

Assembly Level Repair

HP/Agilent Technologies 8922 Series GSM Test Set



**Agilent Part No. 08922-90213
Printed in UK
January 1998**

© Copyright 1998, Agilent Technologies. All rights reserved. Reproduction, adaptation, or translation without prior written permission is prohibited, except as allowed under the copyright laws.

Introduction

The HP/Agilent 8922 product family uses an assembly level repair service strategy. The HP/Agilent 8922 may be sent to an Agilent Technologies Sales and Service office or may be repaired on site. This book is used for both Agilent Technologies service and owner service.

The HP/Agilent 8922 product family currently contains the HP/Agilent 8922A, HP/Agilent 8922B, HP/Agilent 8922E, HP/Agilent 8922F, HP/Agilent 8922G, HP/Agilent 8922H, HP/Agilent 8922M and HP/Agilent 8922S. There are differences in both the hardware and in the operation. In examples and task sequences this book presents general usage, and graphical instrument representations may not exactly match the HP/Agilent 8922 that you are servicing.

Repairing the HP/Agilent 8922

To repair the HP/Agilent 8922, follow the chapters in this book starting at the beginning and following the “where to go next” guidelines.

Book Organization

This book contains problem identification sections, assembly replacement sections, reference information and concept information. The chapters are sectioned in three parts; Service Procedures, Reference Information and Theory. This sectioning helps to identify the type of information found in a group of chapters.

Introduction

Contents

Introduction i

1 Localizing the Problem

Introduction 1-2

Localizing the Problem - Flow Chart (Power-Up) 1-3

Power-Up Checks 1-4

If Power-Up Checks FAILED 1-5

If Power-Up Happened Correctly 1-10

2 Running Diagnostics

Introduction 2-2

Running Memory Card or ROM Based Diagnostics 2-3

Loading and Running the Ram Test 2-7

3 Verifying Performance

Introduction 3-2

Installing and Operating the Software 3-2

Using the Compatibility Switch for the HP/Agilent 8922F/
H or M/S 3-3

4 Using the HP/Agilent 83210A Service Kit

Introduction 4-2

Configuring the RF Extender 4-3

Extending Modules 4-5

Making Measurements 4-6

5 Troubleshooting the Controller/Display

Introduction 5-2

Parallel Bus 5-3

Serial Bus 5-4

Display 5-5

Keyboard 5-6

Contents

6 Troubleshooting the Power Supply

- Introduction 6-2
- Power Cord Verification 6-3
- Line Voltage Selection / Line Fuse Replacement 6-5
- Transformer / Power Switch 6-6
- A28 Power Supply 6-7
- Where To Go Next 6-8

7 Adjustments and Calibration

- Introduction 7-2
- Timebase Adjustments 7-3
- Periodic Calibrations 7-5
- Sum Loop Adjustment Procedure 7-6

8 Assembly and Disassembly Procedures

- Introduction 8-2
- Top and Bottom Cover Removal 8-3
- Inside Protective Covers 8-4
- AF, Digital and RF Assemblies Removal 8-5
- A1 Front Panel Removal 8-7
- A10 Power Supply Regulator Removal 8-9
- A11 Receiver Mixer Removal 8-10
- A12 Pulse Attenuator Removal 8-12
- A21 GPIB Interface Removal 8-14
- A22 Display Removal 8-16
- A23 Input Section Removal 8-18
- A24 Attenuator Removal 8-19
- A28 Power Supply Removal 8-20
- Fan Removal 8-22
- Transformer Removal 8-24

Contents

9 Replacing a Part

- Introduction 9-2
- Replaceable Parts 9-3
- Firmware Upgrades 9-29

10 Service Screen

- Introduction 10-2

11 Self-Test Error Messages

- Introduction 11-2

12 Module I/O Specifications

- Introduction 12-2
- A2 Audio Analyzer 2 12-3
- A3 Audio Analyzer 1 12-5
- A4 Modulation Distribution 12-8
- A5 Premodulation Filter and NSM 12-10
- A6 Signaling Source/Analyzer 12-13
- A9 Global Test and Demod 12-15
- A11 Receiver Mixer 12-19
- A13 Output 12-22
- A14 Pulse Driver 12-24
- A15 Reference 12-26
- A16 Receiver 12-32
- A18 Spectrum Analyzer 12-36
- A19 Measurement 12-38
- A23 Input (HP/Agilent 8922A,B,E,F,G,H) Only 12-43
- A23 Input (Agilent 8922M/S Only) 12-47
- A25 Sum Loop 12-50
- A17, A26 Step Loop 12-53
- A27 DAC/Upconverter 12-56

Contents

A28 Power Supply	12-58
A33 Hop Controller	12-59

13 Instrument Block Diagrams

Introduction	13-2
--------------	------

14 Block Diagram Theory of Operation

Introduction	14-2
Technical Discussion	14-3
Block Diagram 1	14-4
Block Diagram 2	14-9
Block Diagram 3	
HP/Agilent 8922B Only	14-15
Block Diagram 4	14-17
Block Diagram 5	14-18

15 Diagnostics Theory

Introduction	15-2
AF_DIAGS	15-3
RF_DIAGS	15-5
MS_DIAGS	15-11
GSM and DCS Diagnostic Tests	15-12
Interpreting Results	15-13

Contents

16 Measurement Theory

Introduction 16-2

17 GSM Theory

Introduction 17-2

The GSM System 17-3

E-GSM, DCS1800 and PCS1900 Systems 17-4

Index 1

Contents

This Page Intentionally Left Blank

Contents-6

Localizing the Problem

Introduction

This chapter helps to determine if a problem actually exists and which section of the instrument has a problem.

This chapter comprises of four sections.

- Localizing the Problem Flow Chart (Power-Up)
- Power-Up Checks
- If Power-Up Failed
 - Power-Up Self Test Diagnostics
- If Power-Up Happened Correctly
 - Checking the RF Analyzer using the RF Generator
 - Checking the RF Analyzer using the AF Generator

Localizing the Problem - Flow Chart (Power-Up)

See "Power Up Checks", in this Chapter, for details of the steps given in the flow chart below.

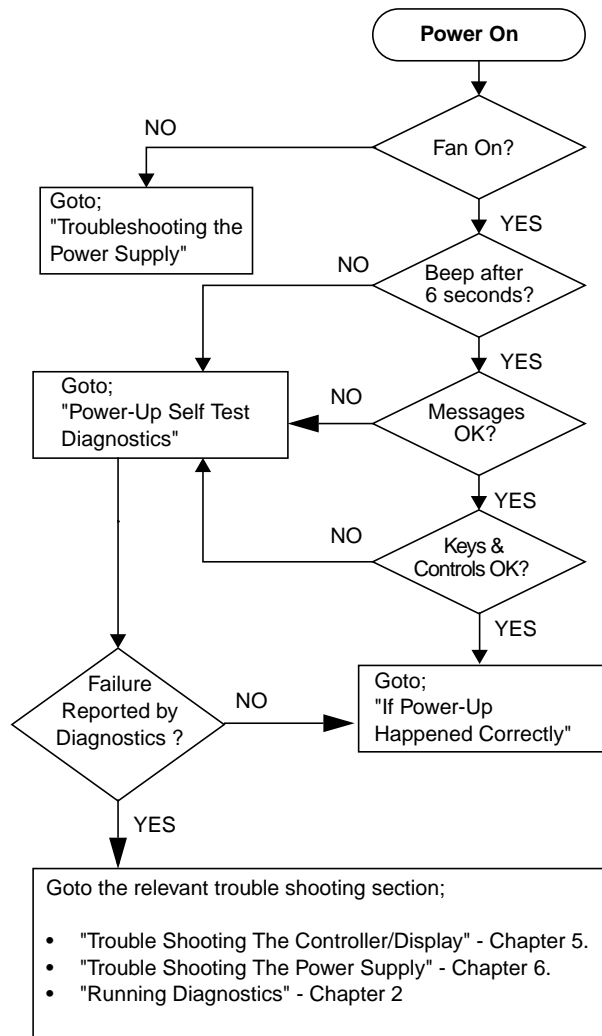


Figure 1-1

Localizing the Problem - Flow Chart

Power-Up Checks

The following checks show whether the instrument is powering up correctly.

- (a) Depress the power button on the front panel (see diagram).
- (b) Check that the fan on the rear panel is working.
- (c) Listen for a single “beep” after pressing the power switch. This can be from 6 to 20 seconds, depending on model type.
- (d) Check the display on the front panel for any error messages. (The normal message which will appear is “All host processor self-tests passed.” and/or “Frequency Reference Cal lost. Perform Reference Calibration”.)

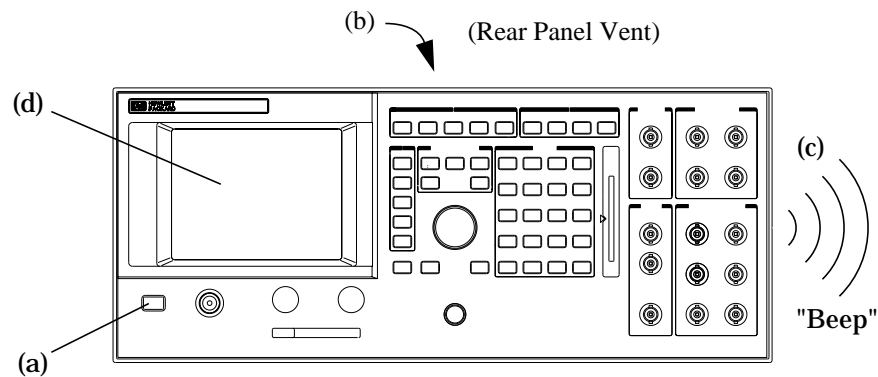


Figure 1-2 Power-Up Checks - Agilent 8922x

NOTE

If an error message appears after power up it may not be the only message which has appeared. Only the last message will be shown on this message line. Press **SHIFT**, **TESTS** (MSG) to access the message *screen* for a list of all the error messages.

If Power-Up Checks FAILED

If the power up checks failed, continue with this section.

- If the fan did not start, see "Troubleshooting the Power Supply", Chapter 6.
- If the fan started, but any of the other power-up checks failed, see "Power-Up Self Test Diagnostics".
- If an error message occurs, refer to the *Agilent 8922x Users Guide* for additional information.

Error Message Numbers

If the error message refers to a self test error it will be of the form:

One or more self tests failed: Error Code **xxxx**

Where xxxx corresponds to the error message number shown in the table below.

Table 1-1

Error Message Numbers

Failure	Error Number	Suspect Assembly
Fatal Error - Host Processor Failure	0002	A7 Controller
Fatal Error - ROM Checksum Failure	0004	A8 Memory
Fatal Error - RAM Failure	0008	A8 Memory
Fatal Error - RAM Failure	0010	A8 Memory
Fatal Error - Timer Failure	0020	A7 Controller
Real Time Clock Failure	0040	A8 Memory
Keyboard Failure	0080	A1 Keyboard
Serial I/O Failure	0100	A21 GPIB
Internal Serial Bus Communication Failure	0200	Serial Bus
CRT Failure	0400	A19 CRT Drive
Miscellaneous Hardware Failure	0800	Miscellaneous H/W

Localizing the Problem
If Power-Up Checks FAILED

Power-Up Self Test Diagnostics

If the power-up sequence failed, the power-up self-tests can be re-run with the covers off. The LED's on the controller board give the results of the power-up self-test.

- (a) Remove the instrument covers. Refer to the section "Top and Bottom Covers", Chapter 8, for details.
- (b) Power up the instrument.
- (c) Read the LED sequence given on the controller board. These LED's can be read with the shields in place (refer to the diagram below)

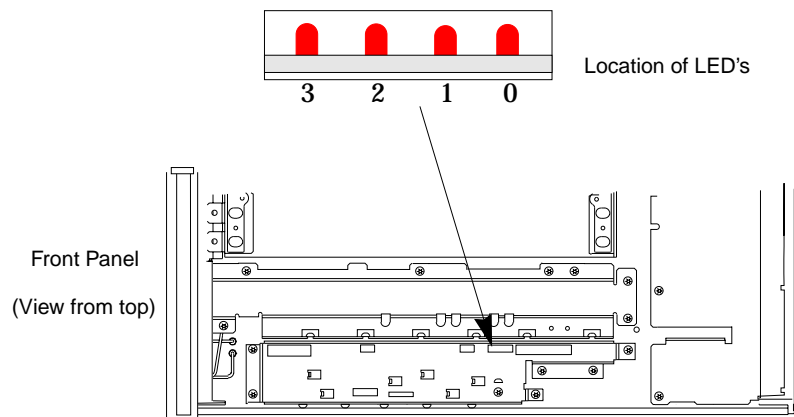





Figure 1-3 Self Test LED Location

NOTE For multiple failures, the patterns for each failure will appear in sequence.

The following conventions are used to represent the LED's throughout this chapter.

Table 1-2

LED Conventions

LED shown in tables	Represents
	A 'lit' LED
	An 'off' LED
	A flashing LED

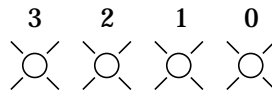
LED Sequences

The LED error sequence will show two states, pass or fail, which are outlined below. The suspect assembly is given in the following tables, before moving on consult the section "Self-Test Diagnostic Result".

