2-21 Service Screen



Gate Time

This field is used to adjust the Test Set's internal frequency counter's gate time. A shorter gate time may enable you to see frequency fluctuations that might not be seen using a longer gate time.

To change the gate time, use the knob to select the Gate Time field. When you select the field a flashing >> cursor is displayed. Rotate the cursor control knob until the desired gate time (10 to 1000 ms in 10 ms increments) is displayed, then press the cursor control knob.

Module

This field is used to manually select the module that contains the circut latches to be selected.

Latch

This field is used to manually select the circuit latches in the module selected in the Module field above. The latches control switch, DAC, and gain settings within the Test Set. The value of the selected latch is displayed and changed in the the Value field. Some settings are read only.

To set a latch:

1. Use the knob to select the **`Module`** . A **`Choices`** menu will appear.
2. Move the cursor to the desired module name and press the knob to select it.
3. Use the knob to select the **`latch`** field. A **`Choices`** menu will appear.
4. Move the cursor to the desired latch name and press the knob to select it.
5. Use the knob to select the **`Value`** field. A flashing >> cursor is displayed.
6. Rotate the cursor control knob or key in a number on the keypad to modify the value (hexadecimal).

Value (hex)

This field displays and changes the hexadecimal value for the latch shown in the **`Latch`** field.

RAM Initialize

Selecting this field clears all SAVE registers and test programs, and any initialized RAM disk(s), that may be in RAM. It also resets all latches to their factory power-up configuration. If you have saved one or more instrument setups using the SAVE function, using this function will permanently remove them.

3 Disassembly and Replaceable Parts

This chapter contains information for the removal and replacement of the assemblies in the Test Set. Illustrations and a parts list are provided for parts identification.

Before You Start

CAUTION Perform the procedures in this chapter only at a static-safe work station. The printed circuit assemblies in this instrument are sensitive to static electricity damage. Wear an anti-static wrist strap that is connected to earth ground.

Recommended Torque

- Screws: Tighten until just snug, use care not to strip threads.
- RF connectors –
  - SMA type: 9.0 lb-in. (102 N-cm)
  - SMC type: 6.0 lb-in. (68 N-cm)

Tools

One or more of the following tools may be required to access and remove Test Set's assemblies.

- TX-10 Torx screwdriver
- TX-15 Torx screwdriver
- Flat-blade screwdriver
- 7-mm socket wrench
- 1/16-inch allen wrench
- 3/16-inch socket wrench
- 1/4 -inch open-end wrench
- 5/16-inch open-end wrench
- 29-mm socket

Ordering Replacement Parts and Support

Repair assistance is available from the factory by phone and email. When calling or writing for repair assistance, please have the following information ready:

- Instrument model number
- Instrument serial number (tag located on the rear panel).
- Installed options - if any (tag located on the rear panel).
- Instrument firmware revision - displayed at the top of the screen when the Test Set is powered up, and is also displayed on the CONFIGURE screen.

Telephone Numbers and Email

- 1-800-922-8920 Agilent Technologies Call Center
- 1-800-827-3848 (Spokane Division Service Assistance, U.S. only)
- 1-509-921-3848 (Spokane Division Service Assistance, International)
- 1-800-227-8164 (Agilent Technologies Direct Parts Ordering, U.S. only)
- 1-916-783-0804 (Agilent Technologies Service Parts Identification, U.S. & International)
- Email: spokane_service@agilent.com

Downloading Calibration Data

Most assemblies in the Test Set require calibration data. To ensure that the Test Set remains calibrated after an assembly is replaced, new calibration data must be downloaded. When required, calibration data is provided on a PCMCIA memory card that is included with the replacement assembly. Refer to Table 2-2, “Relating Assemblies to Troubleshooting Aids,” on page 67 of Chapter 2, “Troubleshooting,”to see which modules require calibration.

Calibration Data Download Procedure

1. Switch the Test Set's power off.
2. Remove the faulty assembly.
3. Install the replacement assembly.
4. Switch the Test Set's power on.
5. Insert the memory card.
6. Press the Tests key.
7. Set the **`Select Procedure Location:`** field to **`Card`**.
8. Set the **`Select Procedure Filename:`** field to: **`DNLDCAL`**.
9. Press the K1 key to run the test.
10. Follow the instructions on the screen.

Disassembly Procedures

This section provides instructions for disassembling the Test Set. The procedures provided in this chapter are mainly organized in sequential order of Test Set disassembly. For component and assembly part numbers refer to the "Parts List" on page 102. The callouts for the parts used in the following illustrations are the same as their descriptions in the parts list.

External and Internal Covers

1. Remove the rear bumpers – two screws secure each bumper. See Figure 3-1.
2. Remove the strap handles (STRAP_HANDLE) from the Test Set.
3. Slide the external cover from the front frame.
4. To access the top-side assemblies remove the screws securing the top internal covers and remove it. See Figure 3-2 on page 86.
5. To access the bottom-side assemblies remove the screws securing the bottom internal cover and remove it. See Figure 3-2 on page 86.

Figure 3-1 Cover Removal

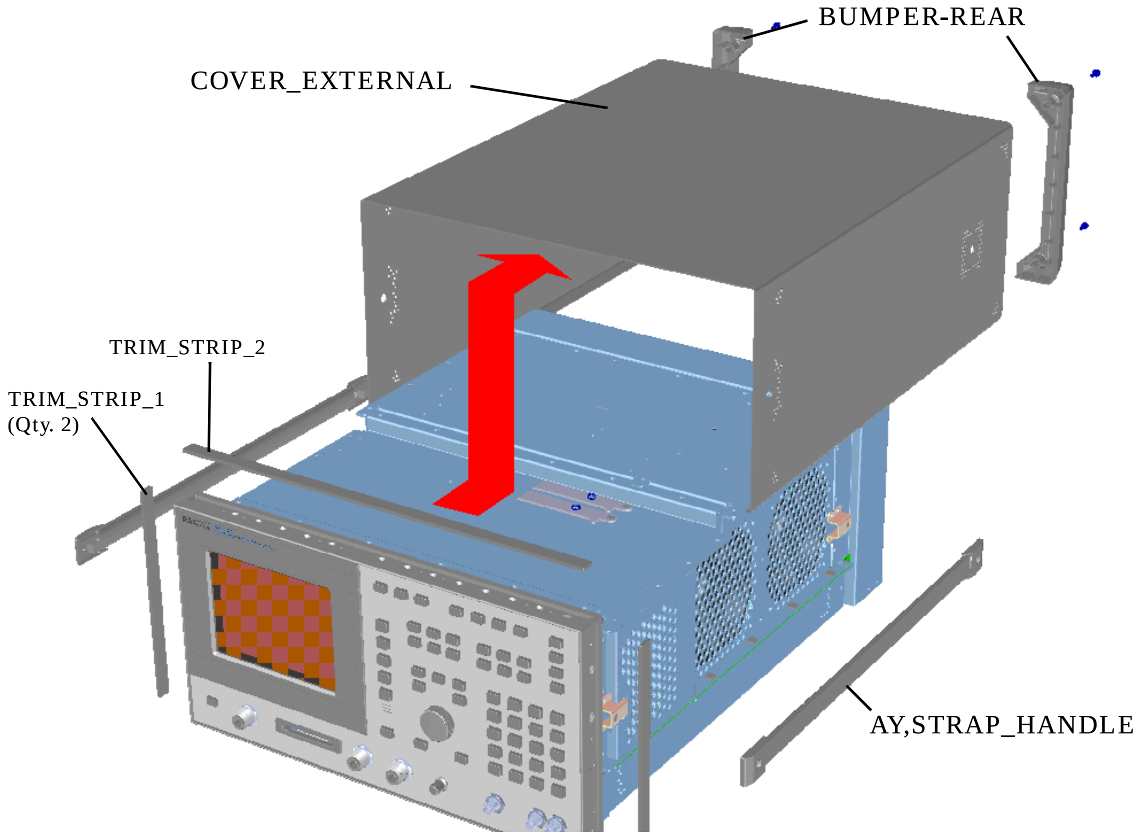
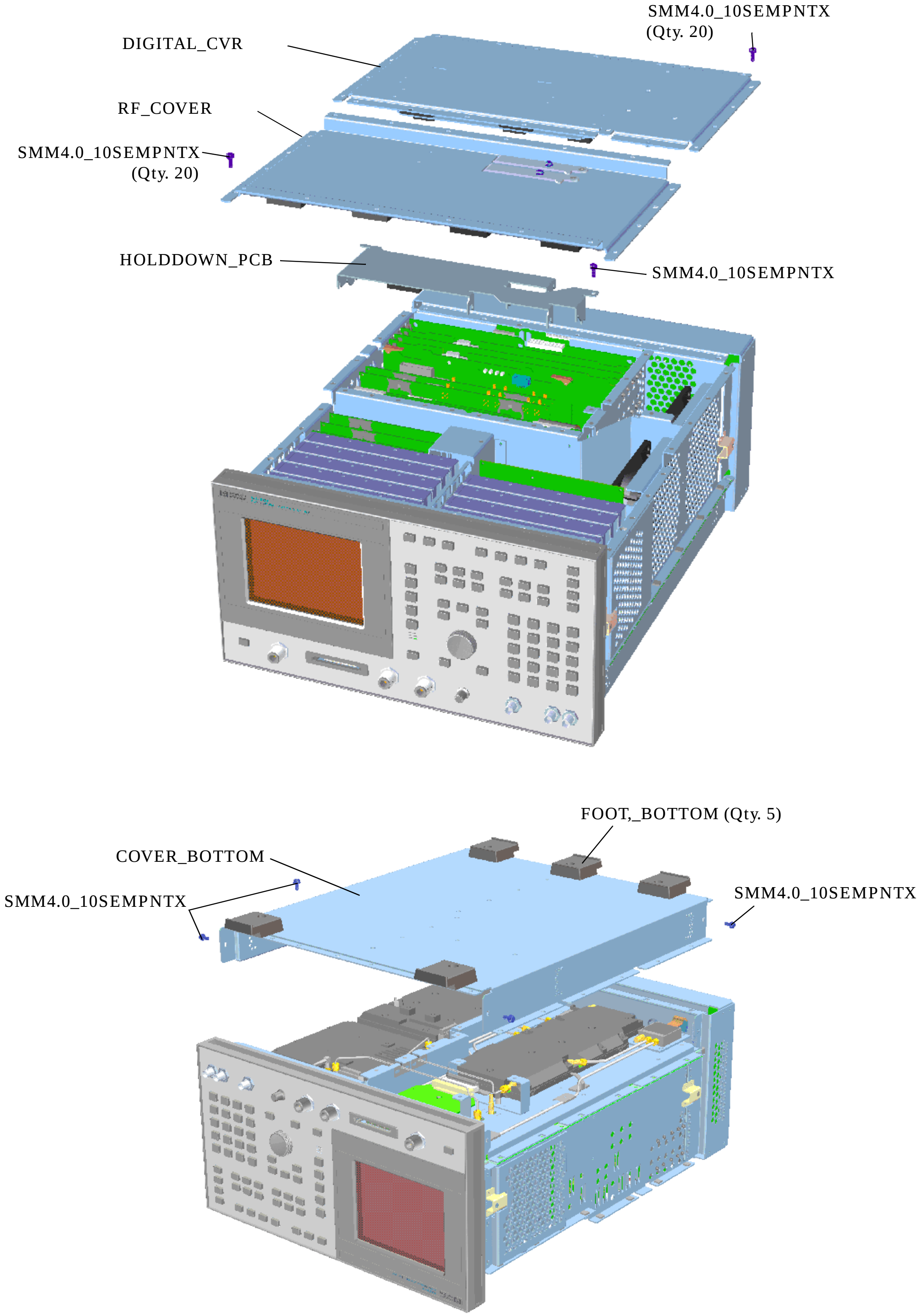


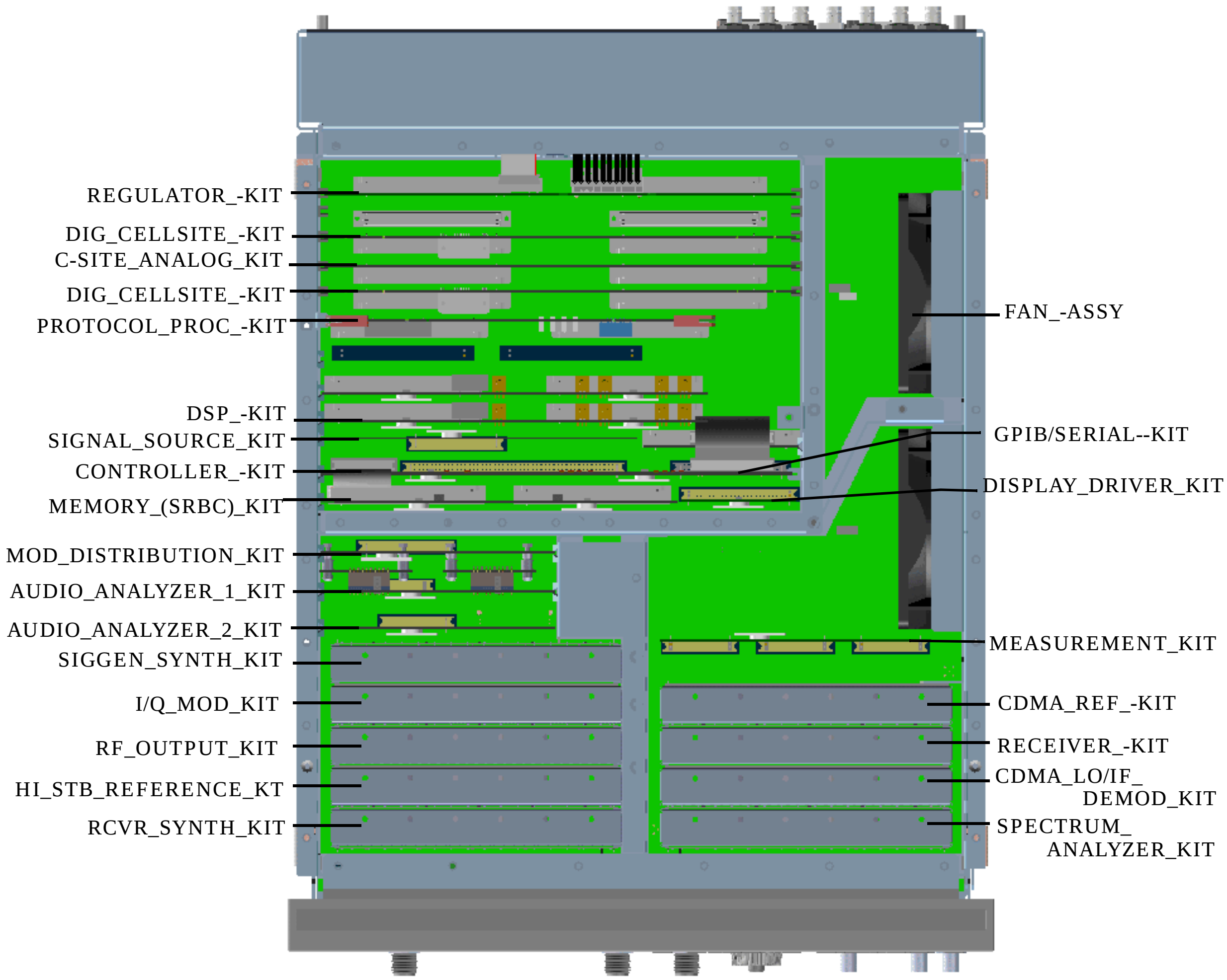
Figure 3-2 Top and Bottom Internal Covers



Top-Side Assemblies

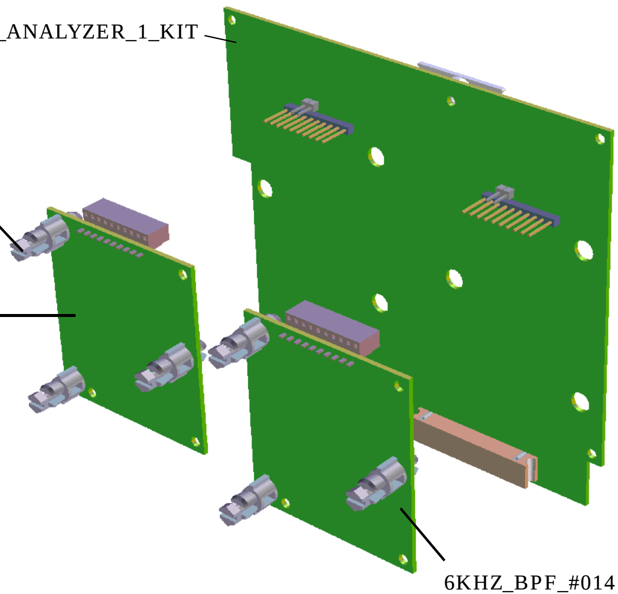
1. Remove the external and internal covers, see "External and Internal Covers" on page 85.
2. Using Figure 3-3, identify the module or board assembly you want to remove and lift the module or board assembly from the mother board.

Figure 3-3 Top-Side Assemblies



Audio Analyzer and Filter Assemblies

Figure 3-4 Audio Analyzer and Filter Assemblies



Opt.	Description
11	CCITT_FLTR
STD	C_MESS_FLTR

Replacing the Controller

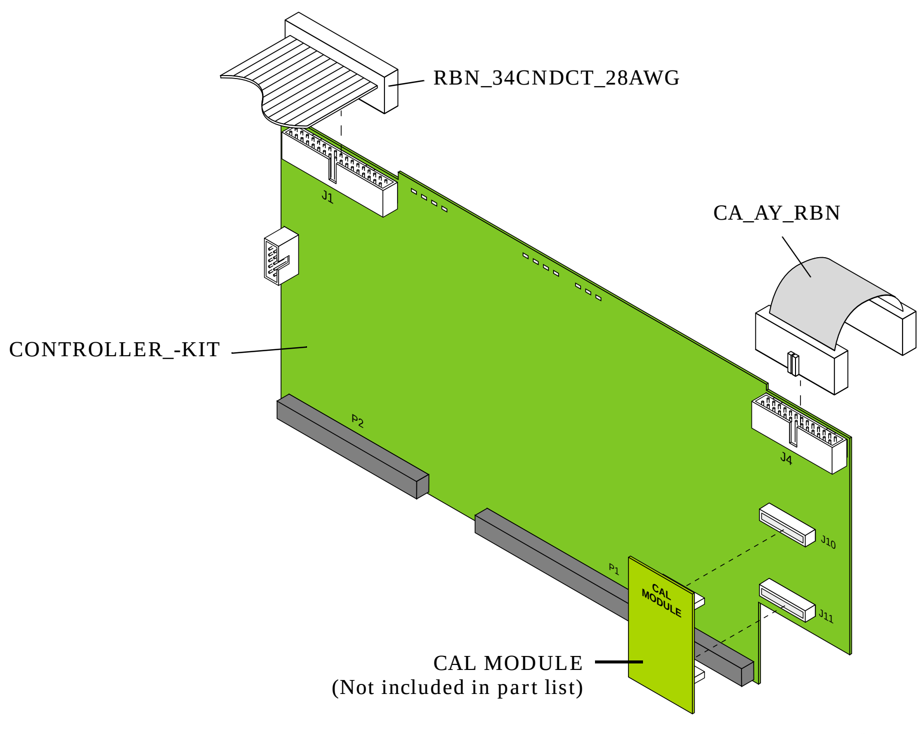
NOTE

Restoring Calibration Data in Controller Assembly
Calibration data for the entire Test Set is stored in EEPROM on the controller (CONTROLLER_-KIT) assembly, see Figure 3-5. When replacing the controller assembly, you must remove the “CAL MODULE” EEPROM assembly from the old controller assembly and insert it onto the replacement controller assembly to preserve the calibration data for the instrument.

“Boot Code” is the firmware that initializes the Test Set on power-up. It also looks at the PCMCIA card port at power-up to see if a firmware revision card has been inserted. This code is stored in the “CAL MODULE” EEPROM on the controller (CONTROLLER_-KIT) assembly. If a new version of boot code needs to be installed, carefully remove the old EEPROM module and insert the new module, being careful to orient the notch on the EEPROM. To replace the controller assembly:

1. Remove the external and internal covers, see "External and Internal Covers" on page 85
2. Locate the controller board (see Figure 3-3 on page 87), disconnect the ribbon cables (see Figure 3-5), and pull it out from the Test Set.
3. Carefully remove the CAL MODULE from the old board and place it on the replacement.

Figure 3-5 Controller and “CAL MODULE” Assemblies



Bottom-Side Assemblies

1. Remove the external and internal cover, see "External and Internal Covers" on page 85.

2. Use Figure 3-6 through Figure 3-11 to identify and remove the assembly desired.

Figure 3-6 Bottom-Side Assemblies

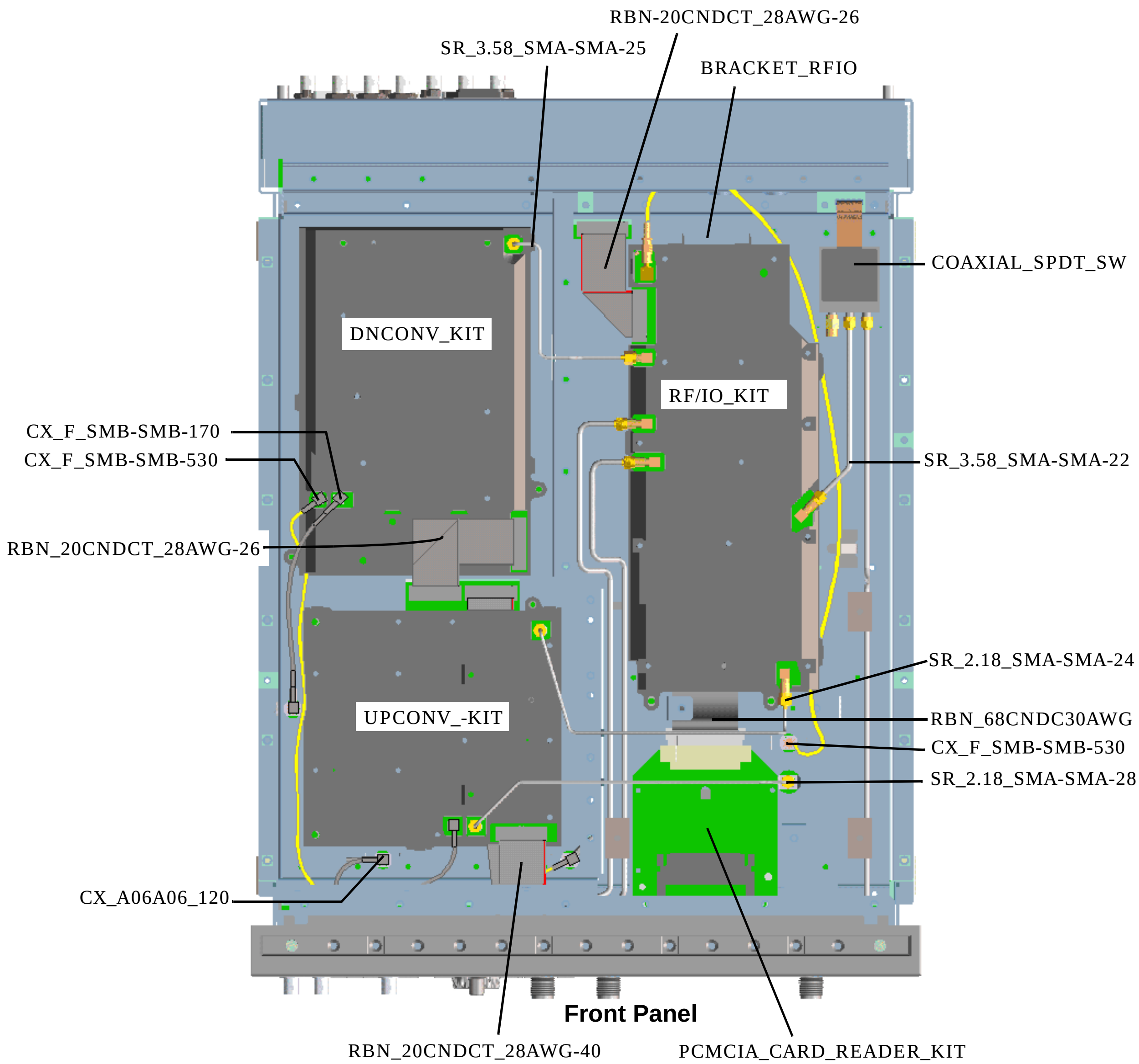
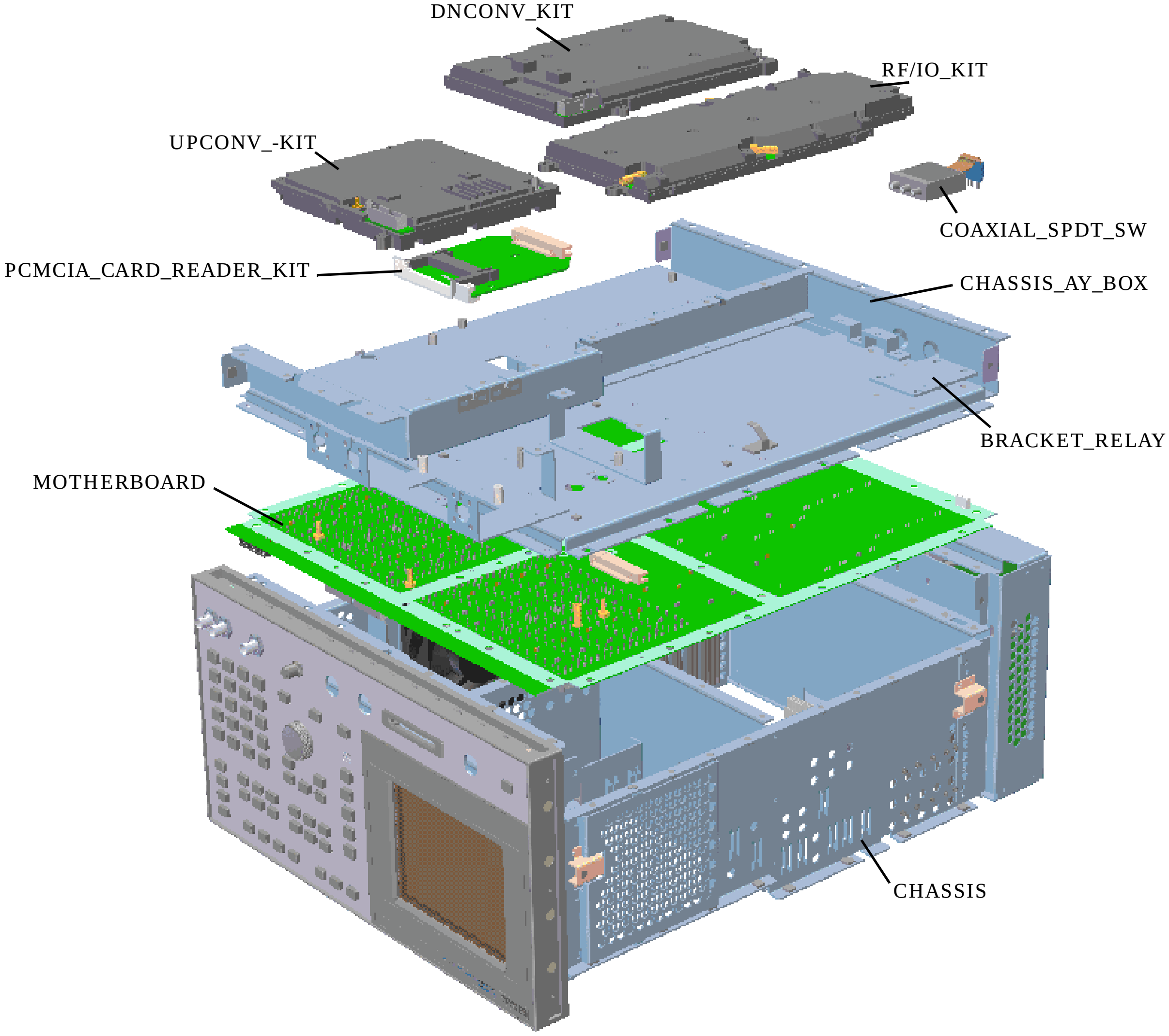


Figure 3-7 Bottom-side Subassemblies

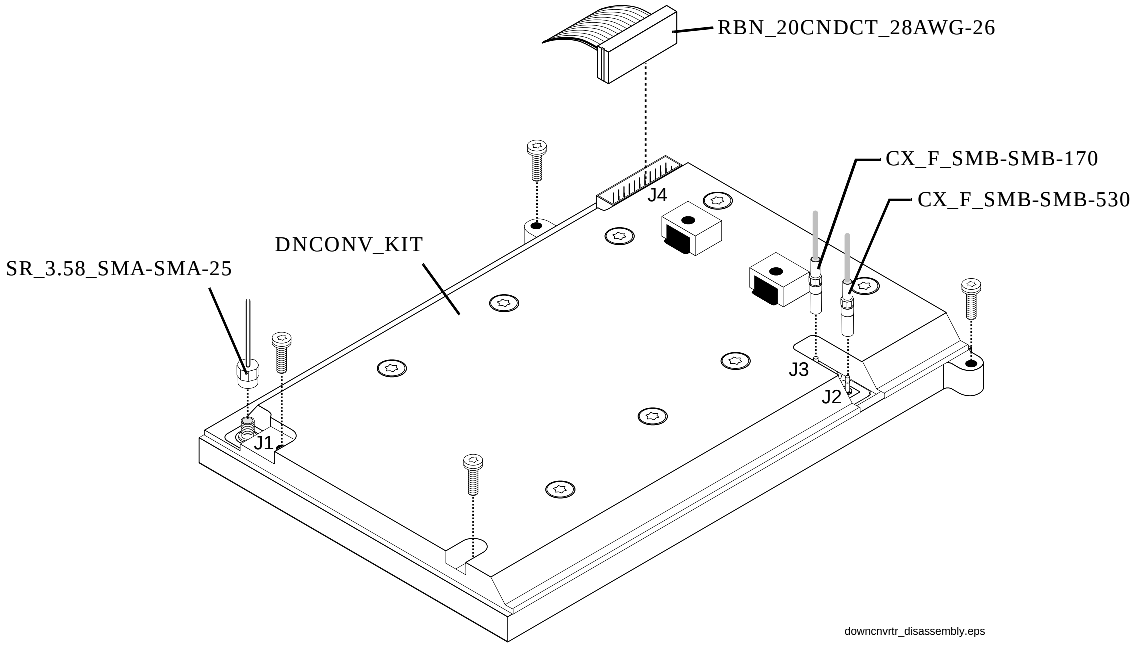


NOTE: There is a combined MOTHERBOARD/CHASSIS KIT.

Downconverter Assembly

To remove this assembly disconnect the cables, connectors, and 4 screws shown in Figure 3-8.

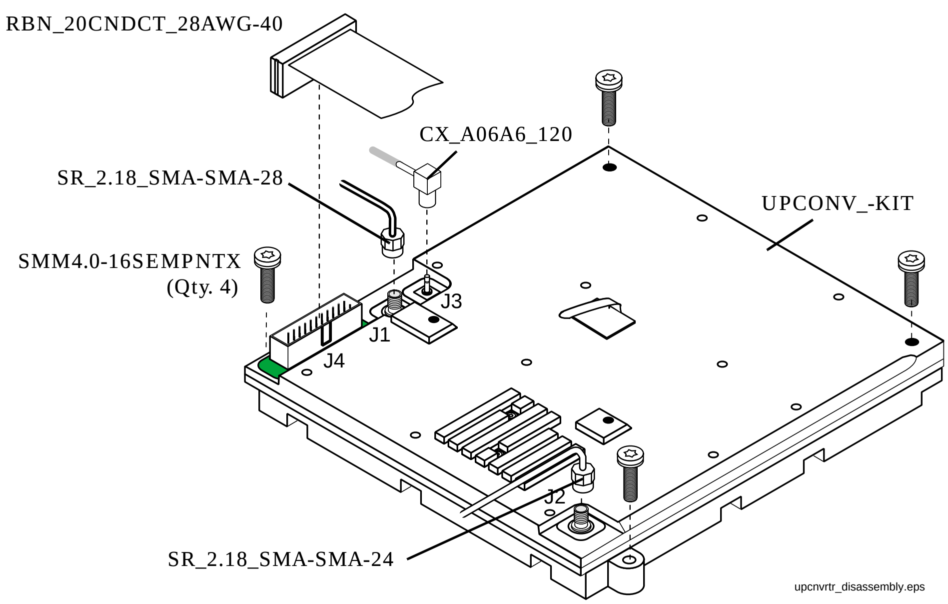
Figure 3-8 Downconverter Removal



Upconverter Assembly

To remove this assembly disconnect the cables, connectors, and 4 screws shown in Figure 3-9.

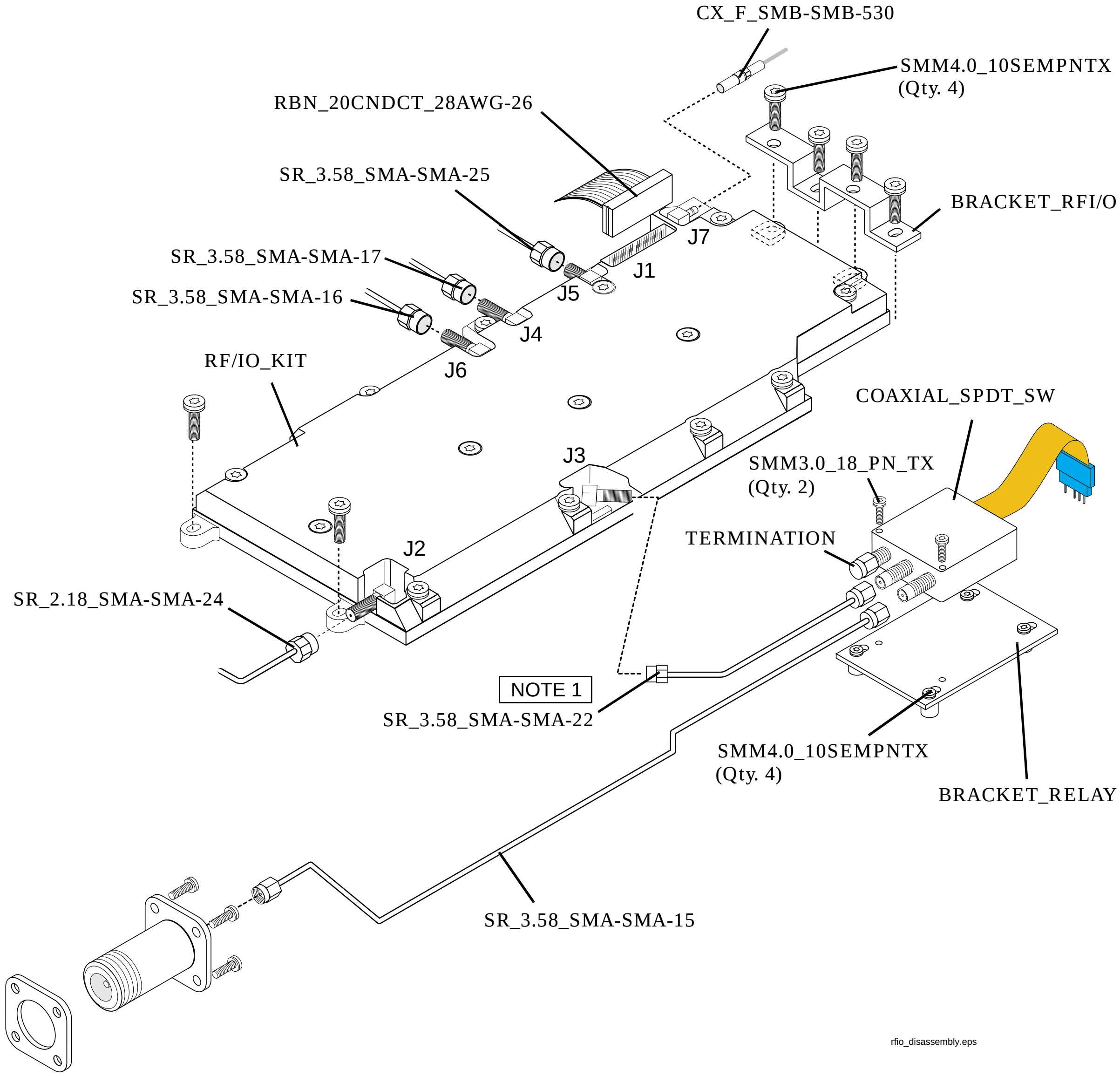
Figure 3-9 Upconverter Removal



RF I/O and Coaxial Switch Assemblies

To remove the RF I/O or coaxial switch assembly, or other associated components, see Figure 3-10.

Figure 3-10 RF I/O and Coaxial Switch Assemblies Removal

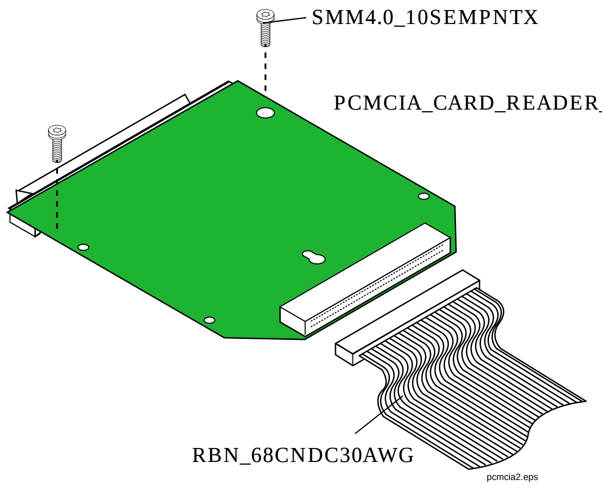


NOTE 1: To remove this cable, it is necessary to loosen the coaxial switch.

PCMCIA Assembly

To remove this assembly, disconnect the ribbon cable and 2 screws securing the assembly.

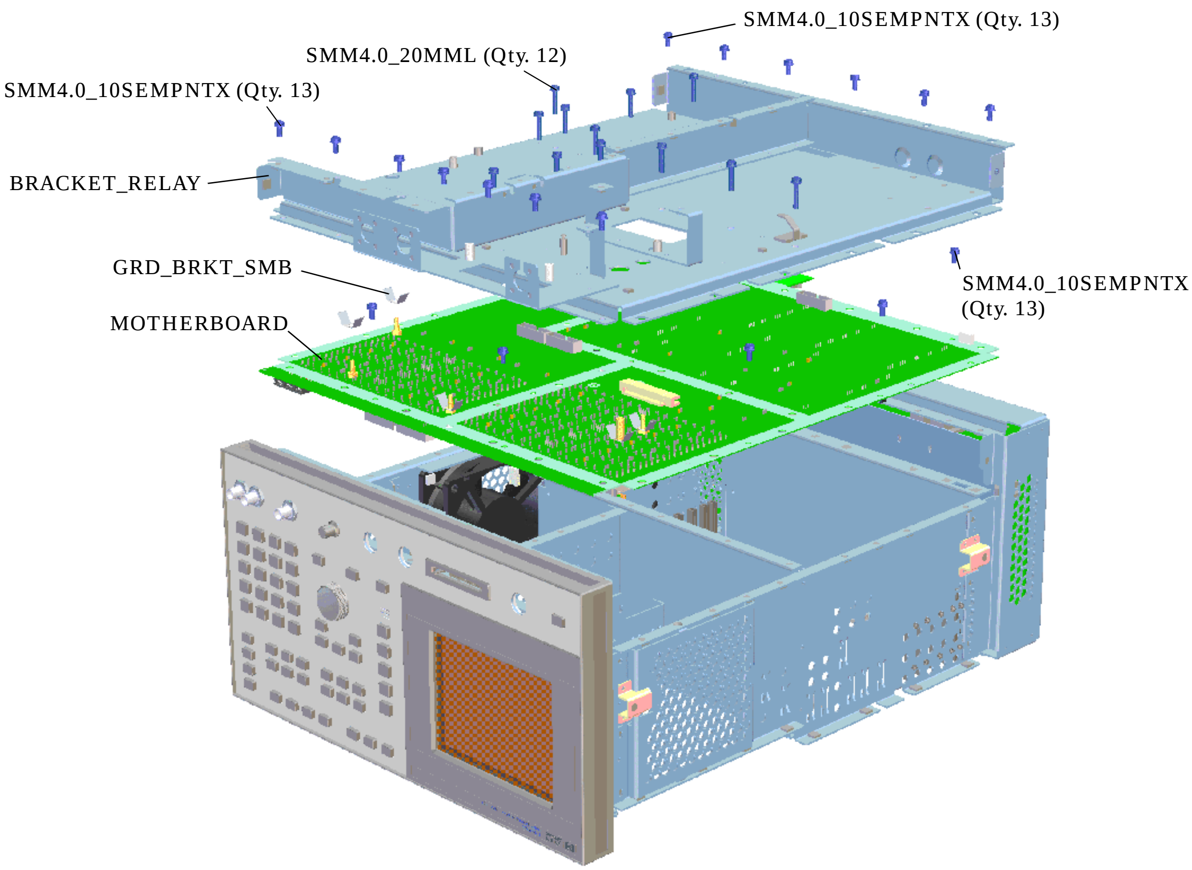
Figure 3-11 PCMCIA Assembly Removal



Motherboard Assembly

1. Remove the external and internal covers, see "External and Internal Covers" on page 85.
2. Remove all top and bottom side subassemblies from the Test Set (see previous disassembly procedures).
3. Remove the bracket relay from the chassis, see Figure 3-12.
4. Remove the screws securing the motherboard to the chassis.

Figure 3-12 Motherboard Disassembly



Front Panel Assembly

The front-panel assembly must be removed from the Test Set's chassis before any of the front panel subassemblies can be removed.

1. Remove the external and internal covers, see "External and Internal Covers" on page 85.
2. Remove the cables, BNC nuts, and 6 screws securing the front panel frame to the Test Set's chassis, see Figure 3-13.
3. See Figure 3-14 on page 97 to identify the desired subassembly for removal.