No Failures

Detected

The LED's will light for approximately 10 seconds, then all will turn off.



Lit for 10 seconds.

Failure Detected

- 1 The LED's will initially all light.
- 2 The next pattern blinks rapidly, and shows that an assembly has failed.
- 3 The third sequence flashes twice and gives further information on the area of the board that has failed.
- 4 The LED's will light then go out.

Localizing the Problem
If Power-Up Checks FAILED

Table 1-3 **Sequence of LED Patterns**

1	3	2	1	0	
2	3	2	1	0	Assembly failure.
3	3	2	1	0	Serial Bus Communication Failures
4	3	2	1	0	No more errors.

NOTE

1. The third patterns are only documented for a serial bus communication failure. This is represented by the two outside LED's flashing.

2. The second and third patterns will be the same. It will appear as if the same pattern has flashed twice.

For more than one error in the Agilent 8922x the LED's will flash in the same sequence for each assembly that is faulty.

Where to Go Next

- If the LED's did not light at all, go to Chapter 6, "Troubleshooting the Power Supply".
- If an error message occurs, use it in Chapter 2, "Running Diagnostics" to choose which diagnostic test to run. See also Chapter 11 "Self Test Error Messages".
- If this section is used due to display problems, go to Chapter 5 "Troubleshooting the Controller/Display" before the error messages are repaired.

Assembly failure table.

IF the First LED Pattern Displayed is	Then the assembly that failed is
<p>3 2 1 0</p> <p>● ● ● ○</p> <p>● ● ○ ●</p> <p>● ● ○ ○</p> <p>● ○ ● ●</p> <p>● ○ ○ ●</p> <p>● ○ ○ ○</p> <p>○ ● ● ●</p> <p>○ ● ● ○</p> <p>○ ● ○ ●</p> <p>○ ● ○ ○</p> <p>○ ● ○ ○</p>	<p>A7 Controller</p> <p>A8 Memory</p> <p>A8 Memory</p> <p>A8 Memory</p> <p>A7 Controller</p> <p>A8 Memory</p> <p>A1 Keyboard</p> <p>A21 GPIB/RS-232</p> <p>Serial Bus Communication (See table)</p> <p>A6 Signal Source/Analyzer</p> <p>A20 CRT Drive</p>

Serial bus communication failure details table.

if the second and third LED patterns are	Then communication failed to
<p>3 2 1 0 3 2 1 0</p> <p>● ● ● ○ ● ● ● ○</p> <p>● ● ○ ● ● ● ○ ●</p> <p>● ● ○ ○ ● ● ○ ○</p> <p>● ○ ● ● ● ○ ● ●</p> <p>● ○ ○ ● ● ○ ○ ●</p> <p>● ○ ○ ○ ● ○ ○ ○</p> <p>○ ● ● ● ○ ● ● ●</p> <p>○ ● ● ○ ○ ● ● ○</p> <p>○ ● ○ ● ○ ● ○ ●</p> <p>○ ● ○ ○ ○ ● ○ ○</p> <p>○ ● ○ ○ ○ ● ○ ○</p>	<p>A4 Mod Distribution</p> <p>A13 Output</p> <p>A3 Audio Analyzer 1</p> <p>A2 Audio Analyzer 2</p> <p>A15 Reference</p> <p>A23 Input</p> <p>A23 Input</p> <p>A16 Receiver</p> <p>A26 Step Loop A</p> <p>A17 Step Loop B</p> <p>A5 Premod FilterNSM</p>

If Power-Up Happened Correctly

If power-up happened correctly and no problem is indicated, this section is used to functionally check most of the hardware. The generators are checked first with external measurements, then the analyzers are checked with the generator. The RF Generator is checked at 935 MHz and 10 dBm. The AF Generator is checked at 1 kHz and 1 V. These checks are for indication only, performance tests in Chapter 3, “Verifying Performance”, will test specifications.

NOTE

If you possess an Agilent 8922S or Agilent 8922M, you should first re-configure your instrument as an HP/Agilent 8922E or HP/8922G. To do this, select the following keys:

- **CONFIG** (this is accessible from the Cell Control screen in the bottom right-hand corner).
 - **Compatible**, select (HP 8922E or HP 8922G)
 - **PRESET**
-

Referring to Figure 1-4, ensure the connections are made.

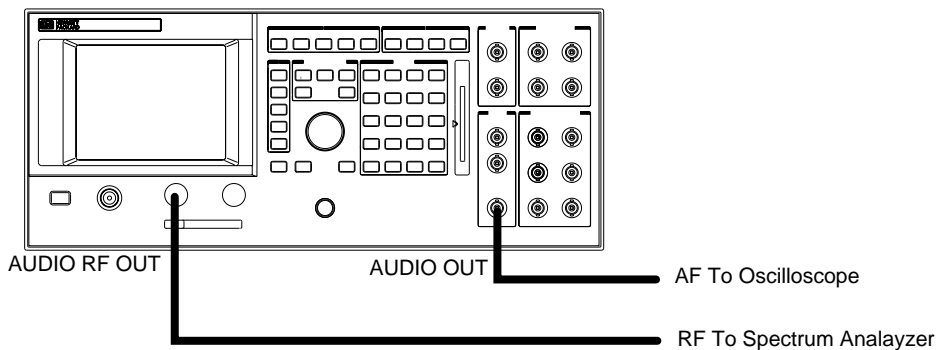


Figure 1-4

Front Panel Connections

Press **RF GEN/RF ANL**.

NOTE

On the HP/Agilent 8922A/B, press **RF GEN/RF ANL**.
On the HP/Agilent 8922E/F/G/H/M/S, press **SHIFT**, **CELL CNTL** (RFG/RFA).

Highlight the RF Output field (1).

Select AUX RF OUT from the list of choices.

Set the RF Generator **Amplitude** field to 10 dBm (2).

Set the AF Generator **Amplitude** field to 1 V (3).

RF GENERATOR / RF ANALYZER				
RF Gen Frequency Hopped RF Output RF IN/OUT	RF Gen Amplitude -85.0 dBm Atten Hold On/Off	Mod Source GMSK Ext DC AM Off Pulse Hop Tris Normal	RF Gen Hop Control Hop Mode Non-Hop/Hop Hop Tris Arr/Disarr	AF Gen Frequency 1.0000 kHz Amplitude 50.0 V Coupling AC/DC
RF Analyzer Frequency 896.000000 MHz RF Input RF IN/OUT	RF Analyzer Amplitude 38.0 dBm Control Manual Accuracy +-3dB	AGC AGC Mode Auto Open/Auto DAC Value 109	RF Analyzer Hop Control Hop Mode Non-Hop/Hop Hop Tris Arr/Disarr	To Screen PHASE FRQ PWR RAMP BIT ERROR OUT RF SP More

Figure 1-5

RF Analyzer Settings

Where to Go Next

- If the generators are within specifications, go to the next section, “Checking the RF Analyzer Using the RF Generator”.
- If one or both of the generators appear to be faulty, go to Chapter 2, “Running Diagnostics” and run the appropriate tests.

Checking the RF Analyzer Using the RF Generator

This section tests the RF Analyzer using the RF Generator as a signal source. This task assumes the same setting used in the previous section.

- Connect the RF In/Out to the Aux RF Out.

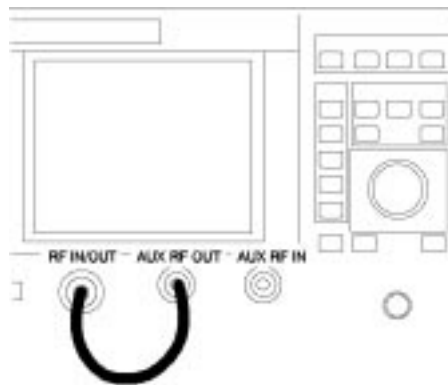


Figure 1-6

Front Panel Connections for the RF Analyzer

Press **RF GEN RF ANL**.

NOTE

On the HP/Agilent 8922A/B, press **RF GEN RF ANL**.

On the HP/Agilent 8922E/F/G/H/M/S, press **SHIFT**, **CELL CNTL** (RF GEN RF ANL).

- Set the RF Analyzer **Frequency** field to **935 MHz** (1).
- Set the RF Analyzer **Amplitude** field to **10 dBm** (2).
- Set the Mod Source **GMSK** field to **Off** (3).
- Select **More** in the bottom right-hand corner of the screen (4).

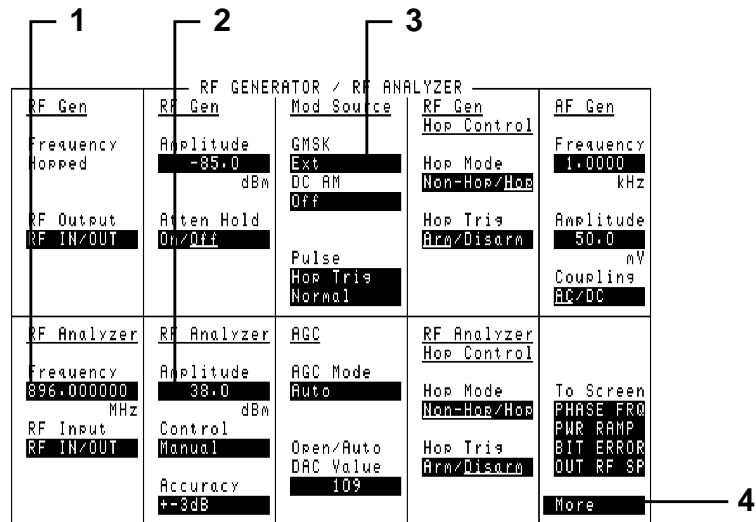


Figure 1-7

RF Generator/Analyzer Settings

Localizing the Problem If Power-Up Happened Correctly

- Select **CW/AF ANL** from the list of choices, and read the **CW Freq (5)** and **CW Power (6)** fields.

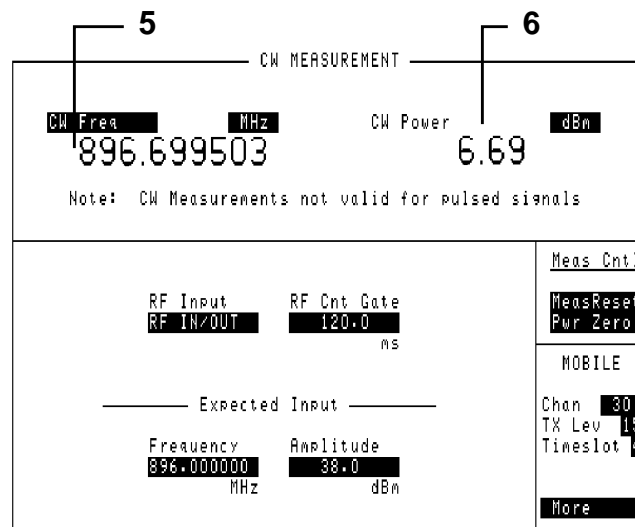


Figure 1-8

CW Readings

Where to Go Next

- If the analyzer measurement was within the specification, go to the next section, “Checking the AF Analyzer using the AF Generator”.
- If the measurement was faulty, go to Chapter 2, “Running Diagnostics”, and run the test related to the RF Analyzer.

Checking the AF Analyzer Using the AF Generator

This section tests the AF Analyzer with the AF Generator as a source. The AF Generator settings are the same as the first task, and displays the CW MEAS/AF ANL screen.

- Connect the AUDIO OUT to the AUDIO IN.

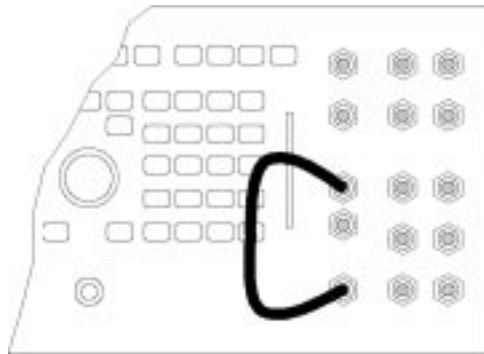


Figure 1-9

Front Panel Connections for the Audio Check

- Select **More** and from the list, select **CW MEAS/AF ANL**.
- Highlight **AF Anl In** and select **AUDIO IN (1)**.
- Read the **AC Level (2)** and the **AF Freq (3)** reading.