Figure 3-13 Front Panel Assembly

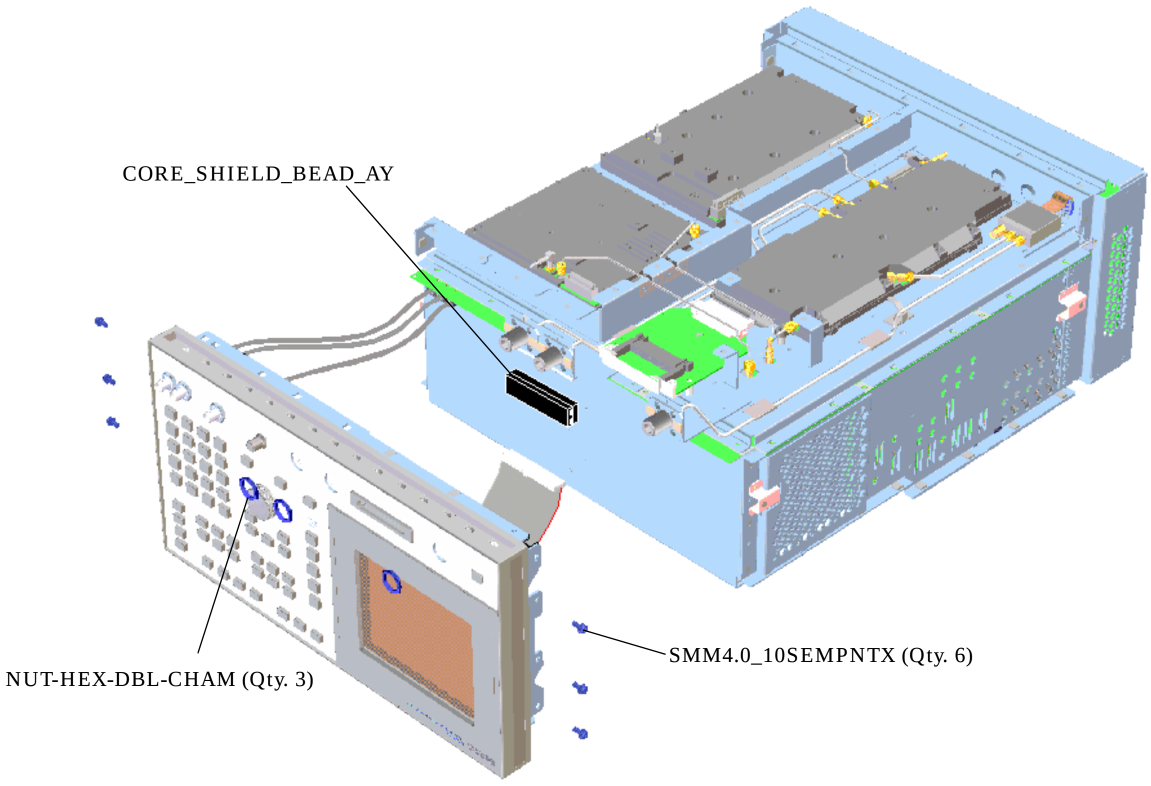
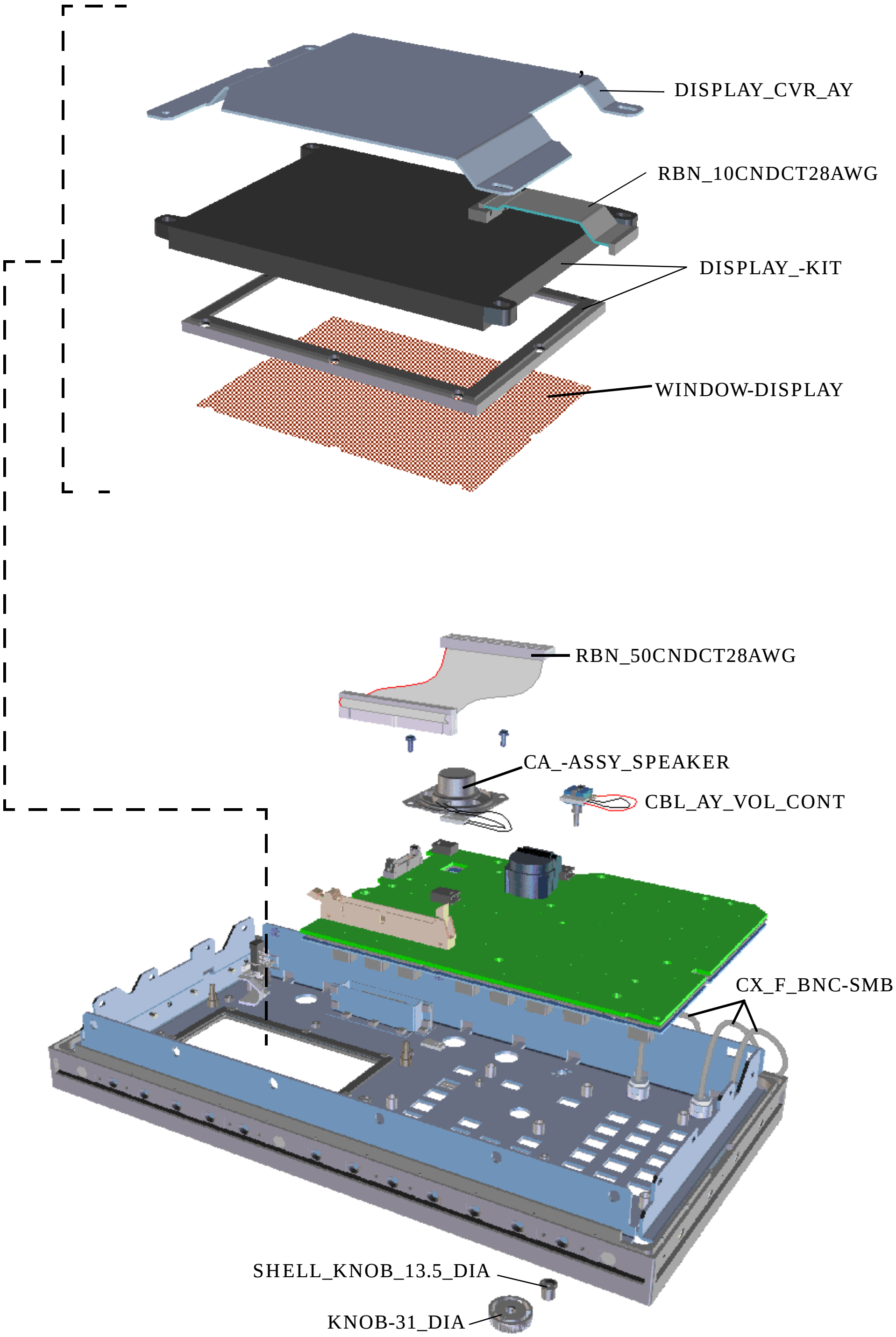


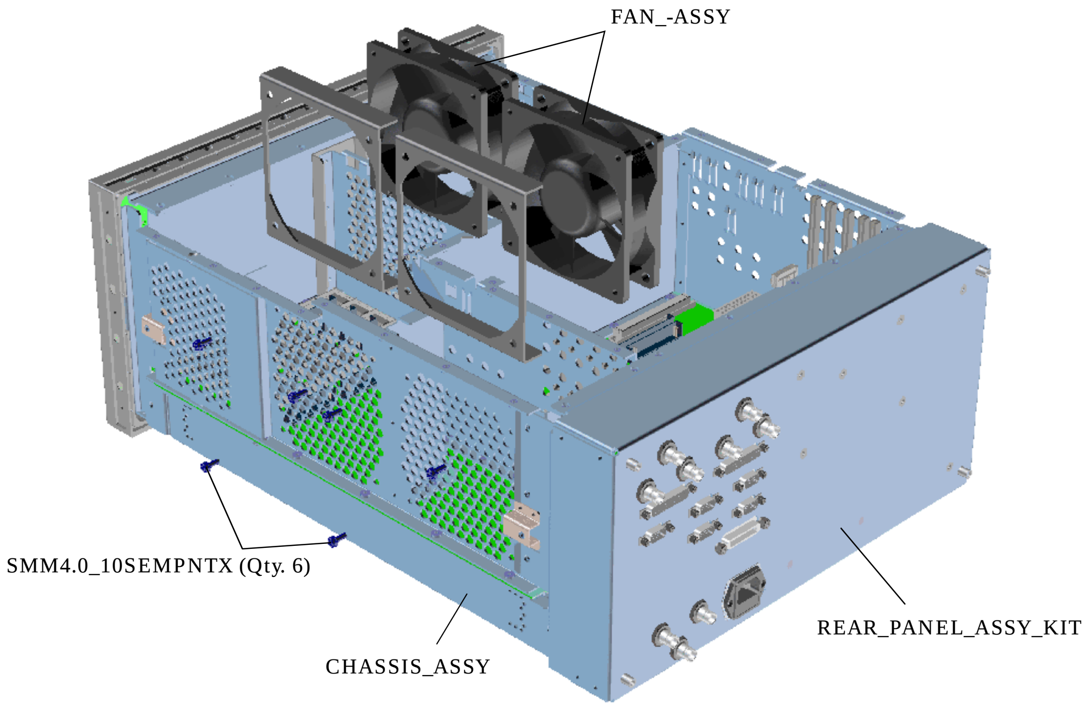
Figure 3-14 Front Panel Subassemblies



Fan

1. Remove the external and internal-top covers. See "External and Internal Covers" on page 85.
2. To remove either fan (see Figure 3-15) disconnect its power connector to the motherboard, and remove the 4 screws securing the fan to the Test Set's chassis.

Figure 3-15 Fan Removal



Power Supply

1. Remove the external and internal top and bottom cover, see Figure 3-2 on page 86.
2. Remove the 6 screws securing the power supply assembly to the Test Set's chassis, see Figure 3-16.
3. Refer to Figure 3-17, "Power Supply Subassemblies," on page 100 and Figure 3-18, "Power Supply Assembly Rear Panel," on page 101 to identify the desired subassembly for removal.

Figure 3-16 Power Supply Assembly

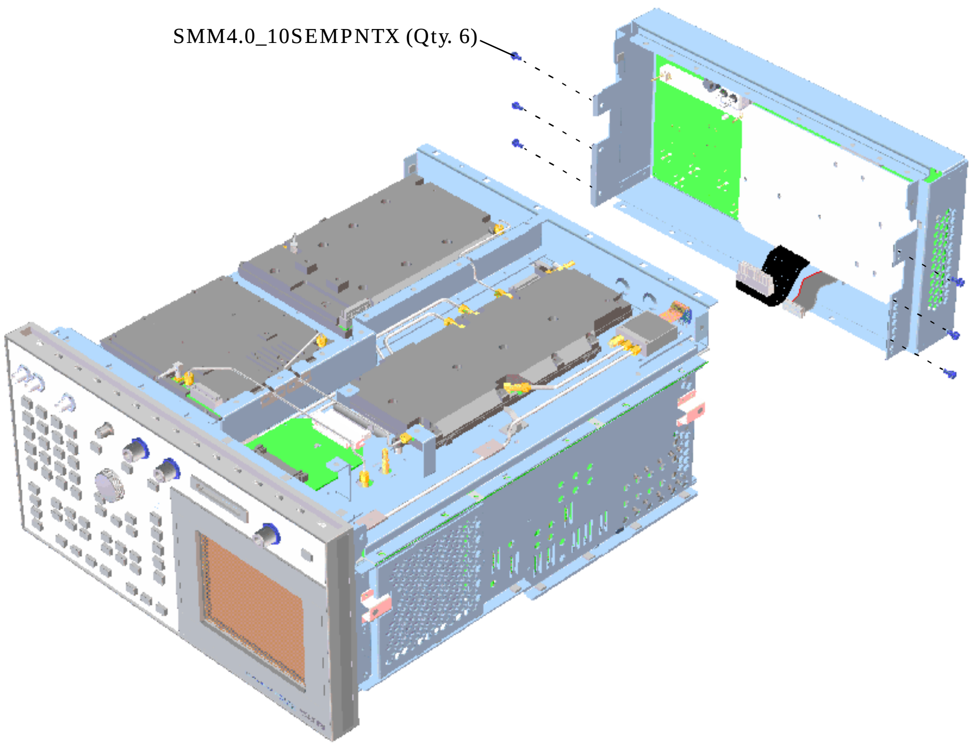


Figure 3-17 Power Supply Subassemblies

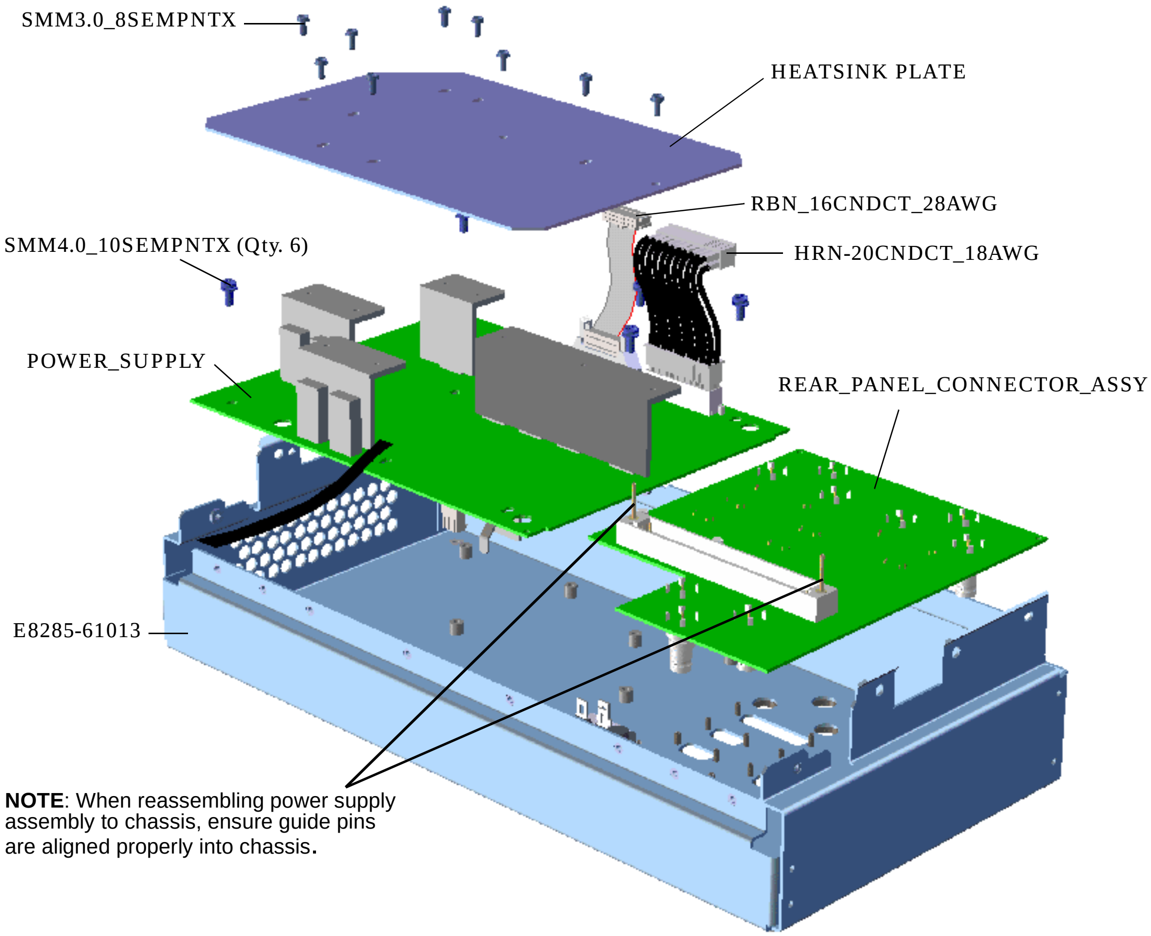
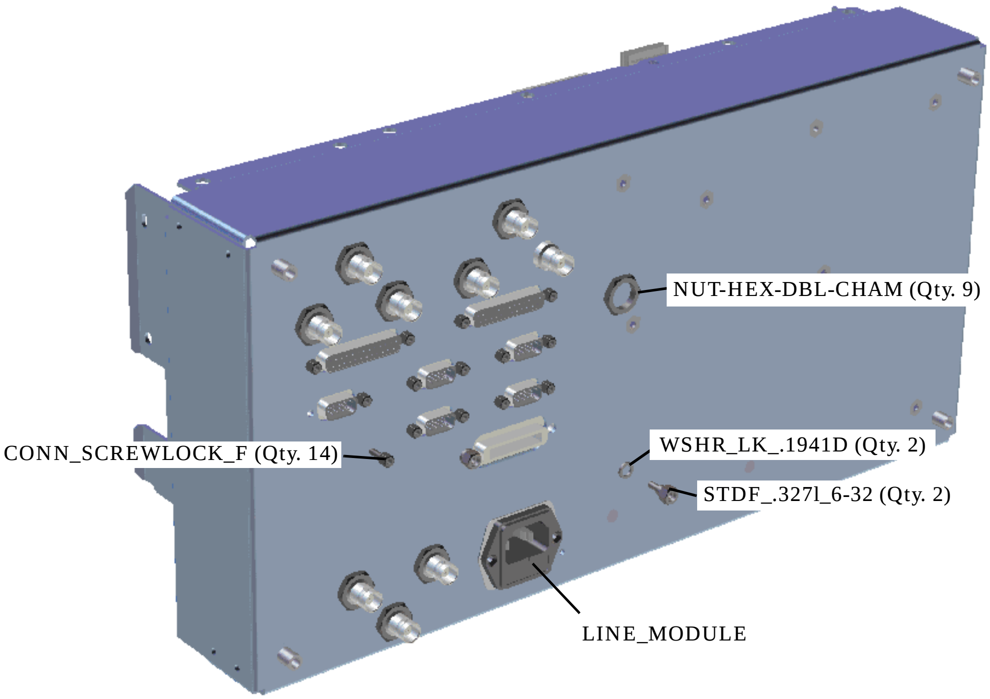


Figure 3-18 Power Supply Assembly Rear Panel



Parts List

Table 3-1 Replaceable Parts

Description	Part Number
6KHZ_BPF_#014_AY	08920-60268
ANALOG_C-SITE_KIT	08924-61807
APPLICATN_GUIDE	E8285-90019
AUDIO_ANALYZER_#1_KIT	08920-61811
AUDIO_ANALYZER_2_KIT	08920-61853
BRACKET_RELAY	E8285-00044
BRACKET_RFIO	E8285-00066
BUMPER-REAR	E5515-40009
C-MESS_FLTR	08920-61056
CA_AY-RBN	E6380-61052
CA_AY_RBN_26_CND	E8285-61057
CBL_AY_LNE_MDL	E8285-61047
CBL_AY_VOL_CONT	E8285-61043
CCITT_FLTR_#011	08920-61055
CDMA_LO/IF_DEMOD_KIT	08924-61805
CDMA_REF_-KIT	E8285-61804
CHASSIS_AY	E8285-61001
CHASSIS_AY_BOT	E8285-61035
COAXIAL_SWITCH	33314-60015
CONDENSE_REF_GDE	E8285-90020
CONN_SCREWLOCK_F	0380-2079
CONTROLLER_-KIT	E8285-61808
CORE_SHIELD_BEAD_AY	E8285-61058
COVER_BOTTOM	E8285-00012
COVER_EXTERNAL	E8285-00013
CX_A06A06_120	8120-5846
CX_F_BNC-SMB	E8285-61018

Description	Part Number
CX_F_SMB-SMB_170	E8285-61049
CX_F_SMB-SMB_530	E8285-61051
DIG_CELLSITE_-KIT	E8285-61832
DIGITAL_CVR_AY	E8285-61009
DISPLAY_-KIT	E8285-61823
DISPLAY_DRIVER_KIT	E6380-61816
DNCONV_KIT	E6380-61808
DSP_-KIT	E8285-61812
FAN_-ASSY	E8285-61014
FOOT,BOTTOM	E5515-40010
FRONT_FRAME_-ASSY	E8285-61822
FUSE_5A_250V	2110-0882
FW_UPGRAD_-KIT	E8285-61815
GRD_BRKT_SMB	E8285-00029
GRND_SPRING_SMA	E8285-00065
GROUND_BRKT_CBL	E8285-00048
HEAT_SINK_PWR_SUP	E8285-00040
HI_STB_REFERENCE_KT	08920-61835
HOLDDOWN_KEYMAT	E8285-00038
HOLDDOWN_PCB	E8285-61052
HOLDDOWN_TYPE_N_AY	E8285-61053
GPIB/SERIAL_-KIT	E8285-61843
HRN-20CNDCT_18AWG	E8285-61033
HRN_PWR_SWITCH	E8285-61042
I/Q_MOD_KIT	08924-61806
KEY_MAT	E8285-40001
KEYBOARD_-ASSY	E8285-60141
KNOB-31_DIA	E5515-21052
KNOB_ASSY_3/8	0370-3409
MANUAL_CD_ROM	E8285-10004

Description	Part Number
MEASUREMENT_KIT	08920-61836
MEMORY_(SBRC)_KIT	E6380-61801
MOD_DISTRIBUTION_KIT	08920-61809
MOTHER_BD_AY	E8285-60101
MOTHERBOARD/CHASSIS_-KIT	E8285-61801
NUT-HEX-DBL-CHAM	0590-2332
PCMCIA_CARD_READER_KIT	E6380-61803
POWER_SUPPLY	0950-2665
PROTOCOL_PROC_-KIT	E8285-61813
RBN_10CNDCT28AWG	1253-0851
RBN_16CNDCT_28AWG	E8285-61032
RBN_20CNDCT_28AWG-26	E8285-61026
RBN_20CNDCT_28AWG-40	E8285-61040
RBN_34CNDCT_28AWG	E8285-61031
RBN_50CNDCT28AWG	E8285-61021
RBN_68CNDC30AWG	E8285-61019
RCVR_SYNTH_KIT	08921-61820
REAR_PANEL_CONNECTOR_ASSY	E8285-60140
REAR_PANEL_KIT	E8285-61810
RECEIVER_-KIT	E8285-61805
REFERENCE_GUIDE	E8285-90016
REGULATOR_-KIT	E8285-61802
RF/IO_KIT	E8285-61856
RF_COVER_AY	E8285-61008
RF_OUTPUT_KIT	E6380-61832
SCR-MACH_MS10.8	0515-2694
SHELL-KNOB_13.5_DIA	E8285-40004
SHIELD_DISPLAY	E8285-00054
SIGGEN_SYNTH_KIT	08921-61819
SIGNAL_SOURCE_KIT	08920-61850

Description	Part Number
SMM3.0_12SEMPNTX	0515-0664
SMM3.0_18_PN_TX	0515-0682
SMM3.0_6_FL_TX	0515-1227
SMM3.0_6SEMPNTX	0515-2126
SMM3.0_8_FL_TX	0515-1102
SMM3.0_8SEMPNTX	0515-0372
SMM4.0_10SEMPNTX	0515-0380
SMM4.0_12SEMPNTX	0515-2243
SMM4.0_16SEMPNTX	0515-2245
SMM4.0_20MML	0515-0456
SMM4.0_6_PN_TX	0515-0684
SPEAKER_ASSY	E8285-61044
SPECTRUM_ANALYZER_KIT	08920-61852
SR_2.18_SMA-SMA	E8285-61024
SR_2.18_SMA-SMA	E8285-61028
SR_3.58_SMA-SMA-15	E8285-61015
SR_3.58_SMA-SMA-16	E8285-61016
SR_3.58_SMA-SMA-17	E8285-61017
SR_3.58_SMA-SMA-22	E8285-61022
SR_3.58_SMA-SMA-25	E8285-61025
STDF_.327L_6-32	0380-0644
STRAP_HANDLE	E8285-61012
TERMINATION	0960-0053
TRANSIT_CASE	E8285-90012
TRIM_STRIP-1	5041-9173
TRIM_STRIP-2	5041-9176
UPCONV_-KIT	E8285-61811
USERS_GUIDE	E8285-90018
WINDOW-DISPLAY	E6380-21009
WSHR_LK_.1941D	2190-0577

4 Functional Verification

The purpose of this chapter is to provide loopback self-tests and mobile phone test procedures that quickly verify the functional performance of the Test Set.

Purpose

The purpose of this chapter is to provide loopback self-tests and mobile phone test procedures that quickly verify the functional performance of the Test Set while racked in a test system or operating stand-alone. If racked in a test system, removing the Test Set should be avoided if all functional performance tests pass. Performing and passing all tests will result in a very high level of confidence that the Test Set is functioning properly. This document is not intended to provide complete troubleshooting instruction for hardware failures.

The desired results of the following procedures are:

- To isolate the cause of test system problems quickly if related to the Test Set
- To minimize unnecessary Test Set swapping
- To identify the root cause of poor test system yields if related to the Test Set
- To improve user test system quality confidence level
- To educate current and new production technicians on Agilent Technologies products

Process Efficiency Recommendations

A. Identify a test-standard “Golden Mobile” phone for each production line. This phone will be used to verify your test system and Test Set performance

B. Characterize components of each test system:

- Generate baseline performance data for each Test Set
- Generate baseline performance data for each fixture
- Generate baseline normalization data for external path losses

C. Maintain Test System binder to include:

- Test Set baseline data
- Fixture baseline data
- Test system normalization calibration tables
- Test system maintenance records. (Performance Verification and PTR Records, Table 4-1 on page 118)

D. Create troubleshooting kits to include

- Golden mobile phone
- Cables and adapters
- Maintenance record sheets
- Firmware cards

E. Use Save/Recall registers to speed-up testing.

Analog Loopback

Analog loopback configures the Test Set to test all of its major functions. A problem located in the RF and audio source or RF and audio analyzer paths will become evident.

In this configuration, the RF and audio generators will be used to simulate a low level modulated transmitter signal. The RF receiver will be used to demodulate this signal and pass it on to the audio analyzer to make the SINAD measurement.

1. Press the green Preset key to configure instrument to default settings.
2. Connect a short RF cable between the DUPLEX OUT port and the ANTENNA IN port.
3. Configure the instrument for loopback mode.

   3a. Press the Config key and set the following fields:
   - **RF Display: Freq**
   - **RF Offset: On**
   - **(Gen) - (Anl): 0 MHz**

   3b. Press the AF analyzer key and set the following fields:
   - **Speaker ALC: ON**
   - **Speaker Vol: POT**

   3c. Press the Duplex key and set the following fields:
   - **Tune Freq: 501 MHz**
   - **Input Port: Ant**
   - **RF Gen Freq: 501 MHz**
   - **Amplitude: –80 dBm**
   - **Output Port: Dupl**
   - **AFGen1 To: FM / 3.10 kHz**
   - **AF Anl In: FM Demod**
   - **Filter 1 300 HPF**
   - **Filter 2 3 kHz LPF**
   - **De-Emphasis OFF**
   - **Detector RMS*SQRT2**
4. Turn up the VOLUME knob to hear the 1 kHz tone.
5. SINAD meter should read >35 dB.
6. Change the **Amplitude** setting to **–100 dBm**., the SINAD meter should read >12 dB.
7. Record results in Table 4-1, “Functional Verification and Performance Test Record” on page 118.

SUGGESTION: Store instrument settings as a Save/Recall register (press the Save key). Name the register SINAD.

Wideband Sweep

NOTE This functional performance test requires the spectrum analyzer option in the Test Set.

Wideband sweep configures the Test Set to test all of its major functions. A problem located in the RF source or RF analyzer paths will become evident. In this configuration, the spectrum analyzer and tracking generator will be used to test and view the RF level and flatness of the RF source and RF analyzer over a 1 GHz span.

1. Begin by using the same setup as analog loopback (Recall “SINAD” register)
2. Connect a short RF cable between the RF IN/OUT port and the ANTENNA IN port
3. Configure the instrument for wideband sweep mode.

   3a. Press the Spectrum analyzer key. On the SPECTRUM ANALYZER screen set the following fields:

   - Set the **Ref Level** field to **0 dBm**
   - Set the **Span** field to **1 GHz**

   3b. On the SPECTRUM ANALYZER / RF Gen screen, set the following fields:

   - Set the **Controls** field to **RF Gen Track**
   - Set the **Port/Sweep** field to **RF Out**
4. Sweep should be:
   - Continuous across the display with no RF level dropouts
   - Fairly flat, about 4 to 5 dB difference between end points
5. Record results in the Table 4-1, “Functional Verification and Performance Test Record” on page 118.

SUGGESTION: Store instrument settings as a Save/Recall register (press the Save key). Name the register WB_SWEEP

Channel Power Loopback Verification Test

Channel power is extremely important in the ability of the Test Set to maintain a link with and properly control power output levels of the mobile phone under test. Channel power loopback verification is a quick way to ensure that both the average and channel power measurements are working properly.

1. Press the green Preset key to configure instrument to default settings.

2. Connect a short RF cable between the RF IN/OUT port and DUPLEX OUT port

3. Configure the Test Set for channel power loopback mode (this is a non-standard user mode).

   3a. Press the (CDMA SCREENS) Call control key and set the **RF Chan Std** field to **US PCS**.

   3b. Press the Config key and set the following fields:
   • **RF Display:** **Freq**
   • **RF Offset: On**
   • **(Gen) - (Anl): 0 MHz**
   • **Output Port: Dupl**
   • **Input Port: RF In**

   3c. Press the (CDMA SCREENS) Call control key. On the CDMA CALL CONTROL screen, set the following fields:
   • **RF Gen Freq: 1900 MHz**
   • Place cursor on the **Avg Power** field and select **Chan Power**
   • Place cursor on the **Power Meas** field.
   • Press the knob or Enter key to begin calibration routine
   • Press the Yes key to continue the calibration routine

4. Perform the Channel Power Loopback Measurement:
   • Place cursor on the **Sctr A Pwr** field
   • Step the **Sctr A Pwr** level from 0 dBm to –60 dBm in 5 dB increments.
   • Measured channel power should be within a few dB of the sector power output level setting

NOTE The "Ideal Mobile Power" value is not applicable for this test

5. Record results in Table 4-1, “Functional Verification and Performance Test Record” on page 118.

Suggestion: Store instrument settings as a Save/Recall register (press the Save key). Name the register CPWR_LB.

ROM-Based Diagnostics and Calibration

Comprehensive internal IBASIC diagnostics are provided to aid in troubleshooting the Test Set. These diagnostic programs use external cabling and the internal measurement and path setting capabilities of the Test Set to diagnose itself for RF and audio hardware problems. No external test equipment is necessary.

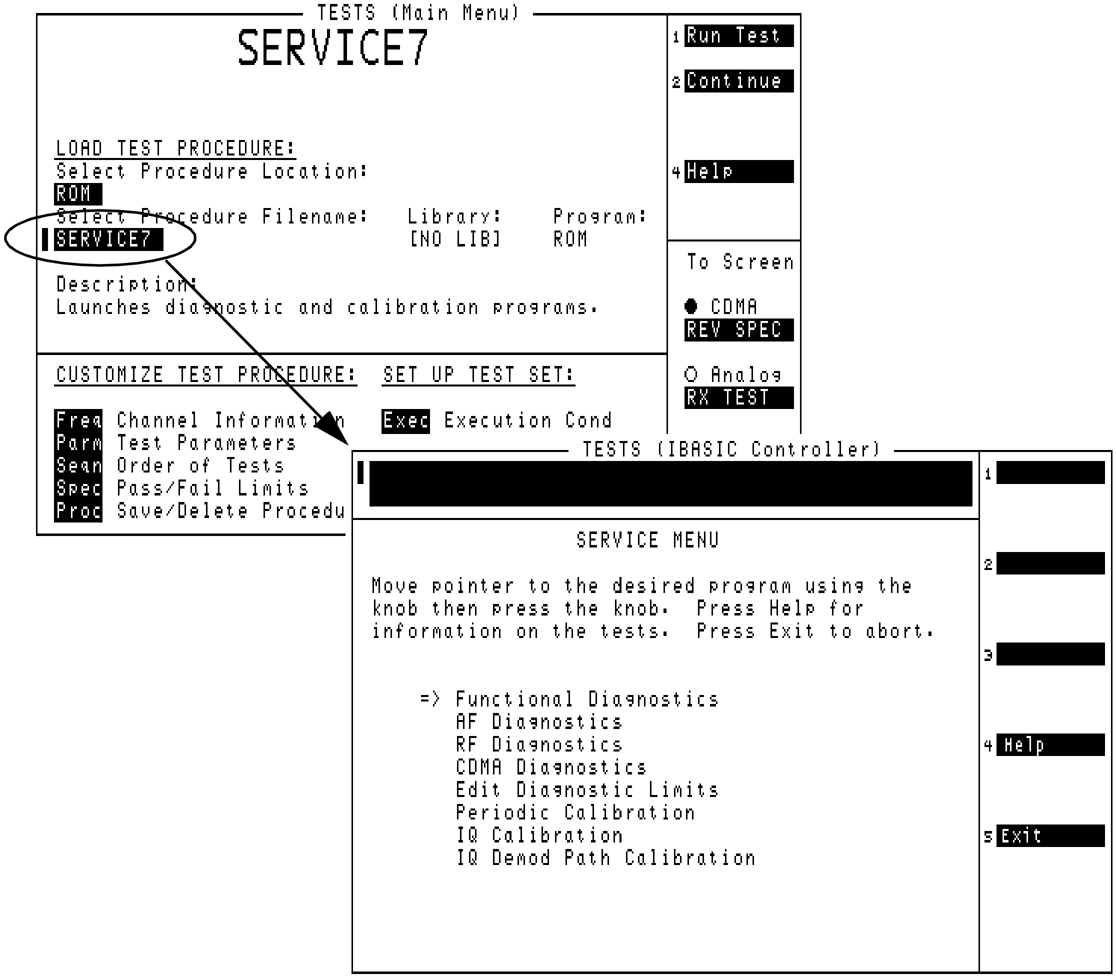
As the diagnostic programs execute, detected problems will be reported with a suggested defective assembly and it's probability of failure. Refer to the appropriate Assembly Level Repair section for more information.

1. Press the Preset key to configure instrument to default settings.
2. Press the Tests key to access to TESTS (Main Menu) screen, see Figure 4-1 on page 114.
3. For **Select Procedure Location:** select **ROM**
4. For **Select Procedure Filename:** select **SERVICE7**
5. Press the K1 key. The SERVICE MENU appears.
6. Load and execute each of the following diagnostic and calibration programs:
    - Under Functional Diagnostics; select RF Modules, Analog Modulation, and CDMA Loopback
    - AF Diagnostics
    - RF Diagnostics
    - CDMA Diagnostics
    - IQ Calibration
    - IQ Demod Path Calibration

NOTE Disregard all other diagnostic or calibration programs that appear on the SERVICE MENU and are not listed in step 6.

7. Load and execute PCB_CAL program:
    - Press the Tests key to access the TESTS (Main Menu) screen.
    - For **Select Procedure Location:** select **ROM**
    - For **Select Procedure Filename:** select **PCB_CAL**
    - Press K1 to execute.
8. Record results in the "Functional Verification Test Record" on page 118.

Figure 4-1 SERVICE MENU



Channel Power Calibration

To ensure the accuracy of the Test Set power measurement, channel power calibration should be run before the mobile phone functional test portion of the performance verification test plan.

1. Press the Preset key to configure instrument to default settings.
2. Connect a short RF cable between the RF IN/OUT port and DUPLEX OUT port
3. Calibrate the channel power measurement:
   - Press the (CDMA SCREENS) Call control key
   - Set **RF Chan Std** field to **US PCS**
   - Set **Avg Power** field to **Chan Power**
   - Place the cursor on the **Power Meas** field and select **Calibrate**
   - Press the knob or Enter key to begin calibration routine.
4. Record results in the “Functional Verification Test Record” on page 118.

Suggestion: Store instrument settings as a Save/Recall register (press the Save key). Name the register CPWR_CAL.

CDMA Mobile Phone Functional Test

1. Connect the mobile phone to the Test Set.
2. Setup for call processing:

NOTE Knowledge of the mobile's System ID, RF Channel, and RF Channel capability are essential to call processing. Therefore, the mobile phone functional test may not be successful if this information is not known.

2a. Press (CDMA SCREENS) Cell config key. On the CDMA CELL SITE CONFIGURATION screen:

- For the **System ID** field, if known, enter system ID number.
- For the **Rgstr SID** field, enter system ID number (same as **System ID** field).
- Set the **Pwr Up Reg** field to **On**.

2b. Press the Config key and set the **Date** field for one month in advance.

2c. Press the (CDMA SCREENS) Call control key:

- Place cursor on the **Avg Power** field and select **Chan Power**
- For the **RF Chan Std** field enter appropriate RF channel standard
- For the **Protocol** field select appropriate protocol
- For the **RF Channel** field enter appropriate RF channel
- For the **Traffic Data Mode** field select **Svc Opt 2**
- For the **Sctr A Pwr** field enter **–55 dBm/BW**

Suggestion: Store instrument settings as a Save/Recall register (press the Save key). Name the register CP.

3. Turn mobile phone on:
   - Ensure Test Set's **Call Status** "**Transmitting**" annunciator is lit.
   - Mobile should obtain service with the Test Set.
   - If capable, mobile will do a power-up registration within 20 seconds indicated by the **ESN** appearing below the **MS Database** field.
   - Mobile RSSI indicator shows four bars.
   - Mobile may display date and time setting of Test Set.

4. Originate Call
   - Dial '123' on mobile then press YES or Send
   - Test Set's **Connected** annunciator should be lit
   - Mobile should be in a connected "Svc Opt 2" state.
   - Press No or End on mobile to end call.
5. Page mobile phone:
   - Press the Call/Page key on the Test.
   - Test Set should page the mobile.
   - Mobile should automatically connect to Test Set.
6. Mobile phone measurements (record all test results in *Table 4-1, "Functional Verification and Performance Test Record" on page 118.):*

   6a. **Receiver FER Test**:

   - Press the (CDMA SCREENS) RX test key
   - Set the **Display Interim Results** field to **<u>Yes</u>**
   - Set the **FER Spec** field to **0.50%**
   - Set **Sctr A Pwr**: field to **–90 dBm/BW** (when no isolation box is used)
   - Set **Meas Cntl** filed to **Single**
   - Begin measurement, highlight the **Arm** field. Test Set should return a **Passed** Status

   6b. **Transmitter Rho Test**:

   - Press the (CDMA SREENS) TX test key.
   - Set **Meas Cntl** field to **Cont**. Measured **Traffic Rho** should be >0.980

   6c. **Mobile Channel Power Test**:

   - Press the (CDMA SCREENS) Call control key.
   - Set **Chan Power** field to **Chan Power**. Measured channel power should be about ±1.5 dB of the calculated "Ideal Mobile Power" value.
7. End call - press the End/Release button on the Test Set.

Functional Verification Test Record

Tested By________________Date_________ Test Set Serial #__________

Cell Phone ESN #________________Cell Phone MIN #_______________.

Table 4-1 Functional Verification and Performance Test Record

Power Up Self-Test	**Pass / Fail**
All self tests passed	
Channel Power Loopback Verification Test	**Pass / Fail**
Channel Power Accuracy	
Analog Loopback	**Pass / Fail**
SINAD @ –80 dB > 25 dB	
SINAD @ –100 dB > 12 dB	
Wideband Sweep	**Pass / Fail**
Acceptable flatness = (Max level – Min level) = <5 dB	
TESTS (Main Menu) Screen ROM Diagnostic Programs	**Pass / Fail**
SERVICE7 / Functional Diagnostics / RF Modules	
SERVICE7 / Functional Diagnostics / Analog Modulation	
SERVICE7 / Functional Diagnostics / CDMA Loopback	
SERVICE7 / AF Diagnostics (All Tests)	
SERVICE7 / RF Diagnostics (All Tests)	
SERVICE7 / CDMA Diagnostics (All Tests)	
TESTS (Main Menu) Screen Calibration Programs	**Pass / Fail**
SERVICE7 / IQ Calibration	
SERVICE7 / IQ Demod Path Calibration	
PCB_CAL	
Channel Power Calibration Procedure (see “Channel Power Calibration” on page 115)	**Pass / Fail**
Channel Power Cal	
Call Setup Procedures (see “CDMA Mobile Phone Functional Test” on page 116)	**Pass / Fail**
Register Mobile	
Page to Mobile	
Origination from Mobile	
Functional Tests Procedures (see “CDMA Mobile Phone Functional Test” on page 116)	**Pass / Fail**
Receiver FER	
Transmitter Rho	
Mobile Channel Power	

5 Periodic Adjustments/Calibration

This chapter contains the periodic adjustment procedures for the Test Set.

Periodic Adjustments

Some assemblies or combinations of assemblies require periodic adjustments to compensate for variations in circuit performance due to age or environment.

There are two types of calibration data:

- Factory-generated digital data either on memory cards, or on ROMs (which are on the assemblies themselves)
- Data generated internally by running calibration programs

In either case calibration data is loaded into non-volatile memory on the controller assembly.

NOTE Because calibration data resides on the controller assembly, it is important that whenever the assembly is replaced that the data be transferred from the original assembly to the new one. The calibration data resides in a socketed “CAL MODULE” EEPROM which can be moved with little danger of losing its contents. Refer to the instructions accompanying the replacement assembly for details.

To download calibration data supplied on a memory card, follow the instructions that come with the replacement assembly. To create and download calibration data for assemblies requiring a periodic adjustment, follow the steps later in this chapter. For a summary of assemblies and their calibration requirements, see table 5-1, "Assembly Calibration Information" on page 121.

Table 5-1 Assembly Calibration Information

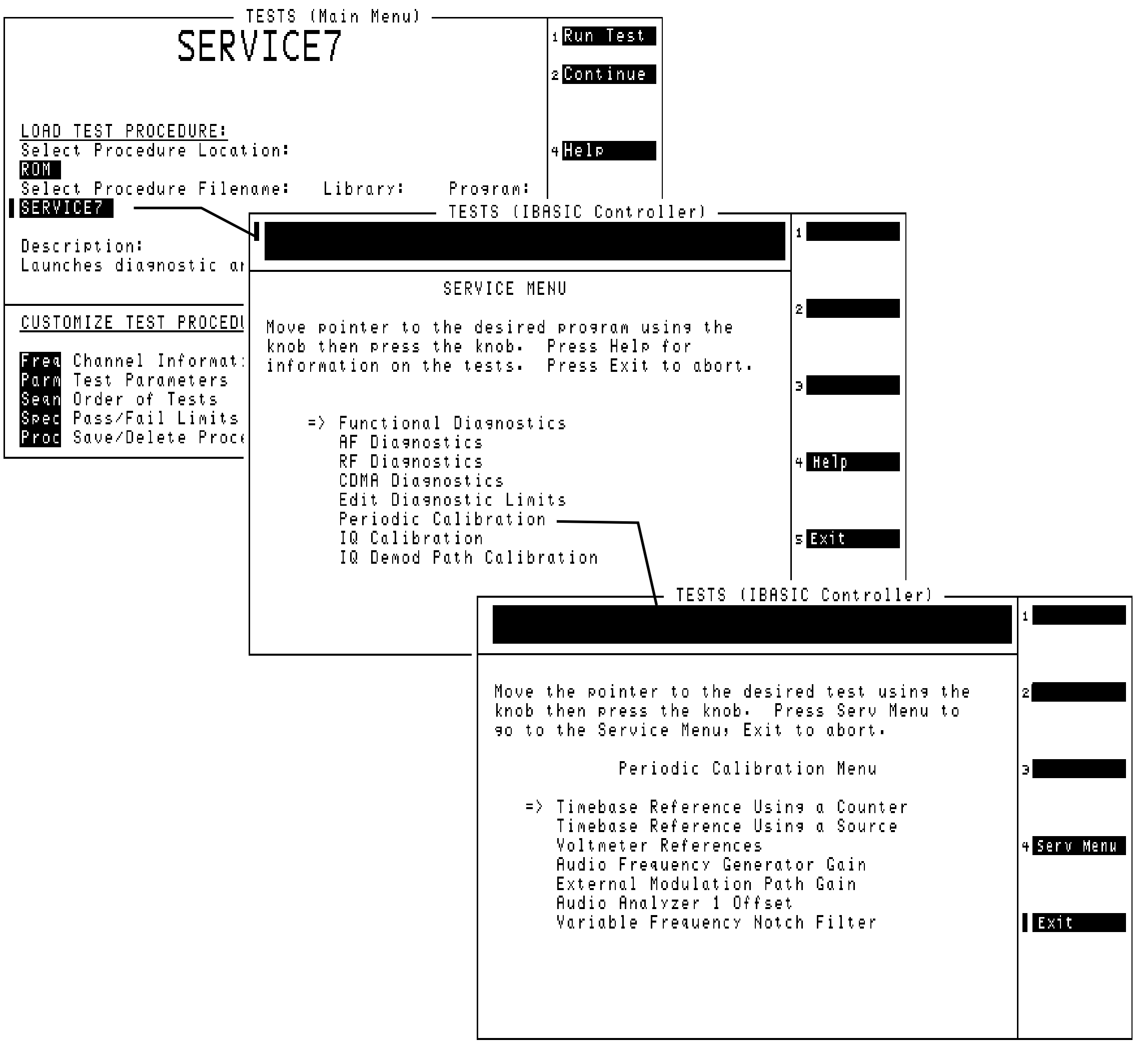
Assembly	Where calibration data is located.		Calibration Program: Sub Program
	Memory Card	on Assembly	
Audio Analyzer 1			Periodic Calibration: Audio Analyzer 1 Offset
Modulation Distribution			Periodic Calibration: External Modulation Path Gain, and, AF GEN Gain
Upconverter		X	
Output Section		X	
Signal Generator Synthesizer		X	
Reference		X	Periodic Calibration: Timebase Reference
Receiver		X	
Receiver Synthesizer		X	
Spectrum Analyzer	X		
Downconverter		X	
Measurement	X		Periodic Calibration: Voltmeter References
RF I/O		X	System Power Calibration
CDMA Reference			IQ Calibration
Controller		X	
LO IF/IQ Modulator			IQ Calibration, and IQ Demod Path Calibration
Digital Cellsite 1 or 2			IQ Calibration
Audio Analyzer 2			Periodic Calibration: Variable Frequency Notch Filter

Test Equipment

Test Equipment for the Periodic Adjustments Programs

- For the **`Timebase Reference Using a Counter`** calibration you will need to connect a frequency counter to the rear-panel 10 MHz REF OUTPUT connector. The accuracy of the counter will determine the accuracy of the Test Set's internal reference. You will use the counter to set the timebase reference DACs.
- For the **`Timebase Reference Using a Source`** calibration you will need to connect a signal generator to the front-panel ANTENNA IN connector.
- For the **`Voltmeter References`** calibration you will need a DC voltmeter that can measure ±5 V with ±0.015% accuracy.

Figure 5-1 Periodic Calibration Menu



Test Equipment Needed for the System Power Calibration Program

For the **`System Power Calibration`** program you will need the equipment listed in table 5-2. Because this calibration program is written specifically for this equipment, no substitutions are possible.

Table 5-2 **Equipment List for System Power Calibration Program**

Equipment Type	Agilent Technologies Model Number
Signal Generator	8648B Option 1EA
Power Meter	436A 437B 438A EPM-441A EPM-442A 8901B 8902A
Power Sensor	8482A ECP-E18A 11722A
Power Splitter	11667A
GPIB Cables (2 cables required, 3 if GPIB printer is used.)	Any GPIB cable
Printer (optional)	Any serial, parallel, or GPIB printer

Storing Calibration Factors

You should understand the calibration-factor-storage process before running any of the following programs: Periodic Calibration, IQ Calibration, IQ Demod Path Calibration, or System Power Calibration.

As a program runs, calibration factors are computed and applied. When all the calibration factors have been acquired, the program stops and asks if the user wants the calibration factors to be stored. At this point, it should be emphasized that the new calibration factors are now being used by the Test Set. If you do not store them at this point, they will be used by the Test Set until the power is switched off even though they have not been stored.

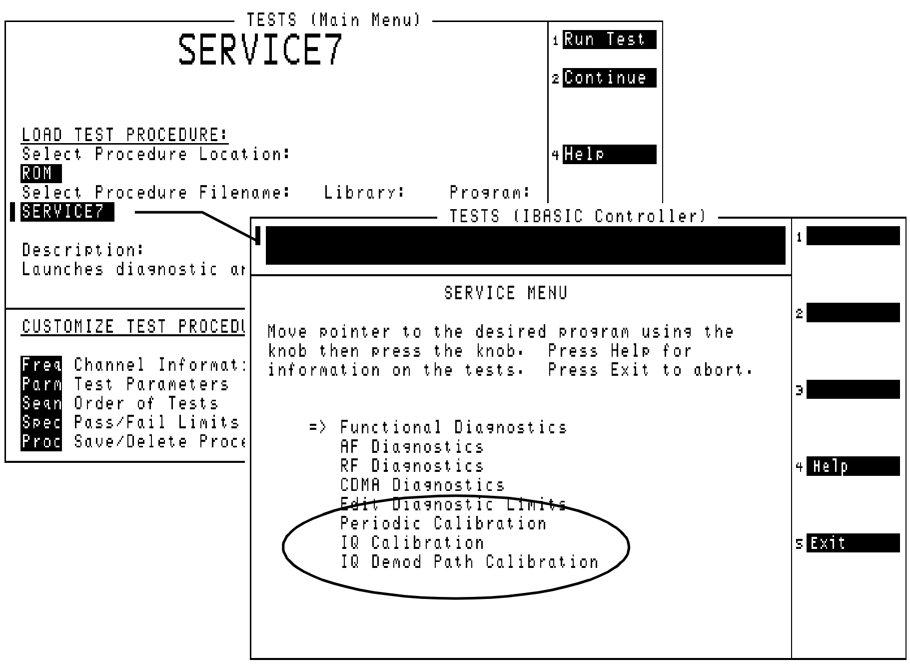
If you do not store the calibration factors but run another calibration program and then store the calibration factors, the calibration factors from the previous program will be stored along with the calibration factors just acquired unless the power is cycled between the tests. Storing calibration factors copies the calibration factors from volatile to non-volatile memory (that is, memory that is not erased when the power is turned off).

Also, when storing calibration factors, be sure to wait for the message **`Updating Flash Calibration Files... DO NOT Interrupt Power!`** to disappear before continuing. Depending on the number of calibration factors being stored, this may take several minutes.

Running the Periodic, IQ, or IQ Demod Path Calibration Programs

1. Press Tests key to access the TESTS (Main Menu) screen, see Figure 5-2.
2. Select the field under **`Select Procedure Location:`**.
3. Select **`ROM`** under the **`Choices`**: menu.
4. Select the field under **`Select Procedure Filename:`**.
5. Select **`SERVICE7`** from the **`Choices:`** menu.
6. Select **`Run Test`** (K1 key).
7. From the SERVICE MENU, select the desired calibration program to perform.
   - **`Periodic Calibration`** - for more detailed information, see "Periodic Calibration Menu Descriptions" on page 127.
   - **`IQ Calibration`** - for more detailed information, see "IQ Calibration Program Description" on page 133
   - **`IQ Demod Path Calibration`** - for more detailed information, see "IQ Demod Path Calibration Program Description" on page 135.
8. Follow the instructions on the screen.

Figure 5-2 SERVICE MENU's Calibration Programs



Running the System Power Calibration Program

This adjustment program is not found in ROM of the Test Set. This program resides on a PCMCIA Memory Card, part-number E6380-61811. It has to be downloaded from the memory card.

This program generates system power calibration factors for the Test Set. The purpose of this program is to generate calibration factors for the RF Input/Output Section. This assures that the Test Set will meet its power measurement accuracy specifications after repair.

An RF signal generator and a power splitter produce two signals with the same power level. One signal is measured by the power meter, the other is applied to the input of the Test Set. The program measures these levels at selected frequencies and then generates calibration factors so the Test Set readings match the power readings. These calibration factors are stored in the Test Set.

Communication between the active instrument(s) is through the Test Set's GPIB port. An optional printer can be connected to the Test Set's GPIB, serial, or parallel port. Typically this is done from the Printer Setup field of the SOFTWARE menu screen.

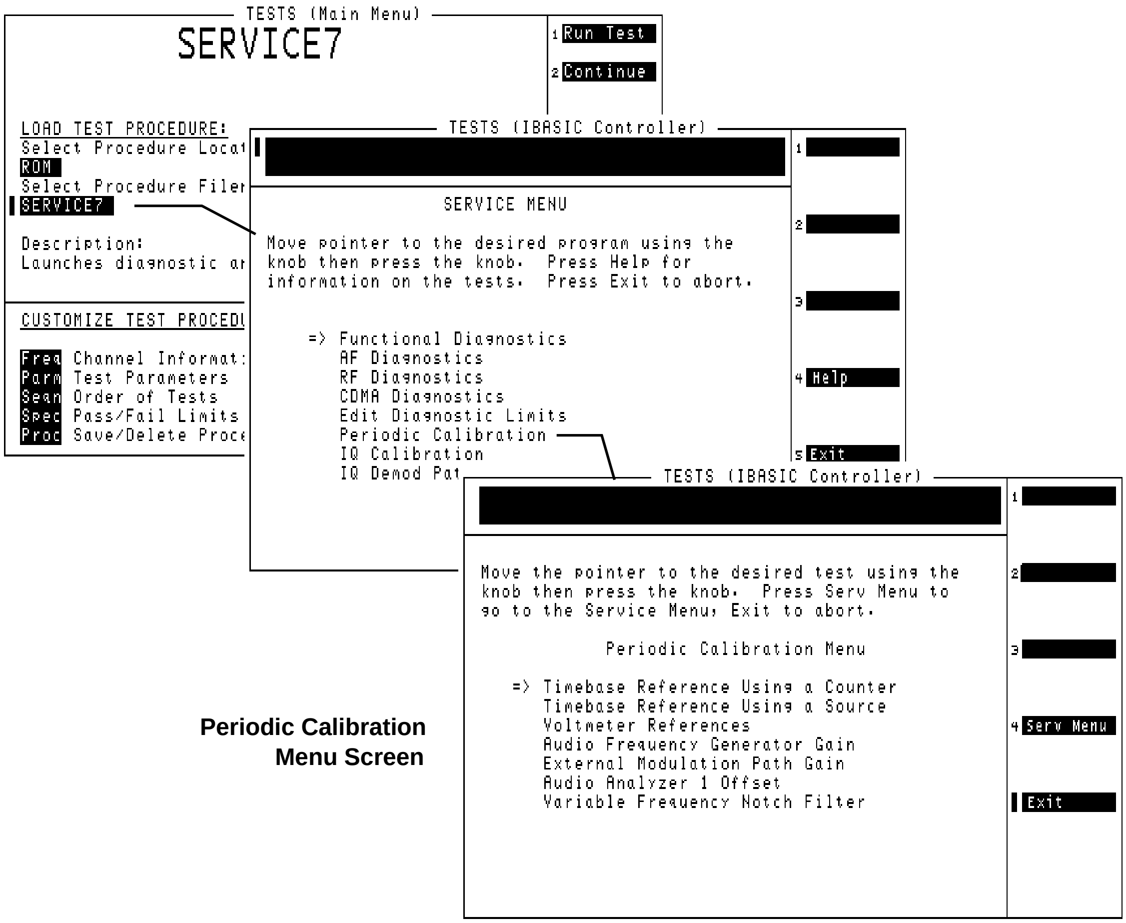
To run the System Power Calibration program:

1. Connect GPIB cables from the Test Set to the signal generator and power meter.
2. Insert the PCMCIA Memory Card, p/n E6380-61811, into the Test Set's memory card slot.
3. Press the Tests key to access the TESTS (Main Menu) screen.
4. Select the field under **Select Procedure Location:**
5. Select **Card** under the **Choices**: menu.
6. Select the field under **Select Procedure Filename:**
7. Select **SYSPWR0**
8. Select **Run Test** (K1 key).
9. Follow the instructions on the screen.

Periodic Calibration Menu Descriptions

This section describes the adjustment programs listed under the Periodic Calibration menu.

Figure 5-3 Periodic Calibration



Timebase Reference Using a Counter

This program is used to manually tune the timebase reference using a frequency counter as the time standard. This procedure has two basic steps:

1. Coarse and fine manual adjustment of the two timebase tuning DACs.
2. Downloading the DAC settings into the Test Set.

If you have not already adjusted the two timebase tuning DACs, exit the program if needed (by selecting the **Adj** user key), and follow the instructions in "Setting the Timebase Latches" on page 131.

If you have adjusted the timebase DACs, run this program and select the **Cal** user key to make the setting permanent.

As an alternate method, you can select the option **Timebase Reference Using a Source** (see following section) and adjust the timebase to a time standard connect to the front-panel ANTENNA IN connector.

Timebase Reference Using a Source

This program automatically tunes the timebase tuning DACs to the signal at the front-panel ANTENNA IN connector, which is input at the frequency that is keyed in from the front-panel keypad. If an external 10 MHz reference is being used, it must be disconnected.

In order for the calibration to be valid, the signal applied to the ANTENNA IN connector must have the following characteristics.

1. The level should be between –30 and +20 dBm (0.001 and 100 mW).
2. The frequency should be between 0.4 and 1000 MHz.
3. The frequency must be as accurate as the application of the Test Set requires.
4. The Test Set must be able to tune to within 10 or 100 kHz of the reference signal with the Test Set’s current timebase reference settings. If this condition is not met, either the keyed-in frequency is incorrect or the Test Set is faulty.
5. The signal must be a CW signal. Specifically, any FM must be less than 100 Hz peak as measured by the Test Set.
6. The coarse tune DAC must be between 3 and 250 (decimal); otherwise, the frequency of the source is out of reach by the tuning DAC.

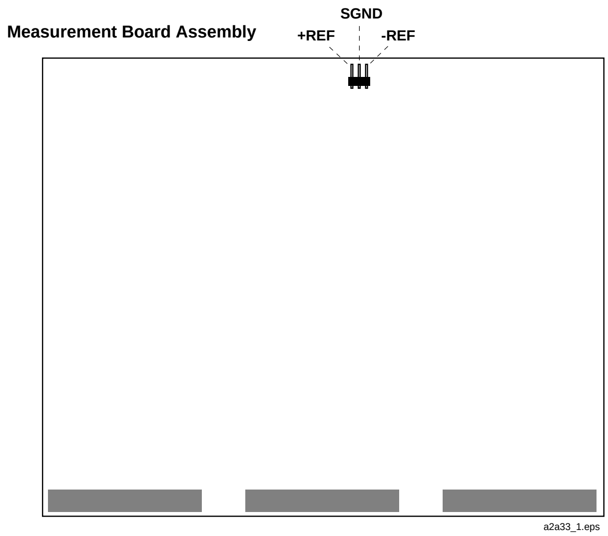
After the coarse and fine tune DAC settings have been determined, the values are downloaded into the Test Set’s memory.

Voltmeter References

When you select the Voltmeter Reference calibration, instructions are displayed explaining how to measure the negative and positive references with an external voltmeter. The user is required to key in the readings. If the readings are within range, the two values are automatically downloaded.

For the Test Set to meet published specifications, the external DC voltmeter must be ±0.015% accurate when measuring ±5 V. The voltmeter is connected to the test points on the Measurement board assembly, see figure 5-4.

Figure 5-4 Measurement Assembly Test Points



Audio Frequency Generator Gain

The gain of the following paths is calibrated:

- The internal paths that run from Audio Frequency Generators 1 and 2 (individually) through the Modulation Distribution assembly, to the monitor select output, then onto Audio Analyzer 1 to the DVM.
- The paths that run from Audio Frequency Generators 1 and 2 (individually) through the Modulation Distribution assembly to the AUDIO OUT connector, externally to the rear-panel MODULATION IN connector, then again through the Modulation Distribution assembly to the monitor select output and to the DVM.

The above-measured levels are used to adjust the output level of the audio generators so that they produce a calibrated level to the modulation inputs of the RF generator. These measurements are made at DC. Both positive and negative levels are measured to produce an optimum calibration factor.

External Modulation Path Gain

The **`Audio Frequency Generator Gain`** program should be performed before running the **`External Modulation Path Gain`** program.

The “path” in this program runs from the external MODULATION IN connector through the Modulation Distribution assembly, through the Monitor Select Switch, and then through Audio Analyzer 1 to the Test Set’s internal DVM. The dc source is Audio Frequency Generator 1 through the AUDIO IN connector and an external cable.

The goal of this procedure is to set the External Level Amplifier gain DAC (on the Modulation Distribution assembly) to produce a gain of exactly 4 between the MODULATION IN connector and output of the Monitor Select Switch. This requires measuring the input and output levels, calculating the gain, changing the DAC setting, and then repeating the process until the calculated gain equals 4.

Audio Analyzer 1 Offset

Two DC offsets are measured and downloaded as calibration factors to the Audio Analyzer 1 assembly. These measurements are determined under the following conditions:

- Input-select switch grounded
- AUDIO INPUT selected with return conductor grounded

Variable Frequency Notch Filter

The calibration factors for tuning the variable-frequency notch filter are determined as follows:

The input to the filter is set to 10 evenly-spaced frequencies between 300 and 10,000 Hz. The DAC that tunes the notch filter is adjusted for best null of the tune error voltage. From this data, three coefficients of a parabola which best fit the tuning data are calculated using a least-squares curve fit. The coefficients are then automatically downloaded into the Test Set’s non-volatile memory.

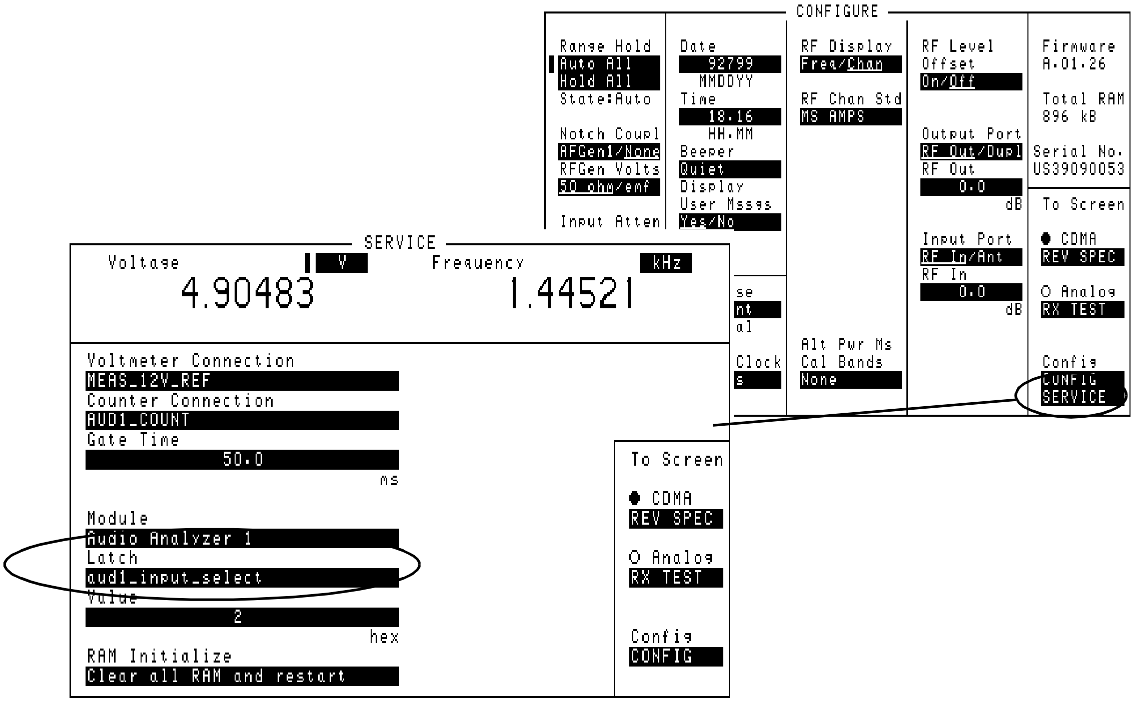
Setting the Timebase Latches

The **`refs_DAC_coarse`** and **`ref_DAC_fine`** values adjust the frequency of the Test Set's internal 10 MHz reference. They are stored in memory. The controller reads the values and sends the appropriate adjustment to the Reference assembly.

The following procedure is to be used when running the program "Timebase Reference Using a Counter" on page 128.

1. Press Config key to access the CONFIGURE screen, see Figure 5-5.
2. On the CONFIGURE screen, select **`SERVICE`**, the SERVICE screen appears.

Figure 5-5 SERVICE Screen



3. Connect a frequency counter to the rear-panel 10 MHz REF OUTPUT connector.
4. Select the **`Latch`** field.
5. Select **`refs_DAC_coarse`** under the **`Choices:`** menu.
6. Select the **`Value`** field.
7. Rotate the knob until the counter reads as close to 10 MHz as possible.
8. Select the **`Latch`** field.
9. Select **`refs_DAC_fine`** under the **`Choices:`** menu.

10. Select the **`Value`** field.
11. Rotate the knob until the counter reads as close to 10 MHz as possible.
12. Store the new DAC values (timebase calibration data) in non-volatile memory by selecting and running the **`Timebase Reference Using a Counter`** routine from the Periodic Calibration Menu. See "Timebase Reference Using a Counter" on page 128.

IQ Calibration Program Description

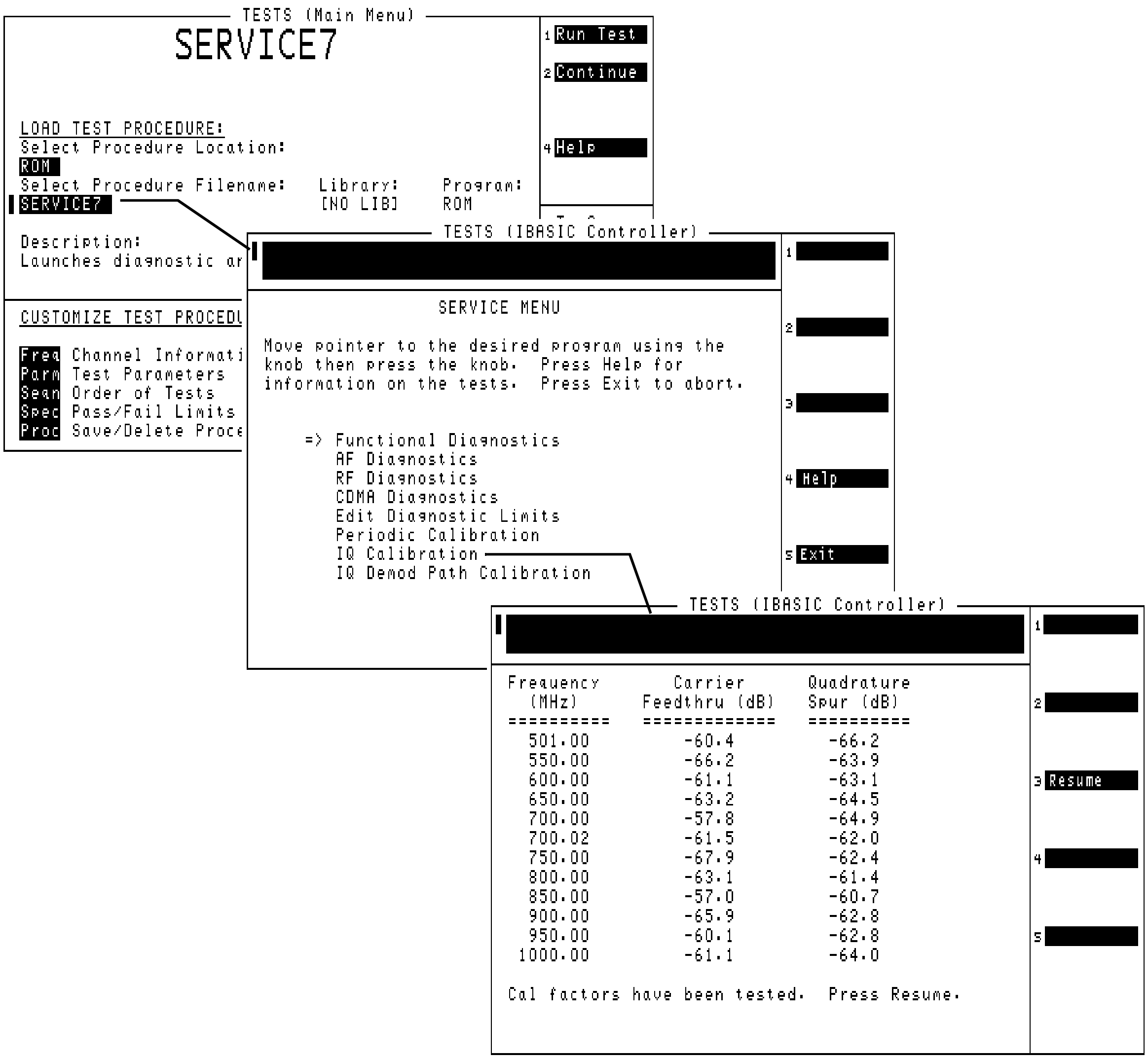
The goal of IQ Calibration (see Figure 5-6 on page 134) is to minimize the carrier feedthrough while maximizing the Rho of the IQ signal. There are four DACs involved in this adjustment:

- buffModN_I_DC_offset_DAC,
- buffModN_Q_DC_offset DAC,
- buffModN_signal_delta_DAC,
- genRef_IQ_quad_DAC

The I and Q dc offset DACs and the signal delta DAC are on the Data Buffer assembly and the Quad DAC is on the CDMA Generator Reference. These DACs can be accessed in the list of Latches on the SERVICE screen. All the DACs are initially set to 127 before starting the calibration adjustment, and the calibration is carried out at several equally spaced frequencies between 800 and 1000 MHz.

The instrument is set into a CDMA loopback mode and the calibration is carried out by first adjusting the I and Q dc offset DACs while monitoring the carrier feedthrough (CFT). Both CFT and rho are measured by the Receive DSP. Once the CFT is minimized (through an iterative process), the signal delta and the quad DACs are adjusted while monitoring rho. When rho is maximized (again through an iterative process), the calibration adjustment is complete. At power down, each DAC setting at each frequency is downloaded to the calibration ROM on the Controller assembly.

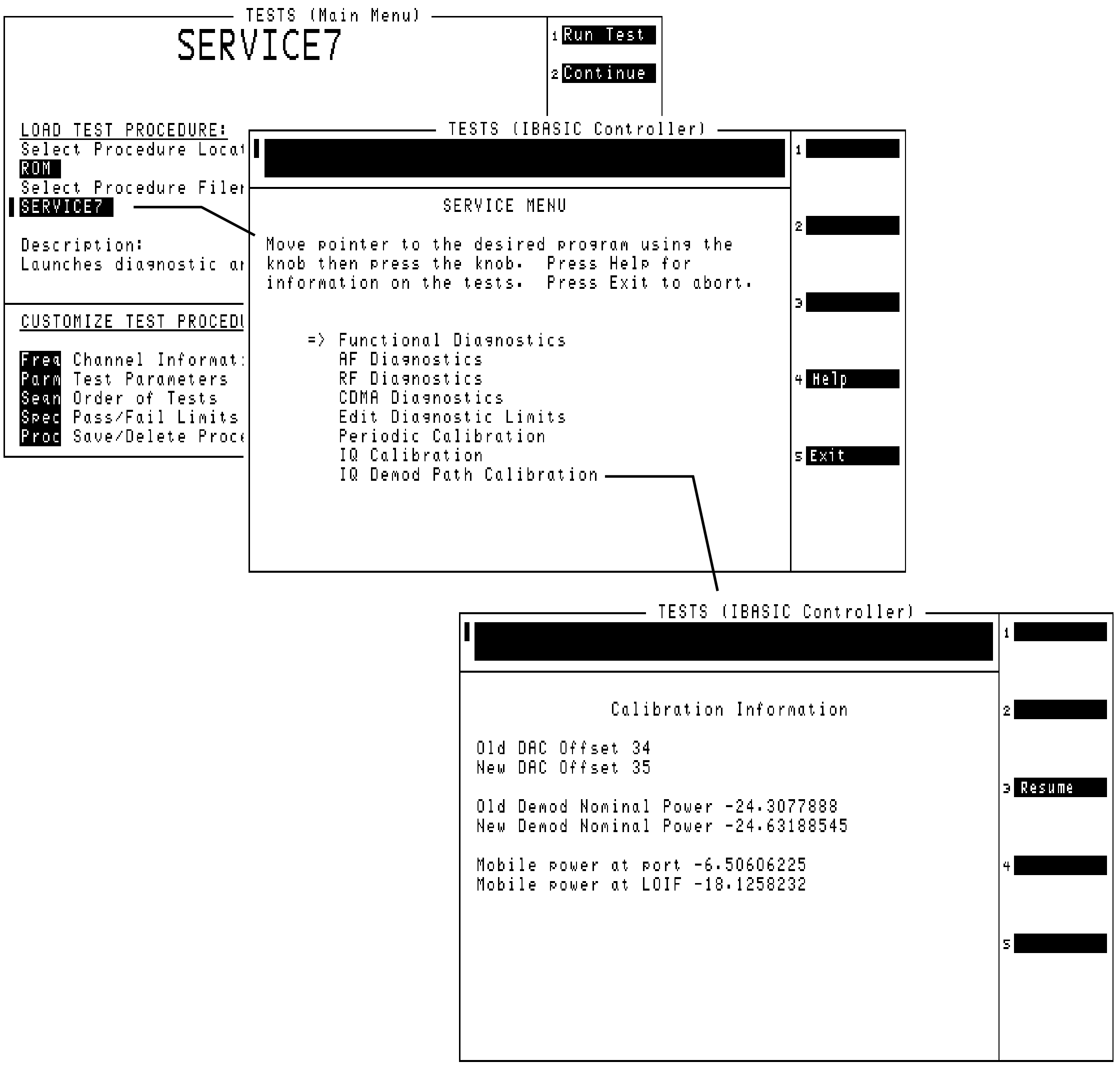
Figure 5-6 IQ Calibration



IQ Demod Path Calibration Program Description

This calibration program.....(does what?)

Figure 5-7 IQ Modulation Path Calibration



6 Performance Tests

This chapter contains the performance test procedures for the Test Set. The tests in this chapter verify that the Test Set performs to its published specifications.

Procedure and Equipment

How to Use the Performance Tests

- Run the Performance Tests in table 6-2, "Performance Tests & Records Location" on page 139 using the specified Test Equipment from table 6-1, "Required Test Equipment by Model" on page 138.
- Compare and record the data for each test onto the applicable Performance Test Record (PTR). Table 6-2 on page 139 shows the page number of the PTR associated with each performance test.

Test Set Operation

To perform the following performance test procedures you need to know basic Test Set operation. You should be familiar with the front panel, the various display screens, and knob operation (cursor control). You should be able to operate the Test Set's RF generator, RF analyzer, AF generators, AF analyzer, spectrum analyzer (optional), and oscilloscope.

NOTE Press **Preset** on the Test Set before beginning each test.

Test Equipment and Operation

The test equipment shown in table 6-1, "Required Test Equipment by Model" on page 138 is needed to do all of the performance tests. Usually, a setup drawing at the beginning of each test procedure shows the equipment and hook-up needed for that particular test. Generic names are used for the test equipment shown in the setup drawings.

To find alternatives to the equipment listed in table 6-1, look up their specifications in the *Agilent Technologies Test and Measurement Catalog* and use the specifications to find equivalent instruments.

The test procedures give critical instrument settings and connections, but they don't tell how to operate the instruments. Refer to each instrument's operating manual.

Table 6-1 Required Test Equipment by Model

Agilent Model Number	Model Name	Test Number
Mini-Circuits ZFL-2000 or equivalent[a]	Amplifier 1	5
GTC RF Products GRF 5016 or equivalent[b]	Amplifier 2	27, 28
3458A	Multimeter	8-9, 12, 15, 18

Agilent Model Number	Model Name	Test Number
5316A	Counter	11, 16
8562A	Spectrum Analyzer	6-7
8663A	Signal Generator (High Performance)	4, 28
8648B Option 1EA	Signal Generator	19
8902A	Measuring Receiver	1-5, 17, 19-22, 25, 27, 28
8903B	Audio Analyzer	4, 10, 12, 16, 18, 20-22
11667A	Power Splitter	19, 27, 28
11715A	AM/FM Test Source	20-23
11722A	Sensor Module	5, 19, 25, 27, 28
11793A	Microwave Converter	1-5
E4420B	Signal Generator	1-5, 24, 27
E6380-61811[c]	System Power Calibration Program Software Kit	19
89441A with options AYA, AY9, UFG	Vector Signal Analyzer	26
EPM-438	Power Meter	25
8482A	Power Sensor	25

a. Required amplifier specifications are frequency range 1.7 to 2.0 GHz, gain >18 dB, noise figure <5 dB. For more information about Mini-Circuits, contact them at (718) 934-4500 or http://www.minicircuits.com.

b. Required amplifier specifications are frequency range 1.0 to 2.0 GHz, gain of 43 dB, output power of +20 dBm. For more information about GTC, contact them at (310) 673-8422 or GTC@primenet.com.

c. To order the System Power Calibration Card see "Ordering Replacement Parts and Support" on page 83.

Table 6-2 Performance Tests & Records Location

Performance Test (in this chapter)	Test Record in Chapter 7, "Performance Test Records."
"RF Generator FM Distortion Performance Test 1" on page 141	page 192
"RF Generator FM Accuracy Performance Test 2" on page 143	page 194
"RF Generator FM Flatness Performance Test 3" on page 145	page 196
"RF Generator Residual FM Performance Test 4" on page 147	page 198
"RF Generator Level Accuracy Performance Test 5" on page 150	page 200

Performance Test (in this chapter)	Test Record in Chapter 7, "Performance Test Records."
"RF Generator Harmonics Spectral Purity Performance Test 6" on page 155	page 208
"RF Generator Spurious Spectral Purity Performance Test 7" on page 156	page 211
"AF Generator AC Level Accuracy Performance Test 8" on page 157	page 213
"AF Generator DC Level Accuracy Performance Test 9" on page 158	page 215
"AF Generator Residual Distortion Performance Test 10" on page 159	page 216
"AF Generator Frequency Accuracy Performance Test 11" on page 160	page 218
"AF Analyzer AC Level Accuracy Performance Test 12" on page 161	page 219
"AF Analyzer Residual Noise Performance Test 13" on page 162	page 220
"AF Analyzer Distortion and SINAD Accuracy Performance Test 14" on page 163	page 221
"AF Analyzer DC Level Accuracy Performance Test 15" on page 164	page 222
"AF Analyzer Frequency Accuracy to 100 kHz Performance Test 16" on page 165	page 223
"AF Analyzer Frequency Accuracy at 400 kHz Performance Test 17" on page 166	page 224
"Oscilloscope Amplitude Accuracy Performance Test 18" on page 167	page 225
"RF Analyzer FM Accuracy Performance Test 20" on page 170	page 228
"RF Analyzer FM Distortion Performance Test 21" on page 172	page 229
"RF Analyzer FM Bandwidth Performance Test 22" on page 174	page 230
"RF Analyzer Residual FM Performance Test 23" on page 177	page 231
"Spectrum Analyzer Image Rejection Performance Test 24" on page 178	page 232
"CDMA Generator RF IN/OUT Amplitude Level Accuracy Performance Test 25" on page 181	page 233
"CDMA Generator DUPLEX OUT Amplitude Level Accuracy Performance Test 26" on page 183	page 234
"CDMA Generator Modulation Accuracy Performance Test 27" on page 185	page 235
"CDMA Analyzer Average Power Level Accuracy Performance Test 28" on page 187	page 236
"CDMA Analyzer Channel Power Level Accuracy Performance Test 29" on page 189	page 237

RF Generator FM Distortion Performance Test 1

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-1, "RF Generator FM Distortion Test 1 Record" on page 192. The FM distortion of the RF generator is measured directly by the measuring receiver. The Test Set's internal audio generator provides the modulation source.

NOTE Two setups are shown below. The first setup can measure signals to 1 GHz. Since the FM generator in the Test Set translates FM in the lower band directly into the 1.7 to 2 GHz range, testing to 1 GHz is adequate when verifying a repair. The second setup has a microwave converter which covers the full measurement range of FM signals to 2 GHz.

Initial Setup

Figure 6-1 Setup for Measurements to 1 GHz

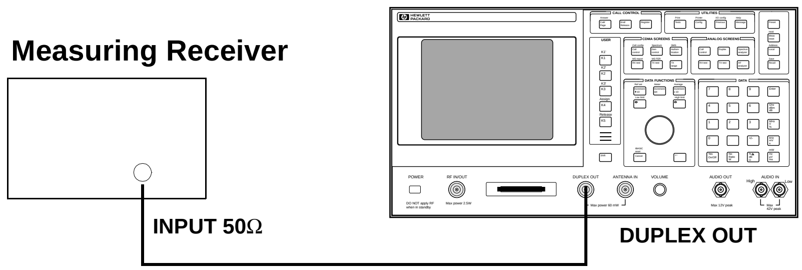
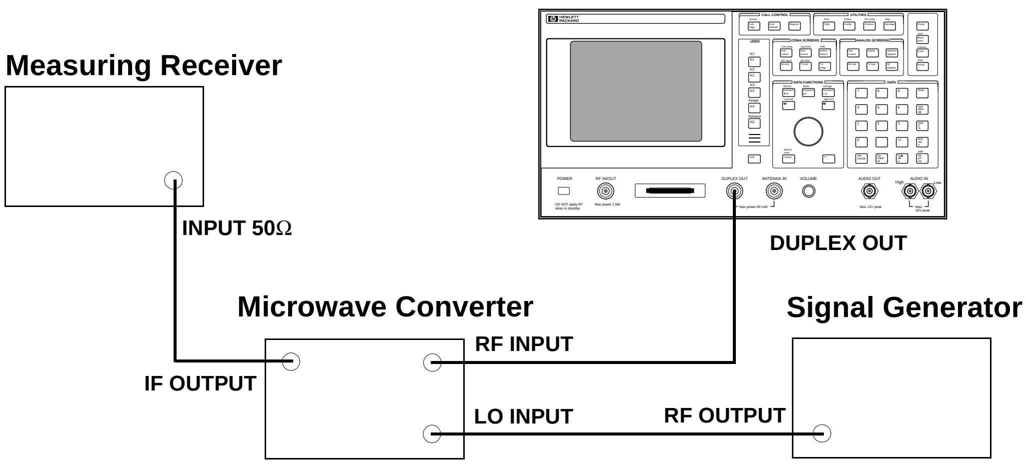


Figure 6-2 Setup for Measurements to 2 GHz Using a Microwave Converter



Procedure

Steps 1, 2, and 3 in the following procedure apply to both of the setups (shown in figure 6-1 **and** figure 6-2 on page 141**).**

1. On the measuring receiver:
   a. Reset the instrument.
   b. Set the high-pass filter to 300 Hz.
   c. Set the low-pass filter to 3 kHz.
   d. Set the measurement mode to FM.
   e. Set the measurement mode to audio distortion.
   f. If the microwave converter is being used, set the frequency offset mode to exit the mode (27.0 Special).
2. On the Test Set:
   a. Press **Preset.**
   b. Select the CONFIGURE screen.
   c. Set the **RF Display** field to **Freq**.
   d. Set the **RF Offset** to **Off**.
   e. Set the **Output Port** field to **Dupl**.
   f. Select the RF GENERNATOR screen.
   g. Set the **RF Gen Freq** to **30 MHz**.
   h. Set the **Amplitude** to **-10 dBm**.
   i. Set the **AFGen1 To** field to **FM** at **99 kHz** deviation.
3. For frequencies up to 1000 MHz measure the FM distortion (audio distortion) at the RF frequencies and deviations shown in the Performance Test Record (PTR) and compare the measured distortion to the limits.

   The following steps are for measurements to 2 GHz.
4. On the signal generator:
   a. Set the frequency to 1500 MHz CW.
   b. Set the level to +8 dBm or whatever level is suitable for the microwave converter's LO input.
5. On the measuring receiver:
   a. Set the frequency offset mode to enter and enable the LO frequency (27.3 Special).
   b. Key in the LO frequency (in MHz) which is 1500.
6. On the Test Set, for frequencies of 1700 and 2000 MHz, measure the FM distortion at the deviations shown in the PTR and compare the measured distortion to the limits.

RF Generator FM Accuracy Performance Test 2

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-2, "RF Generator FM Accuracy Test 2 Record" on page 194. The FM accuracy of the RF generator is measured directly by the measuring receiver. The Test Set's internal audio generator provides the modulation source.

NOTE Two setups are shown below. The first setup can measure signals to 1 GHz. Since the FM generator in the Test Set translates FM in the lower band directly into the 1.7 to 2 GHz range, testing to 1 GHz is adequate when verifying a repair. The second setup has a microwave converter which covers the full measurement range of FM signals to 2 GHz.

Initial Setup

Figure 6-3 Setup for Measurements to 1 GHz

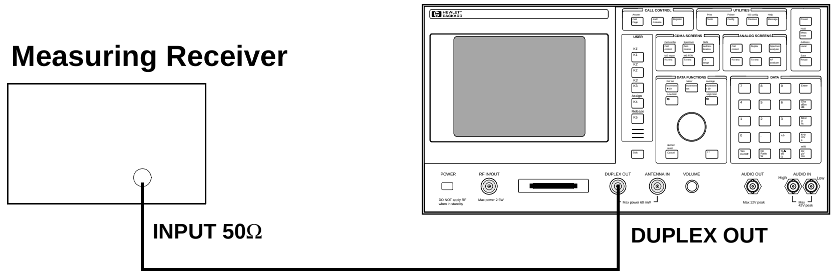
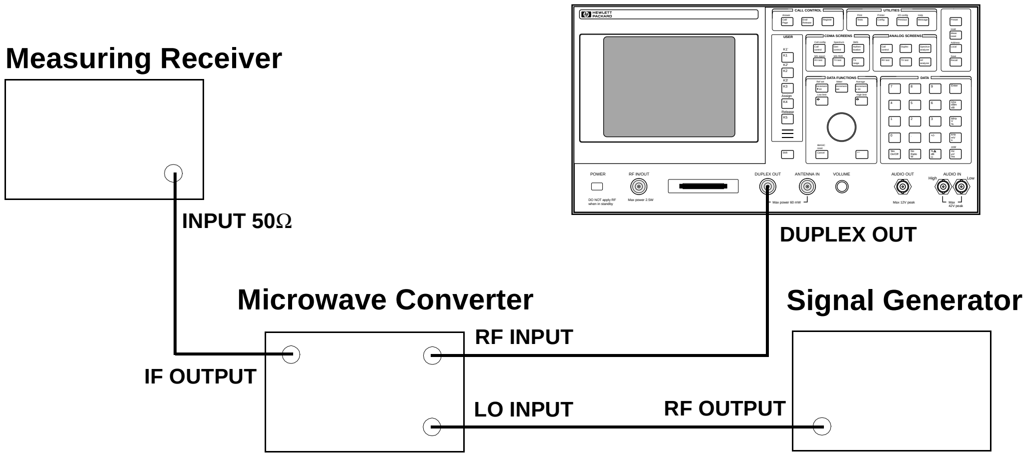


Figure 6-4 Setup for Measurements to 2 GHz Using a Microwave Converter



Procedure

Steps 1, 2, and 3 in the following procedure apply to both of the setups (shown in figure 6-3 and figure 6-4 on page 143).

1. On the measuring receiver:
   a. Reset the instrument.
   b. Set the high-pass filter to 300 Hz.
   c. Set the low-pass filter to 3 kHz.
   d. Set the measurement mode to FM.
   e. Set the FM de-emphasis off.
   f. If the microwave converter is being used, set the frequency offset mode to exit the mode (27.0 Special).
2. On the Test Set:
   a. Press **Preset.**
   b. Select the CONFIGURE screen.
   c. Set the **RF Display** field to **Freq**.
   d. Set the **RF Offset** to **Off**.
   e. Set the **Output Port** field to **Dupl**.
   f. Select the RF GENERATOR screen.
   g. Set the **RF Gen Freq** to **30 MHz**.
   h. Set the **Amplitude** to **-10 dBm**.
   i. Set the **AFGen1 To** field to **FM** at **99 kHz** deviation.
3. For frequencies up to 1000 MHz measure the FM deviation at the RF frequencies and deviations shown in the Performance Test Record (PTR) and compare the measured deviation to the limits.

   The following steps are for measurements to 2 GHz.
4. On the signal generator:

   a. Set the frequency to 1500 MHz CW.

   b. Set the level to +8 dBm or whatever level is suitable for the microwave converter’s LO input.
5. On the measuring receiver:

   a. Set the frequency offset mode to enter and enable the LO frequency (27.3 Special).

   b. Key in the LO frequency (in MHz) which is 1500.
6. On the Test Set, for frequencies of 1700 and 2000 MHz, measure the FM at the deviations shown in the PTR and compare the measured deviation to the limits.

RF Generator FM Flatness Performance Test 3

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-3, "RF Generator FM Flatness Test 3 Record" on page 196. The FM flatness of the RF generator is measured directly by the measuring receiver. The Test Set's internal audio generator provides the modulation source.

NOTE Two setups are shown below. The first setup can measure signals to 1 GHz. Since the FM generator in the Test Set translates FM in the lower band directly into the 1.7 to 2 GHz range, testing to 1 GHz is adequate when verifying a repair. The second setup has a microwave converter which covers the full measurement range of FM signals to 2 GHz.

Initial Setup

Figure 6-5 Setup for Measurements to 1 GHz

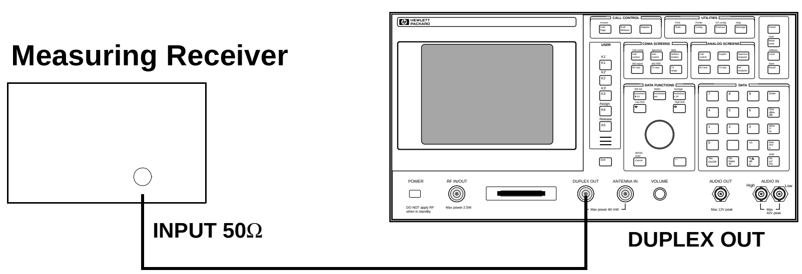
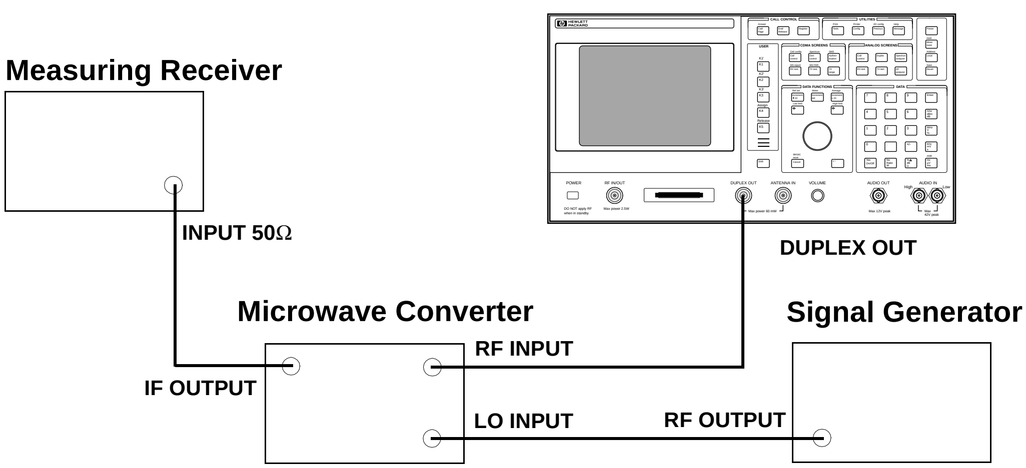


Figure 6-6 Setup for Measurements to 2 GHz Using a Microwave Converter



Procedure

Steps 1, 2, and 3 in the following procedure apply to both of the setups (shown in figure 6-5 **and** figure 6-6 on page 145**).**

1. On the measuring receiver:
   a. Reset the instrument.
   b. Set the measurement mode to FM.
   c. If the microwave converter is being used, set the frequency offset mode to exit the mode (27.0 Special).
2. On the Test Set:
   a. Press **Preset**.
   b. Select the CONFIGURE screen.
   c. Set the **RF Display** field to **Freq**.
   d. Set the **RF Offset** to **Off**.
   e. Set the **Output Port** field to **Dupl**.
   f. Select the RF GENERATOR screen.
   g. Set the **RF Gen Freq** to **521 MHz**.
   h. Set the **Amplitude** to **-10 dBm**.
   i. Set the **AFGen1 To** field to **FM** at **50 kHz** deviation.
3. For frequencies up to 1000 MHz measure the FM deviation at the RF frequencies and rates shown in the Performance Test Record (PTR). Convert the measurement results to dB referenced to the deviation measured at 1 kHz using the following formula and compare the calculated deviation to the limits in the PTR.

$$dB = 20 \bullet \log\left(\frac{\text{Deviation}}{\text{Deviation at 1 kHz}}\right)$$

The following steps are for measurements to 2 GHz.

4. On the signal generator:
   a. Set the frequency to 1500 MHz CW.
   b. Set the level to +8 dBm or whatever level is suitable for the microwave converter's LO input.
5. On the measuring receiver:
   a. Set the frequency offset mode to enter and enable the LO frequency (27.3 Special).
   b. Key in the LO frequency (in MHz) which is 1500.
6. On the Test Set, for frequencies of 1700 and 2000 MHz, measure the FM deviation at the rates shown in the PTR. Convert the measurement results as was done in step 3 and compare the calculated deviation to the limits.

RF Generator Residual FM Performance Test 4

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-4, "RF Generator Residual FM Test 4 Record" on page 198. The residual FM of the RF generator is measured directly by the measuring receiver. An external LO is used to improve the residual FM of the measuring receiver. An audio analyzer with a CCITT psophometric filter is required to measure the demodulated FM.

NOTE Two setups are shown, see figure 6-7 and figure 6-8 on page 148. The first setup is capable of measuring signals to 1 GHz. The second setup has a microwave converter which covers the full measurement range of FM signals to 2 GHz. The microwave converter's LO must be a low residual FM synthesizer.