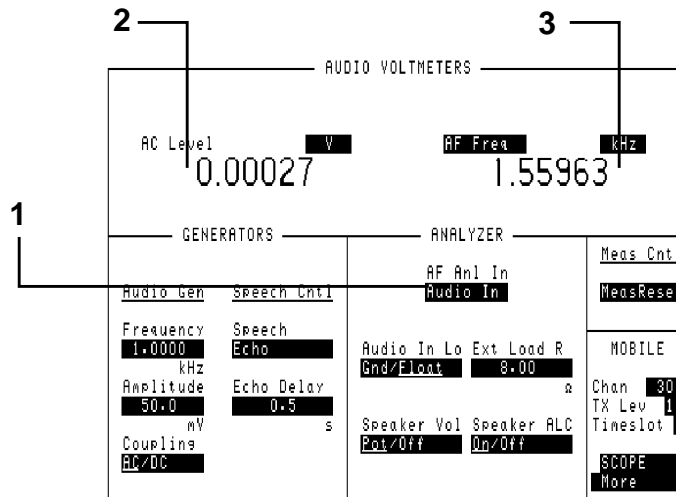


Figure 1-10

Audio Measurements

Localizing the Problem
If Power-Up Happened Correctly

Where to go next

- If the analyzer measurement was within specification, go to Chapter 2, “Running Diagnostics” and run all the tests.
- If the analyzer measurement was faulty, go to Chapter 2, “Running Diagnostics” and run the tests relating to the AF Analyzer.

Running Diagnostics

Introduction

There are two types of diagnostics for the HP/Agilent 8922: diagnostic tests and the HP/Agilent 8922B specific “RAM Test”. The latter is appropriate for the HP/Agilent 8922B only. The diagnostic tests are contained either on the memory card, part number 08922-10003 or in ROM memory for instruments with firmware revision code A.03.00 and above. The HP/Agilent 8922B specific “RAM Test” is contained on the “08922-10001, 8922B Driver” disk supplied with the HP/Agilent 8922B.

Most of the diagnostic tests relate to a fault in a specific instrument section. Therefore, if chapter 1 identified a specific section of the instrument, only those tests need to be run.

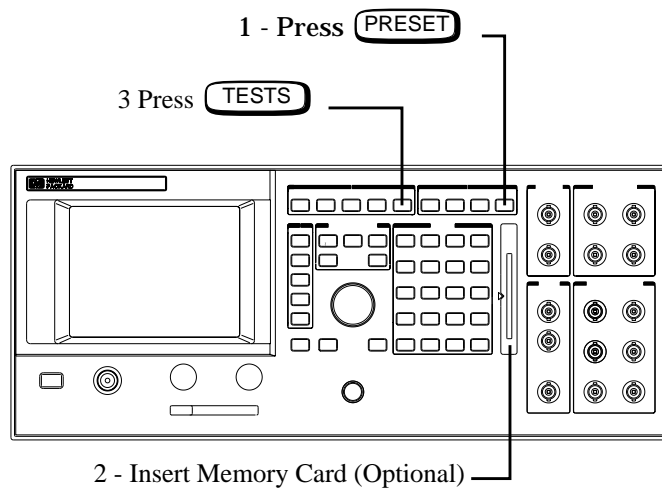
The diagnostic tests whose names begin with E or G are specifically for the HP/Agilent 8922E/G. The other tests are for any HP/Agilent 8922.

This chapter comprises two sections. The first section, “Running Memory Card or RAM Based Diagnostics”, shows how to load and run the memory card based or ROM based diagnostics. The second section, “Loading and Running the RAM Test”, shows how to load and run the HP/Agilent 8922B RAM test. Equipment requirements and installation procedures are given in the HP/Agilent 8922B User’s Guide, Part Number 08922-90020.

This chapter uses the diagnostic test names from an early memory card revision. ROM based diagnostic test names may differ from the names used in this chapter.

Running Memory Card or ROM Based Diagnostics

Do these steps in the order shown



Running Diagnostics

Running Memory Card or ROM Based Diagnostics

6 Move cursor here and press knob.

4 For Memory Cards:
If **CARD** is displayed, go to step 6, if not move the cursor to this field, press knob and continue at step 5.

TESTS			
Procedure:	Location	Library	Program Autostart
	: Card		: Off/On
Comment			
Test Execution Conditions			
On UUT Failure	Run Mode		
Continue/Stop	Continuous/Single Step		
Output Results	Output Destination		
All/Failures	Crt/Printer		
Output Heading			
Test Function			
Edit Sean			

8 Move cursor here and press knob. Follow the instructions to start.

5 Select **CARD**

7 Select,

- AF_DIAGS,
- RF_DIAGS1,
- MS_DIAGS1,
- CAL_REV,
- LOOP_BACK

1 Run Test

2 Continue

Edit Sean

Edit Parm

Edit Spec

To Screen

PHASE FRQ

PWR RAMP

BIT ERROR

OUT RF SP

More

To select another test;

- To select another tests from the same program use the **RESUME** user key.
- To select a test from another program press **TESTS** key and begin at step 6.

Reading Memory Card Diagnostic Test Results

```
TESTS (IBASIC Controller)
Running...
Failure count so far 2

** Failure Detected.
Suspect: Reference Assembly (Medium)

Ext Reference Lock Out

===== Expected Actual =====
                        0      0

** 2 failure(s) occurred in this test.
Suspect: Reference Assembly (high)

=====
                        End of Reference Assembly Test
=====

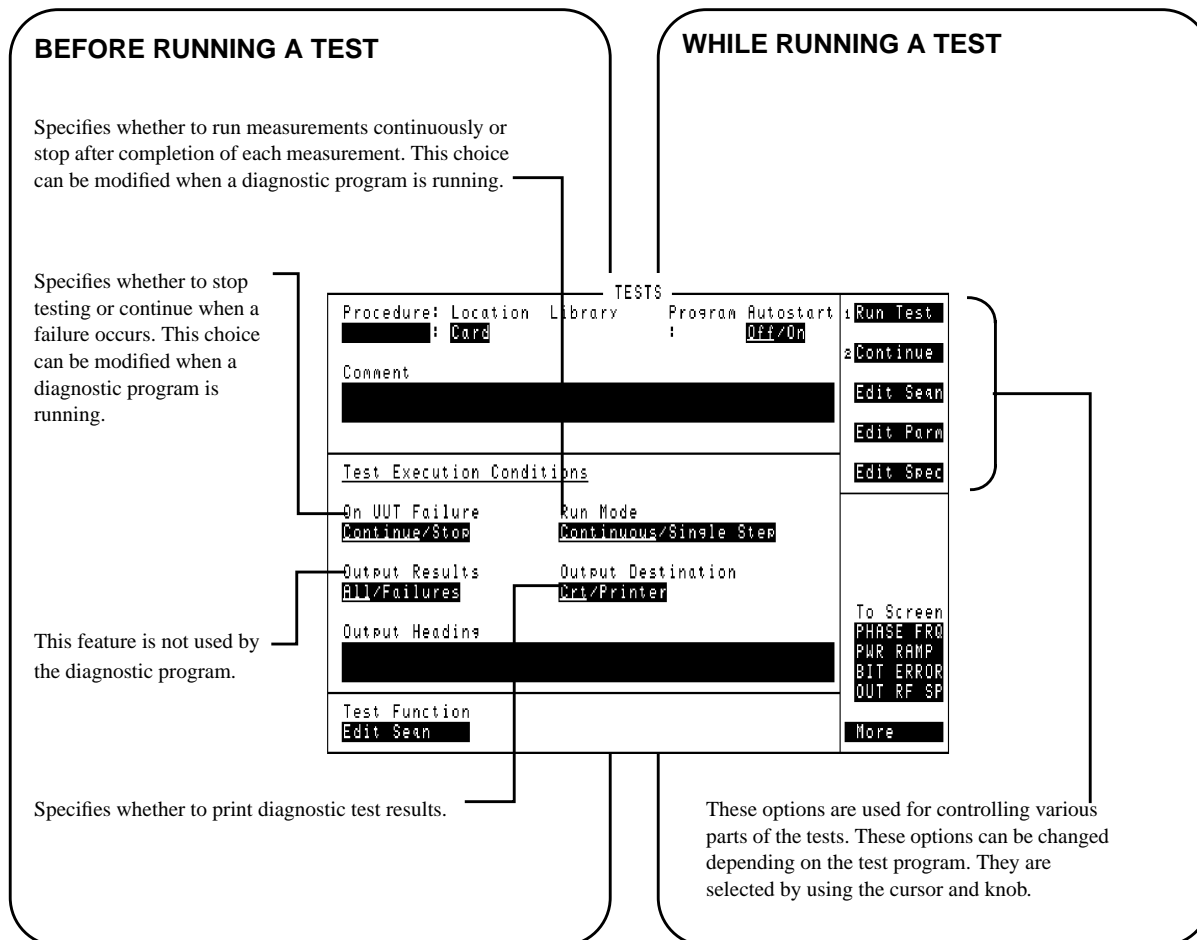
To Screen
BIT ERROR
DSP ANL
OUT RF SP
PULSE

More
```

Test Results
Assemblies suspected to be defective

Probability Indicator
Troubleshoot the assembly with the highest probability first and re-run test. Continue this process with all assemblies listed until the defect is found. See also Chapter 15 "Diagnostic Theory".

Selecting Memory Card Diagnostic Test Execution Conditions



Where to Go Next:

If any high-probability failures occurred, those assemblies can be replaced and the test re-run. When the tests pass, the performance tests can be run to verify performance (refer to Chapter 3). If low-probability failures occur, the performance tests can be run for further indication or measurements can be made to individual assemblies using Chapters 4, 12 and 13.

Loading and Running the Ram Test

Your HP/Agilent 8922B comes with software to test the Data Buffer.

Loading the RAM Test

- 1 Locate the floppy disk labeled "08922-10001, 8922B Driver."
- 2 Insert the disk into the drive.
- 3 Type **MSI A:** (substitute your drive specifier for A: if your drive is not drive A) and press **ENTER**.
- 4 Type **LOAD "DRIVER22B",1** and press **ENTER**.

The Data Buffer Driver will now be loaded and will begin to run.

- 5 Press **K3, "Test RAM"**
- 6 Use the cursor to select the output device.
- 7 Select the area of RAM to test and Press **K0, "Accept"**.
- 8 Repeat selection for each area of RAM.

Where to go next

- If any of the RAM areas tested bad go to chapters 8 and 9.

Selecting from a List

- Use **↑** and **↓** to scroll through the list. A beep will sound when you reach an end of the list.
- Use **SHIFT** **↑** or **PG UP** to move to the first item in the list.
- Use **SHIFT** **↓** or **PG DOWN** to move to the last item in the list.
- Use **ENTER** or **⇒** to select the current item and move to the next field on the screen.
- Use **⇐** to select the current item and move to the previous field on the screen.

Running Diagnostics
Loading and Running the Ram Test

This Page Intentionally Left Blank

Verifying Performance

Introduction

Because of the specialized nature of the HP/Agilent 8922 and the equipment required to support it, it is recommended that calibration and repair be performed only by specially equipped Agilent Technologies service centers.

A list of specifications and verification tests can be found in the *HP/Agilent 8922x User's Guide*.

Verification

Performance Test Software provided with the product is used to verify the electrical performance of the HP/Agilent 8922 GSM Test Set. If the instrument passes this verification, its operation and specifications are assured within the measurement uncertainties provided in the performance test print out.

Installing and Operating the Software

Performance Test Software

This is supplied on a 3.5-inch, double-sided floppy disk and is written to run with BASIC 5.0 and later. Modifications to the program should be limited to changing the default addresses and storing copies for back-up purposes.

Understanding the Tests

Test Descriptions contains a description of each test that is performed by the Performance Test software. This description is intended to help locate problems if the software fails to execute properly or to help users understand the test methodology that is used in each performance test. The descriptions are not step by step procedures for manual performance tests.

To Load the Program in the Agilent 8922M/S.

To verify the performance of the HP/Agilent 8922H/M you need to convert the instrument back from an HP/Agilent 8922G, or convert the HP/Agilent 8922F/S to an HP/Agilent 8922E.

You are now ready to run the Performance Test Software.

- 1) Put the disk in the disk drive.
- 2) Type ``LOAD "PT_8922"`, press ENTER.

After you have completed the Performance Tests, return the instrument back to the HP/Agilent 8922F/S or HP/Agilent 8922H/M using the same process in reverse.

Using the Compatibility Switch for the HP/Agilent 8922F/H or M/S

Back Conversion

To turn the instrument from the HP/Agilent 8922H/M or HP/Agilent 8922F/S back to an HP/Agilent 8922G or an HP/Agilent 8922E, select the following keys:

- CONFIG (this is accessible from the Cell Control screen in the bottom right-hand corner).
- Compatible, select HP 8922G or HP 8922E
- HP-IB Adrs (22)
- PRESET

The instrument is now set up as an HP/Agilent 8922G or HP/Agilent 8922E and ready for Performance Verification testing.

Forward Conversion

To return the instrument from an HP/Agilent 8922G back to an HP/Agilent 8922H/M or an HP/Agilent 8922E to an HP/Agilent 8922F/S, select the following keys:

- More (this is accessible from the Cell Control screen in the bottom right-hand corner). Scroll down the list and select CONFIG.
- Compatible, select HP 8922H/M or HP 8922F/S
- HP-IB Adrs (14)
- PRESET

The instrument is returned to an HP/Agilent 8922H/M or HP/Agilent 8922F/S.

To Configure the GPIB Addresses

- 1) With the program loaded, type ``EDIT DEFAULT_ADDRESS'', press ENTER.
- 2) Modify each line to indicate the proper instrument address (700-730).

It is now possible to re-store the program as "PT_8922" or store it under a different name.