Initial Setup

Figure 6-7 Setup for Measurements to 1 GHz

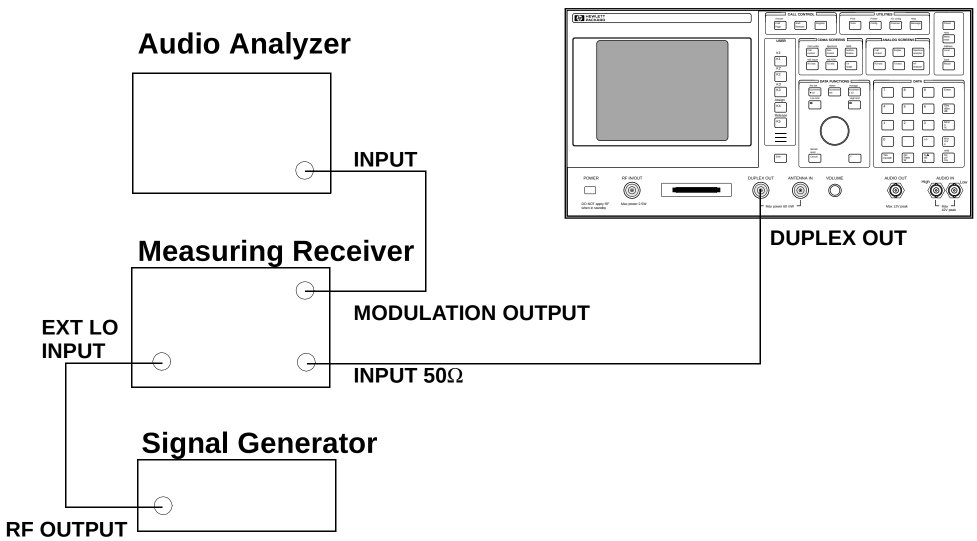
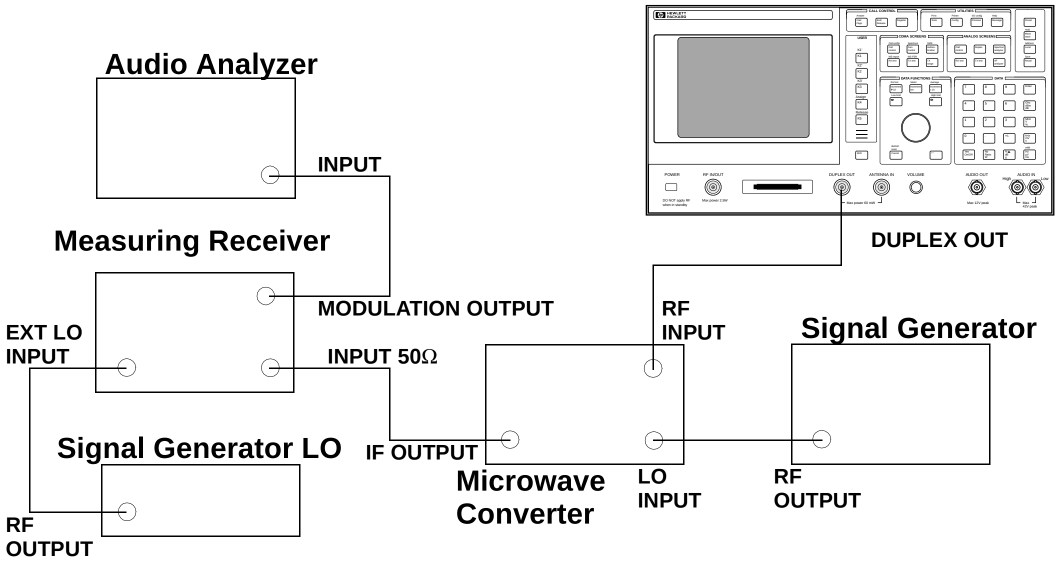


Figure 6-8 Setup for Measurements to 2 GHz Using a Microwave Converter



Procedure

Steps 1 to 5 in the following procedure apply to both setups (shown in figure 6-7 and figure 6-8 on page 148).

1. On the signal generator (to be used as the measuring receiver's LO):
   a. Set the frequency to 11.5 MHz.
   b. Set the level to 0 dBm.
2. On the measuring receiver:
   a. Reset the instrument.
   b. Set the IF to 1.5 MHz (3.2 Special).
   c. Set the high-pass filter to 50 Hz.
   d. Set the low-pass filter to 15 kHz.
   e. Set the measurement mode to FM.
   f. If the instrument has an external LO switch, enable the external LO mode (23.1 Special).
   g. If the microwave converter is being used, set the frequency offset mode to exit the mode (27.0 Special).
3. On the audio analyzer:
   a. Reset the instrument.
   b. Set the measurement mode to AC level.
   c. Select the CCITT Weighting filter.
   d. Set the low-pass filter to 30 kHz.
4. On the Test Set:

a. Press **Preset**.

b. Select the CONFIGURE screen.

c. Set the **RF Display** field to **Freq**.

d. Set **RF Offset** to **Off**.

e. Set **RF Output** to **Dupl**.

f. Select the RF GENERATOR screen.

g. Set the **RF Gen Freq** to **30 MHz**.

h. Set the **Amplitude** to **-10 dBm**.

5. For frequencies up to 1000 MHz and for each line in the Performance Test Record (PTR) do the following:

a. Set the signal generator (used as an LO for the measuring receiver) to the LO frequency shown in the PTR.

b. Set the Test Set to the RF frequencies shown in the PTR.

c. Measure the ac level (in mV) on the audio analyzer.

d. Multiply the measured ac levels by 1000 to convert them to FM deviation in Hz and compare the computed results to the limits shown in the PTR.

The following steps are for measurements to 2 GHz.

6. On the signal generator:

a. Set the frequency to 1500 MHz CW for 1700 MHz, 1800 MHz CW for 2000 MHz.

b. Set the level to +8 dBm or whatever level is suitable for the microwave converter’s LO input.

7. On the measuring receiver:

a. Set the frequency offset mode to enter and enable the LO frequency (27.3 Special).

b. Key in the LO frequency (in MHz) which is 1500 MHz.

8. On the Test Set, for frequencies of 1700 and 2000 MHz, continue on as in step 5.

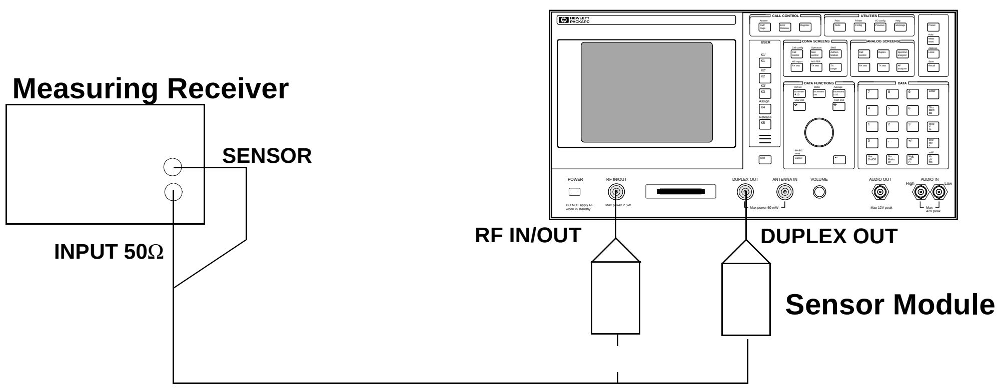
RF Generator Level Accuracy Performance Test 5

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-5, "RF Generator Level Accuracy Test 5 Record" on page 200. Using a measuring receiver and sensor module, at several frequencies up to 1 GHz the Test Set is set to generate levels between –10 and 125 dBm (in 5 dB steps) at it's DUPLEX OUT connector. The level is measured with the tuned RF level feature of the measuring receiver. At each frequency the measuring receiver connection is moved to the RF IN/OUT and the level measured from -40 to –125 dBm. As the test proceeds you may be required to recalibrate the measuring receiver.

To extend the measurement frequency to 2 GHz the second method uses a microwave converter and amplifier to extend the measurement range (see figure 6-10 on page 152).

Setup 1

Figure 6-9 Setup 1 for Measurements to 1 GHz



Procedure 1

Steps 1 to 5 in the following procedure apply to Setup 1 shown in figure 6-9 on page 150**.**

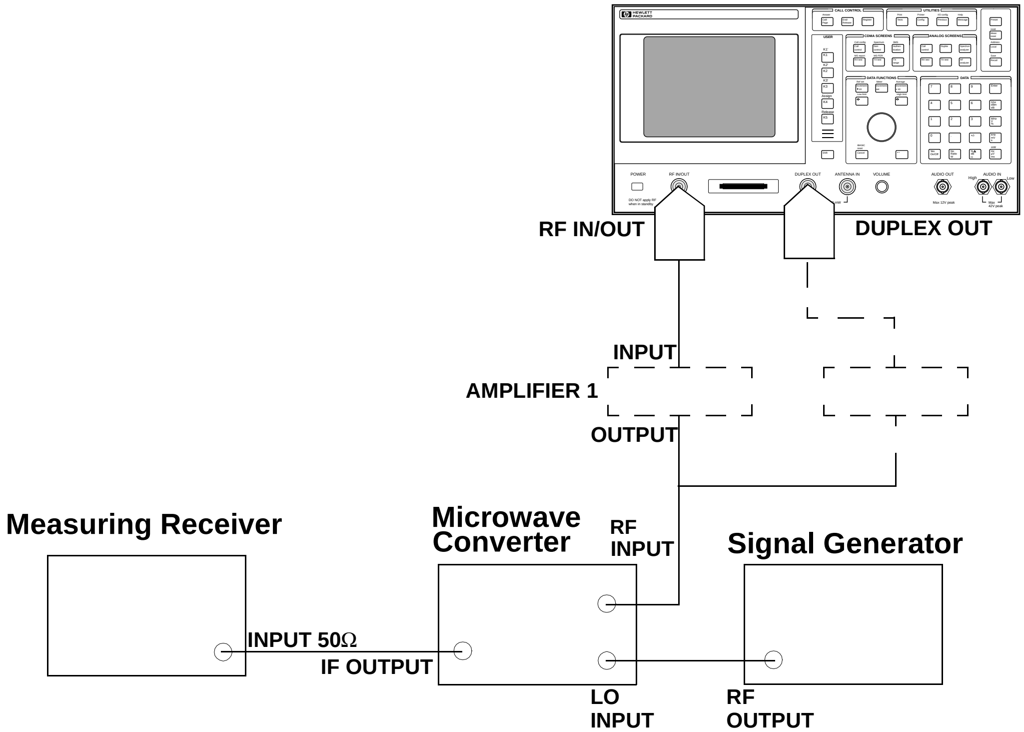
1. Before connecting the Test Set to the measuring receiver:
   a. Reset the instrument.
   b. Zero and calibrate the sensor module.

NOTE Make sure the sensor module's calibration data is entered into the measuring receiver.

2. Connect the equipment as shown in Setup 1 whether intending to measure frequencies to 1 GHz or 2 GHz.
3. On the measuring receiver:
   a. Set the measurement mode to RF Power.
   b. Set the display to log.
4. On the Test Set:
   a. Press **Preset**.
   b. Select the CONFIGURE screen.
   c. Set the **RF Display** field to **Freq**.
   d. Set the **RF Offset** to **Off**.
   e. Set the **Output Port** field to **Dupl**.
   f. Select the RF GENERNATOR screen.
   g. Set the **RF Gen Freq** to **30 MHz**.
   h. Set the **Amplitude** to **-11 dBm**.
5. For each frequency in the Performance Test Record (PTR) do the following:
   a. Set the measuring receiver to measure frequency.
   b. Set the Test Set level to −15 dBm.
   c. After the measuring receiver has acquired the signal, set the measuring receiver to measure tuned RF level.
   d. Measure the RF level at the levels shown in the PTR at the Test Set's **DUPLEX OUT** port and compare the measured RF level to the limits. If the measuring receiver displays the need to recalibrate, press the CALIBRATE key and wait for calibration to be completed.
   e. Move the sensor module to the Test Set's **RF IN/OUT** port.
   f. On the Test Set set the **Output Port** field to **RF Out** and repeat the measurements for the levels shown in the PTR and compare the measured RF level to the limits.
   g. Move the sensor module back to the Test Set's **DUPLEX OUT** port and set the **Output Port** to **Dupl**.

Setup 2

Figure 6-10 Setup 2 for Measurements of 1700 and 2000 MHz



Procedure 2

Steps 1 to 5 in the following procedure apply to Setup 2 shown in figure 6-10 on page 152**.**

1. Make the connections as shown on Setup 2.
2. On the Test Set:
   a. Set the **`Amplitude`** to **`-11 dBm`**.
   b. Set the **`RF Gen Freq`** to **`1700 MHz`**.
3. On the measuring receiver:
   a. Set the measurement mode to RF power.
   b. Key in 1700 MHz.
   c. Measure and record the RF power at the **`DUPLEX OUT`** port.
4. On the Test Set set the **`RF Gen Freq`** to **`2000 MHz`**.
5. On the measuring receiver:
   a. Key in 2000 MHz.
   b. Measure and record the RF power at the **`DUPLEX OUT`** port.
6. On the signal generator set the level to +8 dBm or whatever level is suitable for the microwave converter’s LO input.
7. For frequencies of 1700 and 2000 MHz perform the following:
   a. On the signal generator set the frequency to 1900 MHz CW and 2200 MHz CW respectively.
   b. Reset the measuring receiver.
   c. On the measuring receiver set the frequency offset mode to enter and enable the LO frequency (27.3 Special) then key in the signal generator (LO) frequency (in MHz) which is 1900 or 2200 MHz respectively.
   d. On the measuring receiver set the measurement mode to tuned RF level and the measurement units to dBm then press SET REF.
   e. Measure and record the RF level at the levels down to and including -83 dBm shown in the PTR at the Test Set's **DUPLEX OUT** port. If the measuring receiver displays the need to recalibrate, press the CALIBRATE key and wait for calibration to be completed.
   f. After recording the reading at -83 dBm insert an RF amplifier into the output of the Test Set.
   g. Record the new measured level at -83 dBm.
   h. Continue measuring the level down to –116 dBm.
   i. Move the input to the **RF IN/OUT** port without the amplifier inserted.

j. Measure and record the RF level at the levels down to and including –83 dBm shown in the PTR at the Test Set’s **RF IN/OUT** port.

k. After recording the reading at –83 dBm insert an RF amplifier into the output of the Test Set.

l. Record the new measured level at –83 dBm.

m. Continue measuring the level down to –116 dBm.

n. Correct the measured reading for each level measured without the amplifier as follows: Add the RF power measured in step 3c or 5b to the measured level. (For example, if the level in step 3c is -10.2 dBm and the level at –55 dBm is –45.1 dB, record a level of –10.2 + (-45.1) = 55.3 dBm.) Compare the corrected values with the limits in the PTR.

o. Correct the measured reading for each level measured with the amplifier by summing the following values:

+ RF power measured at –11 dBm in step 3c or 5b

+ RF level measured at –83 dBm in step 7i

– RF level measured at –83 dBm in step 7j

+ RF level measured in step 7k

For example, if:

RF power measured at –11 dBm in step 3b or 5b = –10.2 dBm

RF level measured at –83 dBm in step 7i = –70.1 dB

RF level measured at –83 dBm in step 7j = –52.6 dB

RF level measured at –101 dBm in step 7k = –73.2 dB

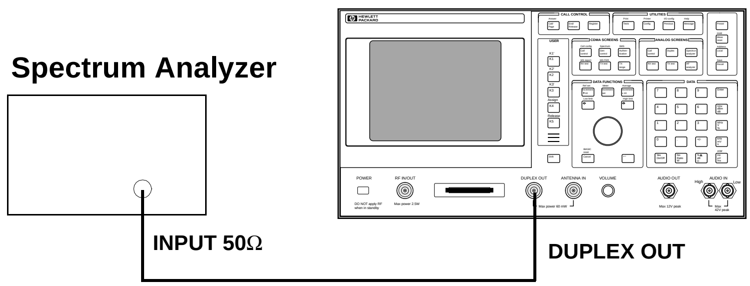
the corrected level at –101 dBm is –10.2 + (–70.1) – (–52.6) + (–73.2) = 100.9 dBm. Compare the corrected values with the limits in the PTR.

RF Generator Harmonics Spectral Purity Performance Test 6

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-6, "RF Generator Harmonics Spectral Purity Test 6 Record" on page 208. Harmonic signals with the carrier set to several frequencies and two different levels (maximum output and minimum level vernier) are searched for by an RF spectrum analyzer.

Setup

Figure 6-11



Procedure

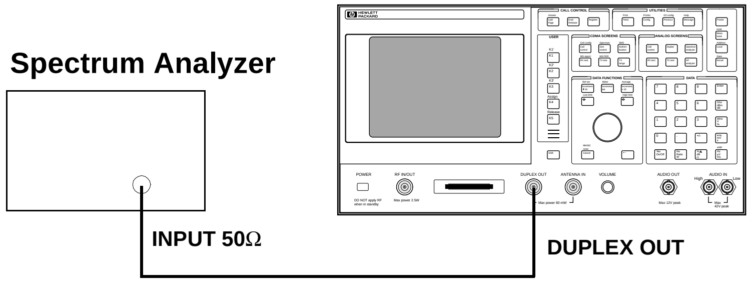
1. Set up the spectrum analyzer in accordance with its operating manual.
2. On the Test Set:
   a. Press **Preset**.
   b. Select the CONFIGURE screen.
   c. Set the **`RF Display`** field to **`Freq`**.
   d. Set the **`RF Offset`** to **`Off`**.
   e. Set the **`Output Port`** field to **`Dupl`**.
   f. Select the RF GENERNATOR screen.
   g. Set the **`RF Gen Freq`** to **`1 MHz`**.
   h. Set the **`Amplitude`** to **`-10 dBm`**.
3. Set the Test Set's RF generator to the frequencies and levels shown in the Performance Test Record (PTR) and measure the second and third harmonics. For each measurement convert the harmonic level to dB below the fundamental (dBc) and compare the computed levels to the limits.

RF Generator Spurious Spectral Purity Performance Test 7

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-7, "RF Generator Spurious Spectral Purity Test 7 Record" on page 211. Spurious signals with the carrier set to several frequencies and two different levels (maximum output and minimum level vernier) are searched for by an RF spectrum analyzer.

Setup

Figure 6-12



Procedure

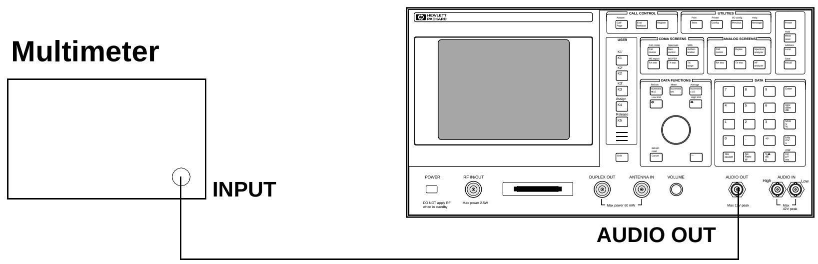
1. Set up the spectrum analyzer in accordance with its operating manual.
2. On the Test Set:
   a. Press **Preset.**
   b. Select the CONFIGURE screen.
   c. Set the **`RF Display`** field to **`Freq`**.
   d. Set the **`RF Offset`** to **`Off`**.
   e. Set the **`Output Port`** field to **`Dupl`**.
   f. Select the RF GENERATOR screen.
   g. Set the **`RF Gen Freq`** to **`242 MHz`**.
   h. Set the **`Amplitude`** to **`-10 dBm`**.
3. Set the Test Set's RF generator to the frequencies and levels shown in the Performance Test Record (PTR) and measure the level of the spurious signals at the frequencies shown. For each measurement convert the harmonic level to dB below the fundamental (dBc) and compare the computed levels to the limits.

AF Generator AC Level Accuracy Performance Test 8

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-8, "AF Generator AC Level Accuracy Test 8 Record" on page 213. There are two audio generators. AC level accuracy is measured directly with a digital multimeter.

Setup

Figure 6-13



Procedure

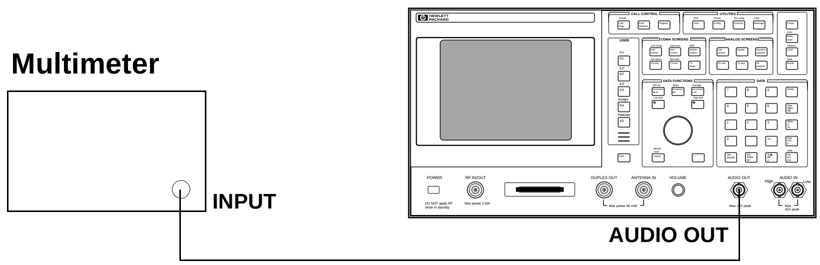
1. Set the multimeter to measure AC volts.
2. On the Test Set:
   a. Press **Preset**.
   b. Select the RF GENERATOR screen.
   c. Set the **`AFGen1 To`** and **`AFGen2 To`** fields to **`Audio Out`**.
3. On the Test Set for Audio Frequency Generator 1 do the following:
   a. Set the **`AFGen2 To`** level field to **`Off`**.
   b. Set the audio frequency and level as shown in the Performance Test Record (PTR) and measure the AC level. Compare the measured voltage to the limits.
4. On the Test Set for Audio Frequency Generator 2 do the following:
   a. Set the **`AFGen1 To`** level field to **`Off`** and **`AFGen2 To`** level field to **`On`**.
   b. Set the audio frequency and level as shown in the PTR and measure the AC level. Compare the measured voltage to the limits.

AF Generator DC Level Accuracy Performance Test 9

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-9, "AF Generator DC Level Accuracy Test 9 Record" on page 215. There are two DC generators. DC level accuracy is measured directly with a digital multimeter.

Setup

Figure 6-14



Procedure

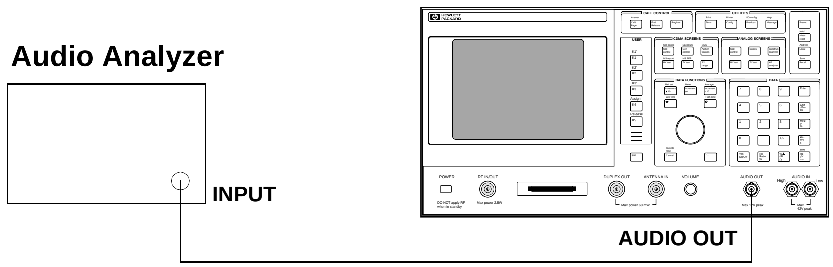
1. Set the multimeter to measure DC volts.
2. On the Test Set:
   a. Press **Preset.**
   b. Select the RF GENERATOR screen.
   c. Set the **`AFGen1 To`** and **`AFGen2 To`** fields to **`Audio Out`**.
   d. Set the **`AFGen1 Freq`** and **`AFGen2 Freq`** fields to **`0.0 Hz`**.
   e. Set the **`Audio Out`** field to **`DC`**.
3. On the Test Set for Audio Frequency Generator 1 do the following:
   a. Set the **`AFGen2 To`** level field to **`Off`**.
   b. Set the audio frequency and level as shown in the Performance Test Record (PTR) and measure the DC level. Compare the measured voltage to the limits.
4. On the Test Set for Audio Frequency Generator 2 do the following:
   a. Set the **`AFGen1 To`** level field to **`Off`** and **`AFGen2 To`** level field to on.
   b. Set the audio frequency and level as shown in the PTR and measure the DC level. Compare the measured voltage to the limits.

AF Generator Residual Distortion Performance Test 10

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-10, "AF Generator Residual Distortion Test 10 Record" on page 216. Audio distortion is measured directly with an audio analyzer.

Setup

Figure 6-15



Procedure

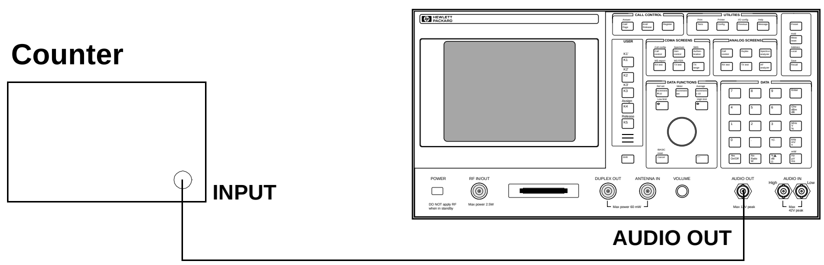
1. On the audio analyzer:
   a. Reset the instrument.
   b. Select the 80 kHz low-pass filter.
   c. Set the measurement mode to distortion.
2. On the Test Set:
   a. Press **Preset.**
   b. Select the RF GENERATOR screen.
   c. Set the **`AFGen1 To`** and **`AFGen2 To`** fields to **`Audio Out`**.
3. On the Test Set for Audio Frequency Generator 1 do the following:
   a. Set the **`AFGen2 To`** level field to **`Off`**.
   b. Set the audio frequency and level as shown in the Performance Test Record (PTR) and measure the audio distortion. Compare the measured distortion to the limits.
4. On the Test Set for Audio Frequency Generator 2 do the following:
   a. Set the **`AFGen1 To`** level field to **`Off`** and **`AFGen2 To`** level field to on.
   b. Set the audio frequency and level as shown in the PTR and measure the audio distortion. Compare the measured distortion to the limits.

AF Generator Frequency Accuracy Performance Test 11

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-11, "AF Generator Frequency Accuracy Test 11 Record" on page 218. Frequency accuracy is measured directly with a frequency counter. The counter must be able to resolve 0.005% at 20 Hz.

Setup

Figure 6-16



Procedure

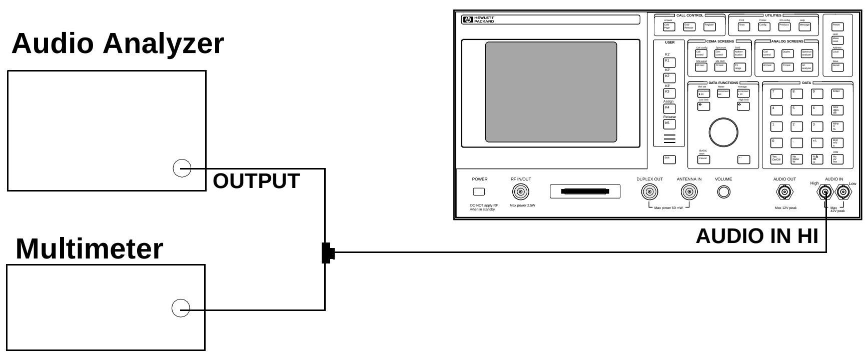
1. Set the counter to measure frequency.
2. On the Test Set:
   a. Press **Preset.**
   b. Select the RF GENERATOR screen.
   c. Set the **`AFGen1 To`** and **`AFGen2 To`** fields to **`Audio Out`**.
3. On the Test Set for Audio Frequency Generator 1 do the following:
   a. Set the **`AFGen2 To`** level field to **`Off`**.
   b. Set the audio frequency and level as shown in the Performance Test Record (PTR) and measure the audio frequency. Compare the measured frequency to the limits.
4. On the Test Set for Audio Frequency Generator 2 do the following:
   a. Set the **`AFGen1 To`** level field to **`Off`** and **`AFGen2 To`** level field to on.
   b. Set the audio frequency and level as shown in the PTR and measure the audio frequency. Compare the measured frequency to the limits.

AF Analyzer AC Level Accuracy Performance Test 12

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-12, "AF Analyzer AC Voltage Accuracy Test 12 Record" on page 219. To measure AC voltage accuracy, an AC signal is measured by an external multimeter and compared to the Test Set's internal AC voltmeter reading.

Setup

Figure 6-17



Procedure

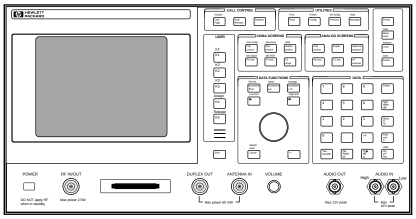
1. Set the digital multimeter to measure AC volts.
2. On the Test Set:
   a. Press **Preset**.
   b. Select the AF ANALYZER screen.
   c. Set the `AF Anl In` field to `Audio In`.
   d. Set the `Filter 1` field to `<20 Hz HPF`.
   e. Set the `Filter 2` field to `>99kHz LPF`.
   f. Set the `De-Emphasis` field to `Off`.
   g. Set the `Detector` field to `RMS`.
   h. Set the `Settling` field to `Slow`.
3. Set the audio analyzer's source to the frequencies and levels shown in the Performance Test Record. (Adjust the level until the digital multimeter reads the correct level.)
4. Measure the AC level on the Test Set and compare the measured level to the limits.

AF Analyzer Residual Noise Performance Test 13

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-13, "AF Analyzer Residual Noise Test 13 Record" on page 220. The AC level of the audio input is measured with no signal source connected.

Setup

Figure 6-18



Procedure

1. On the Test Set:

   a. Press **Preset.**

   b. Select the AF ANALYZER screen.

   c. Set the **`AF Anl In`** field to **`Audio In`**.

   d. Set the **`Filter 1`** field to **`<20 Hz HPF`**.

   e. Set the **`Filter 2`** field to **`15kHz LPF`**.

   f. Set **`De-Emphasis`** field to **`Off`**.

   g. Set the **`Detector`** field to **`RMS`**.

2. Measure the AC level (residual noise) on the Test Set and compare the measured level to the limits shown in the Performance Test Record.

3. Set the **`Filter 2`** field to **`>99kHz LP.`**

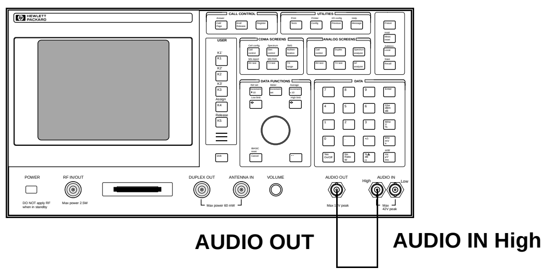
4. Measure the AC level (residual noise) on the Test Set and compare the measured level to the limits shown in the Performance Test Record.

AF Analyzer Distortion and SINAD Accuracy Performance Test 14

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-14, "AF Analyzer Distortion and SINAD Accuracy Test 14 Record" on page 221. A calibrated distortion source is created by summing the two internal audio generators. Levels are measured separately by the internal AC voltmeter. One source is set to a harmonic two or three times the frequency of the other. The measured distortion and SINAD is compared with the calculated value.

Setup

Figure 6-19



Procedure

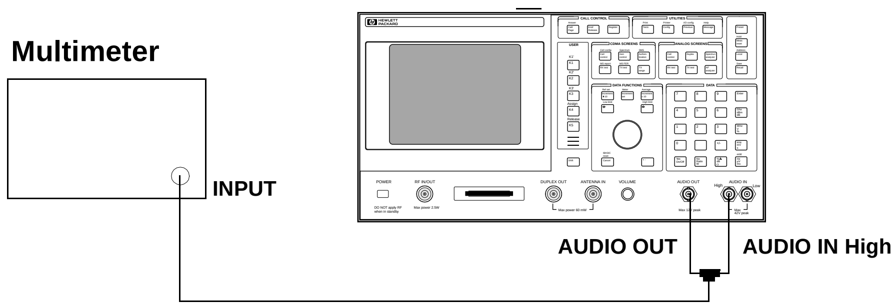
1. On the Test Set:
   a. Press **Preset.**
   b. Select the RF GENERATOR screen.
   c. Set the **`AFGen1 To`** and **`AFGen2 To`** fields to **`Audio Out`**.
   d. Set the **`AFGen1 To`** level field to **`1.00 V`** and **`AFGen1 Freq`** field to **`1 kHz`**.
   e. Set the **`AFGen2 To`** level field to **`100 mv`** and **`AFGen2 Freq`** field to **`2 kHz`**.
2. For the frequency (the harmonic) and level settings of Audio Frequency Generator 2 shown in the Performance Test Record, measure the distortion and SINAD on the Test Set and compare the measured values to the limits.

AF Analyzer DC Level Accuracy Performance Test 15

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-15, "AF Analyzer DC Level Accuracy Test 15 Record" on page 222. To measure DC level accuracy, a DC signal is measured by an external digital multimeter and compared to the Test Set's internal DC voltmeter reading.

Setup

Figure 6-20



Procedure

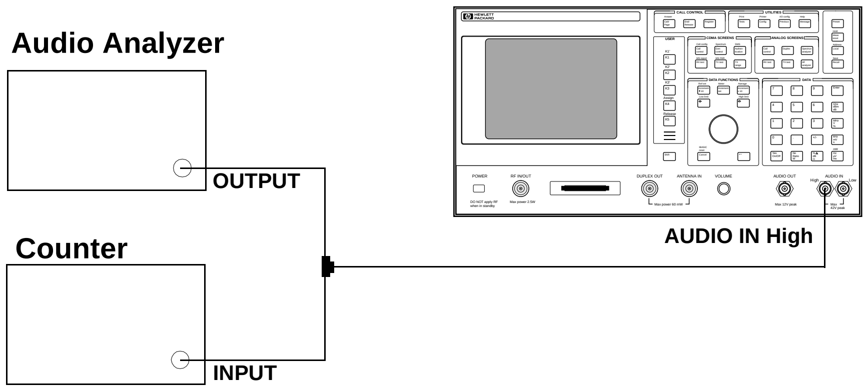
1. Set the multimeter to measure DC volts.
2. On the Test Set:
   a. Press **Preset.**
   b. Select the AF ANALYZER screen.
   c. Set the **`AF Anl In`** field to **`Audio In`**.
   d. Set the lower-right measurement to **`DC level`**.
   e. Select the RF GENERATOR screen.
   f. Set the **`AFGen1 To`** field to **`Audio Out`**.
   g. Set the **`AFGen1 Freq`** field to **`0.0 Hz`**.
   h. Set the **`Audio Out`** field to **`DC`**.
   i. Set the level of Audio Frequency Generator 1 as shown in the Performance Test Record and measure the DC level. Compare the measured voltage to the limits.

AF Analyzer Frequency Accuracy to 100 kHz Performance Test 16

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-16, "AF Analyzer Frequency Accuracy to 100 kHz Test 16 Record" on page 223. To measure frequency accuracy up to 100 kHz, an AC signal at the audio input is measured by an external frequency counter and compared to the Test Set's internal audio frequency counter.

Setup

Figure 6-21



Procedure

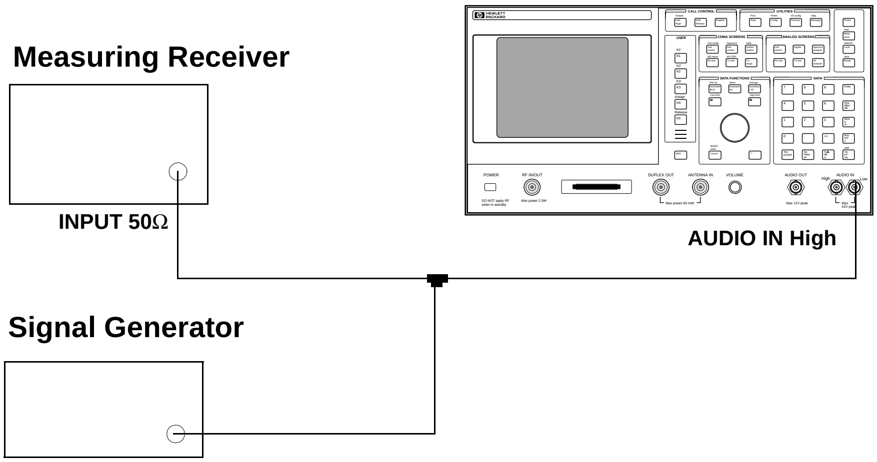
1. Set the frequency counter to measure frequency.
2. On the Test Set:
   a. Press **Preset**.
   b. Select the AF ANALYZER screen.
   c. Set the **AF Anl In** field to **Audio In**.
   d. Set the **Filter 1** field to **<20 Hz HPF**.
   e. Set the **Filter 2** field to **>99kHz LPF**.
   f. Set the lower-right measurement display to **AF Freq**.
3. Set the audio analyzer's source to 1 V and set the frequencies as shown in the Performance Test Record. Measure the frequency on the Test Set and compare the measured frequency to the limits.

AF Analyzer Frequency Accuracy at 400 kHz Performance Test 17

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-17, "AF Analyzer Frequency Accuracy at 400 kHz Test 17 Record" on page 224. To measure frequency accuracy at 400 kHz, the RF signal from the Test Set's DUPLEX OUT port is applied to the audio input and the input to the measuring receiver and the two measured frequencies are compared.

Setup

Figure 6-22



Procedure

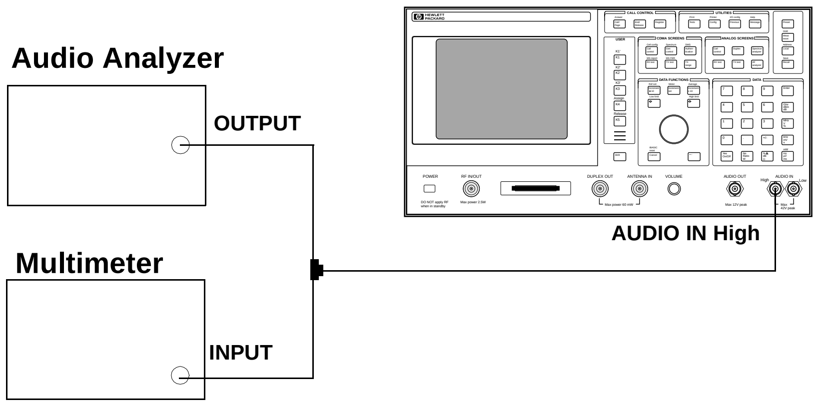
1. On the signal generator:
   a. Set amplitude to 0 dBm.
   b. Set the frequency to 400 kHz.
2. On the measuring receiver:
   a. Reset the instrument.
   b. Set the measurement mode to frequency.
3. On the Test Set:
   a. Press **Preset.**
   b. Select the AF ANALYZER screen.
   c. Set the **`AF Anl In`** field to **`Audio In`**.
   d. Set the **`Filter 2`** field to **`>99kHz LPF`**.
4. Measure the audio frequency on the measuring receiver and the Test Set and note the frequency difference. Compare the calculated difference to the limits shown in the Performance Test Record.

Oscilloscope Amplitude Accuracy Performance Test 18

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-18, "Oscilloscope Amplitude Accuracy Test 18 Record" on page 225. A 5 V ac signal from the audio analyzer is measured by both an external multimeter and by the Test Set's internal oscilloscope. Since the oscilloscope reads peak volts, the RMS reading of the multimeter is multiplied by the square root of two.

Setup

Figure 6-23



Procedure

1. Set the digital multimeter to measure ac volts.
2. On the Test Set:
   a. Press **Preset**.
   b. Select the AF ANALYZER screen.
   c. Set the **`AF Anl In`** field to **`Audio In`**.
   d. Set the **`Filter 2`** field to **`>99kHz LPF`**.
   e. Select the SCOPE screen.
   f. Set the **`Controls`** field to **`Marker`** and move the cursor to the **`Marker To Peak+`** field.
3. Set the audio analyzer's source to 1 kHz and 5 V and fine adjust the level until the voltmeter reads 5 V.
4. Set the frequency as shown in the Performance Test Record (PTR). For each setting, perform the following:
   a. Adjust the level until the digital multimeter reads 5 V.
   b. Set **`Controls`** to **`Main`** and adjust the **`Time/Div`** on the Test Set to display 2 to 3 cycles of the waveform.
   c. Set **`Controls`** to **`Marker`** and press the knob (with the cursor in the **`Marker To Peak+`** field) to move the marker to the peak of the waveform.
   d. Read the **`Lvl`** and compare the reading to the limits in the PTR.

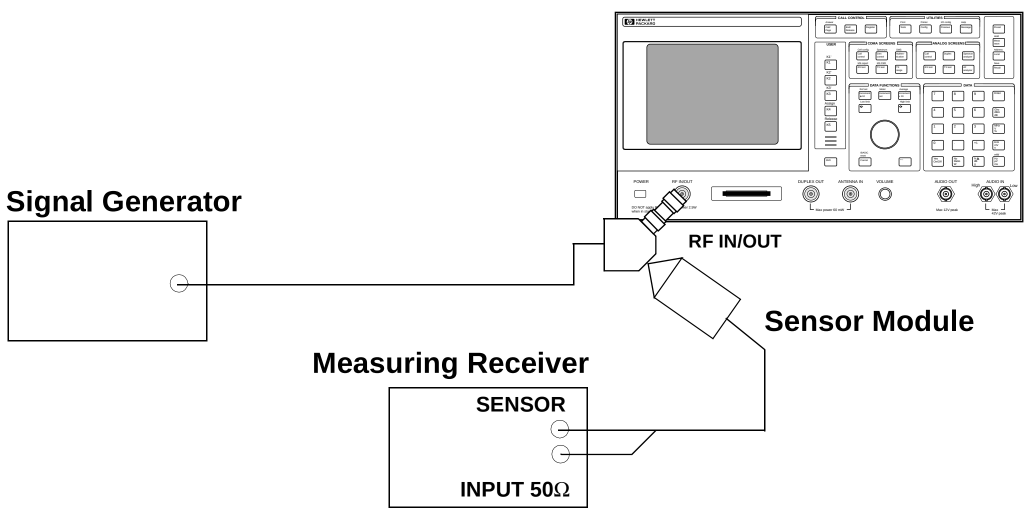
RF Analyzer Level Accuracy Performance Test 19

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-19, "RF Analyzer Level Accuracy Test 19 Record" on page 226. Level accuracy is measured using a system power calibration program that resides on a memory card.

Procedure

1. Obtain the memory card containing the System Power Calibration program.
2. Run the System Power Calibration as follows:
   a. Insert the memory card into the memory card slot.
   b. Select the SOFTWARE MENU screen.
   c. Set the **Select Procedure Location:** field to **Card.**
   d. Set the **Select Procedure Filename** field to **SYSPWR0**.
   e. Press the **Run Test** key.
3. Follow the instructions as they are presented. As the power difference is displayed, write these numbers in the Performance Test Record and compare them with the limits. (If two passes are chosen, average the two sets of data.) After the acquisition of levels is complete, select **No** when asked if you want the calibration factors downloaded into the Test Set's memory.

Figure 6-24



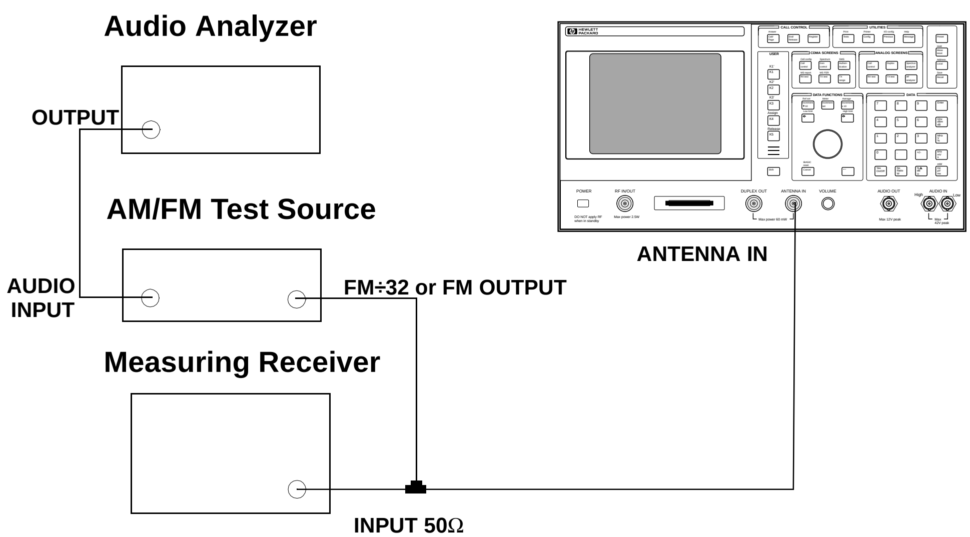
RF Analyzer FM Accuracy Performance Test 20

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-20, "RF Analyzer FM Accuracy Test 20 Record" on page 228. The AM/FM test source provides the RF signal with FM. The signal is measured both by the Test Set's internal RF analyzer and the measuring receiver. The FM signal comes from the external audio source in the audio analyzer. The audio level is varied until the modulation is at the desired FM deviation as measured by the measuring receiver.

NOTE Use the AM/FM test source output labeled FM÷32 for 12.5 MHz and the output labeled FM for 400 MHz. You can measure the frequency with the measuring receiver and adjust it with the carrier frequency tune knob, but the exact frequency is not critical.

Setup

Figure 6-25



Procedure

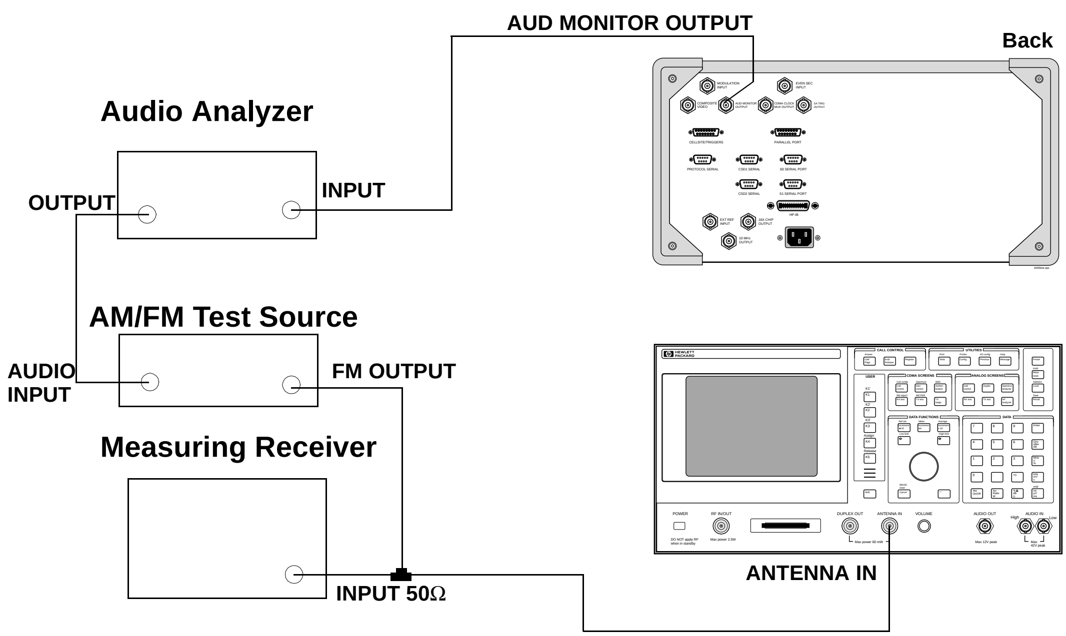
1. On the AM/FM test source, set the test mode to FM.
2. On the measuring receiver:
   a. Reset the instrument.
   b. Set the measurement mode to FM.
   c. Set the detector to RMS.
3. On the audio analyzer:
   a. Reset the instrument.
   b. Set the output frequency to 50 Hz.
4. On the Test Set:
   a. Press **Preset**.
   b. Select the CONFIGURE screen.
   c. Set the **RF Display** field to **Freq**.
   d. Select the RF ANALYZER screen.
   e. Set the **Tune Freq** to **12.5 MHz**.
   f. Set the **Input Port** field to **Ant**.
   g. Set the **IF Filter** field to **230 kHz**.
   h. Set **Squelch** to **Open**.
   i. Select the AF ANALYZER screen.
   j. Set the **AF Anl In** field to **FM Demod**.
   k. Set the **Filter 1** field to **<20 Hz HPF**.
   l. Set the **Filter 2** field to **>99kHz LP**.
   m. Set the **Detector** field to **RMS**.
5. For each RF output from the AM/FM test source (12.5 MHz and 400 MHz corresponding to the FM÷32 and FM outputs) shown in the Performance Test Record (PTR), do the following:
   a. Set the audio analyzer's frequency (rate) as shown in the PTR.
   b. Adjust the audio analyzer's level until the measuring receiver reads the FM deviation shown in the PTR.
   c. Read the FM deviation on the Test Set and compare the results to the limits shown in the PTR.

RF Analyzer FM Distortion Performance Test 21

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-21, "RF Analyzer FM Distortion Test 21 Record" on page 229. An audio signal from the audio analyzer provides FM for the AM/FM test source. The AM/FM test source provides an RF signal (with FM) to the Test Set's internal RF analyzer. The measuring receiver is used to monitor FM deviation as the level of the audio signal from the audio analyzer is varied. The audio analyzer then measures distortion introduced by the Test Set.

Setup

Figure 6-26



Procedure

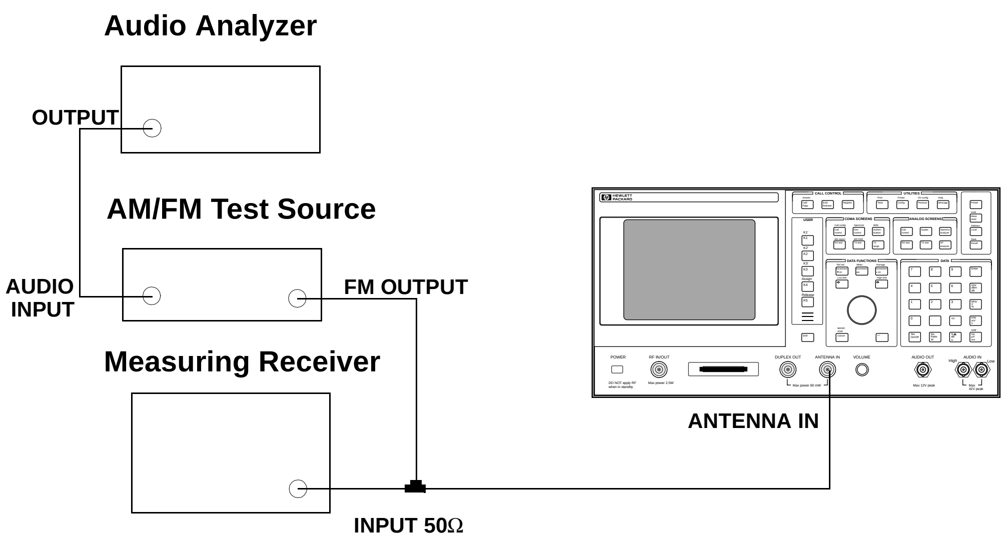
1. On the AM/FM test source, set the test mode to FM.
2. On the measuring receiver:
   a. Reset the instrument.
   b. Set the measurement mode to FM.
   c. Set the high-pass filter to 300 Hz.
   d. Set the low-pass filter to 3 kHz.
3. On the audio analyzer:
   a. Reset the instrument.
   b. Set the output frequency to 1 kHz.
   c. Set the measurement mode to distortion.
4. On the Test Set:
   a. Press **Preset**.
   b. Select the INSTRUMENT CONFIGURE screen.
   c. Set the **RF Display** field to **Freq**.
   d. Select the RF ANALYZER screen.
   e. Set the **Tune Freq** to **400 MHz**.
   f. Set the **Input Port** field to **Ant**.
   g. Set the **IF Filter** field to **230 kHz**.
   h. Set **Squelch** field to **Open**.
   i. Select the AF ANALYZER screen.
   j. Set the **AF Anl In** field to **FM Demod**.
   k. Set the **Filter 1** field to **300Hz HPF**.
   l. Set the **Filter 2** field to **3kHz LPF**.
   m. Set the **Detector** field to **Pk+**.
5. For each FM deviation setting shown in the Performance Test Record (PTR) do the following:
   a. Adjust the audio analyzer’s level until the measuring receiver reads the FM deviation shown in the PTR.
   b. Read the distortion on the audio analyzer and compare the results to the limits shown in the PTR.

RF Analyzer FM Bandwidth Performance Test 22

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-22, "RF Analyzer FM Bandwidth Test 22 Record" on page 230. An audio signal from the audio analyzer provides FM for the AM/FM test source. The AM/FM test source provides an RF signal (with FM) to the Test Set's internal RF analyzer. The measuring receiver is used to monitor FM deviation as the level of the audio signal from the audio analyzer is varied. The audio rate is varied in several steps from 20 Hz to 70 kHz. The difference between the maximum and minimum FM peak deviation is noted.

Setup

Figure 6-27



Procedure

1. On the AM/FM test source, set the test mode to FM.
2. On the measuring receiver:
   a. Reset the instrument.
   b. Set the measurement mode to FM.
   c. Set the all filters off.
3. On the audio analyzer:
   a. Reset the instrument.
   b. Set the output frequency to 1 kHz.
4. On the Test Set:
   a. Press **Preset**.
   b. Select the CONFIGURE screen.
   c. Set the **RF Display** field to **Freq**.
   d. Select the RF ANALYZER screen.
   e. Set the **Tune Freq** to **400 MHz**.
   f. Set the **Input Port** field to **Ant**.
   g. Set the **IF Filter** field to **230 kHz**.
   h. Set the **Squelch** field to **Open**.
   i. Select the AF ANALYZER screen.
   j. Set the **AF Anl In** field to **FM Demod**.
   k. Set the **Filter 2** field to **>99kHz LP**.
   l. Set the **Detector** field to **Pk+**.

5. Set the audio analyzer to the following frequencies: 20 Hz, 100 Hz, 1 kHz, 10 kHz, 35 kHz, and 70 kHz. For each frequency adjust the audio analyzer’s level until the measuring receiver reads 25 kHz FM deviation and record the deviation read on the Test Set.
6. Of the FM deviations measured by the Test Set find the maximum and minimum deviations and make the following calculation:

$$dB = 20 \bullet \log\left(\frac{\text{Maximum Deviation}}{\text{Minimum Deviation}}\right)$$

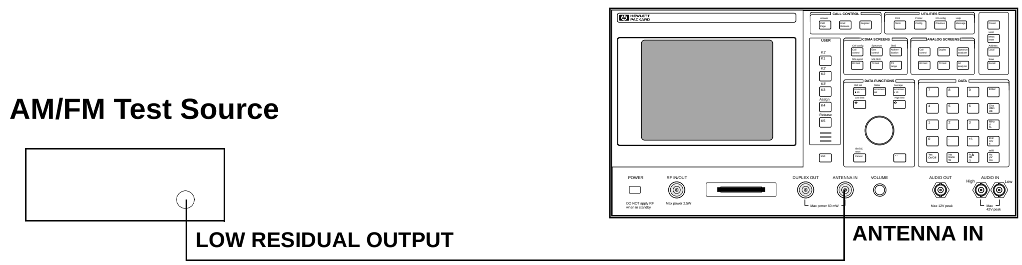
Record the dB difference in the Performance Test Record and compare it with the limits shown.

RF Analyzer Residual FM Performance Test 23

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-23, "RF Analyzer Residual FM Test 23 Record" on page 231. The AM/FM test source provides a CW signal with minimal residual FM. The FM is measured by the Test Set's internal RF analyzer.

Setup

Figure 6-28



Procedure

1. On the AM/FM test source, set the test mode to **RESIDUAL FM**.
2. On the Test Set:
   a. Press **Preset.**
   b. Select the CONFIGURE screen.
   c. Set the **RF Display** field to **Freq**.
   d. Select the RF ANALYZER screen.
   e. Set the **Tune Freq** to **560 MHz**.
   f. Set the **Input Port** field to **Ant**.
   g. Set the **IF Filter** field to **230 kHz**.
   h. Select the AF ANALYZER screen.
   i. Set the **AF Anl In** field to **FM Demod**.
   j. Set the **Filter 1** field to **300Hz HPF**.
   k. Set the **Filter 2** field to **3kHz LPF**.
   l. Set the **Detector** field to **RMS**.
3. Read the FM deviation (residual FM) and record the deviation read on the Test Set in the Performance Test Record and compare it to the limits.

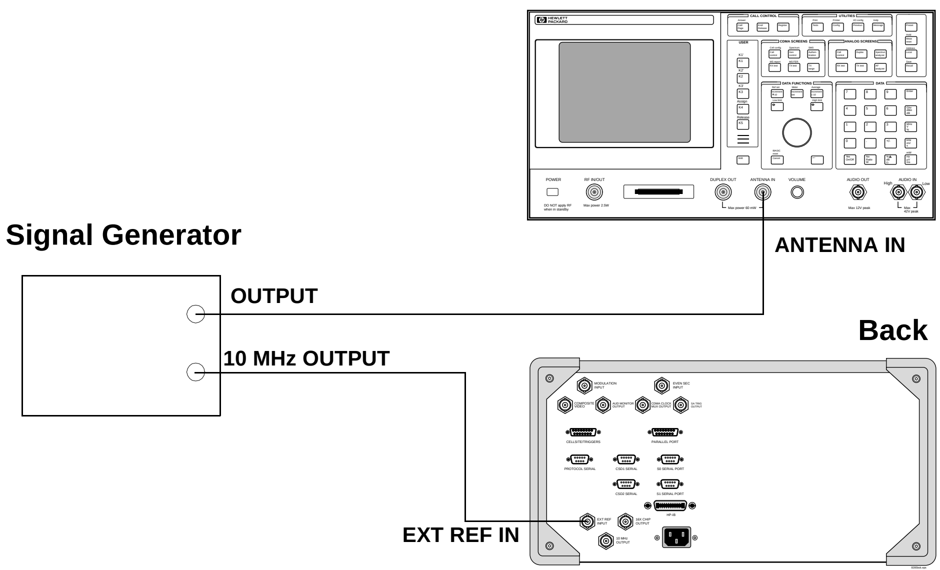
Spectrum Analyzer Image Rejection Performance Test 24

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-24, "Spectrum Analyzer Image Rejection (Image) Test 24 Record" on page 232. This test has two procedures. The first procedure measures the spectrum analyzer's ability to reject image frequencies. The spectrum analyzer is tuned to a signal frequency while an image signal from the signal generator is applied to the antenna input port.

The second procedure measures the spectrum analyzer's residual response at several frequencies.

Setup

Figure 6-29 Spectrum Analyzer Image Rejection Test 24



Procedure 1

1. On the signal generator:
   a. Set the level to -20 dBm.
   b. Set the frequency to 613.6 MHz.
   c. Set modulation off.
2. On the Test Set:
   a. Press **Preset**.
   b. Select the CONFIGURE screen.
   c. Set the **RF Display** field to **Freq**.
   d. Select the SPEC ANL screen.
   e. Set the **RF In/Ant** field to **Ant**.
   f. Set the **Ref Level** field to **-25 dBm**.
   g. Set the **Span** field to **5 kHz**.
   h. Set the **Controls** field to **Marker**.
   i. Set the **Marker To** field to **Center Freq**.
   j. Set the **Controls** field back to **Main**.
3. Set the signal generator's frequency and the Test Set's spectrum analyzer center frequency as shown in the Performance Test Record (PTR) and read the image response on the spectrum analyzer. The image response is the spectrum analyzer's marker level (in dBm) minus the signal generator's output level (minus –20 dBm). (In other words, add 20 dB to the marker level.) Compare the results to the limits.

Procedure 2

1. Disconnect the signal generator from the Test Set.
2. On the Test Set:
   a. Set the **Controls** field to **Auxiliary**.
   b. Set the **Input Atten** field to **Hold** at **0 dB**.
   c. Set the **Controls** field back to **Marker**.
   d. Set the **Marker To** field to **Center Freq**.
   e. Set the **Controls** field to **Main**.
   f. Set the **Span** field to **10 MHz**.
   g. Set the **Ref Level** field to **-20 dBm**.
3. Set the Test Set's **Center Freq** field to the frequencies shown in the PTR and measure the residual response on the spectrum analyzer's marker field and compare it to the limits.

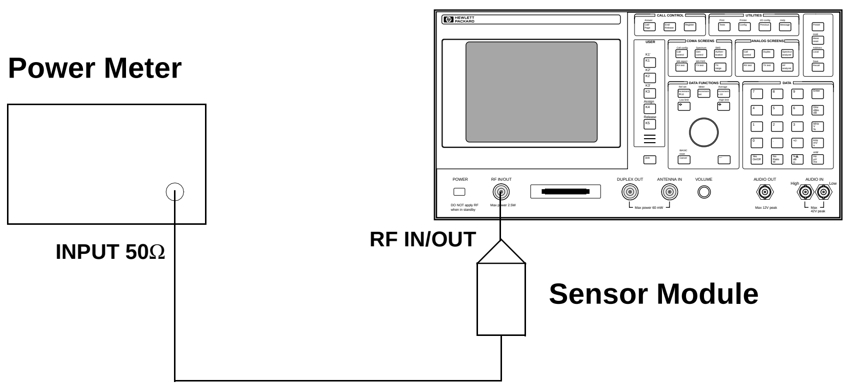
CDMA Generator RF IN/OUT Amplitude Level Accuracy Performance Test 25

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-26, "CDMA Generator RF In/Out Test 25 Record" on page 233. The amplitude level accuracy of the CDMA generator is measured directly with a power meter. These measurements are made at the top and bottom of the CDMA generator's vernier range.

NOTE Two setups follow. The first setup can measure signals to 1 GHz. Since the FM generator in the Test Set translates FM in the lower band directly into the 1.7 to 2 GHz range, testing to 1 GHz is adequate when verifying a repair. The second setup has a microwave converter which covers the full measurement range of FM signals to 2 GHz.

Setups

Figure 6-30 Setup 1 for Measurements to 1 GHz



Procedure 1

1. Before connecting the equipment, on the measuring receiver:
   a. Reset the instrument.
   b. Zero and calibrate the sensor module.

NOTE Make sure the sensor module's calibration data is entered into the measuring receiver.

2. Connect the equipment as shown in Setup 1.
3. On the Test Set:
   a. Press **Preset**.

b. Select the CONFIGURE screen and set RF display to freq.

c. Select the CDMA CALL CONTROL screen.

d. Set the **RF Gen Freq** field to **836.52 MHz**.

e. Select the CDMA GENERATOR CONTROL screen.

f. Set the **Sctr A Pwr** to **−20.5 dBm**.

4. On the measuring receiver:

a. Set the measurement mode to **RF Power**.

b. Set the display to log.

c. Press the Calibrate key.

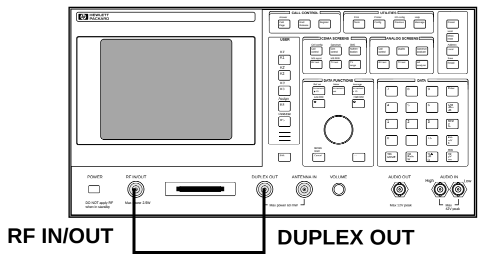
5. Set the Test Set to the frequencies and levels listed in the PTR and record the values.

CDMA Generator DUPLEX OUT Amplitude Level Accuracy Performance Test 26

The purpose of this test is to verify the amplitude level accuracy of the CDMA generator at the DUPLEX OUT port by using the CDMA analyzer to verify it meets the specification limits in PTR (Performance Test Record) table 7-27, "CDMA Generator DUPLEX OUT Sector B Power Level Accuracy Test 26 Record" on page 234.

Setup

Figure 6-31 CDMA Generator Modulation Accuracy Test 26



Procedure

1. Press **Preset.**

DUPLEX OUT Sector B Power

2. Select the CONFIGURE screen and set the **RF Display** field to **Freq**.
3. Set the **(Gen)-(Anl)** field to **0 MHz**.
4. Set the **Output Port** field to **Dupl**.
5. Select the CDMA GENERATOR CONTROL screen.
6. Set the **Scrt A Pwr** field to **Off**.
7. Set the **RF Gen Freq** to **840 MHz**.
8. Set the **Scrt B Pwr** field to the values listed in the PTR for Sector B. See Appendix Table 7-27, "CDMA Generator DUPLEX OUT Sector B Power Level Accuracy Test 26 Record," on page 234.
9. Go to the CDMA CELLULAR MOBILE TRANSMITTER TEST screen.
10. Read the **Avg Power** (average power) and record it in the PTR.

DUPLEX OUT AWGN Power

11. Select the CDMA GENERATOR CONTROL screen.
12. Set the **Sector B Power** field to **Off**.

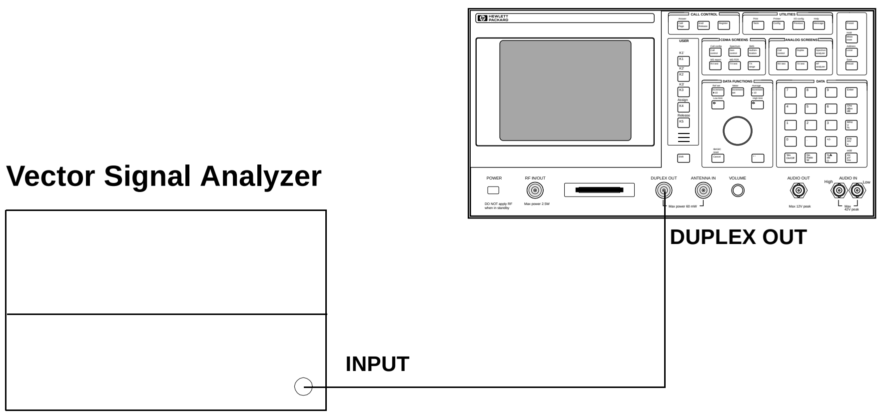
13. Set the **AWGN Power** field to the values listed in the PTR for AWGN power. See table 7-28, "CDMA Generator DUPLEX OUT AWGN Power Level Accuracy Test 26 Record" on page 234.
14. Select the CDMA CALL CONTROL screen.
15. Change the **Avg Power** measurement field to **Chan Power** (Channel Power).
16. Calibrate the channel power by selecting **Calibrate** in the **Power Meas** field.
17. Select the CDMA GENERATOR CONTROL screen.
18. Read the channel power and record it in the PTR.

CDMA Generator Modulation Accuracy Performance Test 27

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-29, "CDMA Generator Modulation Accuracy Test 27 Record" on page 235. The modulation accuracy of the CDMA generator is directly measured with a vector signal analyzer at the DUPLEX OUT port. Because the vector signal analyzer cannot measure rho directly, the modulation accuracy is measured in EVM (Error Vector Magnitude) % rms and rho is calculated from the EVM data.

Setup

Figure 6-32 CDMA Generator Modulation Accuracy Test 26



Procedure

1. On the Test Set:
   a. Press **Preset**.
   b. Select the CONFIGURE screen.
   c. Set the **`RF Display`** field to **`Freq`**.
   d. Set the **`(Gen)-(Anl)`** field to **`0 MHz`**.
   e. Set the **`Output Port`** field to **`Dupl`**.
   f. Select the CDMA CALL CONTROL screen.
   g. Set the **`RF Gen Freq`** field to **`881.52 MHz`**.
   h. Select the CDMA GENERATOR CONTROL screen.
   i. Set the **`Scrt A Pwr`** field to **`–10 dBm`**.
   j. Turn off the **`Synth`**, **`Pager`**, and **`Traffic`** fields.
   k. Set the **`Pilot`** field to **`0 dB`**.

2. On the Vector Signal Analyzer:

   a. Press the **Frequency** key.
   b. Set center frequency to 881.52 MHz.
   c. Set the span to 2.6 MHz.
   d. Press the **Instrument Mode** key
   e. Press the **Digital Demodulation** (F4) key
   f. Press the **Demodulation Setup** (F5) key
   g. Press the **Demodulation Format** (F1) key
   h. Press the **Standard Setup** (F7) key.
   i. Press the **CDMA Base** (F7) key.
   j. Press the **D** key.
   k. Read the Rho measurement or:

3. Use the following equation to calculate rho.

$$\rho = \frac{1}{1 + EVM^2}$$

$\rho = rho$
EVM = Error Vector Magnitude (% rms)

4. Compare and record the rho error calculated in table 7-29, "CDMA Generator Modulation Accuracy Test 27 Record" on page 235

5. Set the CDMA GEN frequency on the Test Set and change the center frequency on the Vector Signal Analyzer to the 1956.25 MHz.

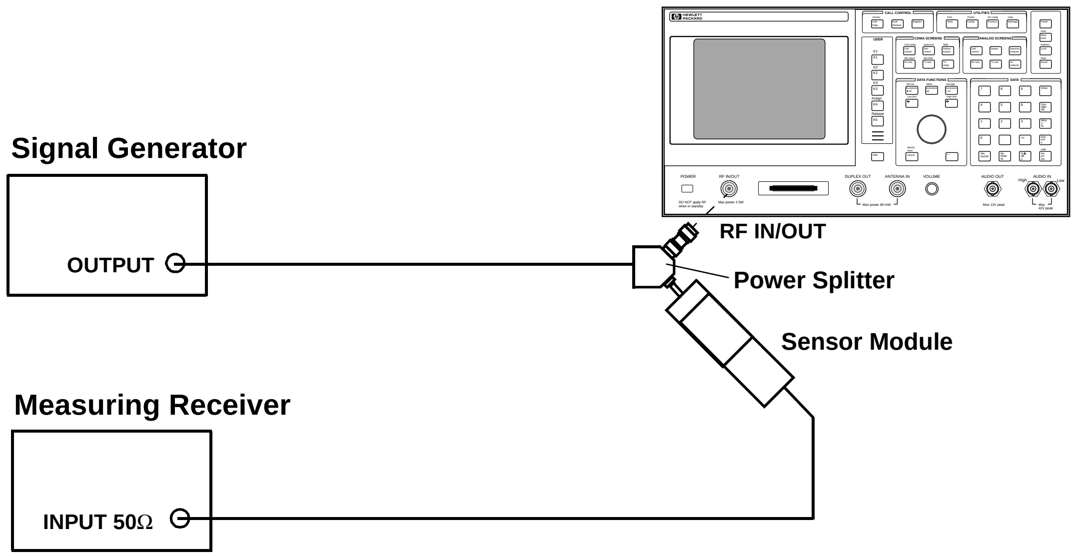
6. Calculate rho (using the above equation), and record the result (rho) in table 7-29, "CDMA Generator Modulation Accuracy Test 27 Record" on page 235.

CDMA Analyzer Average Power Level Accuracy Performance Test 28

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-30, "CDMA Analyzer Average Power Level Accuracy Test 28 Record" on page 236. The CDMA average-power-level accuracy is verified by comparing the measured power in a CW signal with the power level measured by a power meter.

Setup

Figure 6-33 CDMA Analyzer Average Power Level Accuracy Test 27



Procedure

1. On the signal generator:
   a. Set the frequency to **`881.52 MHz`**.
   b. Set the amplitude so the measuring receiver reads 0 dBm.
2. On the Test Set:
   a. Press **Preset**
   b. Select the CONFIGURE screen.
   c. Set the **`RF Display`** field to **`Freq`**.
   d. Set the **`(Gen)-(Anl)`** field to **`0 MHz`**.
   e. Select CDMA CALL CONTROL.
   f. Set **Tune Freq** to 881.52 MHz.

g. Set the **Avg Pwr Units** to **mW**.

3. Record the **Avg Pwr** reading in the PTR (see table 7-28, "CDMA Generator DUPLEX OUT AWGN Power Level Accuracy Test 26 Record" on page 234).

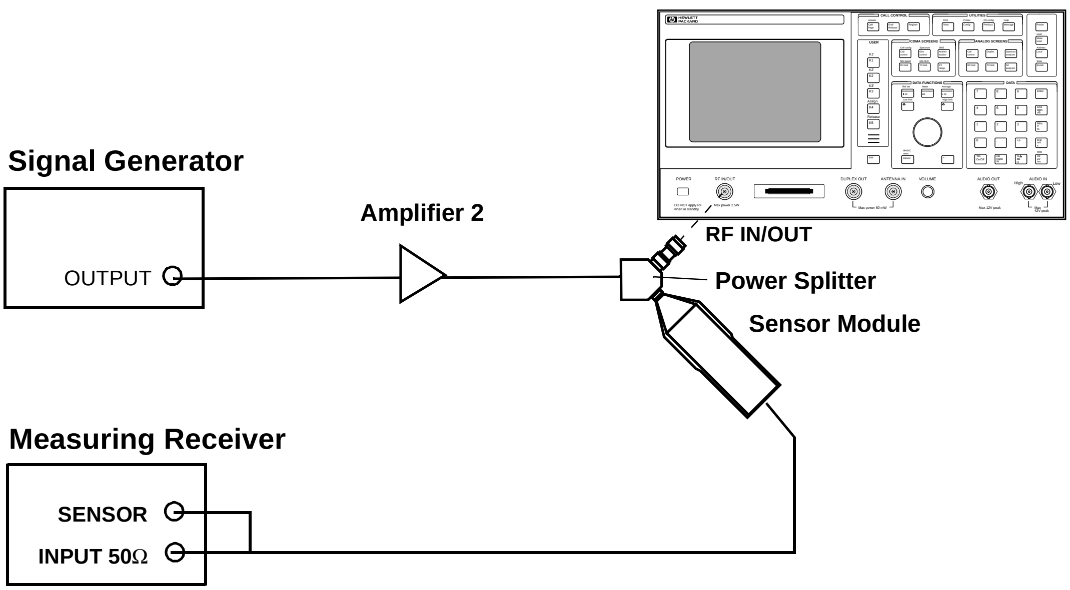
4. Repeat steps 2 and 3 for each of the frequencies and levels listed in the PTR.

CDMA Analyzer Channel Power Level Accuracy Performance Test 29

The purpose of this test is to verify that the Test Set meets the specification limits in PTR (Performance Test Record) table 7-30, "CDMA Analyzer Average Power Level Accuracy Test 28 Record" on page 236. The tuned channel power level accuracy is verified by comparing the measured power in a CW signal with the power level measured by a measuring receiver.

Setup

Figure 6-34 CDMA Analyzer Channel Power Level Accuracy Test 28



Procedure

1. On the measuring receiver
   a. Set the display mode to **LOG**.
   b. Set the measurement mode to **RF POWER**.
   c. Calibrate the power sensor.
2. On the signal generator:
   a. Set the frequency to 836.52 MHz (45 MHz below RF generator frequency).
   b. Set the output level so the measuring receiver reads 11 dBm.
3. On the Test Set:
   a. Press **Preset.**
   b. Change the **Avg Pwr** field to **Chan Pwr**.
   c. Verify the **RF Channel** is set at **384**.
   d. Select **Calibrate** under **Chn Pwr Cal**.
4. Record the **Chan Pwr** measurement in the PTR table 7-31, "CDMA Analyzer Channel Power Level Accuracy Test 29 Record" on page 237.
5. Repeat steps 2 and 3 for each of the data points listed in the PTR.
6. For PCS frequencies:
   a. Set the **RF CHAN Std** to **US PCS**.
   b. Verify the **RF Channel** is set at **525**.

NOTE The **Chan Pwr Cal** is only required when the frequency is changed.

7 Performance Test Records

Use this chapter to record the results of the performance tests in Chapter 7, "Performance Test Records," on page 191.

RF Generator FM Distortion Performance Test 1 Record

For test procedure, see "RF Generator FM Distortion Performance Test 1" on page 141.

Table 7-1 RF Generator FM Distortion Test 1 Record

RF (MHz)	Deviation (kHz)	Rate (kHz)	FM Distortion Limits (%)	
			Upper	Actual
30	99	1	0.50	
30	5	1	0.50	
312.5	5	1	0.50	
425	50	1	0.50	
501	99	1	0.50	
501	50	1	0.50	
501	5	1	0.50	
568.75	50	1	0.50	
656.25	99	1	0.50	
656.25	50	1	0.50	
656.25	5	1	0.50	
750	99	1	0.50	
750	50	1	0.50	
750	5	1	0.50	
856.25	99	1	0.50	
856.25	50	1	0.50	
856.25	5	1	0.50	
956.25	50	1	0.50	
976.002	5	1	0.50	
1000	99	1	0.50	
1000	50	1	0.50	
1000	11	1	0.50	
1000	5	1	0.50	

RF (MHz)	Deviation (kHz)	Rate (kHz)	FM Distortion Limits (%)	
			Upper	Actual
1000	6	1	0.50	
1000	7	1	0.50	
1000	8	1	0.50	
1000	9	1	0.50	
998.401	8	1	0.50	
768.001	8	1	0.50	
512.001	8	1	0.50	
511.601	8	1	0.50	
511.201	8	1	0.50	
The following entries are for the 2 GHz setup.				
1700	99	1	1.00	
1700	50	1	1.00	
1700	5	1	1.00	
2000	99	1	1.00	
2000	50	1	1.00	
2000	5	1	1.00	

RF Generator FM Accuracy Performance Test 2 Record

For test procedure, see “RF Generator FM Accuracy Performance Test 2” on page 143.

Table 7-2 RF Generator FM Accuracy Test 2 Record

RF (MHz)	Deviation (kHz)	Rate (kHz)	FM Deviation Limits (kHz)		
			Lower	Upper	Actual
30	99	1	95.035	102.965	
30	3	1	2.845	3.155	
312.5	3	1	2.845	3.155	
425	50	1	47.750	52.25	
501	99	1	95.035	102.965	
501	50	1	47.750	52.25	
501	3	1	2.845	3.155	
568.75	50	1	47.750	52.25	
656.25	99	1	95.035	102.965	
656.25	50	1	47.750	52.25	
656.25	3	1	2.845	3.155	
750	99	1	95.035	102.965	
750	50	1	47.750	52.25	
750	3	1	2.845	3.155	
856.25	99	1	95.035	102.965	
856.25	50	1	47.750	52.25	
856.25	3	1	2.845	3.155	
956.25	50	1	47.750	52.25	
976.002	3	1	2.845	3.155	
1000	99	1	95.035	102.965	
1000	50	1	47.750	52.25	
1000	11	1	10.115	11.885	

RF (MHz)	Deviation (kHz)	Rate (kHz)	FM Deviation Limits (kHz)		
			Lower	Upper	Actual
1000	3	1	2.845	3.155	
The following entries are for the 2 GHz setup.					
1700	99	1	95.035	102.965	
1700	50	1	47.750	52.25	
1700	3	1	2.845	3.155	
2000	99	1	95.035	102.965	
2000	50	1	47.750	52.25	
2000	3	1	2.845	3.155	

RF Generator FM Flatness Performance Test 3 Record

For test procedure, see "RF Generator FM Flatness Performance Test 3" on page 145.

Table 7-3 RF Generator FM Flatness Test 3 Record

Level (dBm)	RF (MHz)	Deviation (kHz)	AFGEN1 Freq. Rate (kHz)	Computed FM Flatness Limits (dB)		Measured Reading (kHz)	Computed Results (dB)
				Lower	Upper	Reading	Computed
–10	521	50	1	Reference			0 dB
–10	521	50	0.1	–1	1		
–10	521	50	0.2	–1	1		
–10	521	50	2	–1	1		
–10	521	50	10	–1	1		
–10	521	50	25	–1	1		
–10	975.5	50		Reference			0 dB
–10	975.5	50	0.1	–1	1		
–10	975.5	50	0.2	–1	1		
–10	975.5	50	2	–1	1		
–10	975.5	50	10	–1	1		
–10	975.5	50	25	–1	1		
The following entries are for the 2 GHz setup.							
–10	1700	50		Reference			0 dB
–10	1700	50	0.1	–1	1		
–10	1700	50	0.2	–1	1		
–10	1700	50	2	–1	1		
–10	1700	50	10	–1	1		
–10	1700	50	25	–1	1		
–10	2000	50		Reference			0 dB
–10	2000	50	0.1	–1	1		

Level (dBm)	RF (MHz)	Deviation (kHz)	AFGEN1 Freq. Rate (kHz)	Computed FM Flatness Limits (dB)		Measured Reading (kHz)	Computed Results (dB)
				Lower	Upper	Reading	Computed
–10	2000	50	0.2	–1	1		
–10	2000	50	2	–1	1		
–10	2000	50	10	–1	1		
–10	2000	50	25	–1	1		

RF Generator Residual FM Performance Test 4 Record

For test procedure, see "RF Generator Residual FM Performance Test 4" on page 147.

Table 7-4 RF Generator Residual FM Test 4 Record

LO (MHz)	RF (MHz)	Residual FM Limits (Hz)	
		Upper	Actual
31.5	30	7	
101.5	100	7	
249.5	248	7	
251.5	250	4	
401.5	400	4	
501.5	500	4	
502.5	501	7	
512.701	511.201	7	
513.101	511.601	7	
513.501	512.001	7	
626.5	625	7	
736.5	735	7	
741.5	740	7	
746.5	745	7	
751.5	750	7	
769.501	768.001	7	
846.5	845	7	
851.5	850	7	
856.5	855	7	
866.5	865	7	
901.5	900	7	
999.901	998.401	7	

LO (MHz)	RF (MHz)	Residual FM Limits (Hz)	
		Upper	Actual
1001.5	1000	7	
The following entries are for the 2 GHz setup.			
201.5	1700	14	
501.5	2000	14	

RF Generator Level Accuracy Performance Test 5 Record

For test procedure, see “RF Generator Level Accuracy Performance Test 5” on page 150.

Table 7-5 RF Generator Level Accuracy Test 5 Record

Port	RF (MHz)	Level (dBm)	Level Limits (dBm)		
			Lower	Upper	Actual
The following entries are for Procedure 1.					
DUPLEX OUT	30	–11	–12	–10	
DUPLEX OUT	30	–16	–17	–15	
DUPLEX OUT	30	–21	–22	–20	
DUPLEX OUT	30	–26	–27	–25	
DUPLEX OUT	30	–31	–32	–30	
DUPLEX OUT	30	–36	–37	–35	
DUPLEX OUT	30	–41	–42	–40	
DUPLEX OUT	30	–46	–47	–45	
DUPLEX OUT	30	–51	–52	–50	
DUPLEX OUT	30	–56	–57	–55	
DUPLEX OUT	30	–61	–62	–60	
DUPLEX OUT	30	–66	–67	–65	
DUPLEX OUT	30	–71	–72	–70	
DUPLEX OUT	30	–76	–77	–75	
DUPLEX OUT	30	–81	–82	–80	
DUPLEX OUT	30	–86	–87	–85	
DUPLEX OUT	30	–91	–92	–90	
DUPLEX OUT	30	–96	–97	–95	
DUPLEX OUT	30	–101	–102	–100	
DUPLEX OUT	30	–106	–107	–105	
DUPLEX OUT	30	–111	–112	–110	
DUPLEX OUT	30	–116	–117	–115	

Port	RF (MHz)	Level (dBm)	Level Limits (dBm)		
			Lower	Upper	Actual
RF IN/OUT	30	–22	–23	–21	
RF IN/OUT	30	–27	–28	–26	
RF IN/OUT	30	–32	–33	–31	
RF IN/OUT	30	–37	–38	–36	
RF IN/OUT	30	–42	–43	–41	
RF IN/OUT	30	–47	–48	–46	
RF IN/OUT	30	–52	–53	–51	
RF IN/OUT	30	–57	–58	–56	
RF IN/OUT	30	–62	–63	–61	
RF IN/OUT	30	–67	–68	–66	
RF IN/OUT	30	–72	–73	–71	
RF IN/OUT	30	–77	–78	–76	
RF IN/OUT	30	–82	–83	–81	
RF IN/OUT	30	–87	–88	–86	
RF IN/OUT	30	–92	–93	–91	
RF IN/OUT	30	–97	–98	–96	
RF IN/OUT	30	–102	–103	–101	
RF IN/OUT	30	–107	–108	–106	
RF IN/OUT	30	–112	–113	–111	
RF IN/OUT	30	–117	–118	–116	
DUPLEX OUT	687.5	–11	–12	–10	
DUPLEX OUT	687.5	–16	–17	–15	
DUPLEX OUT	687.5	–21	–22	–20	
DUPLEX OUT	687.5	–26	–27	–25	
DUPLEX OUT	687.5	–31	–32	–30	
DUPLEX OUT	687.5	–36	–37	–35	
DUPLEX OUT	687.5	–41	–42	–40	
DUPLEX OUT	687.5	–46	–47	–45	
DUPLEX OUT	687.5	–51	–52	–50	

Port	RF (MHz)	Level (dBm)	Level Limits (dBm)		
			Lower	Upper	Actual
DUPLEX OUT	687.5	–56	–57	–55	
DUPLEX OUT	687.5	–61	–62	–60	
DUPLEX OUT	687.5	–66	–67	–65	
DUPLEX OUT	687.5	–71	–72	–70	
DUPLEX OUT	687.5	–76	–77	–75	
DUPLEX OUT	687.5	–81	–82	–80	
DUPLEX OUT	687.5	–86	–87	–85	
DUPLEX OUT	687.5	–91	–92	–90	
DUPLEX OUT	687.5	–96	–97	–95	
DUPLEX OUT	687.5	–101	–102	–100	
DUPLEX OUT	687.5	–106	–107	–105	
DUPLEX OUT	687.5	–111	–112	–110	
DUPLEX OUT	687.5	–116	–117	–115	
RF IN/OUT	687.5	–22	–23	–21	
RF IN/OUT	687.5	–27	–28	–26	
RF IN/OUT	687.5	–32	–33	–31	
RF IN/OUT	687.5	–37	–38	–36	
RF IN/OUT	687.5	–42	–43	–41	
RF IN/OUT	687.5	–47	–48	–46	
RF IN/OUT	687.5	–52	–53	–51	
RF IN/OUT	687.5	–57	–58	–56	
RF IN/OUT	687.5	–62	–63	–61	
RF IN/OUT	687.5	–67	–68	–66	
RF IN/OUT	687.5	–72	–73	–71	
RF IN/OUT	687.5	–77	–78	–76	
RF IN/OUT	687.5	–82	–83	–81	
RF IN/OUT	687.5	–87	–88	–86	
RF IN/OUT	687.5	–92	–93	–91	
RF IN/OUT	687.5	–97	–98	–96	

Port	RF (MHz)	Level (dBm)	Level Limits (dBm)		
			Lower	Upper	Actual
RF IN/OUT	687.5	–102	–103	–101	
RF IN/OUT	687.5	–107	–108	–106	
RF IN/OUT	687.5	–112	–113	–111	
RF IN/OUT	687.5	–117	–118	–116	
DUPLEX OUT	1000	–11	–12	–10	
DUPLEX OUT	1000	–16	–17	–15	
DUPLEX OUT	1000	–21	–22	–20	
DUPLEX OUT	1000	–26	–27	–25	
DUPLEX OUT	1000	–31	–32	–30	
DUPLEX OUT	1000	–36	–37	–35	
DUPLEX OUT	1000	–41	–42	–40	
DUPLEX OUT	1000	–46	–47	–45	
DUPLEX OUT	1000	–51	–52	–50	
DUPLEX OUT	1000	–56	–57	–55	
DUPLEX OUT	1000	–61	–62	–60	
DUPLEX OUT	1000	–66	–67	–65	
DUPLEX OUT	1000	–71	–72	–70	
DUPLEX OUT	1000	–76	–77	–75	
DUPLEX OUT	1000	–81	–82	–80	
DUPLEX OUT	1000	–86	–87	–85	
DUPLEX OUT	1000	–91	–92	–90	
DUPLEX OUT	1000	–96	–97	–95	
DUPLEX OUT	1000	–101	–102	–100	
DUPLEX OUT	1000	–106	–107	–105	
DUPLEX OUT	1000	–111	–112	–110	
DUPLEX OUT	1000	–116	–117	–115	
RF IN/OUT	1000	–22	–23	–21	
RF IN/OUT	1000	–27	–28	–26	
RF IN/OUT	1000	–32	–33	–31	

Port	RF (MHz)	Level (dBm)	Level Limits (dBm)		
			Lower	Upper	Actual
RF IN/OUT	1000	–37	–38	–36	
RF IN/OUT	1000	–42	–43	–41	
RF IN/OUT	1000	–47	–48	–46	
RF IN/OUT	1000	–52	–53	–51	
RF IN/OUT	1000	–57	–58	–56	
RF IN/OUT	1000	–62	–63	–61	
RF IN/OUT	1000	–67	–68	–66	
RF IN/OUT	1000	–72	–73	–71	
RF IN/OUT	1000	–77	–78	–76	
RF IN/OUT	1000	–82	–83	–81	
RF IN/OUT	1000	–87	–88	–86	
RF IN/OUT	1000	–92	–93	–91	
RF IN/OUT	1000	–97	–98	–96	
RF IN/OUT	1000	–102	–103	–101	
RF IN/OUT	1000	–107	–108	–106	
RF IN/OUT	1000	–112	–113	–111	
RF IN/OUT	1000	–117	–118	–116	
The following entries are for the 2 GHz setup					
DUPLEX OUT	1700	–13	–14	–12	
DUPLEX OUT	1700	–18	–19	–17	
DUPLEX OUT	1700	–23	–24	–22	
DUPLEX OUT	1700	–28	–29	–27	
DUPLEX OUT	1700	–33	–34	–32	
DUPLEX OUT	1700	–38	–39	–37	
DUPLEX OUT	1700	–43	–44	–42	
DUPLEX OUT	1700	–48	–49	–47	
DUPLEX OUT	1700	–53	–54	–52	
DUPLEX OUT	1700	–58	–59	–57	
DUPLEX OUT	1700	–63	–64	–62	

Port	RF (MHz)	Level (dBm)	Level Limits (dBm)		
			Lower	Upper	Actual
DUPLEX OUT	1700	–68	–69	–67	
DUPLEX OUT	1700	–73	–74	–72	
DUPLEX OUT	1700	–78	–79	–77	
DUPLEX OUT	1700	–83	–84	–82	
DUPLEX OUT	1700	–88	–89	–87	
DUPLEX OUT	1700	–93	–94	–92	
DUPLEX OUT	1700	–98	–99	–97	
DUPLEX OUT	1700	–103	–104	–102	
DUPLEX OUT	1700	–108	–109	–107	
DUPLEX OUT	1700	–103	–114	–112	
DUPLEX OUT	1700	–118	–119	–117	
RF IN/OUT	1700	–23	–24.25	–21.75	
RF IN/OUT	1700	–28	–29.25	–26.75	
RF IN/OUT	1700	–33	–24.25	–31.75	
RF IN/OUT	1700	–38	–39.25	–36.75	
RF IN/OUT	1700	–43	–44.25	–41.75	
RF IN/OUT	1700	–48	–49.25	–46.75	
RF IN/OUT	1700	–53	–54.25	–51.75	
RF IN/OUT	1700	–58	–59.25	–56.75	
RF IN/OUT	1700	–63	–64.25	–61.75	
RF IN/OUT	1700	–68	–69.25	–66.75	
RF IN/OUT	1700	–73	–74.25	–71.75	
RF IN/OUT	1700	–78	–79.25	–76.75	
RF IN/OUT	1700	–83	–84.25	–81.75	
RF IN/OUT	1700	–88	–89.25	–86.75	
RF IN/OUT	1700	–93	–94.25	–89.75	
RF IN/OUT	1700	–98	–99.25	–96.75	
RF IN/OUT	1700	–103	–104.25	–101.75	
RF IN/OUT	1700	–108	–109.25	–106.75	

Port	RF (MHz)	Level (dBm)	Level Limits (dBm)		
			Lower	Upper	Actual
RF IN/OUT	1700	–113	–114.25	–111.75	
RF IN/OUT	1700	–118	–119.25	–116.75	
DUPLEX OUT	2000	–13	–14	–12	
DUPLEX OUT	2000	–18	–19	–17	
DUPLEX OUT	2000	–23	–24	–22	
DUPLEX OUT	2000	–28	–29	–27	
DUPLEX OUT	2000	–33	–34	–32	
DUPLEX OUT	2000	–38	–39	–37	
DUPLEX OUT	2000	–43	–44	–42	
DUPLEX OUT	2000	–48	–49	–47	
DUPLEX OUT	2000	–53	–54	–52	
DUPLEX OUT	2000	–58	–59	–57	
DUPLEX OUT	2000	–63	–64	–62	
DUPLEX OUT	2000	–68	–69	–67	
DUPLEX OUT	2000	–73	–74	–72	
DUPLEX OUT	2000	–78	–79	–77	
DUPLEX OUT	2000	–83	–84	–82	
DUPLEX OUT	2000	–88	–89	–87	
DUPLEX OUT	2000	–93	–94	–92	
DUPLEX OUT	2000	–98	–99	–97	
DUPLEX OUT	2000	–103	–104	–102	
DUPLEX OUT	2000	–108	–109	–107	
DUPLEX OUT	2000	–113	–114	–112	
DUPLEX OUT	2000	–118	–119	–117	
RF IN/OUT	2000	–23	–24.25	–21.75	
RF IN/OUT	2000	–28	–29.25	–26.75	
RF IN/OUT	2000	–33	–34.25	–31.75	
RF IN/OUT	2000	–38	–39.25	–36.75	
RF IN/OUT	2000	–43	–44.25	–41.75	

Port	RF (MHz)	Level (dBm)	Level Limits (dBm)		
			Lower	Upper	Actual
RF IN/OUT	2000	–48	–49.25	–46.75	
RF IN/OUT	2000	–53	–54.25	–51.75	
RF IN/OUT	2000	–58	–59.25	–56.75	
RF IN/OUT	2000	–63	–64.25	–61.75	
RF IN/OUT	2000	–68	–69.25	–66.75	
RF IN/OUT	2000	–73	–74.25	–71.75	
RF IN/OUT	2000	–78	–79.25	–76.75	
RF IN/OUT	2000	–83	–84.25	–81.75	
RF IN/OUT	2000	–88	–89.25	–86.75	
RF IN/OUT	2000	–93	–94.25	–91.75	
RF IN/OUT	2000	–98	–99.25	–96.75	
RF IN/OUT	2000	–103	–104.25	–101.75	
RF IN/OUT	2000	–108	–109.25	–106.75	
RF IN/OUT	2000	–113	–114.25	–111.75	
RF IN/OUT	2000	–118	–119.25	–116.75	

RF Generator Harmonics Spectral Purity Performance Test 6 Record

For test procedure, see "RF Generator Harmonics Spectral Purity Performance Test 6" on page 155.