To Run the Program

- 1) Type ``RUN'', press ENTER.
- 2) Follow the directions as they appear on the screen.

Notes on Running the Program.

The first screen which appears is the GPIB status of each piece of test equipment that is supported. It is only necessary to have the instruments responding that will be used in each particular test. Make certain that each instrument you will be using is responding at the proper address. Duplicate addresses may make an instrument appear to be responding but this is not allowed. Press "I" (for Ignore) to continue past this screen.

The second screen prompts you for the instrument model. If you have disk 08922-10006, select HP 8922G (for HP/Agilent 8922H/M performance testing) or HP 8922E (for HP/Agilent 8922F/S performance testing). The third screen which will appear is the main Performance Tests selection menu. Three options are available on this screen:

- Select the performance test to run, remember the test instruments and UUT must be responding over GPIB.
- Turn the printer function ON or OFF. If the printer function is turned on it must be responding over GPIB or the program will lock up.
- Exit from the program.

Press the key corresponding to the option that you would like to perform.

The other screens that appear are connection instructions, error messages and output results.

Using the HP/Agilent 83210A Service Kit

Introduction

This section is a supplement to the diagnostics program for troubleshooting the HP/Agilent 8922 to the assembly level. The extender boards should be used when the diagnostics cannot correctly isolate a defective assembly, or when it is necessary to verify the module level performance of the HP/Agilent 8922.

The section provides the information necessary to extend and troubleshoot the input and output signals for most RF, audio, and digital assemblies.

Configuring the RF Extender

To extend RF modules, it is necessary to use the RF extender board (08922-60129) with the correct coax jumper cables. These cables route the RF signals to and from the module and allow the signal path to be accessed for measurements. The following table and diagram shows the coax jumpers that are required for each RF module.

Table 4-1 Coax Jumpers for RF Extender Board

Assembly Number	On PLUG 1 Connect Pin Number					On PLUG 3 Connect Pin Numbers					
	3	7	9	13	17	3	9	13	15	17	20
ForA13	X				X			X			
For A14	X			X	X	X	X			X	
For A15	X		X	X	X		X	X		X	X
ForA16	X	X		X		X	X	X			
For A17	X					X					
For A18	X				X					X	
For A25	X					X				X	
For A26	X					X					
ForA27		X	X	X					X		

Using the HP/Agilent 83210A Service Kit
Configuring the RF Extender

The following example shows how to interpret table 4-2 and install the coax jumpers on the extender board. This example shows the configuration for the A13 assembly.

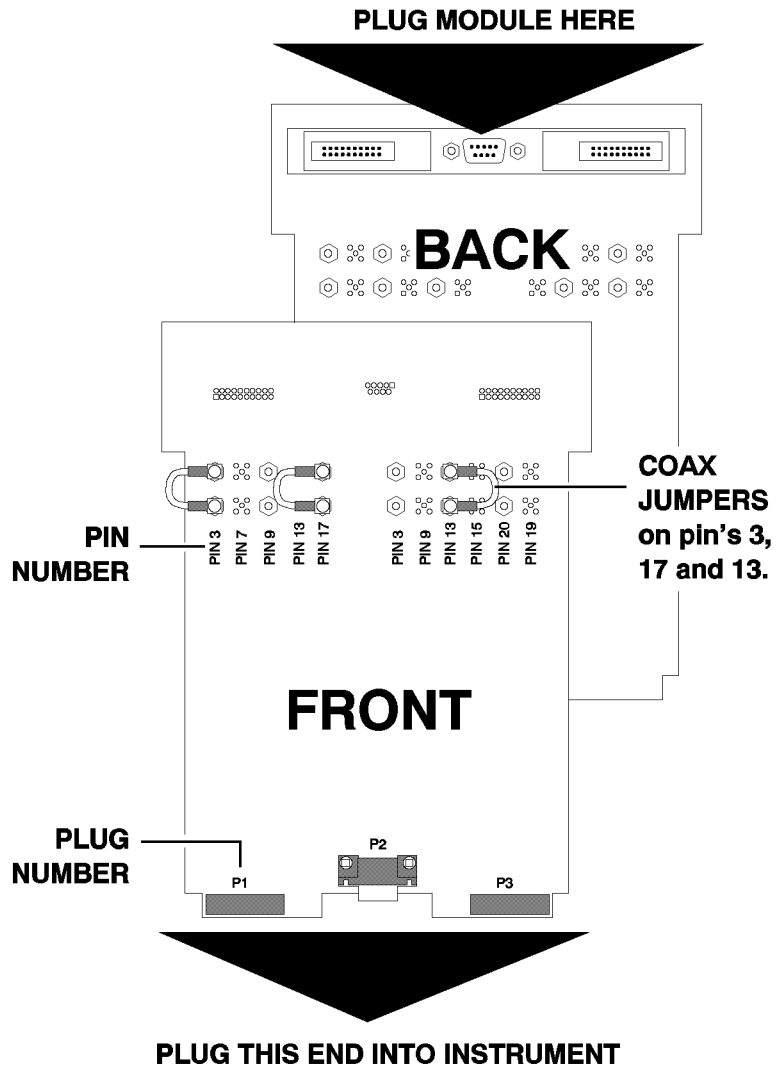


Figure 4-1

RF Extender Board

Extending Modules

The modules shown in the following table can be extended using the appropriate extender boards from the HP/Agilent 83210A Service Kit. Assemblies that cannot be extended can usually be accessed directly while the assembly is installed in the instrument.

Table 4-2

Extender Board Part Numbers

REF #	DESCRIPTION	EXTENDER
A2	Audio Analyzer 2	08920-60142
A3	Audio Analyzer 1	08920-60142
A4	Modulation Distribution	08920-60141
A5	Premod Filter and NSM	08922-60132
A6	Signaling Source / Analyzer	08920-60140
A7	Controller	08920-60133 08920-90135
A8	Memory	08922-60132
A9	Global Test and Demod	08922-60133
A13	Output	08922-60129
A14	GSM Timing Gen	08922-60129
A15	Reference	08922-60129
A16	Receiver	08922-60129
A17	Step Loop B	08922-60129
A18	Spectrum Analyzer	08922-60129
A19	Measurement	08920-60138
A20	CRT Driver	08920-60135
A25	Sum Loop	08922-60129
A26	Step Loop A	08922-60129
A27	DAC / Upconverter	08922-60129
A33	Hop Controller	08920-60133

Making Measurements

Audio / Digital Assemblies

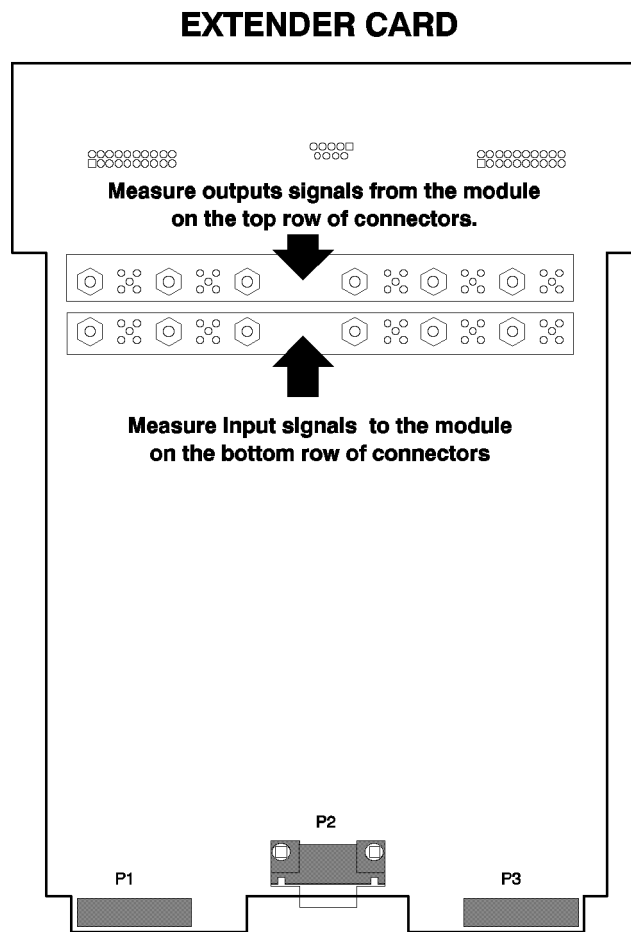
The extender boards for the audio and digital assemblies allow the boards to be extended above the instrument. This provides better access to signals going to and from these assemblies. Refer to the “Block Diagrams” (chapter 13) or “Module I/O Specs” (chapter 12) for pin numbers and typical I/O characteristics for each assembly. Use the extender board shown.

RF ASSEMBLIES

The extender boards for the RF assemblies extend the modules above the instrument. This allows better access to control signals and allows the RF input and output signal paths to be opened for making measurements. The following procedure outlines the steps necessary to make measurements on the RF modules with the RF extender board.

1. Configure the RF extender card with the proper coax jumpers. Refer to table 4-2 and figure 4-1.
2. Decide the signal path that needs to be measured. Find the correct plug number and pin number on the “Block Diagrams” (chapter 13) or “Module I/O Specs” (chapter 12).

3. Remove the correct coax jumper and connect a measurement instrument as shown in the following diagram. To measure signals going TO the module, measurements should be made on the lower row of connectors on the extender module. Outputs coming FROM the modules (going into the instrument) are measured on the top row of connectors on the extender board.



4. Turn off the instrument's power switch. Remove the module from the instrument. Install the module onto the extender board and install the extender board into the instrument.
5. Power on the instrument and make the measurements.

Using the HP/Agilent 83210A Service Kit
Making Measurements

This Page Intentionally Left Blank

Troubleshooting the Controller/Display

Introduction

This chapter helps isolate problems in the control sections of the instrument, the sections are:

- A1 Keyboard
- A7 Controller
- A8 Memory
- A20 CRT Driver
- A21 HP-IB Interface
- A33 Hop Controller

Problems in the Control sections can be broken into four types, these types are:

- Parallel Bus
- Serial Bus
- Display
- Keyboard

This chapter addresses each category in a separate section. This chapter assumes that Chapter 13, Instrument Block Diagram will be used as a reference.

Parallel Bus

The parallel bus is at the center of the control section. The parallel bus is defined as direct connections to the A7 Controller. These connections include the data bus, address bus and dedicated parallel control lines.

The assemblies on the parallel bus are:

- A1 Keyboard
- A6 Signalling Source/Analyzer
- A7 Controller
- A8 Memory
- A9 Global Test/Demod
- A19 Measurement Board
- A20 CRT Driver
- A21 GPIB Interface
- A32 GSM Controller
- A33 Hop Controller

Most problems with the parallel bus are accounted for in the power-up self-tests. The self-tests check the A7 Controller first, then the A8 Memory. If these two tests pass, the instrument will beep once after approximately 10 seconds. If these tests do not pass, the problem is probably on one of the two boards or something is pulling down the parallel bus.

The assemblies that are not directly checked by the power-on self-tests are the A1 Keyboard and the A21 GPIB Interface.

Serial Bus

The serial bus controls many of the assemblies through individual serial control lines. The serial control lines are generated at the A33 Hop Controller.

The A33 Hop Controller takes parallel data from the A7 Controller and de-multiplexes the data for the assemblies on the serial bus. In the power-up self-tests, the A33 Hop Controller and the assemblies on the serial bus are tested. If a power-up self-test serial bus failure occurs and no A33 failures have occurred, the problem could be between the A33 Hop Controller and the assembly identified in the failure.

Display

The display section contains the A22 CRT, and the A20 CRT Drive. The A20 CRT Drive receives parallel data from the A7 Controller and generates the drive signals for the A22 CRT. The A20 CRT Drive is tested during the power-up self-tests for the ability to receive data and to respond back to the A7 Controller. If the A20 CRT Drive passes the power-up self-tests and the display does not respond the signals going to the A22 CRT can be checked at J6 on the A29 Motherboard.

Line Name	Pin Number	Description
INTHIGH	J6(1)	CRT intensity reference high. Up to 100 V with respect to INTLOW. Floating with respect to ground. From the A22 CRT to bias the intensity drive circuit at the A20 CRT Drive.
INTW	J6(2)	CRT intensity control voltage. Up to 100 V with respect to INTLOW. Floating with respect to ground. From the A20 CRT Drive to the A22 CRT to vary the intensity of the display.
INTLOW	J6(3)	CRT intensity reference low. Floats with respect to ground. From the A22 CRT to the low side of the intensity drive circuit at the A20 CRT Drive.
HSYNC	J6(4)	Horizontal sync pulse for the A22 CRT. A TTL pulse at approximately 19 kHz. From the A20 CRT Drive to the A22 CRT. The HP/Agilent 8922F/H/M/S use a 15 kHz PAL signal.
+12CRT	J6(5)	Filtered +12AUX for the A22 CRT. There is a 20 kHz low pass filter on the A29 Motherboard to filter the +12AUX for the A22 CRT.
VID	J6(6)	Video signal for the A22 CRT. A TTL signal to turn the signals off and on. The rate is approximately 6.25 MHz. From the A20 CRT Drive to the A20 CRT.
VSYNC	J6(7)	Vertical sync pulse for the A22 CRT. A TTL signal from the A20 CRT Drive to the A22 CRT at a rate of approximately 60 Hz.
GND	J6(8)	

Keyboard

The A1 Keyboard assembly contains both the keys and the knob. The keyboard is configured in a matrix with the rows being scanned with pulses from the A7 Controller and the columns being read by the controller. The column lines are pulled up through resistors and are pulled low when a key is pressed. The A7 Controller determines which key is being pressed by reading which column line is pulled low and which row the column line is being pulled low through. Since the row outputs are tri-state, the low-going pulses are not seen on the output until a key is pressed and the current path is completed.