Table 7-6 RF Generator Harmonics Spectral Purity Test 6 Record

Level (dBm)	RF Freq (MHz)	Harmonic Number	Harmonic Limits (dBc)	
			Upper	Actual
-10	30	2nd	–18.000	
-10	30	3rd	–18.000	
-10	50	2nd	–18.000	
-10	50	3rd	–18.000	
-10	100	2nd	–18.000	
-10	100	3rd	–18.000	
-10	200	2nd	–18.000	
-10	200	3rd	–18.000	
-10	300	2nd	–18.000	
-10	300	3rd	–18.000	
-10	400	2nd	–18.000	
-10	400	3rd	–18.000	
-10	500	2nd	–18.000	
-10	500	3rd	–18.000	
-10	600	2nd	–18.000	
-10	600	3rd	–18.000	
-10	700	2nd	–18.000	
-10	700	3rd	–18.000	
-10	800	2nd	–18.000	
-10	800	3rd	–18.000	
-10	900	2nd	–18.000	
-10	900	3rd	–18.000	
-10	1000	2nd	–18.000	

Level (dBm)	RF Freq (MHz)	Harmonic Number	Harmonic Limits (dBc)	
			Upper	Actual
-10	1000	3rd	–18.000	
-10	1700	2nd	–18.000	
-10	1700	3rd	–18.000	
-10	1800	2nd	–18.000	
-10	1800	3rd	–18.000	
-10	1900	2nd	–18.000	
-10	1900	3rd	–18.000	
-10	2000	2nd	–18.000	
-10	2000	3rd	–18.000	
-11	30	2nd	–18.000	
-11	30	3rd	–18.000	
-11	50	2nd	–18.000	
-11	50	3rd	–18.000	
–11	100	2nd	–18.000	
–11	100	3rd	–18.000	
–11	200	2nd	–18.000	
–11	200	3rd	–18.000	
–11	300	2nd	–18.000	
–11	300	3rd	–18.000	
–11	400	2nd	–18.000	
–11	400	3rd	–18.000	
–11	500	2nd	–18.000	
–11	500	3rd	–18.000	
–11	600	2nd	–18.000	
–11	600	3rd	–18.000	
–11	700	2nd	–18.000	
–11	700	3rd	–18.000	
–11	800	2nd	–18.000	
–11	800	3rd	–18.000	

Level (dBm)	RF Freq (MHz)	Harmonic Number	Harmonic Limits (dBc)	
			Upper	Actual
–11	900	2nd	–18.000	
–11	900	3rd	–18.000	
–11	1000	2nd	–18.000	
–11	1000	3rd	–18.000	
–12	1700	2nd	–18.000	
–12	1700	3rd	–18.000	
–12	1800	2nd	–18.000	
–12	1800	3rd	–18.000	
–12	1900	2nd	–18.000	
–12	1900	3rd	–18.000	
–12	2000	2nd	–18.000	
–12	2000	3rd	–18.000	

RF Generator Spurious Spectral Purity Performance Test 7 Record

For test procedure, see “RF Generator Spurious Spectral Purity Performance Test 7” on page 156.

Table 7-7 RF Generator Spurious Spectral Purity Test 7 Record

Spurious Source	Level (dBm)	RF Freq (MHz)	Spur Freq (MHz)	Spurious Signal Limits (dBc)	
				Upper	Actual
3/2 Mixer	–10	242	274	–45.000	
3/2 Mixer	–10	247	259	–45.000	
Supply	–11	100	100.03	–45.000	
Supply	–11	400	400.03	–60.000	
Supply	–11	501	501.03	–60.000	
Supply	–11	1000	999.97	–60.000	
RF Feedthru	–11	61	939	–45.000	
RF Feedthru	–11	81	919	–45.000	
RF Feedthru	–11	91	909	–45.000	
RF Feedthru	–11	101	899	–45.000	
RF Feedthru	–11	111	889	–45.000	
RF Feedthru	–11	121	879	–45.000	
3/2 Mixer	–11	242	274	–45.000	
3/2 Mixer	–11	247	259	–45.000	
4/3 Mixer	–11	242	32	–45.000	
4/3 Mixer	–11	247	12	–45.000	
5/4 Mixer	–11	211	55	–45.000	
5/4 Mixer	–11	217	85	–45.000	
5/4 Mixer	–11	221	105	–45.000	
5/4 Mixer	–11	227	135	–45.000	
5/4 Mixer	–11	231	155	–45.000	
5/4 Mixer	–11	237	185	–45.000	
Ref 10 MHz	–11	165	175	–45.000	

Spurious Source	Level (dBm)	RF Freq (MHz)	Spur Freq (MHz)	Spurious Signal Limits (dBc)	
				Upper	Actual
Ref 1 MHz	–11	150	150.2	–45.000	
Ref 1 MHz	–11	150	149.8	–45.000	
Ref 1 MHz	–11	150	150.4	–45.000	
Ref 1 MHz	–11	150	149.6	–45.000	
Ref 1 MHz	–11	150	150.6	–45.000	
Reference	–11	150	149.4	–45.000	
Signal Feedthru	–10	1700	1000	–55.000	
Signal Feedthru	–10	1700	2000	–55.000	
LO Feedthru	–10	1700	2700	–55.000	
Signal Feedthru	–10	1851	800	–55.000	
Signal Feedthru	–10	1851	1600	–55.000	
LO Feedthru	–10	1851	1651	–55.000	

AF Generator AC Level Accuracy Performance Test 8 Record

For test procedure, see "AF Analyzer AC Level Accuracy Performance Test 12" on page 161.

Table 7-8 AF Generator AC Level Accuracy Test 8 Record

AF Generator	Frequency (Hz)	Level (mV)	AC Level Limits (mV)		
			Lower	Upper	Actual
1	25000	4000	3885.000	4115.000	
1	25000	700	682.500	717.500	
1	25000	75	70.000	80.000	
1	10000	4000	3885.000	4115.000	
1	10000	700	682.500	717.500	
1	10000	75	70.000	80.000	
1	1000	4000	3885.000	4115.000	
1	1000	700	682.500	717.500	
1	1000	75	70.000	80.000	
1	100	4000	3885.000	4115.000	
1	100	700	682.500	717.500	
1	100	75	70.000	80.000	
2	25000	4000	3885.000	4115.000	
2	25000	700	682.500	717.500	
2	25000	75	70.000	80.000	
2	10000	4000	3885.000	4115.000	
2	10000	700	682.500	717.500	
2	10000	75	70.000	80.000	
2	1000	4000	3885.000	4115.000	
2	1000	700	682.500	717.500	
2	1000	75	70.000	80.000	

AF Generator AC Level Accuracy Performance Test 8 Record

AF Generator	Frequency (Hz)	Level (mV)	AC Level Limits (mV)		
			Lower	Upper	Actual
2	100	4000	3885.000	4115.000	
2	100	700	682.500	717.500	
2	100	75	70.000	80.000	

AF Generator DC Level Accuracy Performance Test 9 Record

For test procedure, see "AF Generator DC Level Accuracy Performance Test 9" on page 158.

Table 7-9 AF Generator DC Level Accuracy Test 9 Record

AF Generator	Level (mV)	DC Level Limits (mV)		
		Lower	Upper	Actual
1	4000	3870.000	4130.000	
1	1000	975.000	1025.000	
2	4000	3870.000	4130.000	
2	1000	975.000	1025.000	

AF Generator Residual Distortion Performance Test 10 Record

For test procedure, see "AF Generator Residual Distortion Performance Test 10" on page 159.

Table 7-10 AF Generator Residual Distortion Test 10 Record

AF Generator	Frequency (Hz)	Level (mV)	Distortion Limits (%)	
			Upper	Actual
1	25000	4000	0.125	
1	25000	2000	0.125	
1	25000	200	0.125	
1	10000	4000	0.125	
1	10000	2000	0.125	
1	10000	200	0.125	
1	1000	4000	0.125	
1	1000	2000	0.125	
1	1000	200	0.125	
1	100	4000	0.125	
1	100	2000	0.125	
1	100	200	0.125	
2	25000	4000	0.125	
2	25000	2000	0.125	
2	25000	200	0.125	
2	10000	4000	0.125	
2	10000	2000	0.125	
2	10000	200	0.125	
2	1000	4000	0.125	
2	1000	2000	0.125	
2	1000	200	0.125	

AF Generator	Frequency (Hz)	Level (mV)	Distortion Limits (%)	
			Upper	Actual
2	100	4000	0.125	
2	100	2000	0.125	
2	100	200	0.125	

AF Generator Frequency Accuracy Performance Test 11 Record

For test procedure, see "AF Generator Frequency Accuracy Performance Test 11" on page 160.

Table 7-11 **AF Generator Frequency Accuracy Test 11 Record**

AF Generator	Frequency (Hz)	Frequency Limits (Hz)		
		Lower	Upper	Actual
1	25000	24993.750	25006.250	
1	10000	9997.500	10002.500	
1	5000	4998.750	500.125	
1	2000	1999.500	2000.500	
1	1000	999.750	1000.250	
1	500	499.875	500.125	
1	200	199.950	200.050	
1	100	99.975	100.025	
1	50	49.988	50.012	
1	20	19.995	20.005	
2	25000	24993.750	25006.250	
2	10000	9997.500	10002.500	
2	5000	4998.750	500.125	
2	2000	1999.500	2000.500	
2	1000	999.750	1000.250	
2	500	499.875	500.125	
2	200	199.950	200.050	
2	100	99.975	100.025	
2	50	49.988	50.012	
2	20	19.995	20.005	

AF Analyzer AC Level Accuracy Performance Test 12 Record

For test procedure, see "AF Analyzer AC Level Accuracy Performance Test 12" on page 161.

Table 7-12 AF Analyzer AC Voltage Accuracy Test 12 Record

Frequency (Hz)	Level (mV)	AC Voltage Limits (mV)		
		Lower	Upper	Actual
15000	5000	4850.00	5150.00	
2000	5000	4850.00	5150.00	
200	5000	4850.00	5150.00	
20	5000	4850.00	5150.00	
15000	500	485.00	515.00	
2000	500	485.00	515.00	
200	500	485.00	515.00	
20	500	485.00	515.00	
15000	50	48.50	51.50	
2000	50	48.50	51.50	
200	50	48.50	51.50	
20	50	48.50	51.50	

AF Analyzer Residual Noise Performance Test 13 Record

For test procedure, see “AF Analyzer Residual Noise Performance Test 13” on page 162.

Table 7-13 AF Analyzer Residual Noise Test 13 Record

Residual Noise Limits (µV)		
Filter 2	**Upper**	**Actual**
15 kHz LPF	150	
>99 kHz LP	450	

AF Analyzer Distortion and SINAD Accuracy Performance Test 14 Record

For test procedure, see "AF Analyzer Distortion and SINAD Accuracy Performance Test 14" on page 163.

Table 7-14 AF Analyzer Distortion and SINAD Accuracy Test 14 Record

AF Generator 2 Frequency (kHz)	AF Generator 2 Level (mV)	Measurement Type	Distortion and SINAD Limits		
			Lower	Upper	Actual
2	100	Distortion	8.856 %	11.144 %	
2	100	SINAD	19.043 dB	21.043 dB	
3	100	Distortion	8.856 %	11.144 %	
3	100	SINAD	19.043 dB	21.043 dB	
2	10	Distortion	0.890 %	1.120 %	
2	10	SINAD	39.000 dB	41.000 dB	
3	10	Distortion	0.890 %	1.120 %	
3	10	SINAD	39.000 dB	41.000 dB	
2	5	Distortion	0.445 %	0.560 %	
2	5	SINAD	45.021 dB	47.021 dB	
3	5	Distortion	0.445 %	0.560 %	
3	5	SINAD	45.021 dB	47.021 dB	

AF Analyzer DC Level Accuracy Performance Test 15 Record

For test procedure, see "AF Analyzer DC Level Accuracy Performance Test 15" on page 164.

Table 7-15 AF Analyzer DC Level Accuracy Test 15 Record

AF Generator 1 Level (mV)	DC Voltage Limits (mV)		
	Lower	Upper	Actual
5000	4905.000	5095.000	
500	450.000	550.000	

AF Analyzer Frequency Accuracy to 100 kHz Performance Test 16 Record

For test procedure, see "AF Analyzer Frequency Accuracy to 100 kHz Performance Test 16" on page 165.

Table 7-16 AF Analyzer Frequency Accuracy to 100 kHz Test 16 Record

Frequency (Hz)	Frequency Limits (Hz)		
	Lower	Upper	Actual
21	20.896	21.104	
100	99.880	100.120	
1000	999.700	1000.300	
10000	9997.90	10002.10	
100000	99979.9	100020.1	

AF Analyzer Frequency Accuracy at 400 kHz Performance Test 17 Record

For test procedure, see "AF Analyzer Frequency Accuracy at 400 kHz Performance Test 17" on page 166.

Table 7-17 AF Analyzer Frequency Accuracy at 400 kHz Test 17 Record

Frequency Difference Limits (kHz)		
Lower	**Upper**	**Actual**
–0.080	0.080	

Oscilloscope Amplitude Accuracy Performance Test 18 Record

For test procedure, see "Oscilloscope Amplitude Accuracy Performance Test 18" on page 167.

Table 7-18 Oscilloscope Amplitude Accuracy Test 18 Record

Frequency (kHz)	Amplitude Limits (V)		
	Lower	Upper	Actual
1	6.765	7.377	
10	6.765	7.377	
50	5.000	10.000	

RF Analyzer Level Accuracy Performance Test 19 Record

For test procedure, see "RF Analyzer Level Accuracy Performance Test 19" on page 169.

Table 7-19 **RF Analyzer Level Accuracy Test 19 Record**

Frequency (MHz)	Level Difference Limits (dB)		
	Lower	Upper	Actual
30	−0.314	0.314	
50	−0.314	0.314	
100	−0.314	0.314	
150	−0.314	0.314	
200	−0.314	0.314	
250	−0.314	0.314	
300	−0.314	0.314	
350	−0.314	0.314	
400	−0.314	0.314	
450	−0.314	0.314	
500	−0.314	0.314	
550	−0.314	0.314	
600	−0.314	0.314	
650	−0.314	0.314	
700	−0.314	0.314	
750	−0.314	0.314	
800	−0.314	0.314	
850	−0.314	0.314	
900	−0.314	0.314	
950	−0.314	0.314	
1000	−0.314	0.314	
1700	−0.334	0.334	
1725	−0.334	0.334	

Frequency (MHz)	Level Difference Limits (dB)		
	Lower	Upper	Actual
1750	–0.334	0.334	
1775	–0.334	0.334	
1800	–0.334	0.334	
1825	–0.334	0.334	
1850	–0.334	0.334	
1875	–0.334	0.334	
1900	–0.334	0.334	
1925	–0.334	0.334	
1950	–0.334	0.334	
1975	–0.334	0.334	
2000	–0.334	0.334	

RF Analyzer FM Accuracy Performance Test 20 Record

For test procedure, see "RF Analyzer FM Accuracy Performance Test 20" on page 170.

Table 7-20 RF Analyzer FM Accuracy Test 20 Record

RF (MHz)	Deviation (kHz)	Rate (Hz)	FM Deviation Limits (kHz)		
			Lower	Upper	Actual
12.5	1	50	0.950	1.050	
12.5	1	1000	0.950	1.050	
12.5	1	25000	0.950	1.050	
12.5	10	50	9.500	10.500	
12.5	10	1000	9.500	10.500	
12.5	10	25000	9.500	10.500	
400	10	50	9.500	10.500	
400	10	1000	9.500	10.500	
400	10	25000	9.500	10.500	
400	17	50	16.150	17.850	
400	17	1000	16.150	17.850	
400	17	25000	16.150	17.850	

RF Analyzer FM Distortion Performance Test 21 Record

For test procedure, see "RF Analyzer FM Distortion Performance Test 21" on page 172.

Table 7-21 RF Analyzer FM Distortion Test 21 Record

FM Deviation (kHz)	FM Distortion Limits (%)	
	Upper	Actual
5	1.000	
25	1.000	
75	1.000	

RF Analyzer FM Bandwidth Performance Test 22 Record

For test procedure, see "RF Analyzer FM Bandwidth Performance Test 22" on page 174.

Table 7-22 RF Analyzer FM Bandwidth Test 22 Record

FM Deviation Difference Limits (dB)	
Upper	**Actual**
3.0	

RF Analyzer Residual FM Performance Test 23 Record

For test procedure, see "RF Analyzer Residual FM Performance Test 23" on page 177.

Table 7-23 RF Analyzer Residual FM Test 23 Record

FM Deviation Limits (Hz)	
Upper	**Actual**
7.0	

Spectrum Analyzer Image Rejection Performance Test 24 Record

For test procedure, see "Spectrum Analyzer Image Rejection Performance Test 24" on page 178.

Table 7-24 Spectrum Analyzer Image Rejection (Image) Test 24 Record

RF Generator Frequency (MHz)	Spectrum Analyzer Frequency (MHz)	Image Response Limits (dB)	
		Upper	Actual
613.6	385.0	–47	
873.6	645.0	–47	
883.6	655.0	–47	
1023.6	795.0	–47	
1000.0	771.4	–47	
576.4	805.0	–47	
771.4	1000.0	–47	
319.02	300.0	–47	

Table 7-25 Spectrum Analyzer Image Rejection (Residual) Test 24 Record

Spectrum Analyzer Center Frequency (MHz)	Residual Response Limits (dBm)	
	Upper	Actual
5.534	–70	
10.0	–70	
20.0	–70	
21.4	–70	
107.126	–70	
164.28	–70	
257.139	–70	
271.4	–70	
347.607	–70	
500.0	–70	

CDMA Generator RF IN/OUT Amplitude Level Accuracy Performance Test 25 Record

For test procedure, see "CDMA Generator RF IN/OUT Amplitude Level Accuracy Performance Test 25" on page 181.

Table 7-26 CDMA Generator RF In/Out Test 25 Record

Sector	RF (MHz)	Level (dBm)	Measured Level Limits (dBm)		
			Lower	Upper	Actual
A	881.52	–20.50	–21.75	–19.25	
A	881.52	–25.49	–26.74	–24.24	
B	881.52	–20.50	–21.75	–19.25	
B	881.52	–25.49	–26.74	–24.24	
A	1956.25	–21.50	–22.85	–20.15	
A	1956.25	–26.49	–27.84	–25.14	
B	1956.25	–21.50	–22.85	–20.15	
B	1956.25	–26.49	–27.84	–25.14	

CDMA Generator DUPLEX OUT Amplitude Level Accuracy Performance Test 26

For test procedure, see “CDMA Generator DUPLEX OUT Amplitude Level Accuracy Performance Test 26” on page 183.

Table 7-27 CDMA Generator DUPLEX OUT Sector B Power Level Accuracy Test 26 Record

RF Freq. (MHz)	Level (dBm)	Measured Level Limits (dBm)		
		Lower	Upper	Actual
840	–10.50	–11.75	–9.25	
840	–15.49	–16.74	–14.24	
1950	–11.50	–12.85	–10.15	
1950	–16.49	–17.84	–15.14	

Table 7-28 CDMA Generator DUPLEX OUT AWGN Power Level Accuracy Test 26 Record

RF Freq. (MHz)	Level (dBm)	Measured Level Limits (dBm)		
		Lower	Upper	Actual
840	–7.50	–9.25	–5.75	
840	–9	–10.75	–7.25	
1950	–7.50	–9.35	–5.65	
1950	–9	–10.85	–9.15	

CDMA Generator Modulation Accuracy Performance Test 27 Record

For test procedure, see "CDMA Generator Modulation Accuracy Performance Test 27" on page 185.

Table 7-29 CDMA Generator Modulation Accuracy Test 27 Record

RF (MHz)	Level (dBm)	Measured EVM (%rms)	Calculated Rho	
			Lower Limit	Actual
881.52	–10		0.97	
1956.25	–10		0.97	

CDMA Analyzer Average Power Level Accuracy Performance Test 28 Record

For test procedure, see "CDMA Analyzer Average Power Level Accuracy Performance Test 28" on page 187.

Table 7-30 CDMA Analyzer Average Power Level Accuracy Test 28 Record

RF (MHz)	Level (dBm)	Measured Level Limits (mW)		
		Lower	Upper	Actual
881.52	0	-0.343	0.318	
881.52	-10	-10.39	-9.65	
1956.25	0	-0.366	0.338	
1956.25	-10	-10.41	-9.63	

CDMA Analyzer Channel Power Level Accuracy Performance Test 29 Record

For test procedure, see "CDMA Analyzer Channel Power Level Accuracy Performance Test 29" on page 189.

Table 7-31 CDMA Analyzer Channel Power Level Accuracy Test 29 Record

Sig. Gen. Freq. Setting (MHz)	RF Channel (MHz)	Level (dBm)	Measured Level Limits (dBm)		
			Lower	Upper	Actual
836.52	384	11	10.25	11.75	
836.52	384	6	5.25	6.75	
836.52	384	1	0.25	1.75	
836.52	384	–4	–4.75	–3.25	
836.52	384	–9	–9.75	–8.25	
836.52	384	–14	–14.75	–13.25	
836.52	384	–19	–19.75	–18.25	
1876.52	525	11	10.25	11.75	
1876.52	525	6	5.25	6.75	
1876.52	525	1	0.25	1.75	
1876.52	525	–4	–4.75	–3.25	
1876.52	525	–9	–9.75	–8.25	
1876.52	525	–14	–14.75	–13.25	
1876.52	525	–19	–19.75	–18.25	

8 Block Diagrams

This chapter contains block diagrams and descriptions that focus on how the Test Set generates signal and performs measurements.

Signal Flow and Interconnections

Shown in Figure 8-1, “Signal Flow and Interconnections,” on page 242 is a block-diagram overview of the Test Set. For details on individual assemblies refer to Table 8-1 on page 241.

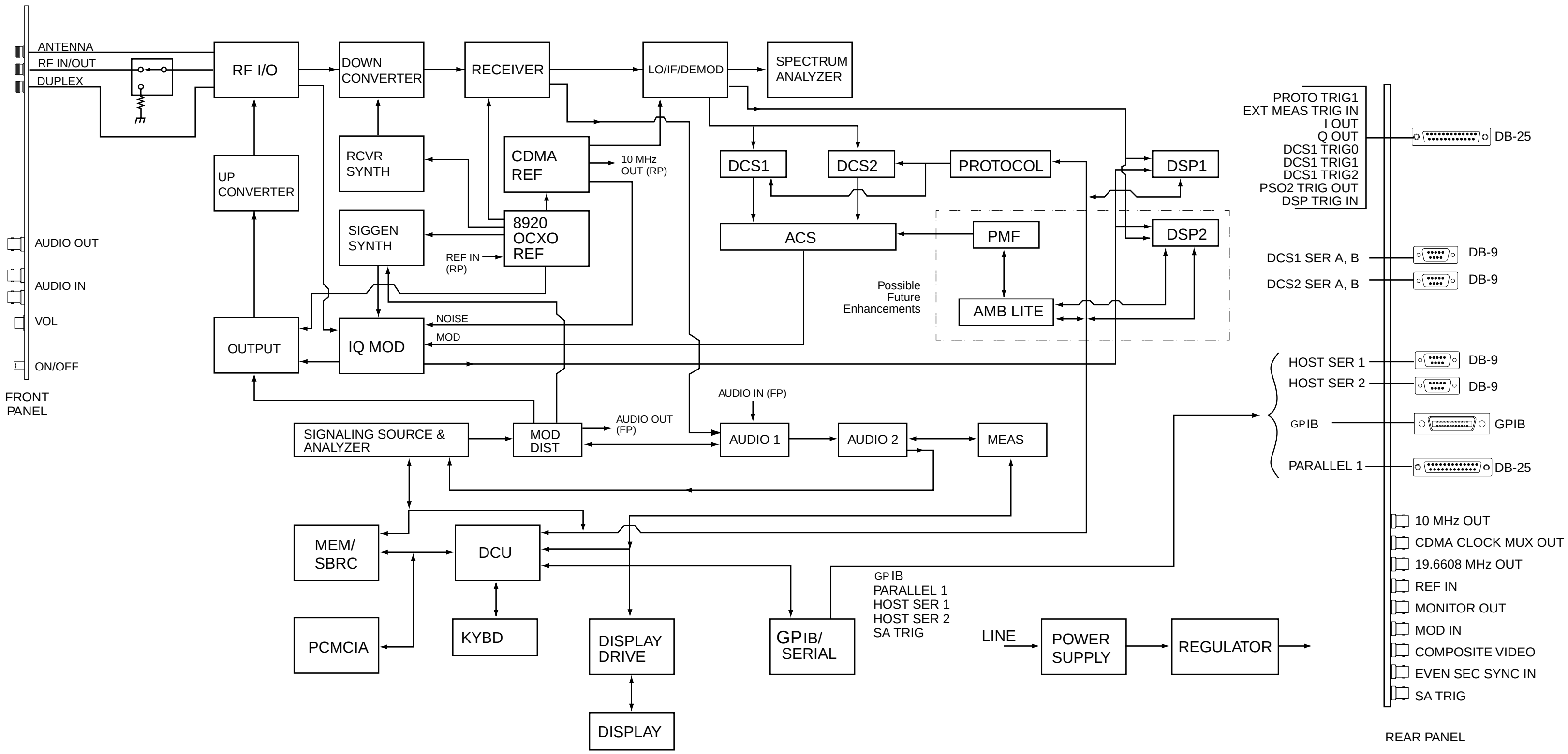
This chapter is organized into the following sections which provide a detailed view of each individual assembly shown in the overview:

- RF Input/Output
- RF Analyzer
- Audio Analyzer
- CDMA Analyzer
- CDMA Generator
- Audio Generator
- RF Generator
- Reference/Regulator
- Instrument Control

Input/output and switch information is included to help you determine if voltages and signals are getting to the assemblies with the proper levels, shapes, and frequencies. Line names and connector pin numbers are given on the block diagrams when applicable.

Table 8-1 Block Diagrams

Figure 8-1 Signal Flow and Interconnections



RF Input/Output Section

RF Power Measurement

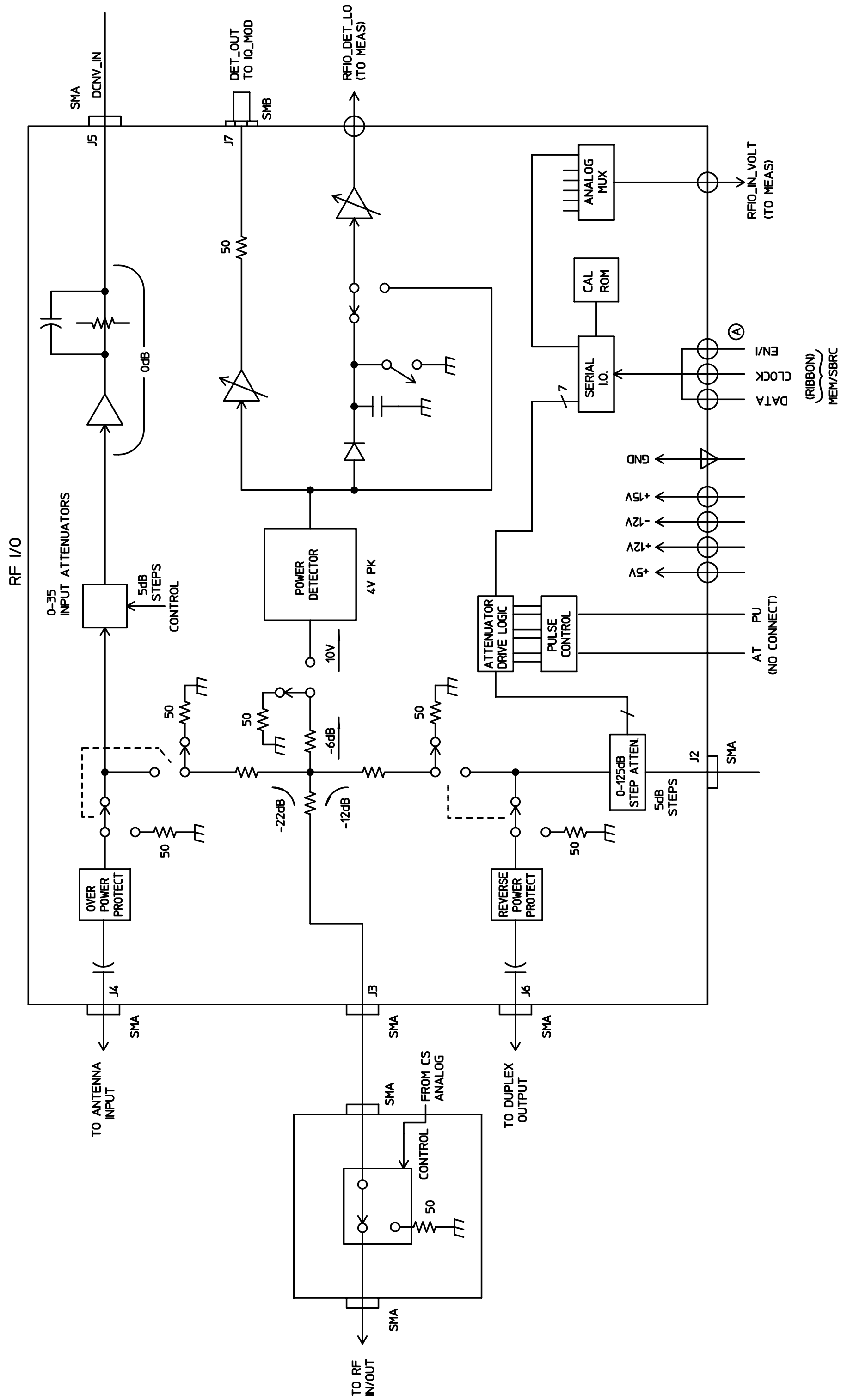
An RF power measurement can only be made by supplying a signal to the RF IN/OUT port of the Test Set. See Figure 8-2, “RF I/O,” on page 244. A power splitter then splits the signal between an RF analysis path and a power measurement path. The power detector has a direct path to the Receive DSP where average power measurements are made. There’s also a diode peak detector to provide a peak power measurement through the Measurement assembly.

Accuracy is insured by factory-generated calibration data which is stored in CAL ROM.

Input Gain Control

Step attenuators in the RF Input/Output Section are switched in and out, manually or automatically. This keeps the input level within an optimum range for the mixers, IF amplifiers, and detectors.

Figure 8-2 RF I/O



RF Analyzer Section

Frequency Conversion

The Downconverter, see Figure 8-3 on page 247, produces an IF of 114.3, 385.7 or 614.3 MHz. The LO is provided by the Receiver Synthesizer, see Figure 8-4 on page 248. The IF frequencies developed are as follows in Table 8-2.

Table 8-2 Downconverter Signal Paths

Tune Frequency (MHz)	RF Filter	IF Frequency (MHz)	Conversion Module	LO Filter (LO freq range)	RSYN_500_ 1000M Range (MHz)
.4 to <150	150 MHz LPF	614.3	high-side LO	NA	614.7-764.3
150 to <380.7	150-386 MHz BPF	614.3	high-side LO	NA	764.3-995.0
380.7 to <650	350-650 MHz TBPF	114.3	high-side LO	NA	945.0-764.3
650 to <800	600-1000 MHz TBPF	114.3	high-side LO	NA	764.3-914.3
800 to 1000	600-1000 MHz TBPF	114.3	low-side LO	NA	685.7-885.7
1400 to <1614.3	1400-2200 MHz TBPF	385.7	high-side LO	PDC/Unlic_PCS (1600-2000 MHz)	892.85-1000.0[a]
1614.3 to 2000	1400-2200 MHz TBPF	385.7	low-side LO	PCS (1200-1620 MHz)	614.3-807.15[b]
>2000 to 2200	1400-2200 MHz TBPF	385.7	low-side LO	PDC/Unlic_PCS (1600-2000 MHz)	807.15-907.15[c]

a. This LO input is doubled to 1785.7-2000 MHz prior to mixing.
b. This LO input is doubled to 1228.6-1614.3 MHz prior to mixing.
c. This LO input is doubled to 1614.3-1814.3 MHz prior to mixing.

Filters are automatically switched in to remove image and other interfering signals. The frequency ranges of the filters are as follows:

- 150 MHz low-pass
- 150 MHz - 386 MHz bandpass
- 350 MHz - 650 MHz tunable bandpass
- 650 MHz - 1000 MHz tunable bandpass
- 1400 MHZ - 2200 MHz tunable bandpass

Modulation Measurement

The Receiver assembly, see Figure 8-5 on page 249, demodulates the IF into its FM, AM, and SSB components. The demodulated signal is sent to the Audio Analyzer section for measurement.

Figure 8-3 Downconverter

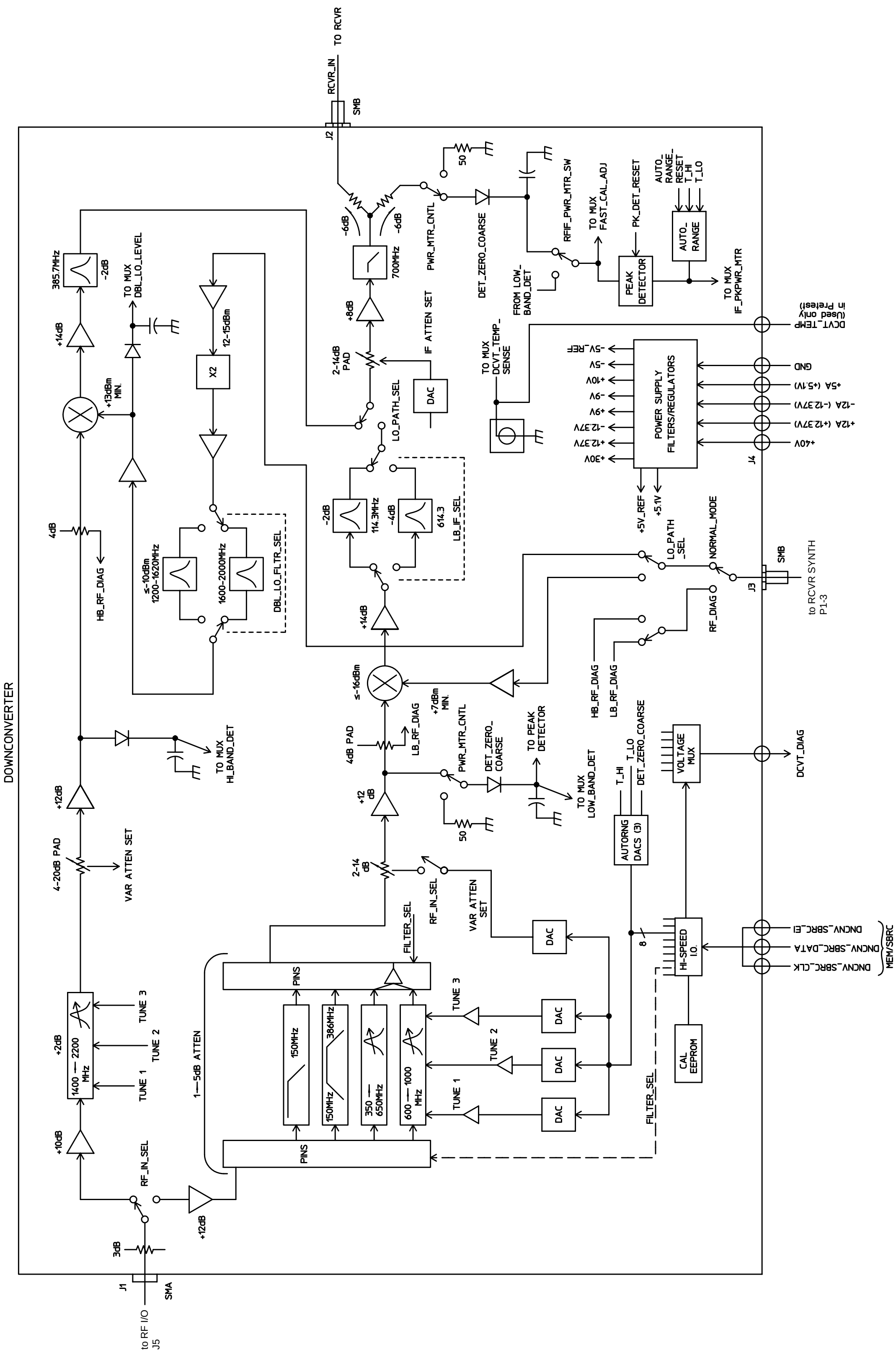


Figure 8-4 Receiver Synthesizer

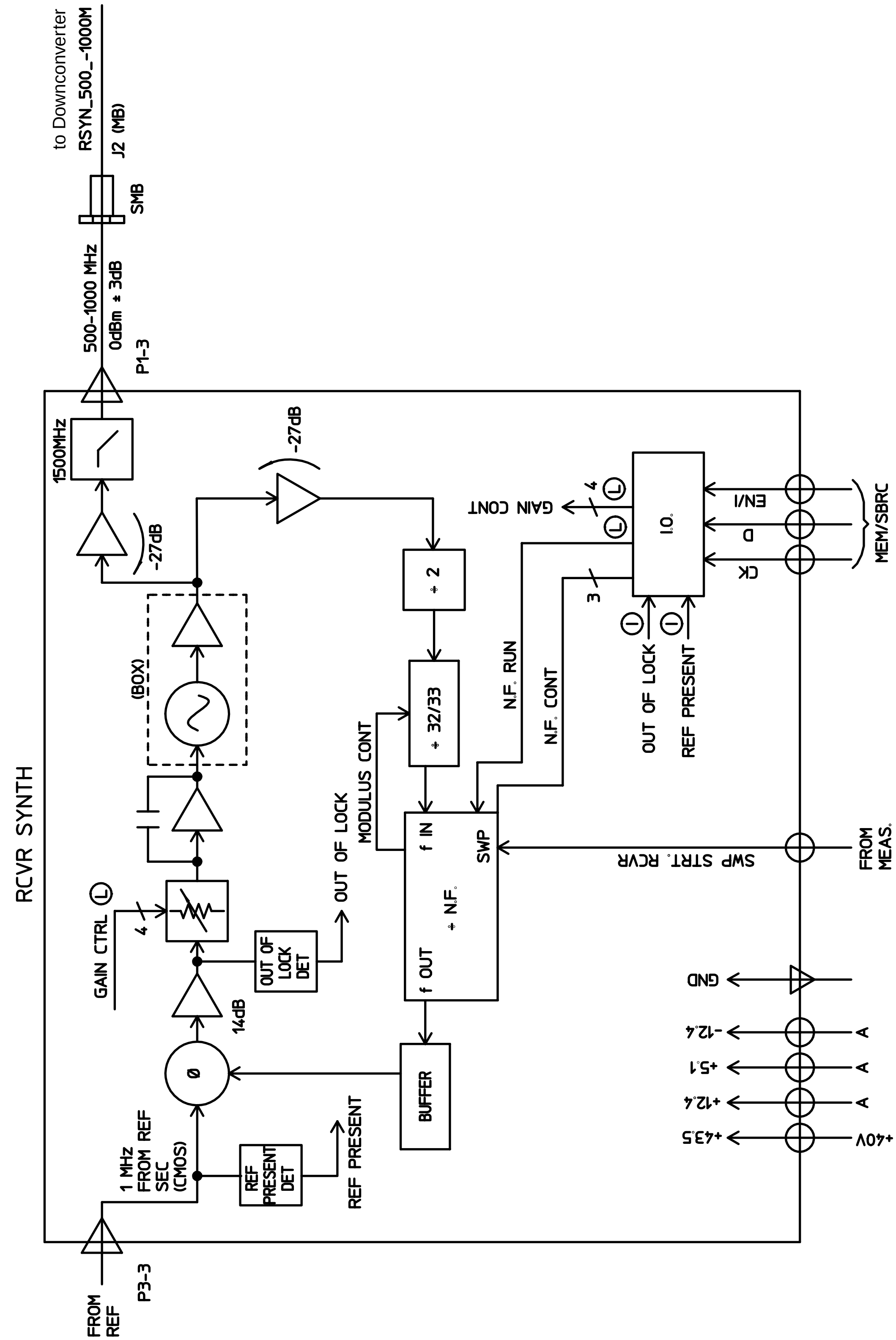


Figure 8-5 Receiver

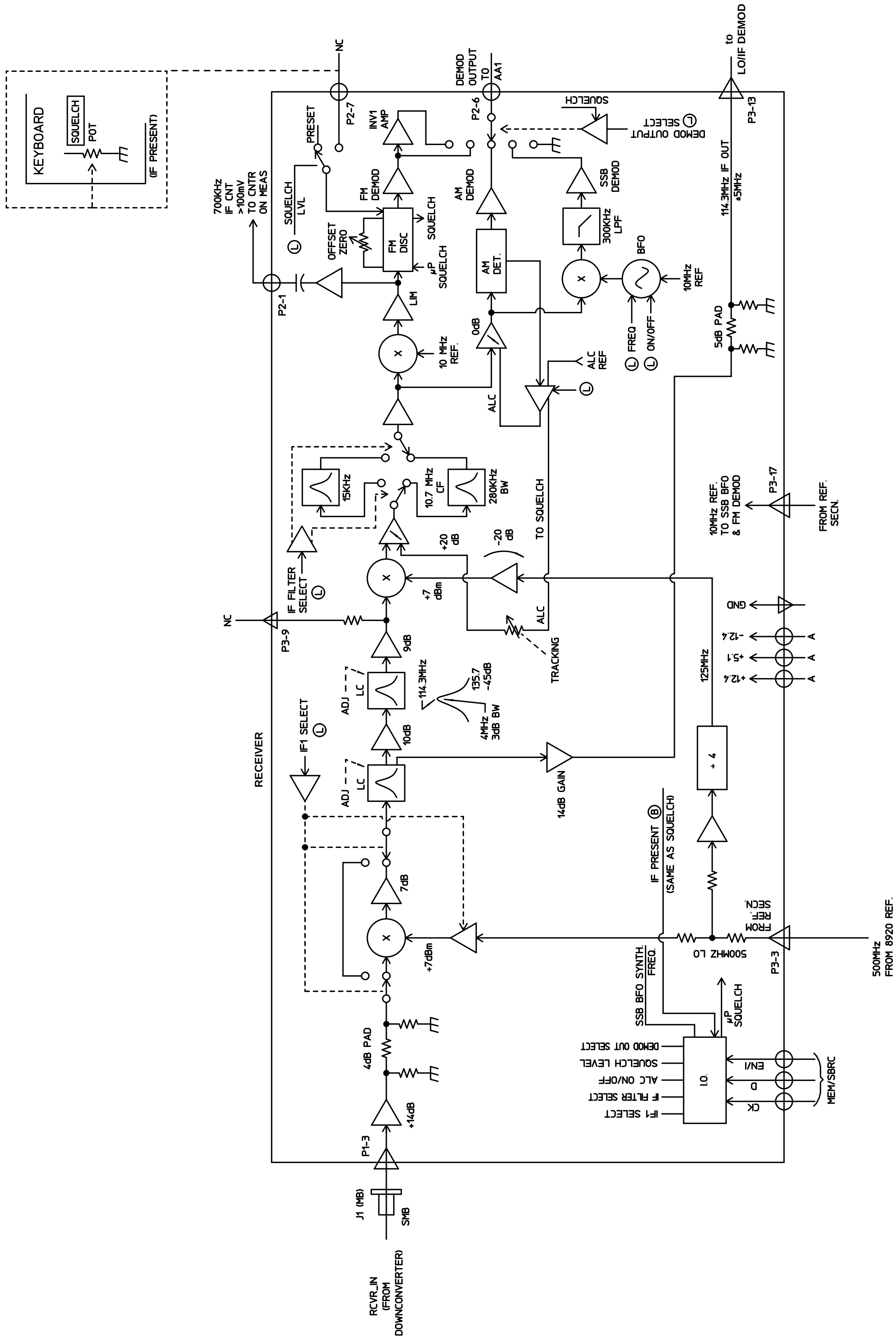


Figure 8-6 Digital Cellsite 1 & 2

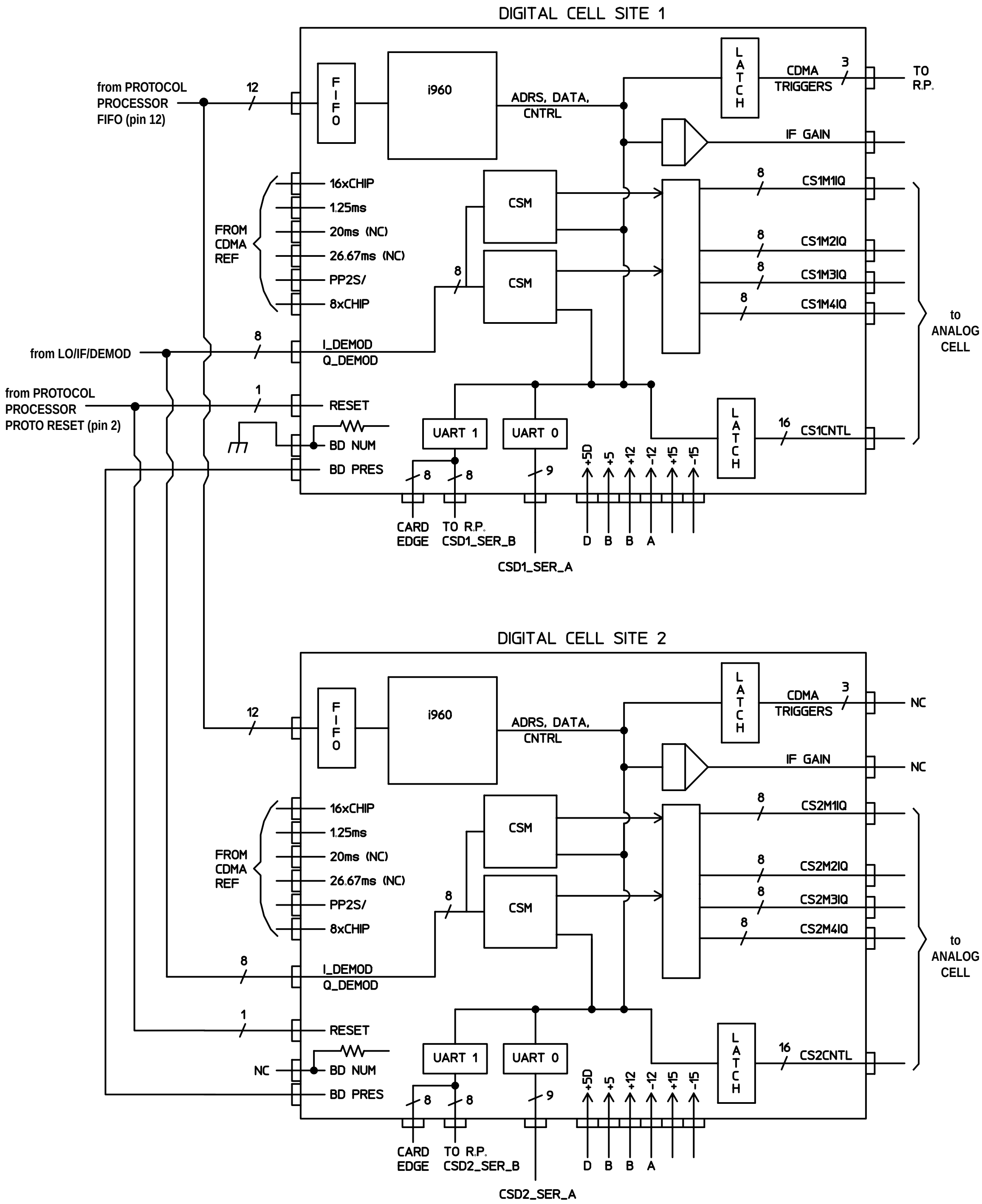


Figure 8-7 Analog Cell Site

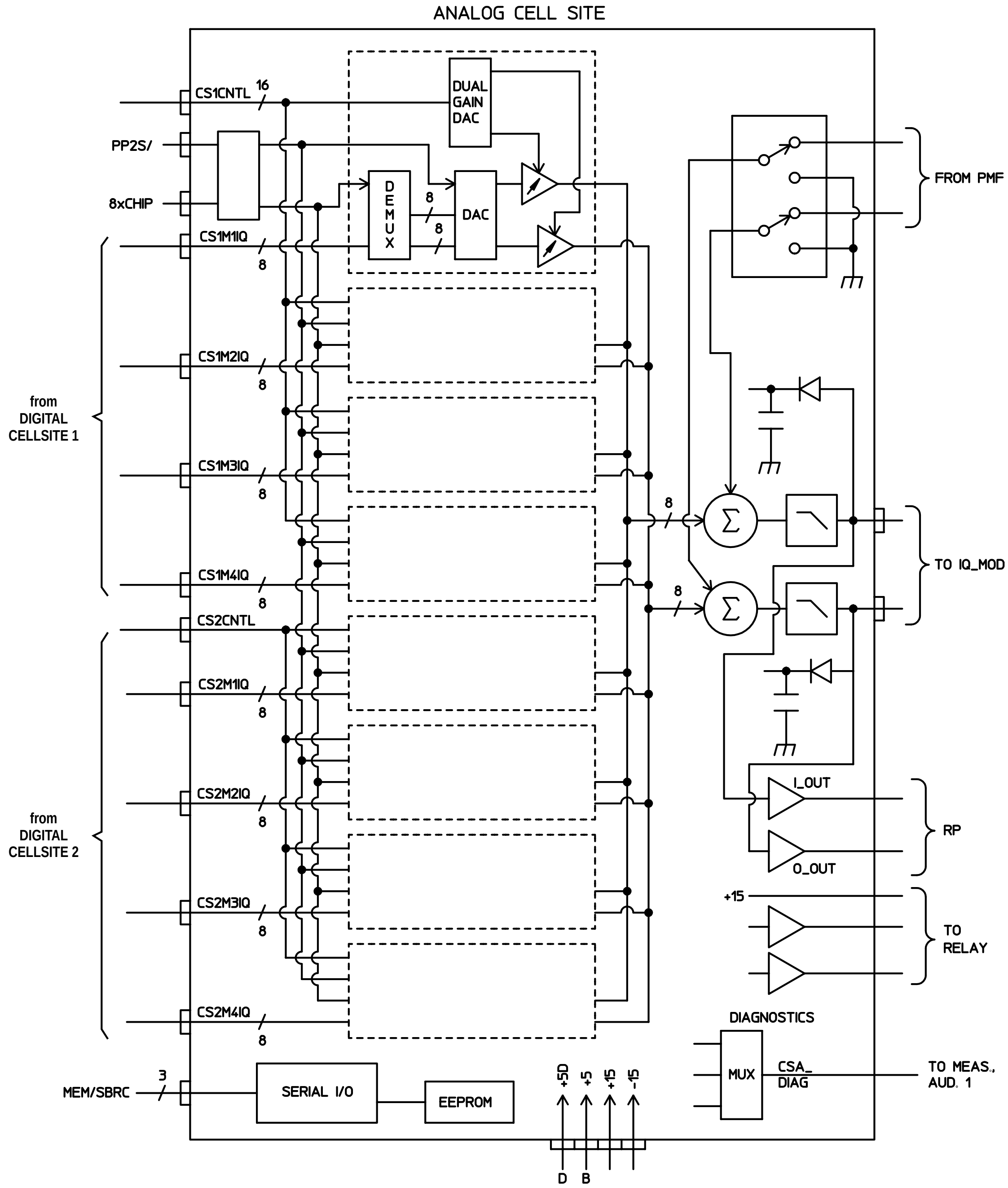
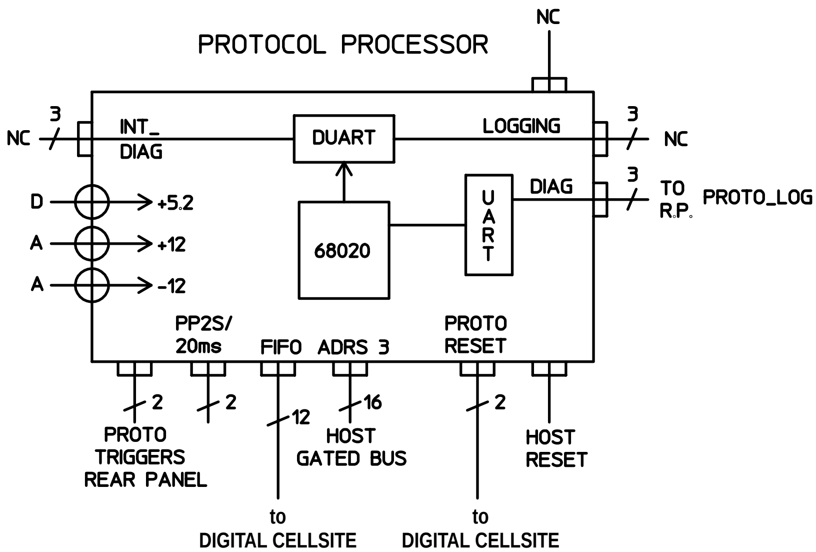


Figure 8-8 Protocol Processor



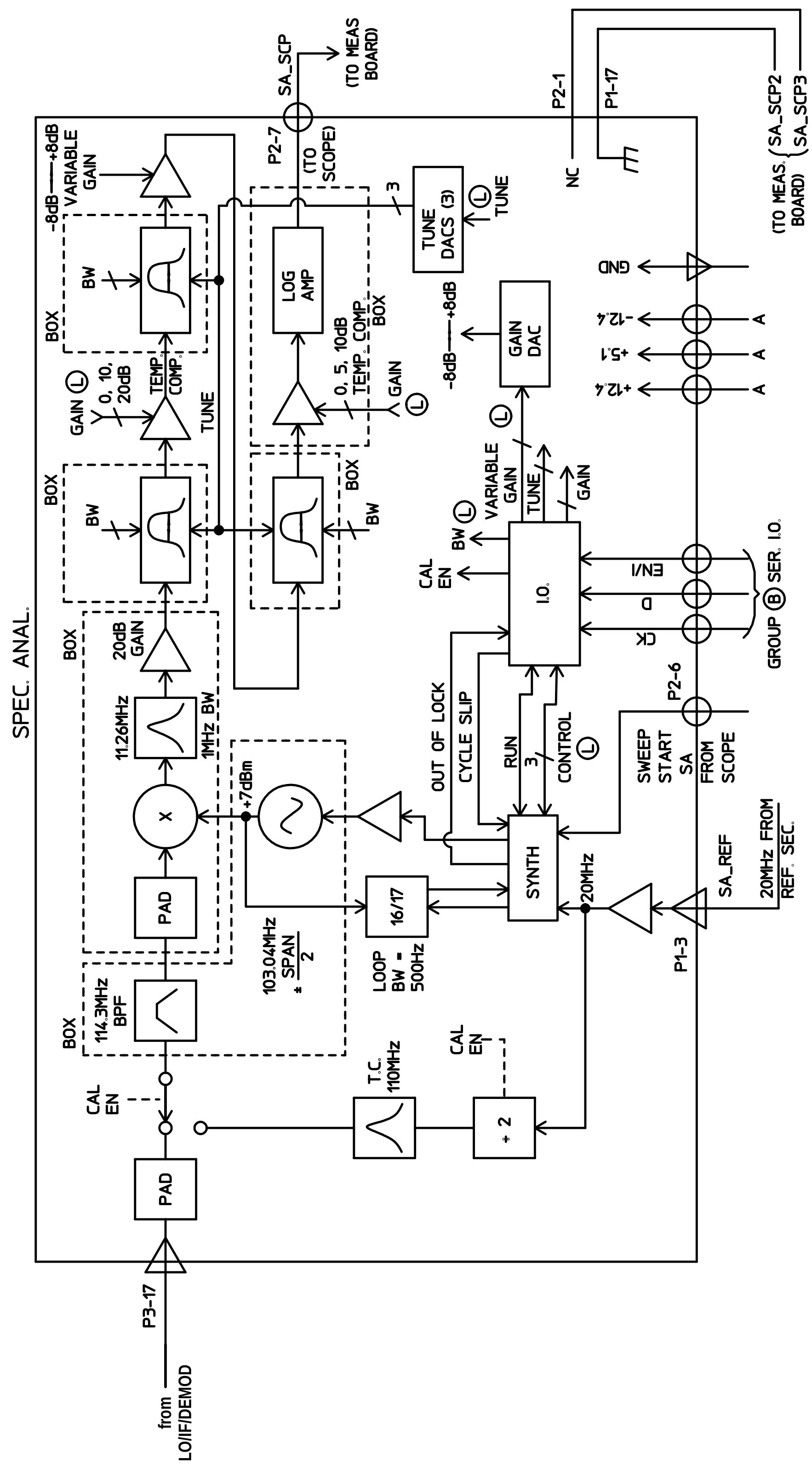
Spectrum Analyzer

Spectrum Analysis (option 102)

The LO on the Spectrum Analyzer, see figure 8-9 on page 254, is swept across the span by the Controller. The LO starts sweeping when the oscilloscope circuits on the Measurement board trigger the display sweep to start. As the LO sweeps, the spectrum analyzer filters and then amplifies the IF signal in a logarithmic detector so the signal voltage will be proportional to the log of power. The signal voltage is measured by a sampler on the Measurement board and displayed.

Spectrum analyzer resolution bandwidth is determined by switching bandwidth IF filters on the Spectrum Analyzer. These filters are set by the Controller as a function of the span selected from the front panel.

Figure 8-9 Spectrum Analyzer



Audio Analyzer Section

Input Level Control

Switchable gain amplifiers on the Audio Analyzer 1 and Audio Analyzer 2 (figure 8-10 on page 256, and figure 8-11 on page 257) assemblies keep the audio input signal within a range suitable for the detectors.

AC and DC Level Measurements

Detected voltages from the Peak+, Peak –, and RMS detectors are measured on the Measurement assembly. The Controller calculates the displayed value taking into account the detector selected from the front panel, the gain of the amplifiers, and the source of the input signal (demodulators, front panel).

Distortion and SINAD Measurements

Distortion and SINAD can be measured on 300 Hz to 10 kHz audio signals. The Controller calculates distortion and SINAD by comparing the ratio of the voltage after the variable notch filter to the ratio of the voltage before the notch filter.

Oscilloscope Functions

The Test Set has no specialized oscilloscope assemblies. The and Audio Analyzer assemblies, Measurement assembly (figure 8-12 on page 258), and the Controller (figure 8-26 on page 278) work together to perform the oscilloscope functions.

The audio or dc signal to be displayed goes from the Audio Analyzer 2 assembly to a sampler on the Measurement assembly (the same sampler used by the Spectrum Analyzer). The Controller calculates the display level by taking the value of the measured signal at each point of the sweep, the gain of the signal path in the Audio Analyzer assemblies, and the volts-per-division setting.

The oscilloscope’s trigger signals from the side-panel connector, the Signaling Source and Analyzer assembly (figure 8-18 on page 266), and the internal trigger signal are used by the Measurement assembly and the Controller to determine when to start the scope sweep. The Controller adds the pre-triggering time entered from the front panel.

Figure 8-10 Audio Analyzer 1

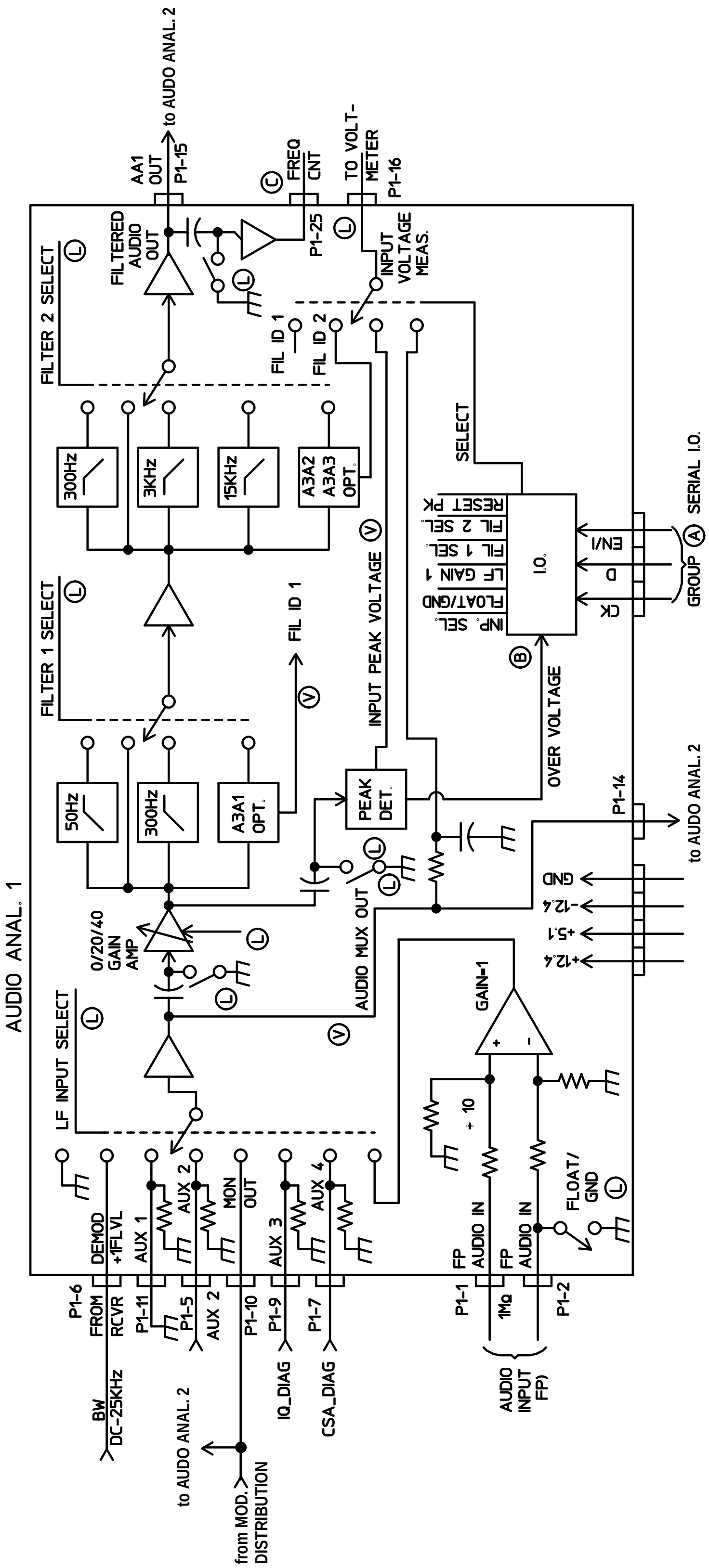


Figure 8-11 Audio Analyzer 2

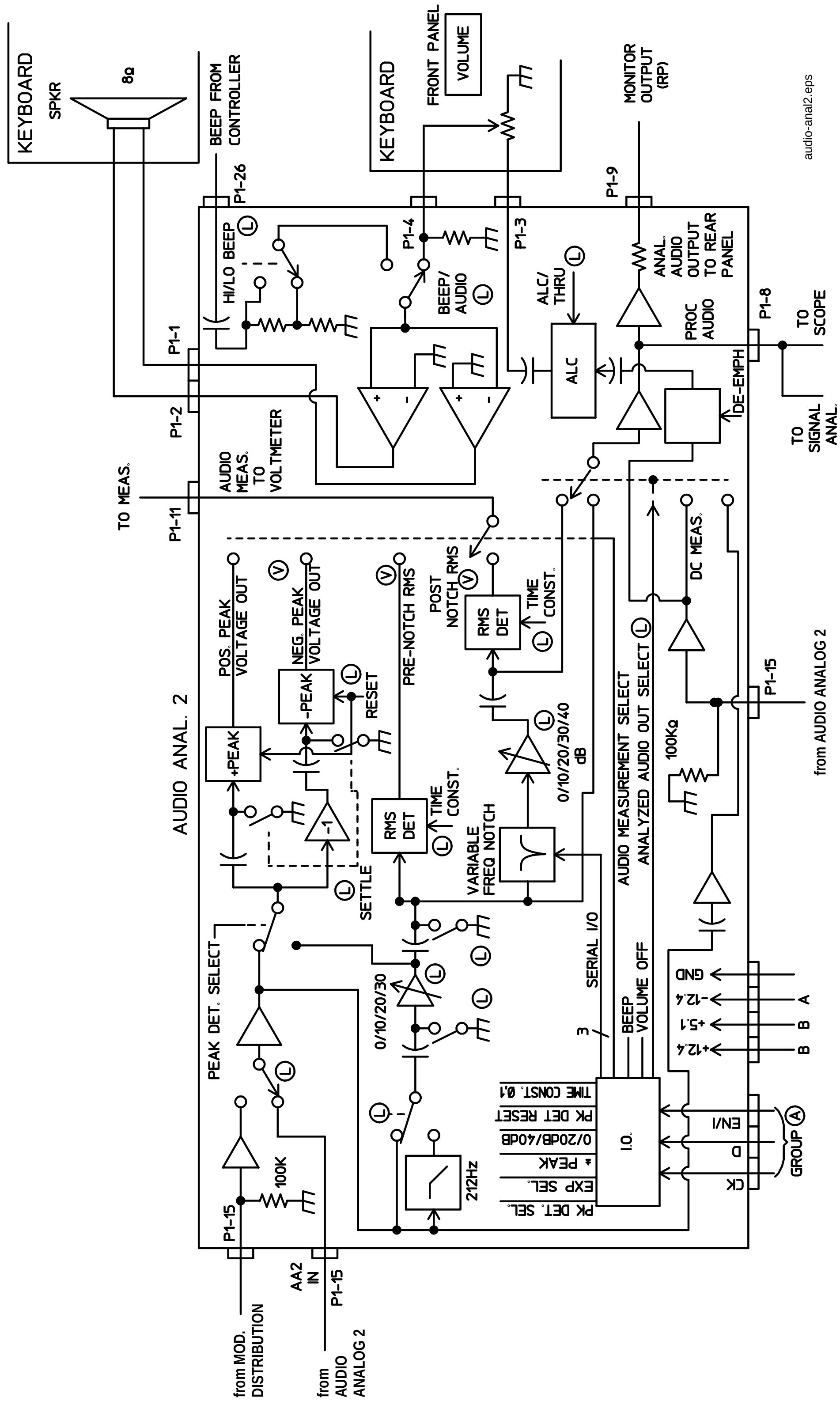


Figure 8-12 Measurement Board

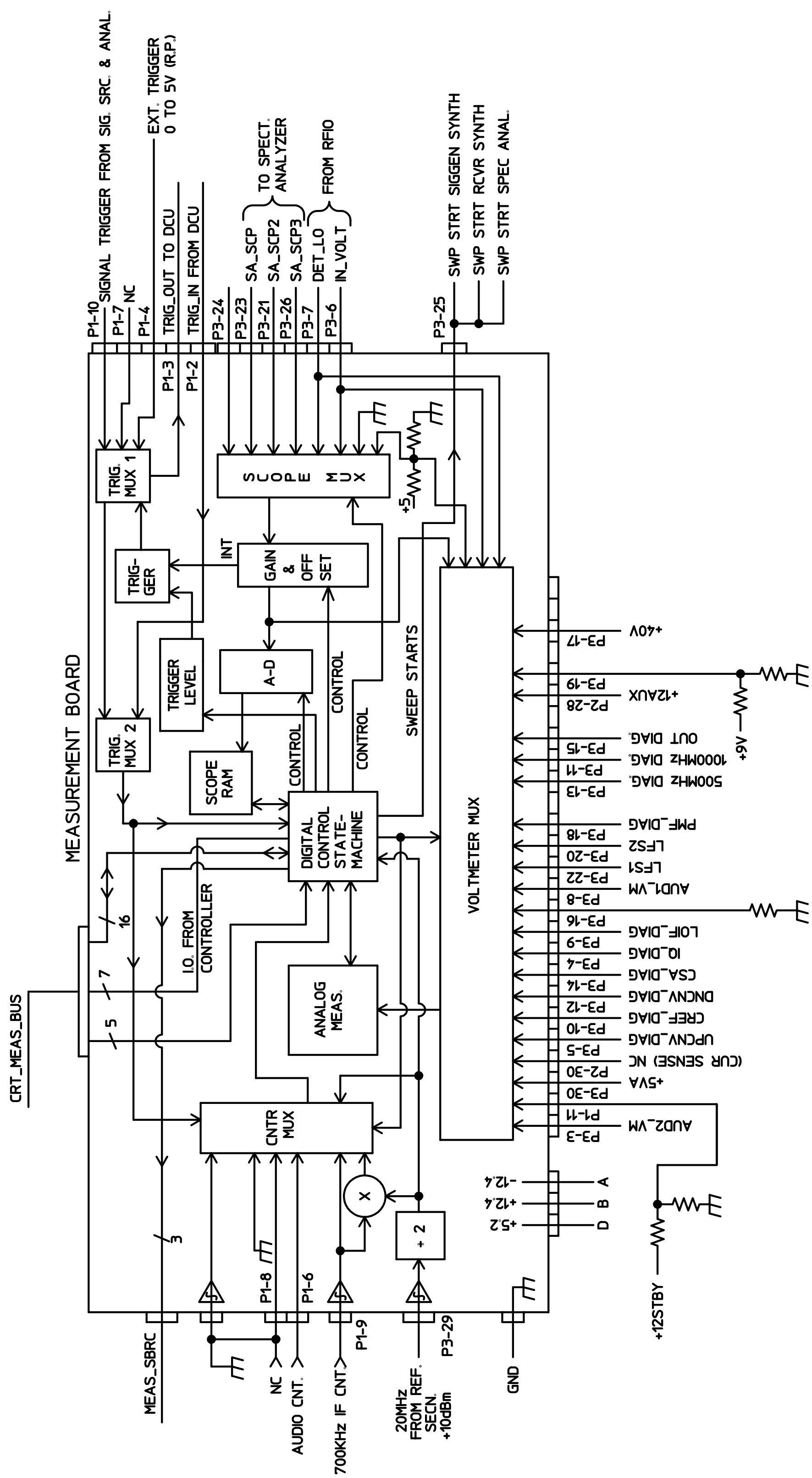
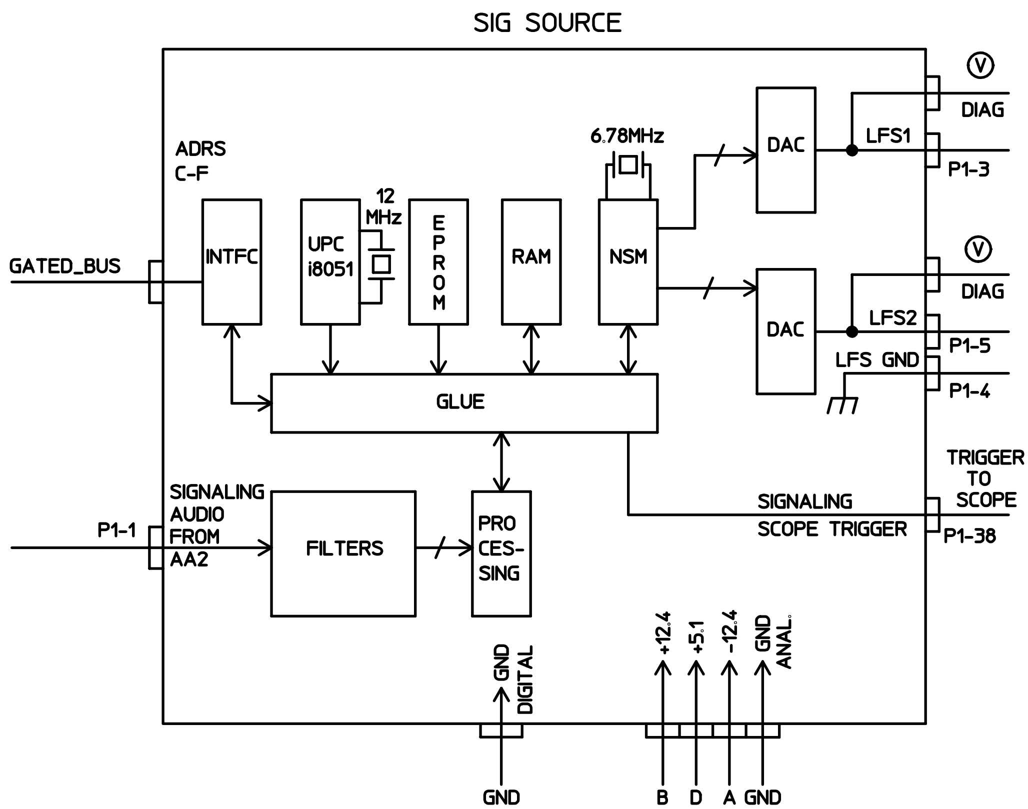


Figure 8-13 Signaling and Analyzer Assembly



CDMA Analyzer Section

IF Conversion

To downconvert the CDMA the signal, the 114.3 MHz IF is mixed with a 110.6136 MHz LO to produce a 3.6864 MHz IF in the IQ Modulator assembly, see figure 8-14 on page 261. The oscillator that produces the LO signal is phase locked to a 10 MHz signal from the CDMA Reference assembly, see figure 8-17 on page 265.

CDMA Signal Analysis

The 3.6864 MHz signal goes to the DSP assembly. The DSP assembly analyzes the 3.6864 MHz signal to make IQ modulation measurements, such as rho, timing accuracy, carrier feedthrough, and phase error.

Power Measurements

The DSP assembly also makes average power measurements through a direct link from the RF Input/Output assembly (figure 8-2 on page 244).

Figure 8-14 IQ Modulator

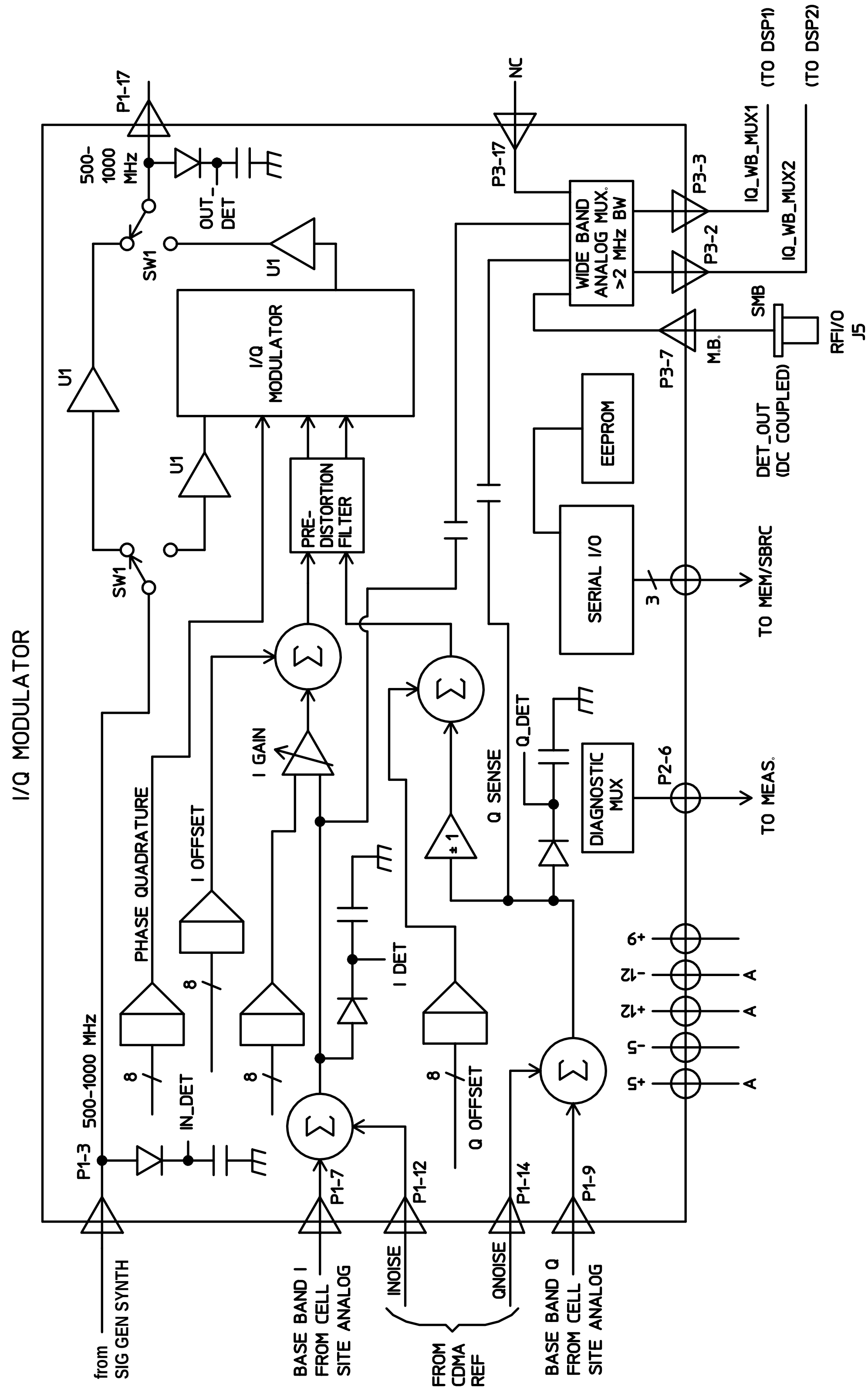


Figure 8-15 LO/IF/Demodulator

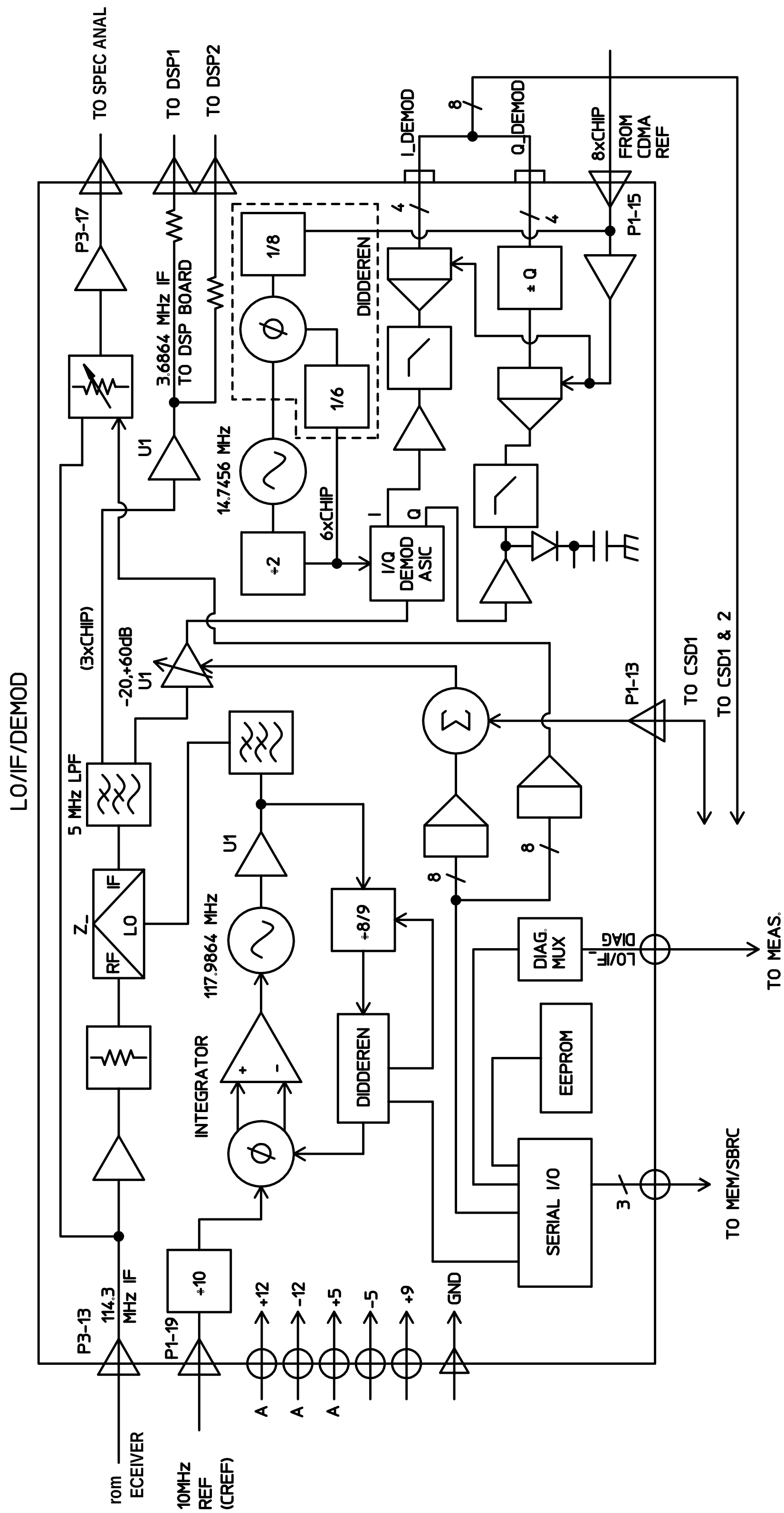
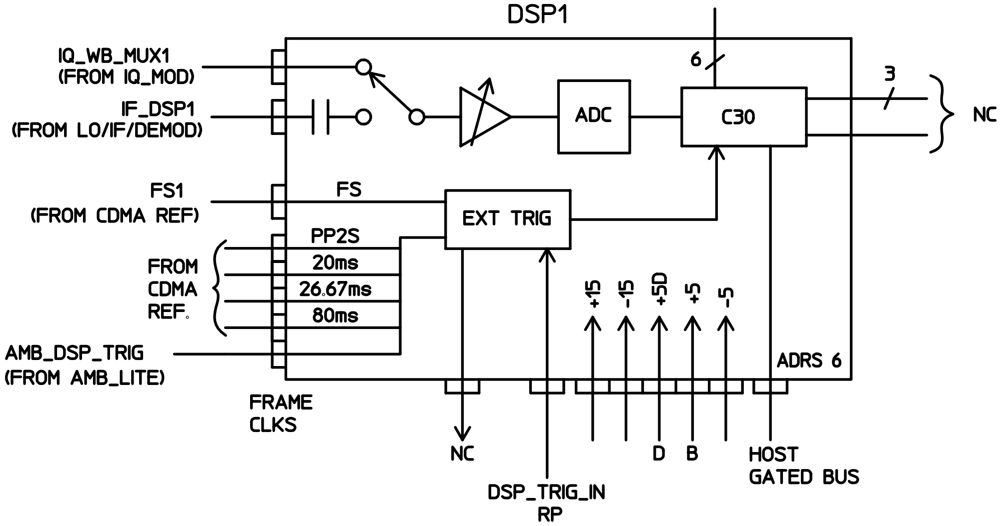


Figure 8-16 Digital Signal Processor 1 (DSP1)



CDMA Generator Section

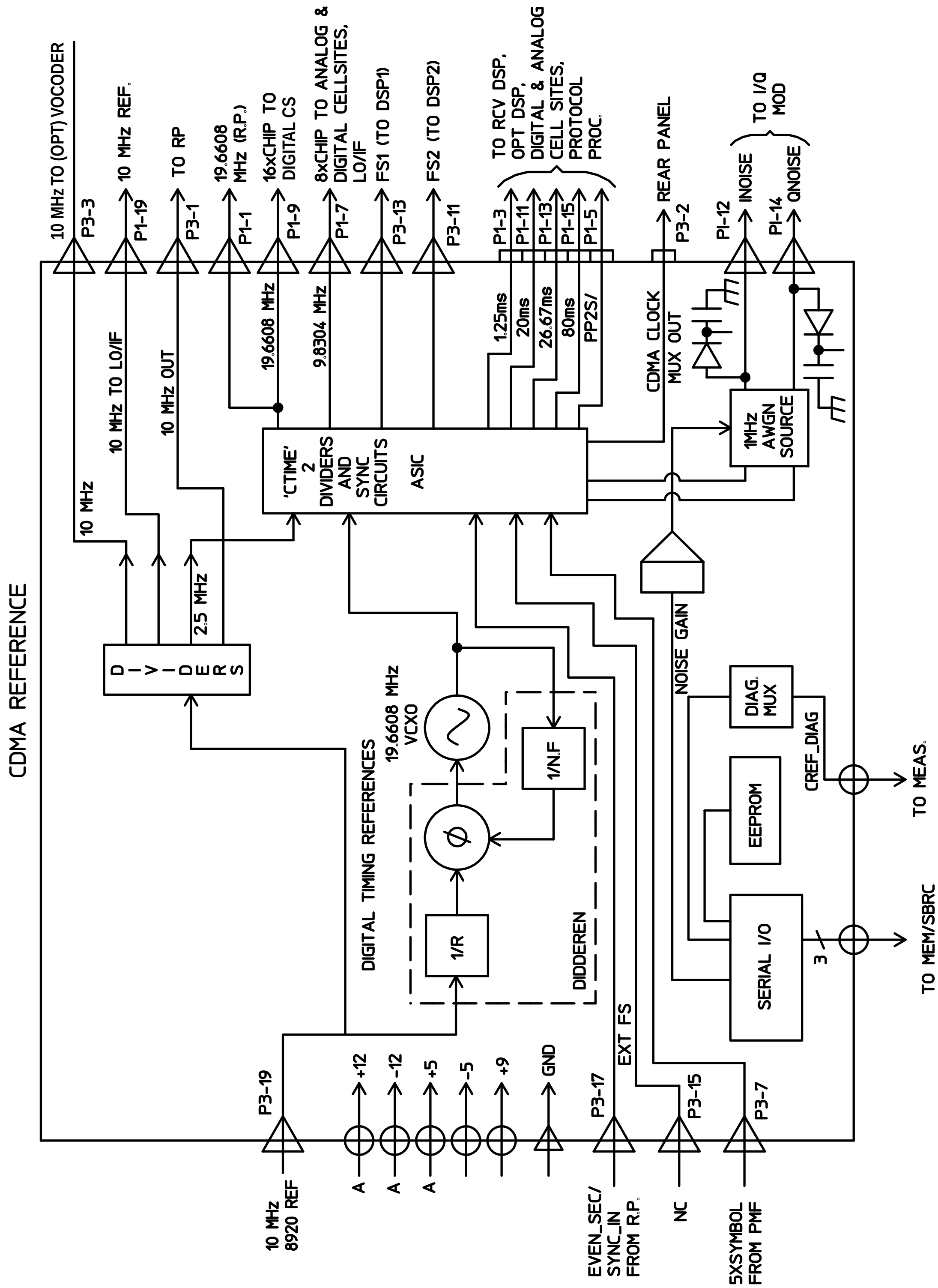
Data Generation

The Digital Cellsite assembly, see figure 8-6 on page 250, generates or buffers external data that emulates a CDMA traffic channel and outputs this data to the CDMA Reference, see figure 8-17 on page 265. The CDMA Reference assembly converts the data into I and Q drive signals and sends it back to the Digital Cellsite assembly to be summed with calibrated noise sources. The signals are then passed to the IQ Modulator (figure 8-14 on page 261) for modulation with RF.

CDMA Reference

The CDMA Reference supplies all the CDMA clocks for the Receive DSP and the Digital Cellsite assemblies. The CDMA Reference also provides reference switching for an external or the internal reference source.

Figure 8-17 CDMA Reference



Audio Generator Section

Waveform Generation

The Signal Source and Analyzer, see figure 8-18 on page 266, gets frequency and wave shape information from the Controller. Waveform values are calculated real-time by a digital waveform synthesis IC. The LFS1 output is always a sine-wave. The LFS2 output is a sine-wave unless one of the function generator waveforms is selected, or signaling is selected from the front panel.

Level Control

Audio level is controlled by the Modulation Distribution assembly, see figure 8-19 on page 267, by using a DAC and variable attenuators. The leveled audio signal is passed on to the RF Generator section.