The keyboard can be checked with an oscilloscope by disconnecting the ribbon cable from the keyboard and checking for the pull-up voltages on the column pins. Then with the keyboard connected, check that the lines are being pulled low at the A7 Controller connector J4. The pin numbers on A7-J4 are the same as those on A1-J1. The ribbon cable connector has a mark to indicate to pin 1. Pin 2 is directly opposite pin 1.

Table 5-1

HP/Agilent 8922E/F/G/H/M/S Keyboard (HP/Agilent 8922 A/B keys shown in parenthesis)

Column 0 Pin 9	Column 1 Pin 10	Column 2 Pin 11	Column 3 Pin 12	Column 4 Pin 13	Column 5 Pin 14
CELL CONFIG (RF GEN/ RF ANL)	ORGCALL (K1)	RCVCALL (K2)	ENDCALL (K3)	L1(K4)	L2(K5)
CELL CNTL (HOP CNTRL)	INCR÷10	down arrow	not used	SHIFT	CANCEL
MEAS SYNC	INCRSET	PRESET	not used	not used	not used
PREV	INCR×10	up arrow	not used	not used	leftarrow
TESTS	7	4	1	0	ON/OFF
MEAS ARM	8	5	2	.	ppm W
RECALL	9	6	3	+/-	% dBμV
LOCAL	ENTER	GHZ dBm	MHz V	kHzmV	Hz μV

If the pull-up voltages are present at the end of the ribbon cable and the voltages are not pulled down when a key is pressed, the problem is most likely on the A1 Keyboard assembly. If the pull up voltages are present and are pulled down when a key is pressed but the controller does not respond, the problem is most likely at the A7 Controller assembly.

The knob can be checked with an oscilloscope at the J4 connector on the A7 Controller. When the knob is turned, pulses should be present on A7-J4 pins 19 and 21. When the knob is pushed the level at A7-J4 pin 23 should change states. The A1 Keyboard end of the ribbon cable should also be checked for +5 V on pins 15 and 16. If the signals are getting to the A7 Controller the problem is most likely at the A7 Controller assembly.

Where to Go Next

If either the A1 Keyboard or A7 Controller assemblies measured in-correctly, go to chapters 8 and 9.

Troubleshooting the Controller/Display
Keyboard

This Page Intentionally Left Blank

Troubleshooting the Power Supply

Introduction

This chapter helps verify that the power supply is at fault when no indication for power is present upon power-up. If the power supply appears defective, the problem can be localized to the line module, mains (line) fuse, transformer, power supply, regulator, motherboard, or power switch. This chapter is arranged to check each section of the power supply. The views of the instrument in this chapter are both top and bottom views with the covers removed. Refer to chapter 8 “Assembly/Disassembly” for help in removing the covers.

NOTE

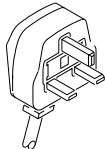
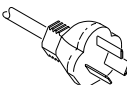
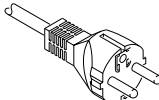
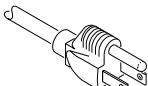
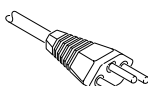
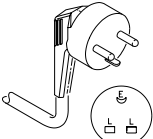
The mains (line) fuses and power supply DC fuses in the HP/Agilent 8922 are all fast-blow fuses (not “slow-blow”).

Power Cord Verification

Use this diagram to verify that the correct line cord is being used.

Table 6-1

Line Cords

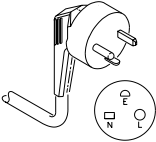
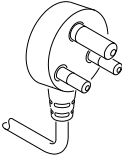
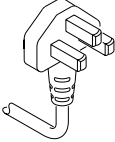
Plug Type	Cable Agilent Part Number	C D	Plug Description	Length, inches (mm)	Cable Color	For Use In Country
	8120-1351 8120-1703	0 4	90/Straight BS1363A ^a 90	90 (229) 90 (229)	Mint Gray Mint Gray	United Kingdom, Cyprus, Nigeria, Rhodesia, Singapore
	8120-1369 8120-0696	0 4	Straight NZSS198/ASC112 ^a Straight/90	79 (201) 87 (221)	Gray Gray	Australia, Argentina, New Zealand, Mainland China
	8120-1689 8120-1692	7 2	Straight 90	79 (201) 79 (201)	Mint Gray Mint Gray	East and West Europe, Central African Republic, Arabia, Egypt
	8120-1378 8120-4753 8120-1521 8120-4754	1 6 1	Straight NEMA5-15P ^a Straight 90 90	80 (203) 90 (230) 80 (203) 90 (230)	Jade Gray Jade Gray Jade Gray	United States, Canada, Mexico, Phillipines, Taiwan, Japan
	8120-1348 8120-1538	2 3	Straight 90	80 (203) 80 (203)	Dark Gray Dark Gray	
	8120-2104	3	Straight SEV 1011 1959-24507, Type 12	79 (201)	Gray	Switzerland
	8120-2296	4	Straight/90	79 (201)	Gray	
	8120-3997	4	Straight/90	177 (402)	Gray	
	8120-0698	6	Straight/NEMA6-15P	90 (230)	Black	United States, Canada

Continued Over

Troubleshooting the Power Supply
Power Cord Verification

Table 6-1

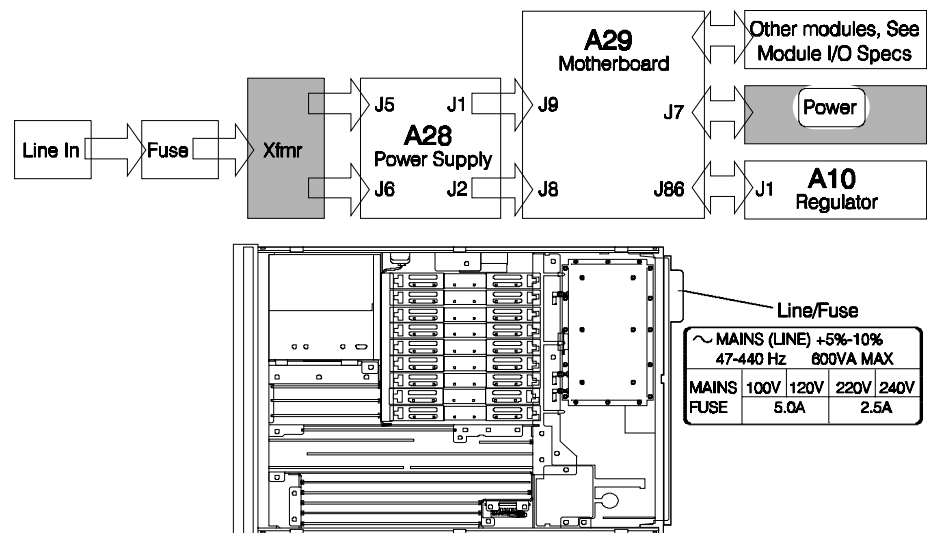
Line Cords

Plug Type	Cable Agilent Part Number	C D	Plug Description	Length, inches (mm)	Cable Color	For Use In Country
	8120-2956 8120-2957 8120-3997	3 4 4	90/Straight 90/90 Straight/Straight	79 (201)	Gray Gray Gray	Denmark
	8120-4211 8120-4600	7 8	Straight IEC83-B1 ^a Straight/90	79 (201) 79 (201)	Black Gray	South Africa, India
	8120-1860 8120-1575 8120-2191 8120-4379	6 0 8 8	Straight CEE22-V1 (Systems Cabinet Use) Straight/Straight Straight/90 90/90	59 (150) 31 (79) 59 (150) 80 (203)	Jade Gray Jade Gray Jade Gray	

a. Part number shown for plug is industry identifier for plug only. Number shown for cable is Agilent Part Number for complete cable including plug. E = Earth Ground; L = Line; N = Neutral.

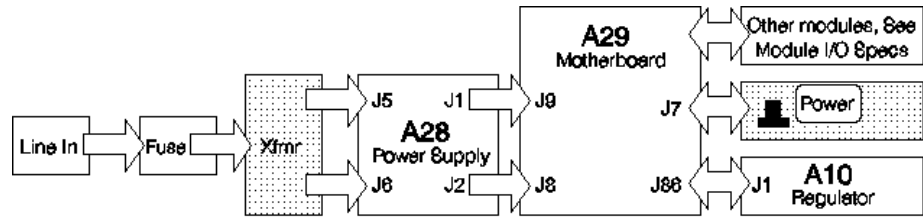
Line Voltage Selection / Line Fuse Replacement

Use this diagram to verify that the line module is set to the correct line voltage, that the fuse is not blown, and that it is the correct value.

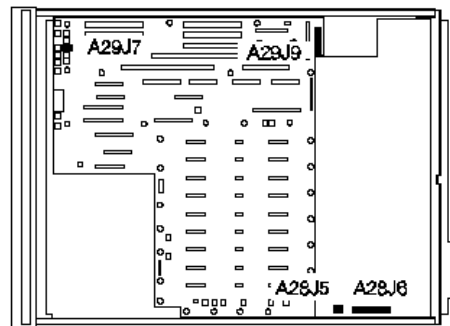
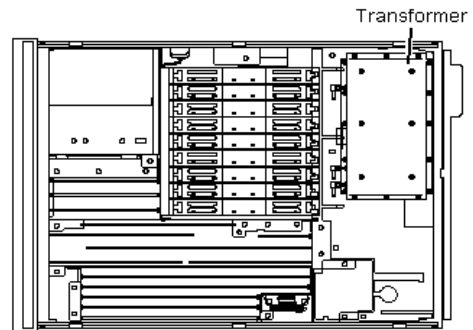


Transformer / Power Switch

Use this diagram to verify that the correct voltages are present when the instrument's power cord is connected. The table shows the expected values and pin numbers.

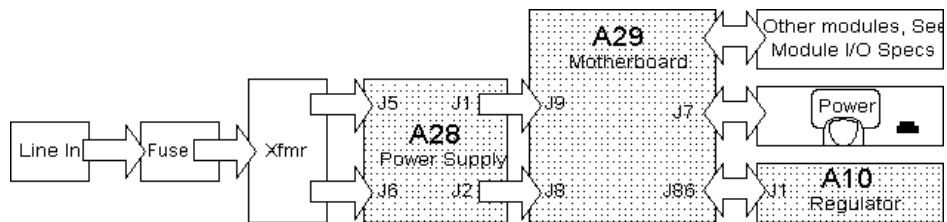


	Unswitched Voltage	Pin Number(s)
A28J5	50Vp AC	1,2
A28J6	45Vp AC	3,5
	35Vp AC	1,2
	25Vp AC	6,7,10,11
	Ground	4,8,9
A29J7	+10	4
A29J9	+30	8
	+21	26
	+10	25



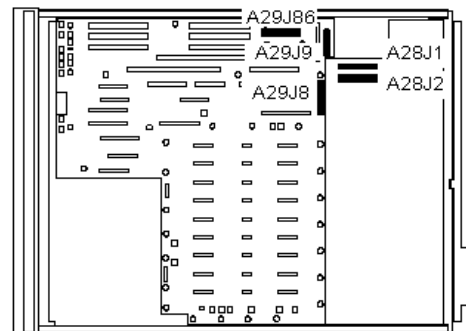
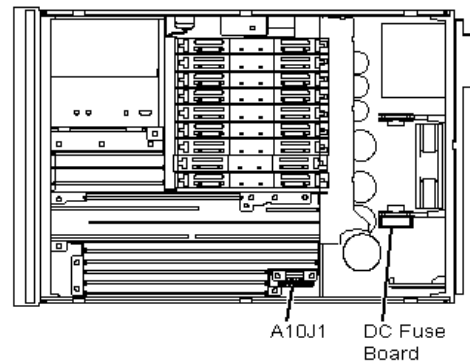
A28 Power Supply

Use this diagram to verify that the regulated voltages are present and correct at the output of the power supply board, and at the mother board connection to the regulator. Use this diagram also to check the fuses on the fuse board. The tables show the voltages, connectors, pin numbers, and fuse values.



	Voltage	Pin Number(s)
A10J1 A29J86	+15	1,4,5
	+12.6	8
	-15	3
	-12.6	9
A28J2 A29J8	+15	5
	+12	3
	+5	7,8
	-15	4
	-5	2
A28J1 A29J9	+38	15
	+21	26
	+15	16-18
	+12	21,22
	+5	9-14
	-15	19,20
	-5	23,24

	Amps	Fuse
DC Fuse Board	5A	F1
	3A	F2,4,6



Where To Go Next

If any part of the power supply is defective refer to chapter 8 “Assembly/Disassembly” and chapter 9 “Replacing a Part” for removal and replacement. After the power supply is repaired, go to chapter 1 “Localizing the Problem” to verify that no other problems exist.

Adjustments and Calibration

Introduction

This chapter contains information to perform the necessary calibrations and adjustments for periodic maintenance or following repairs. Each year the timebase and periodic calibration adjustments should be performed. Also, the overall performance of the instrument should be verified each year with the automated performance tests in chapter 3 “Running Performance Tests”.

The calibrations and adjustments covered in this chapter are divided into three sections:

- Timebase Adjustments
 - Standard Timebase
 - Optional High Stability Timebase
- Periodic Calibrations (ROM based)
 - Voltmeter Reference
 - Audio Frequency Generator Gain
 - External Modulation Path Gain
 - Audio Analyzer 1 Offset
- Sum Loop Adjustment Procedure

Timebase Adjustments

Standard Timebase Adjustment Procedure (Reference Calibration)

NOTE

This procedure should only be performed after the instrument has warmed up at least 30 minutes. It should be performed after replacement of the reference section A15, or if the instrument gives an error message “Frequency reference cal lost. Perform reference calibration.”

1. Connect a 10 MHz source to the rear panel REF IN connector.
2. On the configuration screen, select the “Calibrate” field.
3. Wait approximately 15 seconds; the reference will be calibrated.

Option 001 High Stability Timebase Adjustment Procedure

1. Remove the instrument top cover. Power up the instrument and let it warm up for approximately 1 hour.
2. Remove the rear-panel cable between the Opt. 001 REF OUT and REF IN connectors (if present).
3. Attach a high accuracy frequency counter to the rear panel OPT 001 REF OUT. The frequency counter resolution and accuracy should be at least 1 Hz at 10 MHz.
4. Adjust the high stability timebase (see figure 7-1) until the frequency counter reads 10 MHz.

NOTE

After performing this calibration, it is necessary to install a cable from the OPT 001 REF OUT to the REF IN connector for the instrument to use the high stability timebase as the reference.

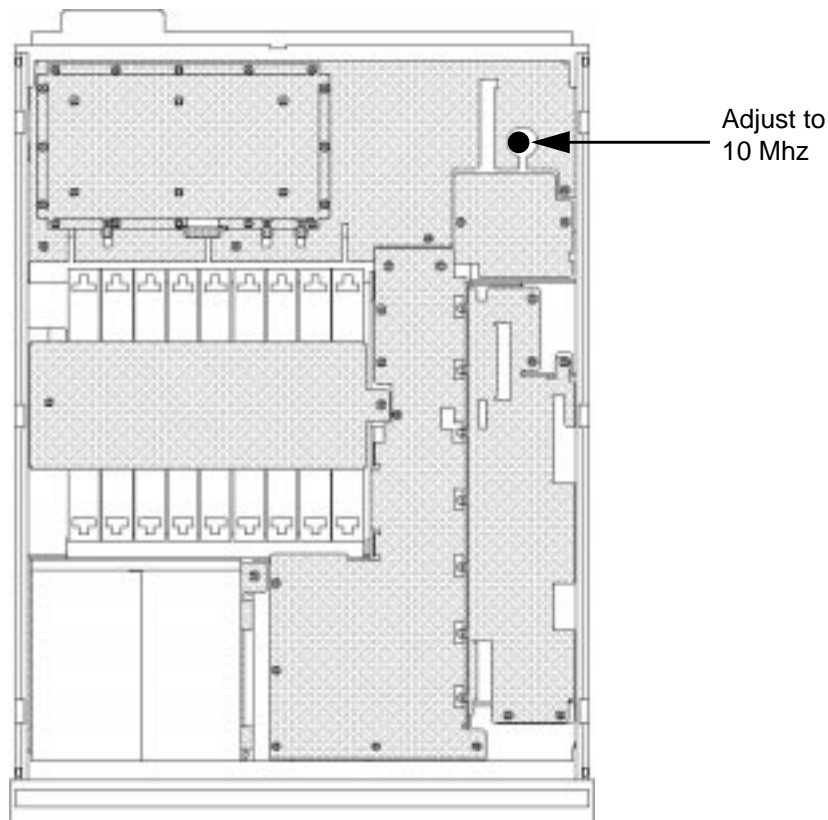


Figure 7-1

High Stability Timebase Adjustment

Periodic Calibrations

To Run the Periodic Self-Calibration Program

1. Press **TESTS** to access the **TESTS** screen.
2. Select the field to the right of the colon under **Procedure**.
3. Select **ROM** under the **Choices:** menu.
4. Select the field to the left of the colon under **Procedure**.
5. Select **PER_CAL** under the **Choices:** menu.
6. Select **RUN TEST**.
7. Follow the instructions on the screen.

Sum Loop Adjustment Procedure

This procedure should be performed whenever Step Loop A Assembly (A26) or Sum Loop Assembly (A25) is replaced. It is not necessary to perform this adjustment for a periodic calibration.

A spectrum analyzer is required to measure the instrument's output during these procedures. It is recommended to use a synthesized spectrum analyzer if possible.

Procedure:

1. Turn off the HP/Agilent 8922.
2. Remove the instrument top cover and the DAC/Upconverter Module (A27). (It is necessary to remove the RF Cover plate that holds the module in the instrument.)
3. Power up the instrument, select the RF GENERATOR/RF ANALYZER screen, and set the RF Gen Amplitude to -20 dBm at the RF IN/OUT connector.
4. Prepare the spectrum analyzer. Set the reference level to -10 dBm. Connect the HP/Agilent 8922 RF IN/OUT to the spectrum analyzer input.

First Adjustment

5. Again from the RF GENERATOR screen, set the HP/Agilent 8922 frequency to 800 MHz.
6. Set the spectrum analyzer center frequency to 786.6 MHz. (The output from the HP/Agilent 8922 is 13.4 MHz lower than was entered because the DAC/Upconverter is gone).
7. Set the spectrum analyzer span to 10 MHz per division. ADJUST R32 "OFFSET" on top of Sum Loop (A25) until the signal on the spectrum analyzer is between 776.6 and 796.6 MHz.
8. Reduce the spectrum analyzer span to 1 MHz per division and adjust R32 again until the signal on the spectrum analyzer is centered within 2 divisions (2 MHz).

NOTE

Some modules (prefix 3050A and lower) only need to be centered within 10 MHz for all of these adjustments.

Second Adjustment

9. Now set the HP/Agilent 8922 frequency to 502 MHz.
10. Set the spectrum analyzer center frequency to 488.6 MHz with a span of 10 MHz per division.
11. Adjust R180 "GAIN" on top of Sum Loop (A25) until the signal on the spectrum analyzer is centered within 10 MHz.
12. Reduce the spectrum analyzer span to 1 MHz per division, and adjust R180 again until the signal on the spectrum analyzer is centered within 2 divisions (2 MHz).

Final Adjustment

13. Set the HP/Agilent 8922 frequency to 1000 MHz.
14. Set the spectrum analyzer frequency to 986.6 MHz, then set the span to 10 MHz per division.
15. Adjust R160 "KNEE GAIN" on top of Sum Loop (A25) until the signal on the spectrum analyzer is centered within 1 division (10 MHz).
16. Reduce the spectrum analyzer span to 1 MHz per division, then adjust R160 again until the signal on the spectrum analyzer is centered within 2 divisions (2 MHz).

Final Check

17. Repeat the above procedures until all three adjustments pass without any further fine tuning.
18. Turn the instrument power off and reinstall the DAC/Upconverter Module. The adjustment is now complete.

Adjustments and Calibration
Sum Loop Adjustment Procedure

This Page Intentionally Left Blank

Assembly and Disassembly Procedures

Introduction

Removing and replacing assemblies is straightforward. This chapter contains tool lists, hints and drawings to help you do it effectively. Detailed step-by-step procedures are not given for all assemblies.

After replacing certain assemblies you will need to load new calibration data into the HP/Agilent 8922 or perform adjustments. The calibration data is supplied on a Memory Card that is included with the replacement assembly.

Refer to chapter 9, “Replacing a Part”, for information about adjustments that are required after replacing certain assemblies.

CAUTION

Perform the following procedures only at a static safe work station. The printed circuit assemblies in this instrument are very sensitive to STATIC ELECTRICITY DAMAGE. Wear an anti-static wrist strap that is connected to earth ground.

Recommended Torque

1. Screws: Tighten until just snug.
2. RF connectors (SMC SMA): 62 N-cm (5.5 lb-in.)
3. Nuts holding semi-rigid coax: 51 N-cm (4.5 lb-in.)

Further Information

For further information, refer to chapter 9. This chapter contains more information about:

- Part numbers for replaceable parts.
- Ordering information.
- Adjustments required after assemblies are replaced.

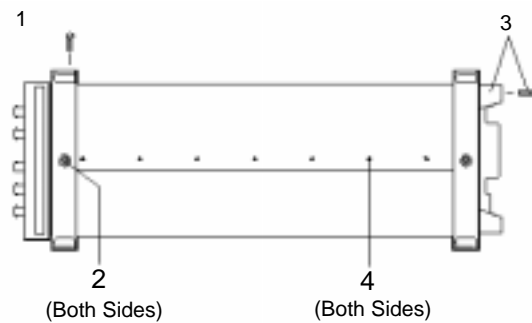
Top and Bottom Cover Removal

1. Remove four 2-pt. Pozidriv top bumper mounting screws.
2. Remove four 2-pt. Pozidriv side mounting screws and bumpers.
3. Remove four 2-pt. Pozidriv screws and standoffs.
4. Remove fourteen TX-10 screws and top cover.
5. Remove two TX-10 screws and bottom foot.
6. Remove two TX-15 screws and bottom cover.

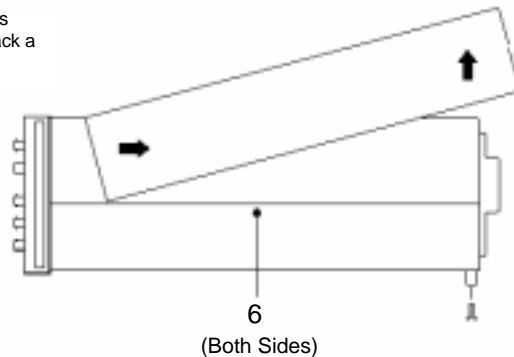
Tools Required

- TX-15 screw driver
- TX-10 screw driver
- 2-pt. Pozidriv screw driver

SIDE VIEW

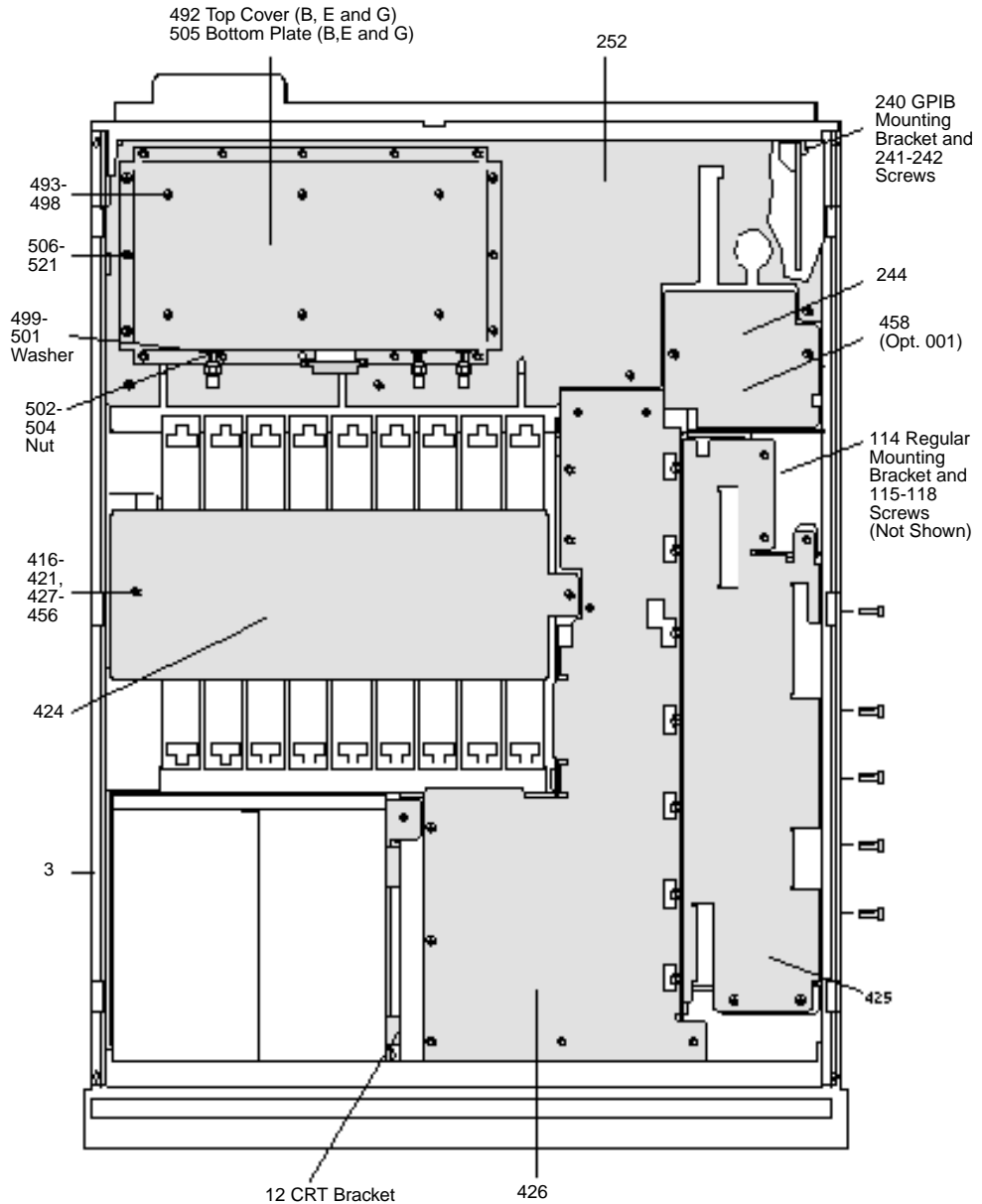


To remove covers, pull sides slightly apart, slide them back a few inches and lift off.