Figure 8-18 Signaling and Analyzer Assembly

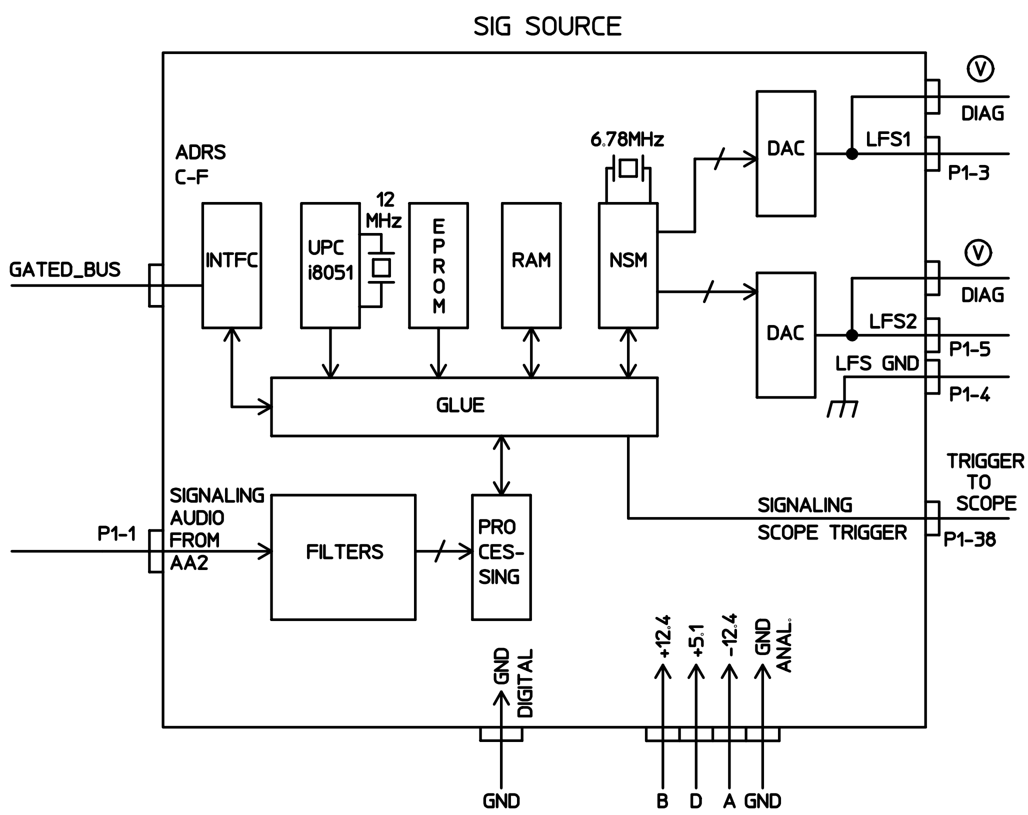
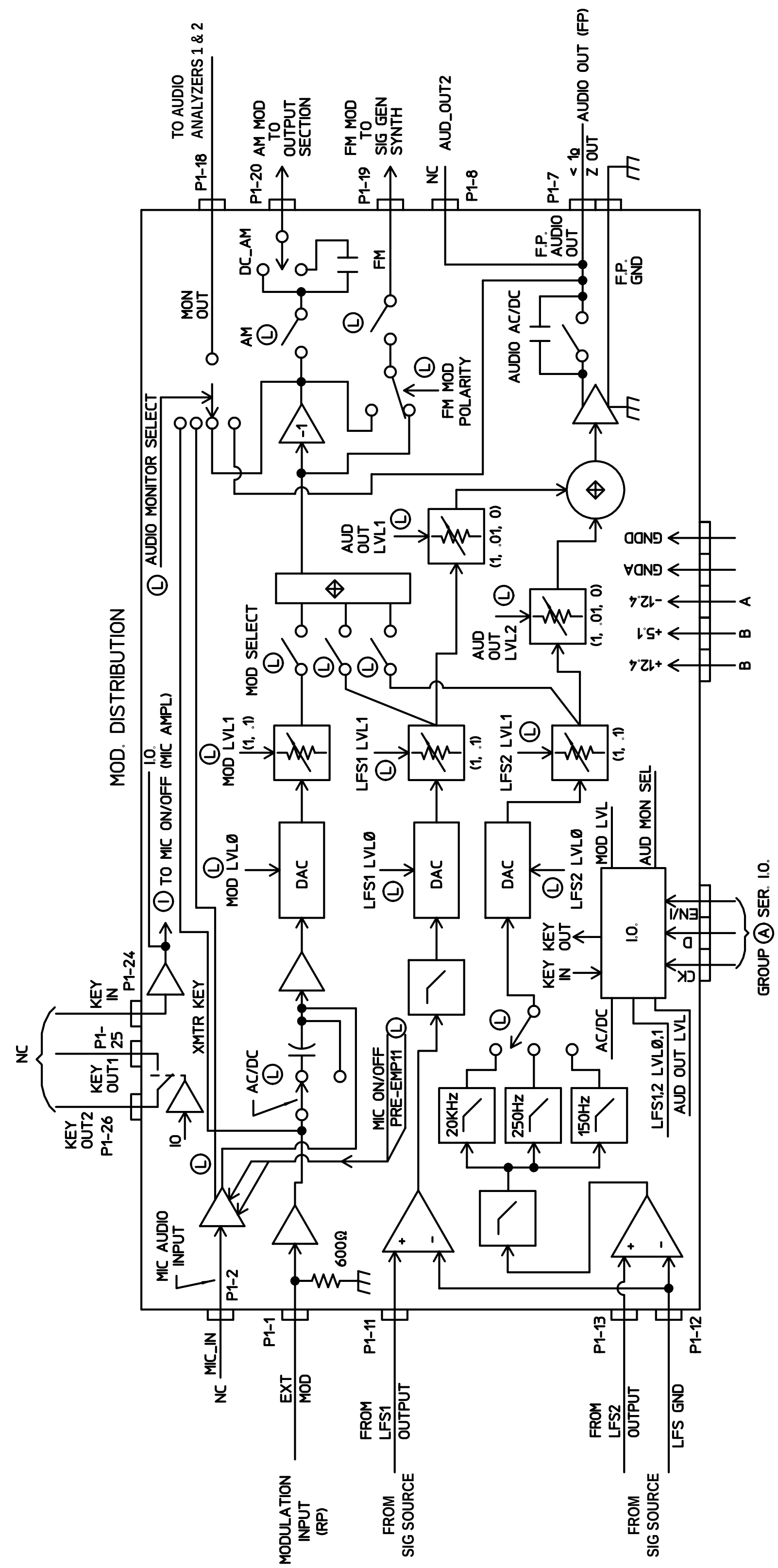


Figure 8-19 Modulation Distribution



RF Generator Section

Frequency Generation

The Signal Generator Synthesizer (figure 8-20 on page 270) develops a 500 MHz to 1000 MHz signal which is phase-locked to the 200 kHz reference from the Reference Assembly (figure 8-23 on page 274). An out-of-lock indicator LED lights if the phase-lock-loop is out-of-lock. When you turn the Test Set's power on, the LED lights for a few seconds then goes out. If it stays on or comes on again, the loop is out-of-lock.

The RF Output Section assembly (figure 8-21 on page 271) develops the RF Generator's 0.4 to 000 MHz frequency range by mixing, dividing, or passing the 500 MHz to 1000 MHz from the Signal Generator Synthesizer. The frequencies are derived as shown in table 8-3.

The Upconverter assembly (figure 8-22 on page 272) develops the RF generator's 1.2 to 2.0 GHz range by mixing the 800-1000 MHz signal from the output section with a 1.5-3.0 GHz LO.

Table 8-3

Output Frequency	Derivation
400 kHz - 250 MHz	mix
250 MHz - 500 MHz	divide
500 MHz - 1 GHz	pass
1.7 GHz - 2.0 GHz	mix

Level Control

The RF Output Section assembly (figure 8-21 on page 271) has an automatic-level-control (ALC) loop that acts as a vernier control of RF level between –2 and +9 dBm. A step attenuator in the RF I/O assembly (figure 8-2 on page 244) takes the level down to –127 dBm (–137 dBm at the RF IN/OUT connector) in 5 dB steps.

Assemblies that affect output level calibration have factory-generated calibration data stored in the Test Set's EEPROM. Calibration data is fed to digital-to-analog-converters which control level-adjustable devices in the RF path. These assemblies are:

- RF I/O
- RF Output Section

Modulation

Amplitude modulation (AM) is done on the RF Output Section assembly (figure 8-21 on page 271). The modulating signal from the Modulation Distribution assembly is applied to the ALC loop's control voltage.

IQ modulation is done on the IQ Modulator assembly (figure 8-14 on page 261 Digital Cellsite is modulated onto the RF signal from the Signal Generator Synthesizer assembly (figure 8-20 on page 270).

Figure 8-20 Signal Generator Synthesizer

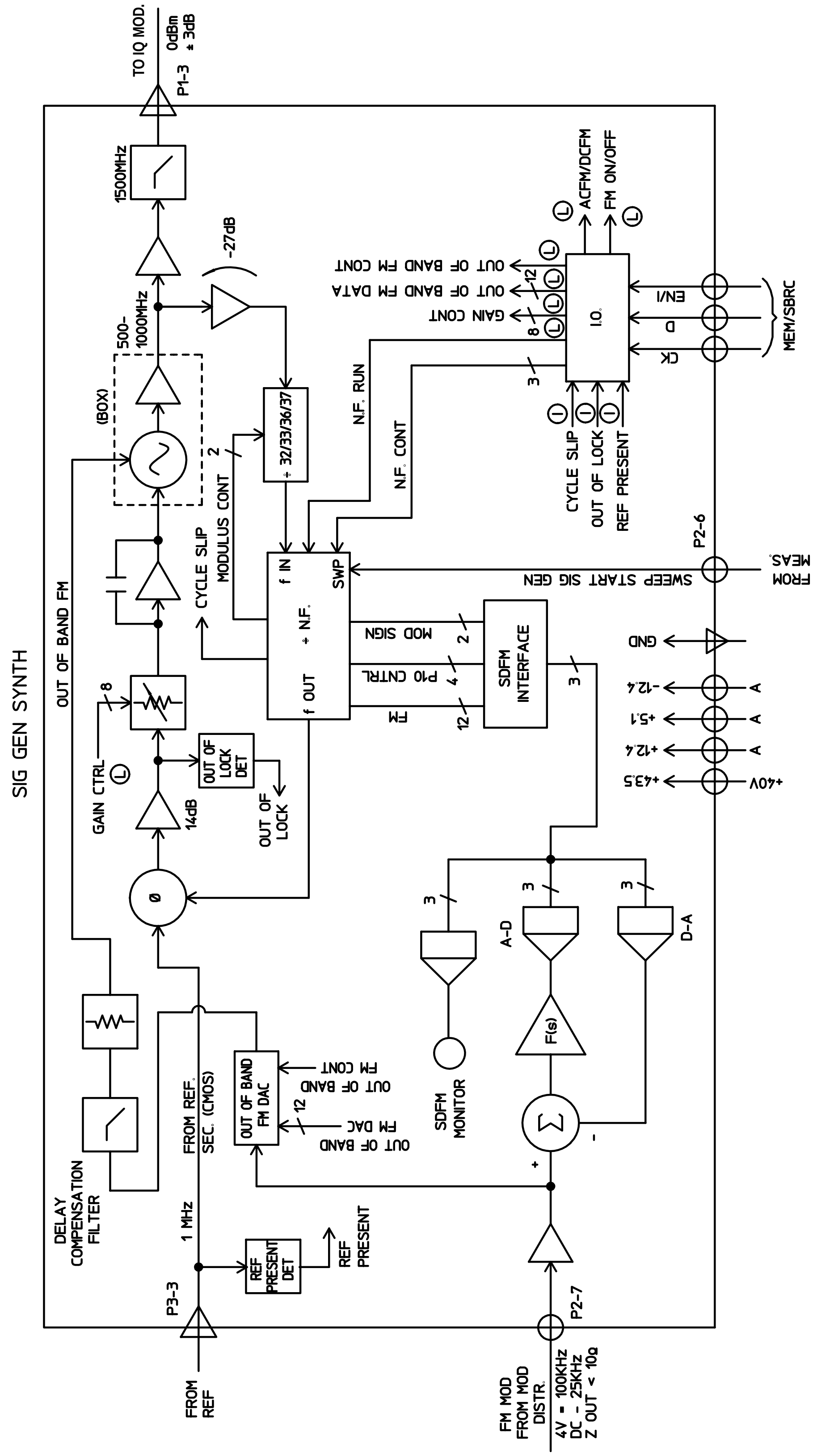


Figure 8-21 RF Output Section

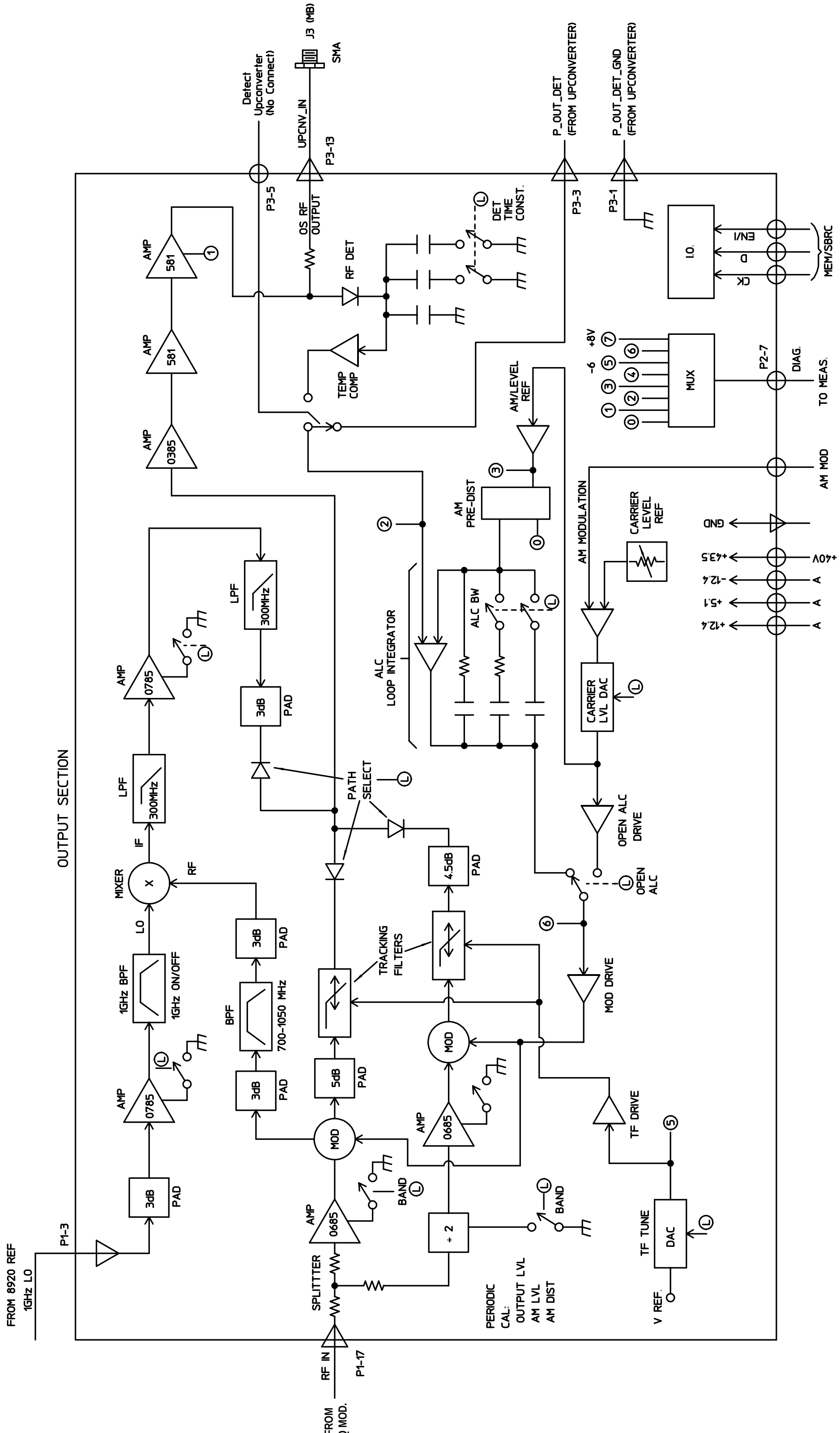
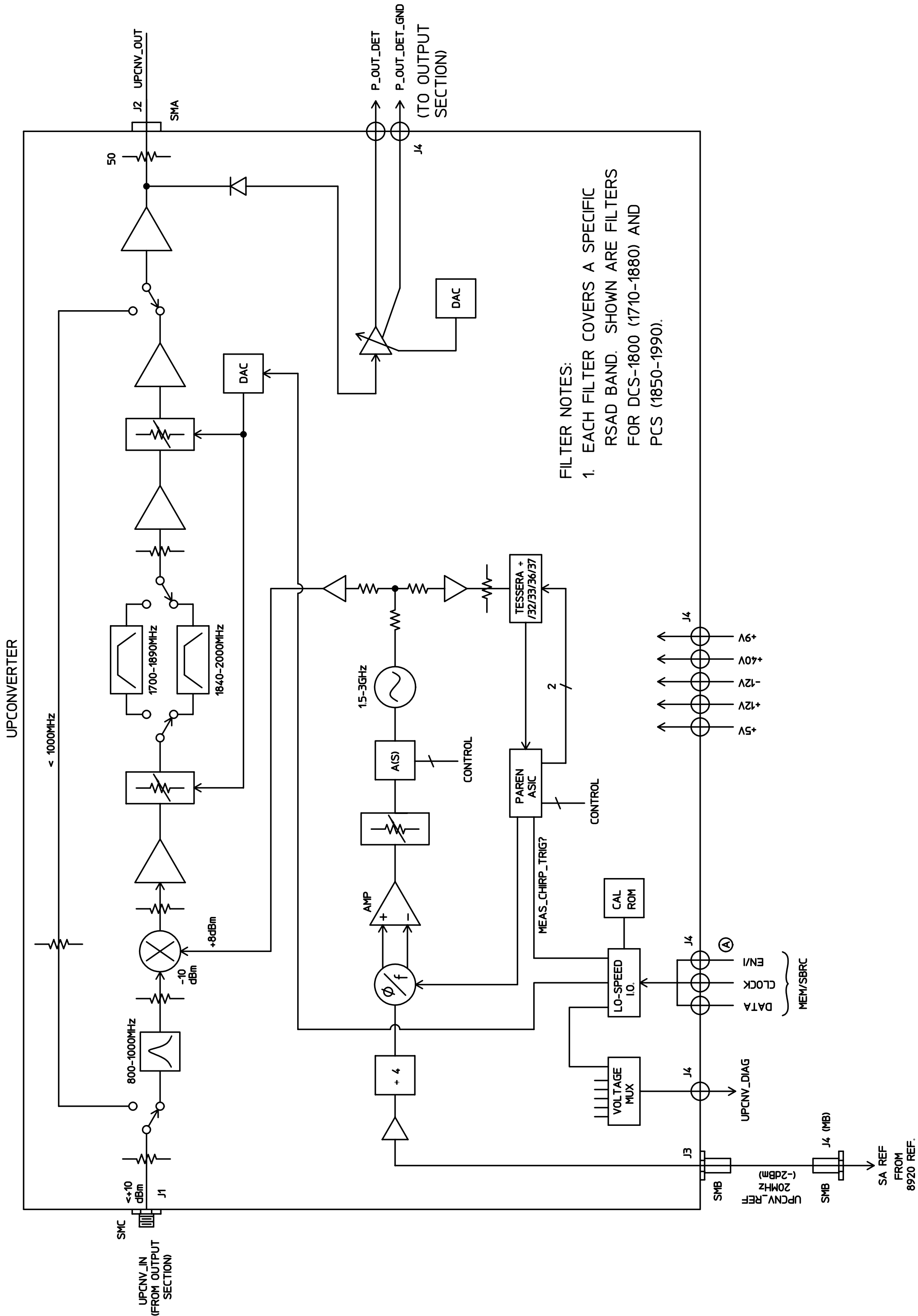


Figure 8-22 Upconverter



Reference/Regulator Section

Reference

All frequencies are derived from a 10 MHz reference which can come from an external reference or from a 10 MHz crystal oscillator on the Reference assembly (figure 8-23 on page 274). The High Stability Reference assembly develops the local oscillator (LO) and reference signals needed by the assemblies that make up the RF generator, RF analyzer, spectrum analyzer, and the Measurement assembly.

Power Supply Regulator

Power supply regulators (figure 8-24 on page 275) are distributed to all of the modules and assemblies by the Power Supply Regulator assembly through the motherboard.

Power Supply

The Power Supply assembly is a switching type supply. The power supply generates five different dc supplies. They are:

- +5.5 Vdc
- +13.4 Vdc
- –13.4 Vdc
- +43.5 Vdc
- –12 Vdc AUX

Power Supply voltages are distributed to all of the modules and assemblies through the motherboard.

Figure 8-23 High Stability Reference

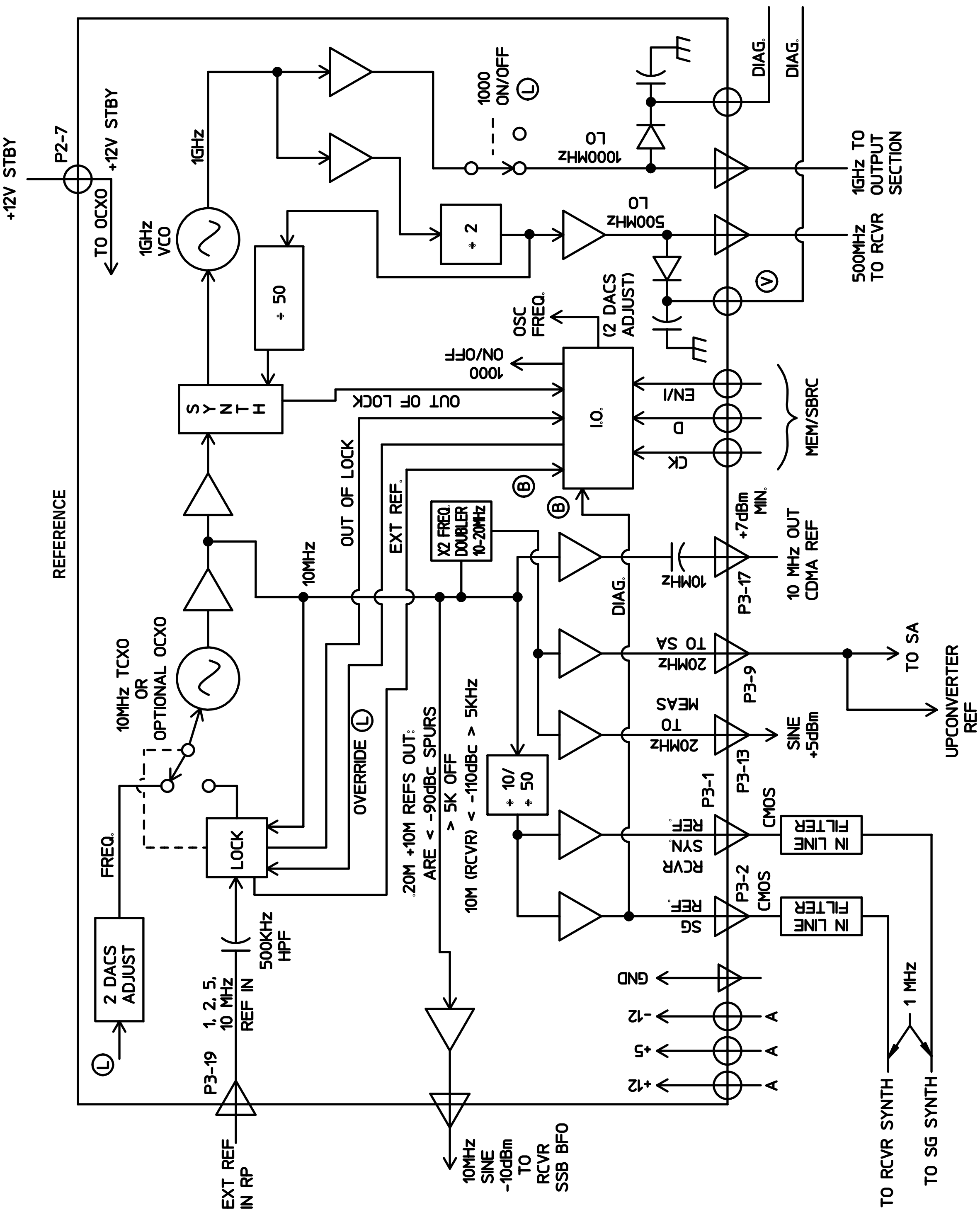
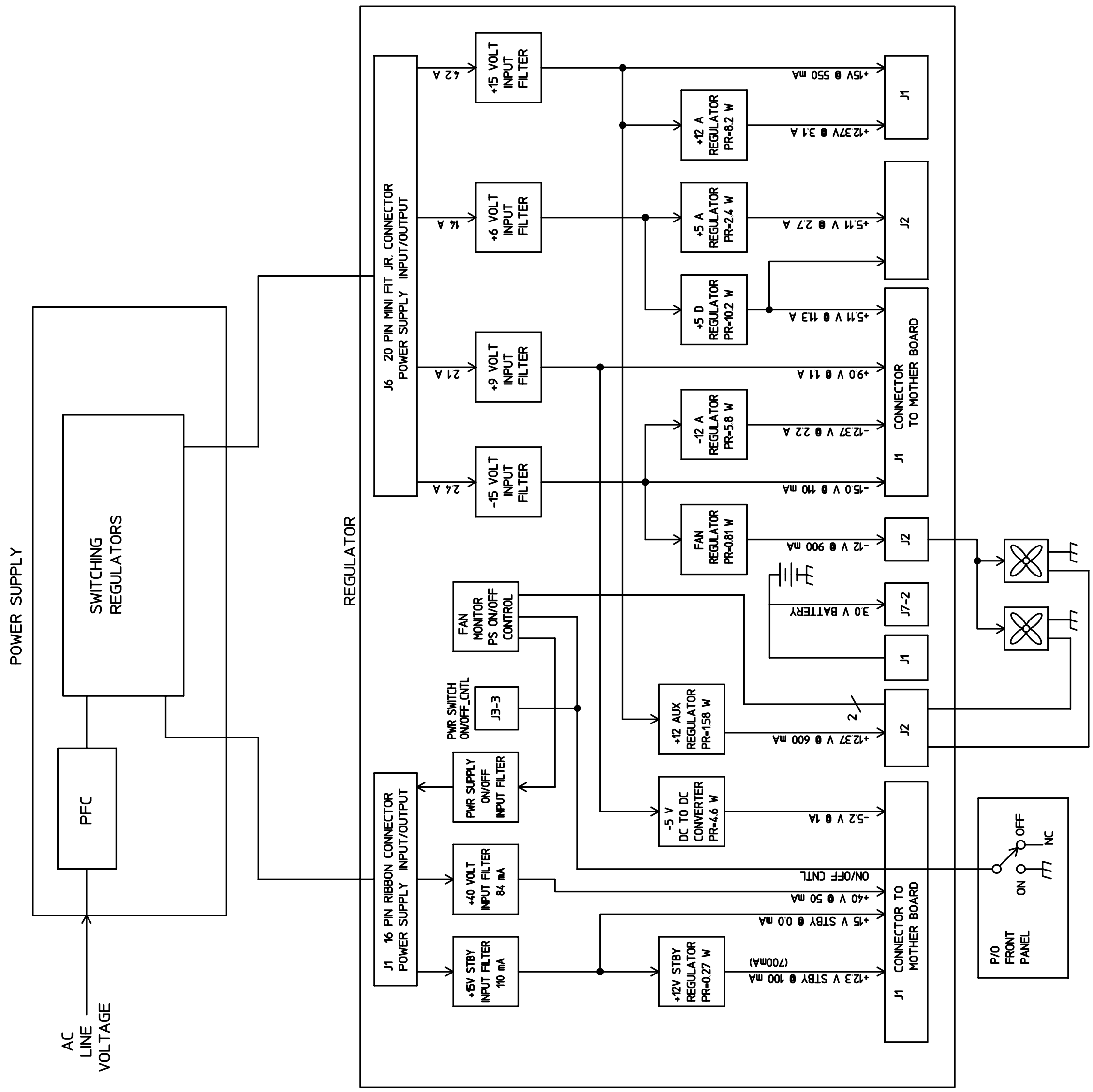


Figure 8-24 Regulator



Instrument Control Section

Digital Control

The Test Set's digital control is driven by two assemblies:

- Memory/SBRC
- Controller

The controller receives user control information by either the control interface or by the front panel. Operating firmware on the Memory/SBRC (figure 8-25 on page 277) is then used by the Controller (figure 8-26 on page 278) assembly to generate digital control for the Test Set. The digital control bus information is passed back to the Memory/SBRC assembly which controls most of the Test Set's modules and assemblies.

Display

The Test Set's display data is first generated by the Controller and then passed on to the Display Driver (figure 8-27 on page 279). The Display Driver converts the digital information into analog vertical and horizontal drive signals for the display. The Display Driver drive also provides brightness and contrast signals for the display.

Figure 8-25 Memory SBRC

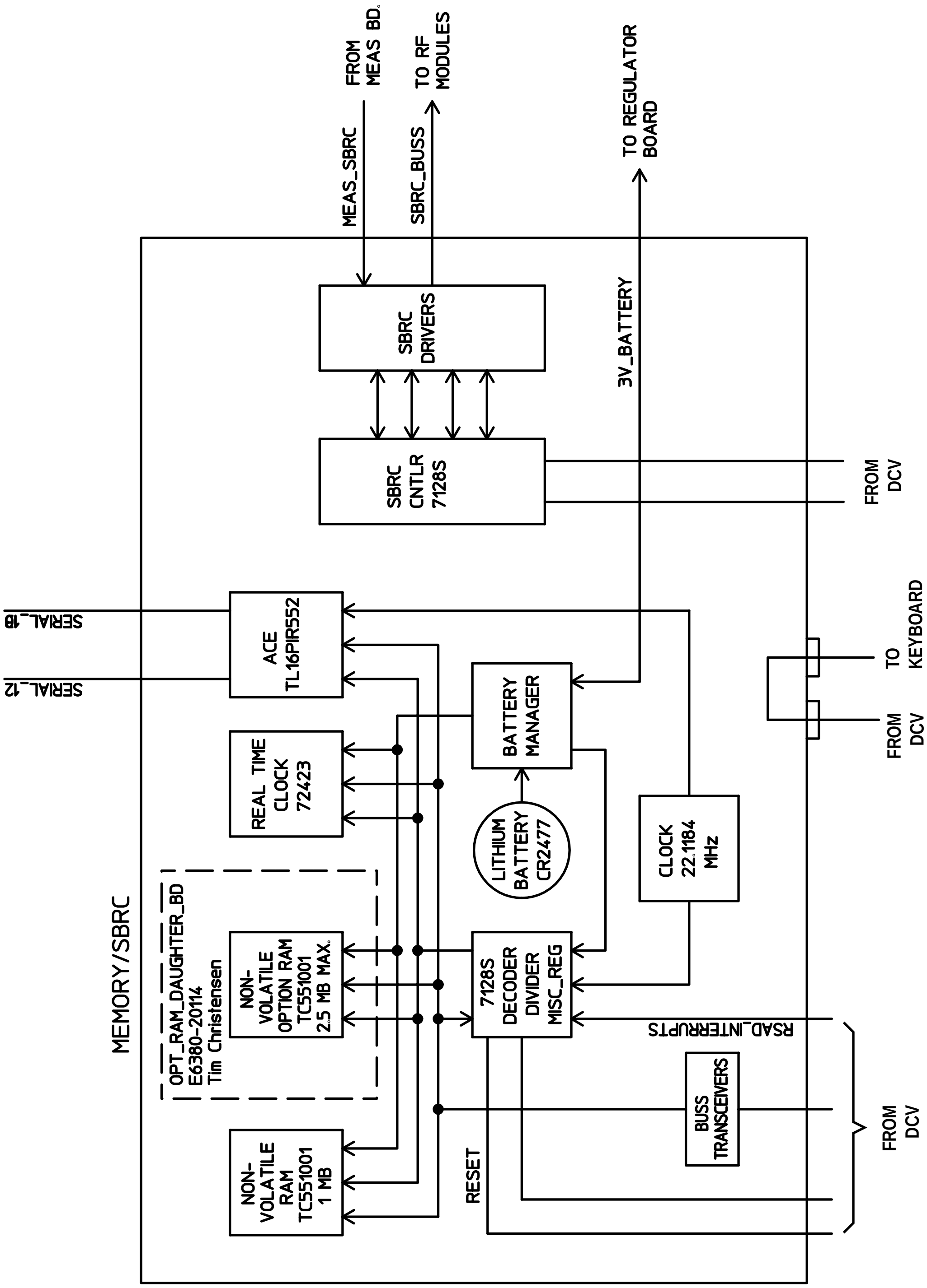


Figure 8-26 Controller

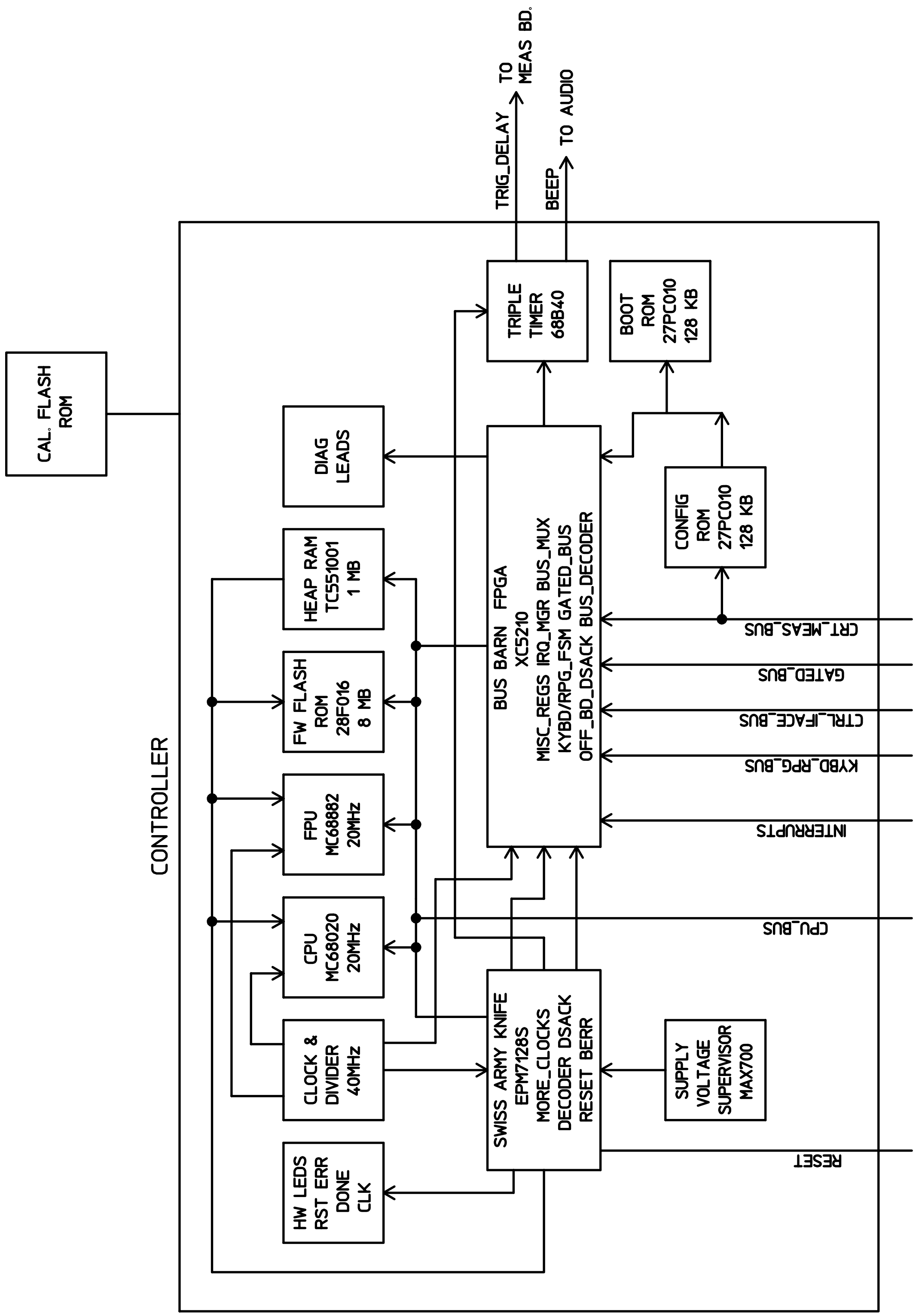
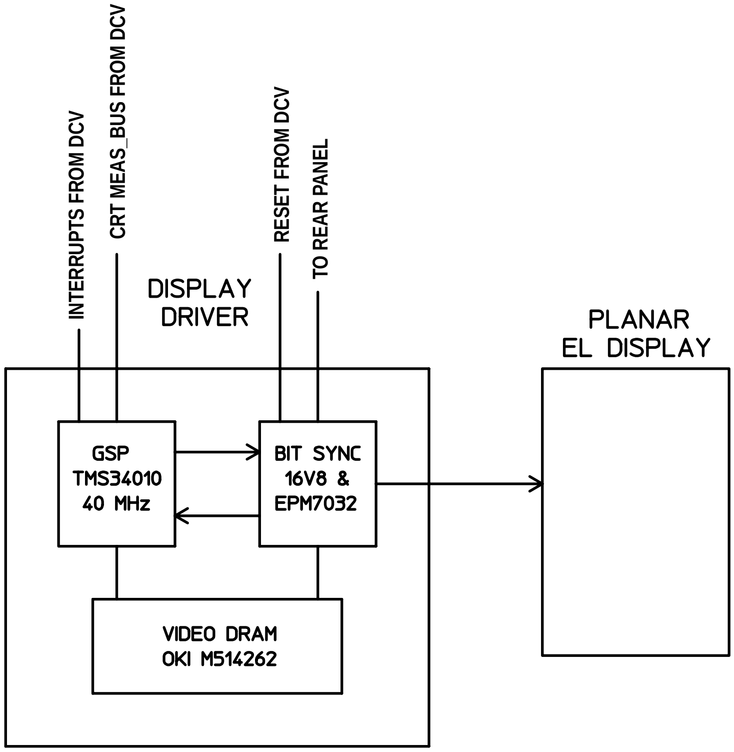
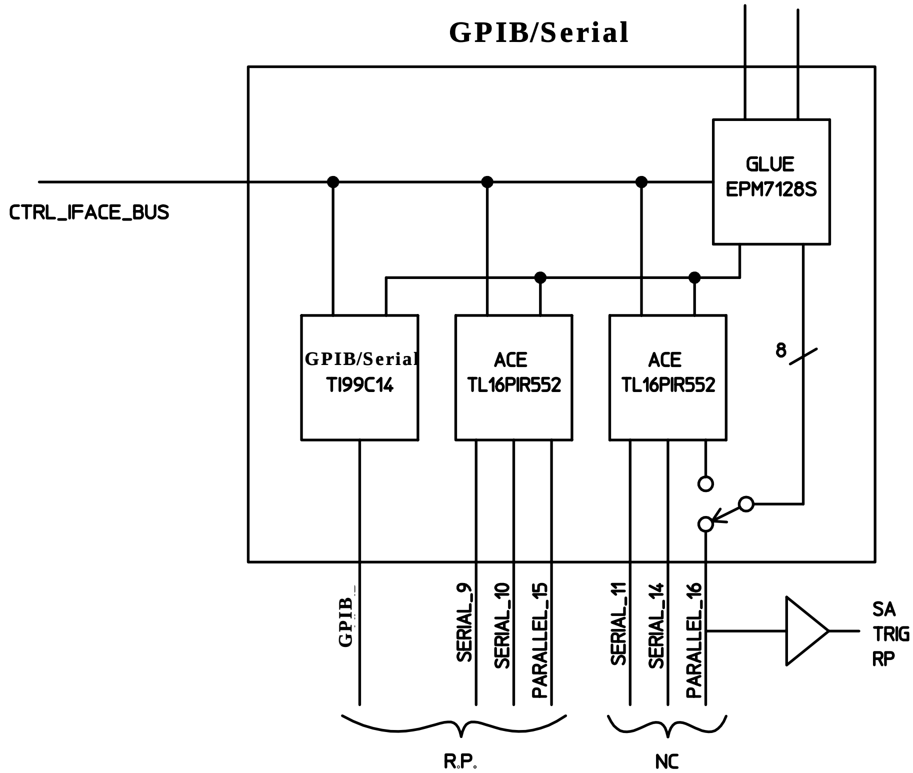


Figure 8-27 Display Driver



GPIB Serial

Figure 8-28 GPIB/Serial



9 Service Screen

This chapter describes the SERVICE screen as a diagnostic aid for the Test Set.

Troubleshooting with the SERVICE Screen

The SERVICE screen, see Figure 9-1 on page 283, uses the internal voltmeter and frequency counter functions to monitor specific nodes in most assemblies. A large number of latch and DAC settings used throughout the Test Set can also be read and/or set to alter standard operation. These functions are primarily intended to allow the automated internal diagnostic routines to verify proper instrument operation, and to allow the periodic adjustment routines (PER_CAL3, CDMA_CAL, and PCB_CAL) to modify Test Set operation.

Access to these functions under manual control is provided to allow further troubleshooting when the diagnostics cannot isolate a failure to a specific assembly. To do this, you must understand how to operate the Test Set and, especially, understand how the assemblies in the Test Set work together.

Detailed manual Test Set operation is provided in the Agilent Technologies E8285A user's guide. Refer to Chapter 8, "Block Diagrams," on page 239 for information on how the overall instrument and each module work.

How to Access the SERVICE Screen

1. Press Preset key.
2. Press the Config key on the Test Set to access the CONFIGURE screen, see Figure 9-1 on page 283.
3. Select the **SERVICE** field in bottom-right corner of the screen.

Field Names and Descriptions

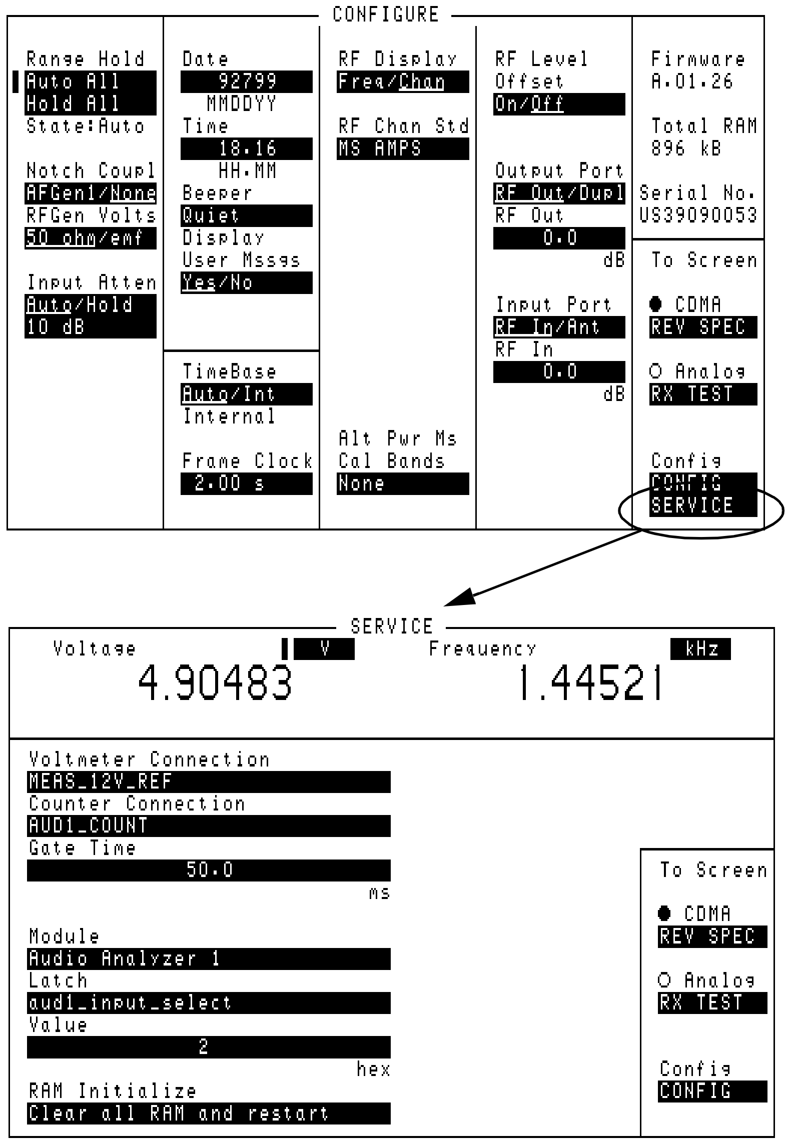
Voltmeter Connection

This field (see Figure 9-1) selects the desired circuit node for voltage measurements. To change the voltmeter connection, move the cursor in front of the **Voltmeter Connection** field and push the cursor control knob. A **Choices** menu will appear. Move the cursor to the desired circuit node in the list and push the cursor control knob. The reading is displayed in the **Voltage** measurement field at the top left of the display.

Because the diagnostic MUX points being measured must be in the range of 0 to ±5 volts, the measurement of some points are scaled to that measurement range. For example; the +12 Volt reference (**MEAS_12V_REF** should measure about +5volts. The –12 Volt reference (**MEAS_NEG_12V_REF** should measure about –5 volts. Many of the voltage measurements are only valid after a number of instrument settings are changed.

When run, the diagnostic routines make the necessary circuit changes and measurements automatically, comparing the measurements to known limits for each node.

Figure 9-1 CONFIGURE and SERVICE Screens



Counter Connection

This field selects the desired circuit node to connect to the Test Set’s internal frequency counter. The reading is displayed in the **Frequency** measurement field at the top right of the display.

To change the counter connection, move the cursor in front of the **Counter Connection** field and push the cursor control knob. A **Choices** menu will appear, then move the cursor to the desired circuit node and push the cursor control knob.

Gate Time

This field is used to adjust the Test Set's internal frequency counter's gate time. A shorter gate time may enable you to see frequency fluctuations that might not be seen using a longer gate time.

To change the gate time, move the cursor in front of the **Gate Time** field and push the cursor control knob. Rotate the cursor control knob until the desired gate time (10 to 1000m in 10m increments) is displayed, then press the cursor control knob.

Latch

This field is used to manually alter the circuit latches that control switch, DAC, and gain settings within the Test Set. The value of the selected latch is displayed and changed in the **Value** field. Some settings are read-only.

To set a switch, DAC, or gain setting:

1. Move the cursor in front of the **Latch** field and push the cursor control knob. A **Choices** menu will appear.
2. Move the cursor to the desired latch name and push the cursor control knob.
3. Move the cursor in front of the **Value** field and push the cursor control knob.
4. Rotate the cursor control knob to modify the value (hexadecimal).

NOTE If any of the switches, DACs, or gain settings are changed with the **Latch** field, the Test Set will generate the message **"Direct latch write occurred. Cycle power when done servicing."** To clear this message, cycle the Test Set's power. Upon power-up, the internal controller will return the Test Set to its default settings and values.

The first part of the names in the **Choices** menu relates to the assembly where the switch, DAC, or gain setting is located. Some latch names are not listed here.

- dstr: Modulation Distribution
- aud1: Audio Analyzer 1
- aud2: Audio Analyzer 2
- refs: Reference
- inpt: Input

- out: Output
- rcvr: Receiver
- gsyn: Signal Generator Synthesizer
- rsyn: Receiver Synthesizer
- spec: Spectrum Analyzer
- meas: Measurement
- metron: Measurement
- afg1: Signaling Source/Analyzer
- afg2: Signaling Source/Analyzer
- sgnl: Displays version number of the Signaling Source/Analyzer firmware.
- cellSite1: Cell Site 1 Digital board
- cellSite2: Cell Site 2 Digital board
- cdmaRef: CDMA Reference
- iq_mod: I/Q Modulator
- loif: LO/IF Demod
- main_dsp: Main DSP Receiver
- aux_dsp: optional DSP Receiver
- protocol: Protocol Processor

Value (hex)

This field displays and changes the value for the latch shown in the **Latch** field.

RAM Initialize

Selecting this field clears all SAVE registers and test programs, and any initialized RAM disk(s), that may be in RAM. It also resets all latches to their factory power-up configuration. If you have saved one or more instrument setups using the SAVE function, using this function will permanently remove them.

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