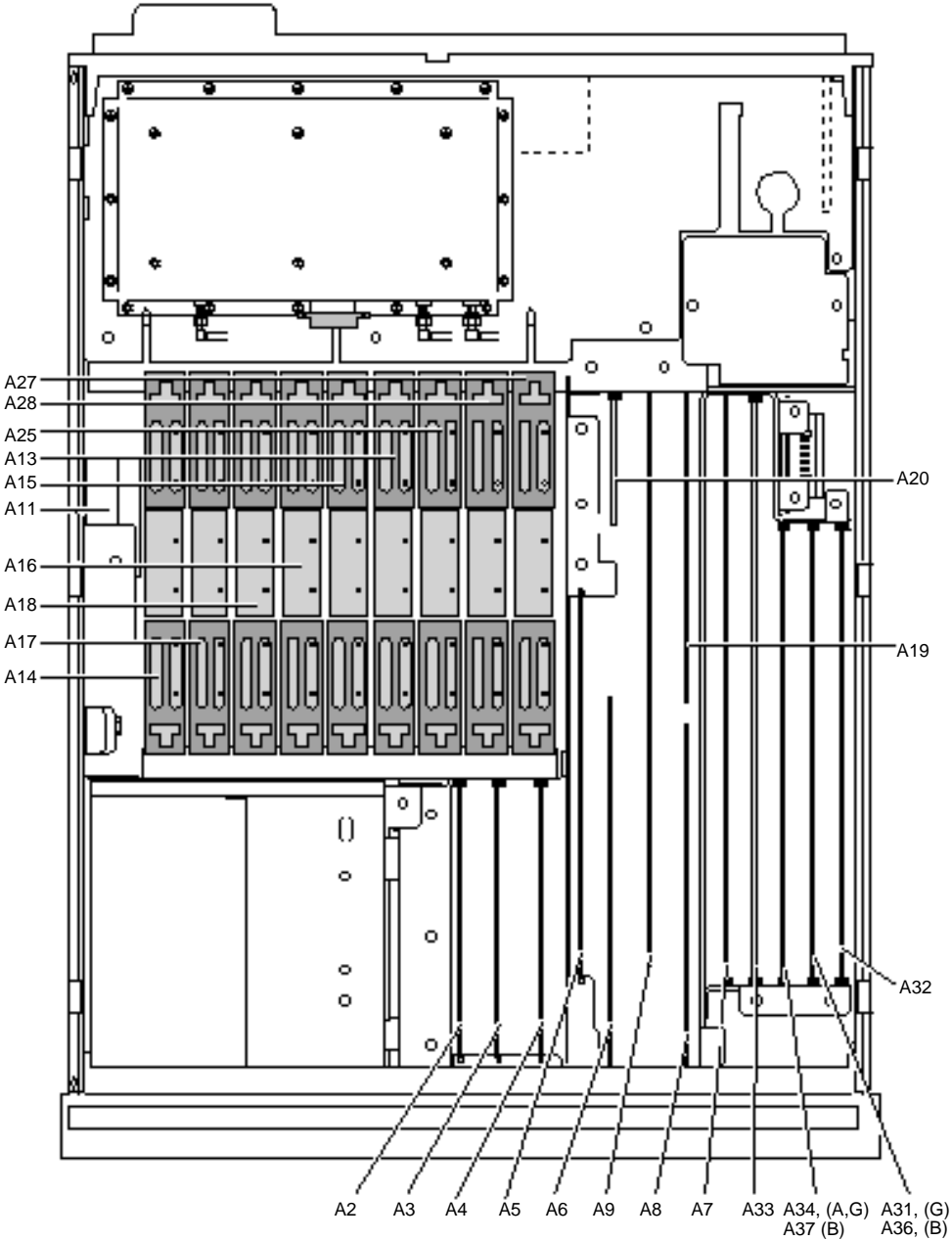


Inside Protective Covers

All covers can be removed with a TX-15 screw driver. Screws shown circled only require loosening.

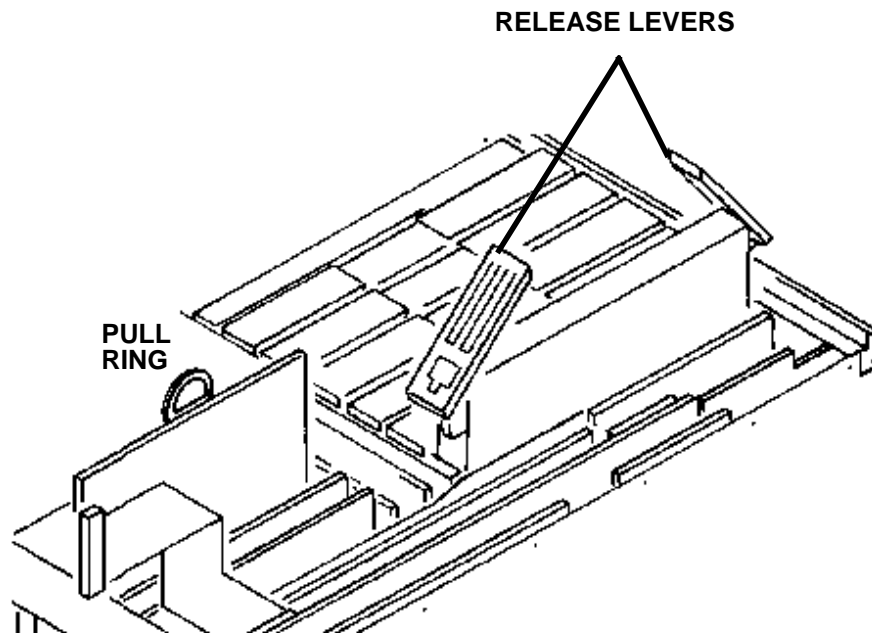


AF, Digital and RF Assemblies Removal



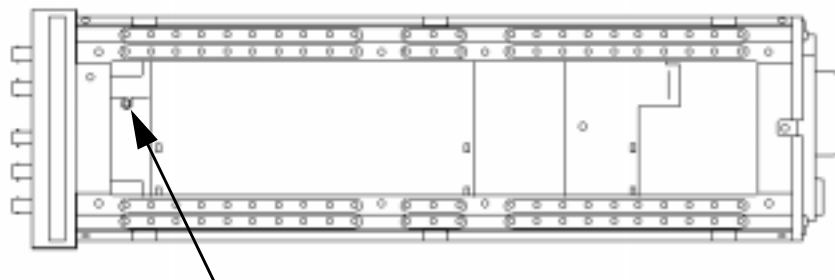
Assembly and Disassembly Procedures
AF, Digital and RF Assemblies Removal

This can only be done once the top cover and inside protective covers have been removed.



CAUTION

Before pulling ring on the A8 Memory Board loosen the securing screw.



Use a TX-10 Torx head screwdriver to loosen.

A1 Front Panel Removal

Done with top, bottom, and inside protective covers removed.

Removing Modules

1. Remove RF cover.
2. Remove RF modules.

Disconnecting Cables

3. Disconnect RF cable on mixer assembly. (1/4-inch SMA connector)
4. Disconnect cable from connector J77 on motherboard.
5. Disconnect top cable from pulse switch.
6. Disconnect cable from connector J6 on motherboard.
7. Disconnect cable from connector J5 on motherboard.
8. Disconnect ribbon cable from front panel.

Detaching Front Panel

9. Remove TX-15 top CRT mounting screw.
10. Remove 2 TX-15 side CRT mounting screws.
11. Remove 8 TX-10 front panel mounting screws. (both sides)

NOTE

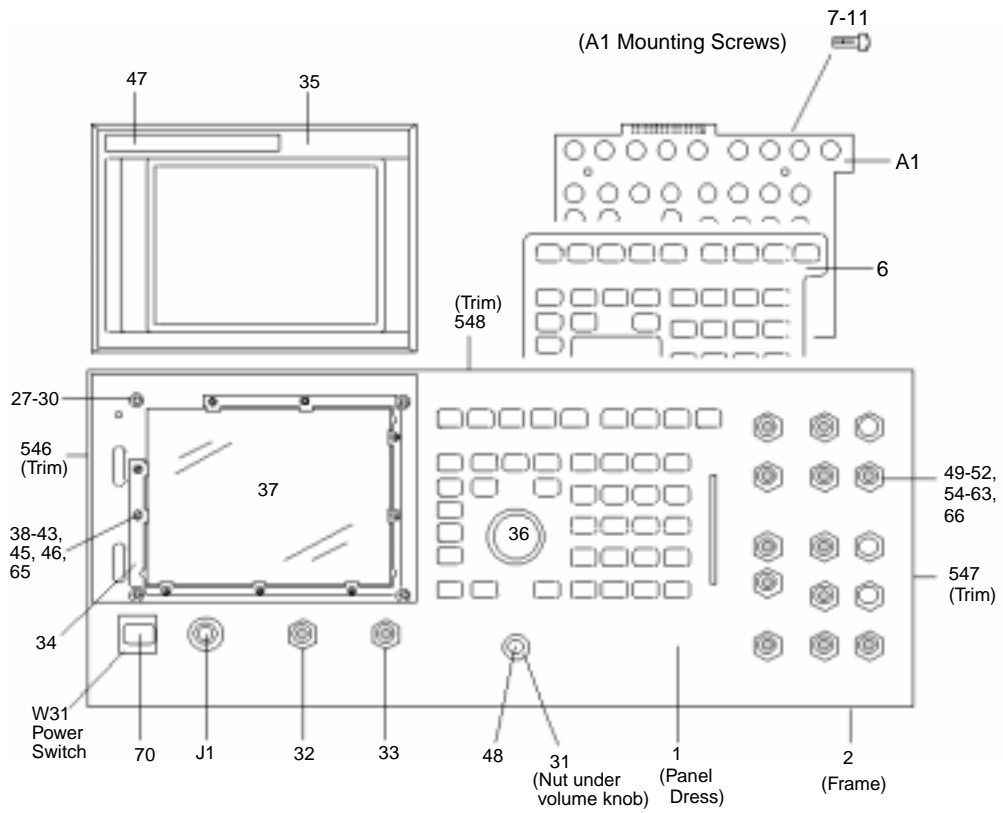
Steps 12 and 13 are necessary only when complete removal of the front panel is desired. Most repairs can be made without completing these steps.

12. Remove 15 5/8-inch hex nuts.
13. Pull front panel assembly away from chassis until speaker assembly is visible. Remove 3 TX-10 mounting screws and disconnect the speaker cable from J7 on motherboard.

Tools Required

- TX-15 screw driver
- TX-10 screw driver
- 2-pt. Pozidriv
- 5/8-inch wrench
- 1/4-inch wrench

A1 Front Panel Removal



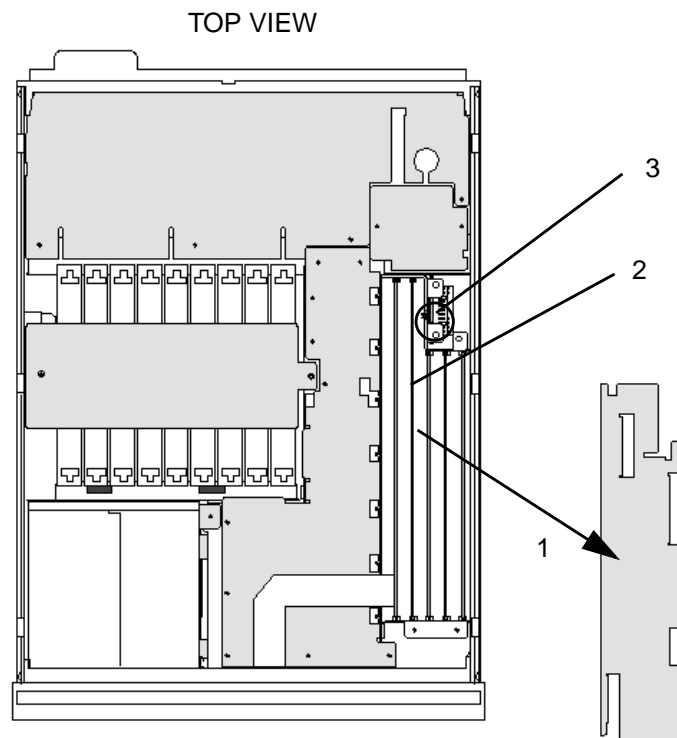
A10 Power Supply Regulator Removal

Done with top cover removed.

1. Remove Digital cover.
2. Remove A33 Hop Controller to expose A10 screw.
3. Loosen TX-15 screw.
4. Disconnect attached cable and remove power regulator.

Tools Required

- TX-15 screw driver
- TX-10 screw driver
- 1/4-inch wrench



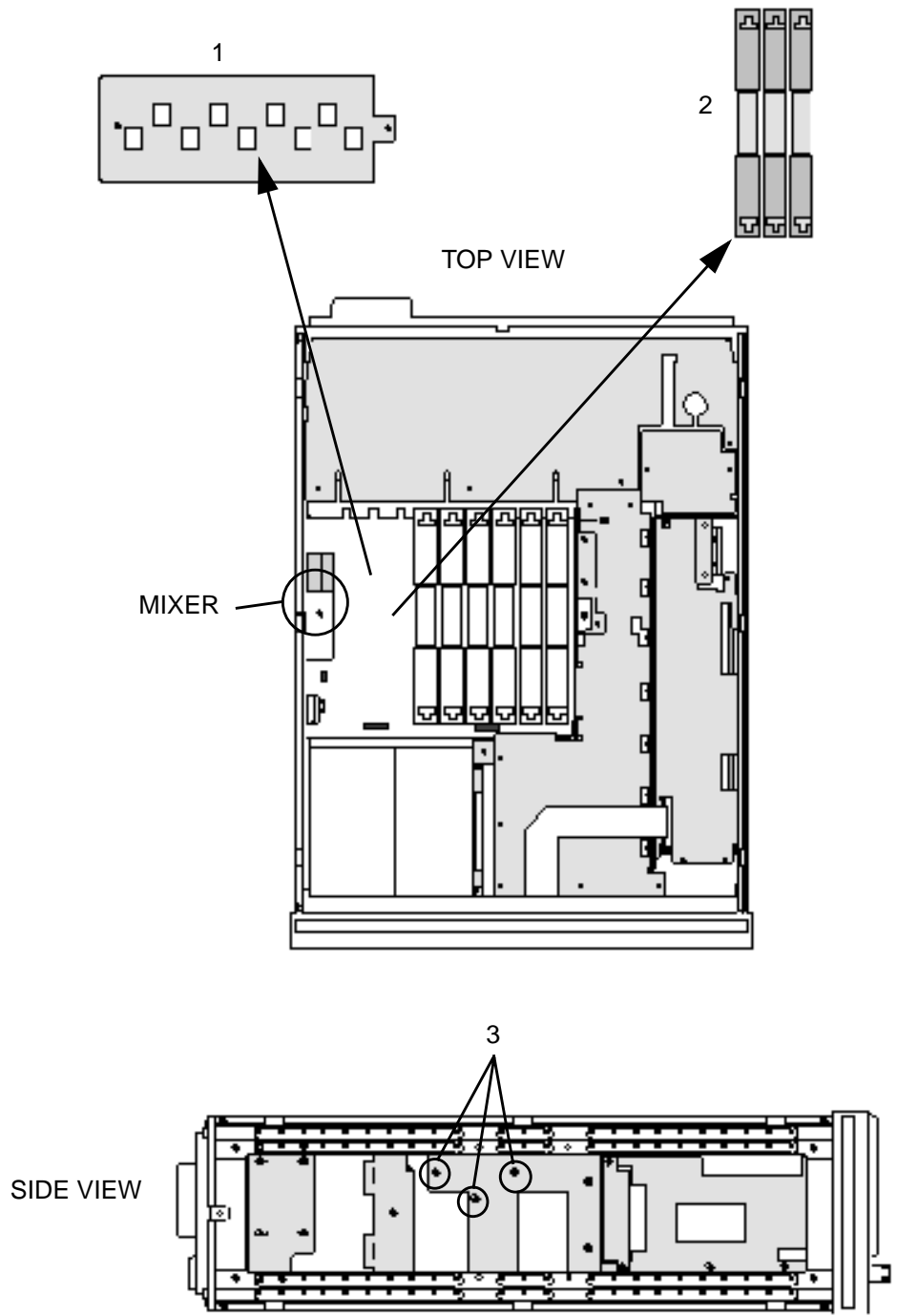
A11 Receiver Mixer Removal

Done with top cover removed.

1. Remove RF cover.
2. Remove at least three RF modules.
3. Remove three TX-10 screws.
4. Disconnect all cables and remove the A11 Receiver Mixer assembly.

Tools Required

- TX-15 screw driver
- TX-10 screw driver
- 1/4-inch wrench



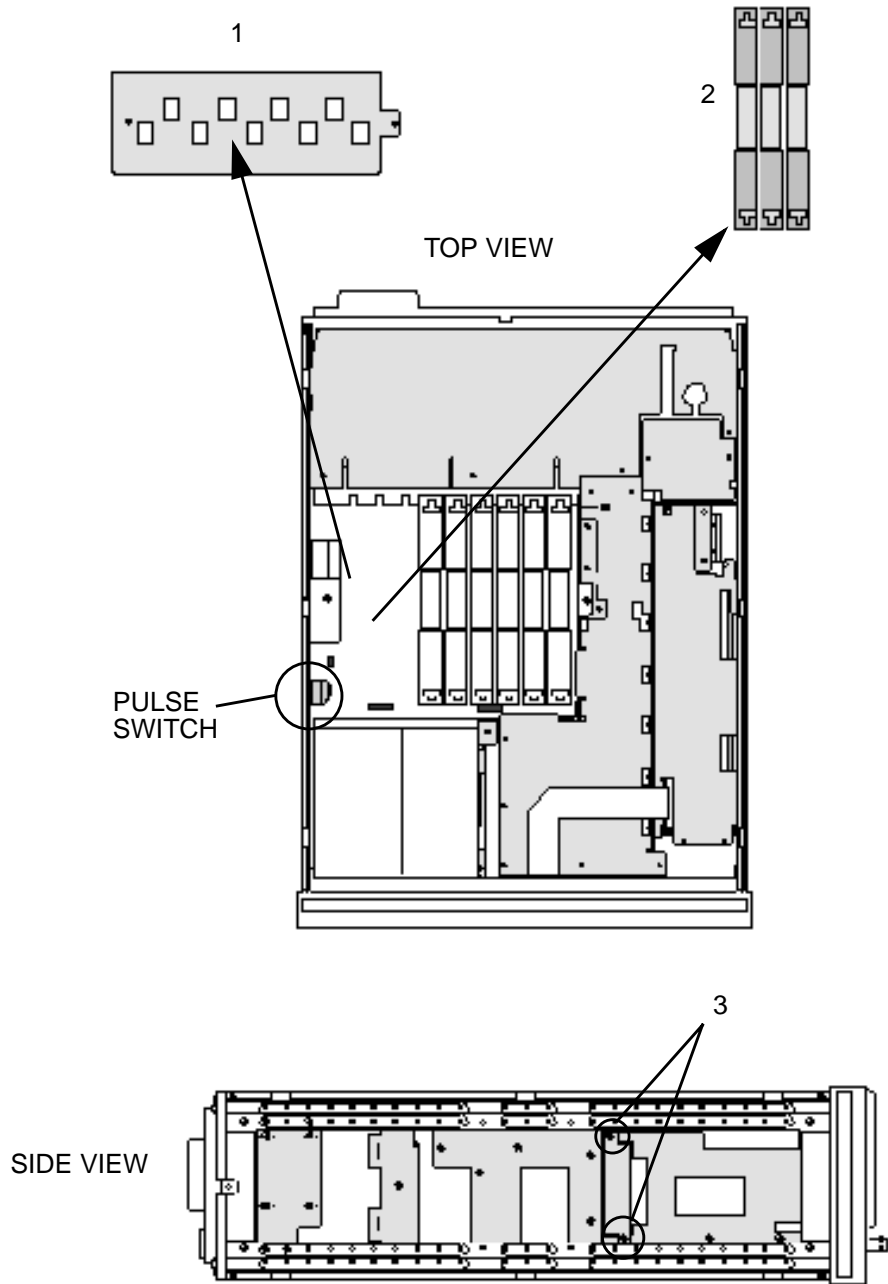
A12 Pulse Attenuator Removal

Done with top cover removed.

1. Remove RF cover.
2. Remove at least three RF modules.
3. Remove two TX-10 screws.
4. Disconnect all cables and remove A12.

Tools Required

- TX-15 screw driver
- TX-10 screwdriver
- 1/4-inch wrench



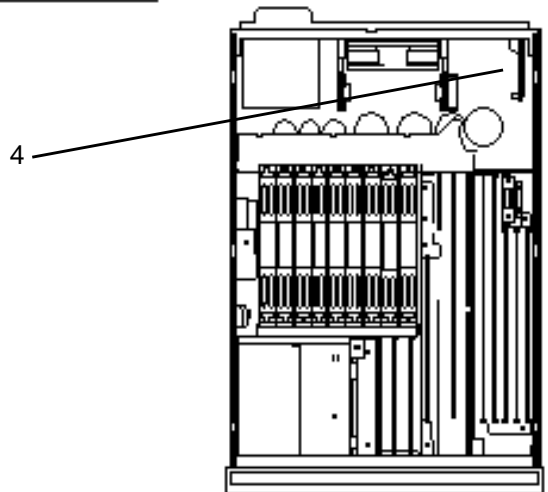
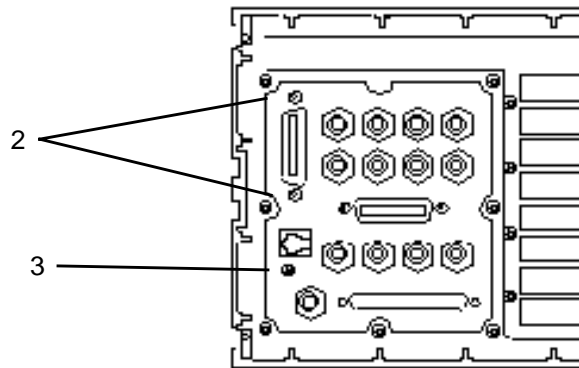
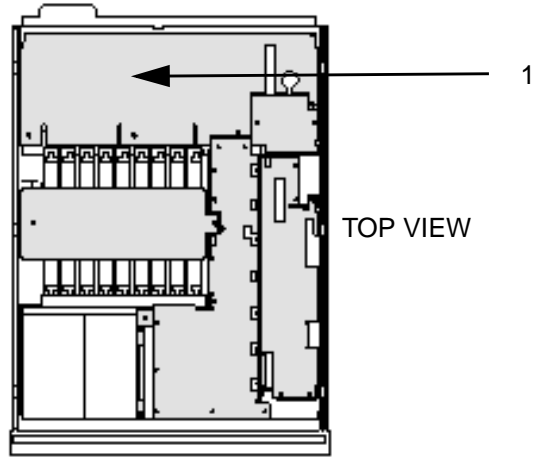
A21 GPIB Interface Removal

Done with top cover removed.

1. Remove four TX-15 power supply cover screws.
2. Remove two 7mm bolts.
3. Remove one TX-10 screws.
4. Disconnect ribbon cable.

Tools Required

- TX-15 screw driver
- TX-10 screw driver
- 7mm wrench



A22 Display Removal

Done with instrument top and bottom covers removed.

1. Do steps 1 through 11 of the A1 Front Panel removal instructions.

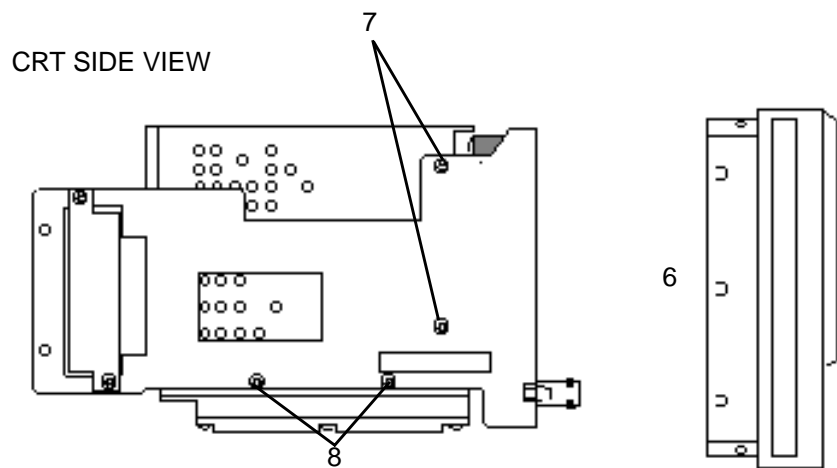
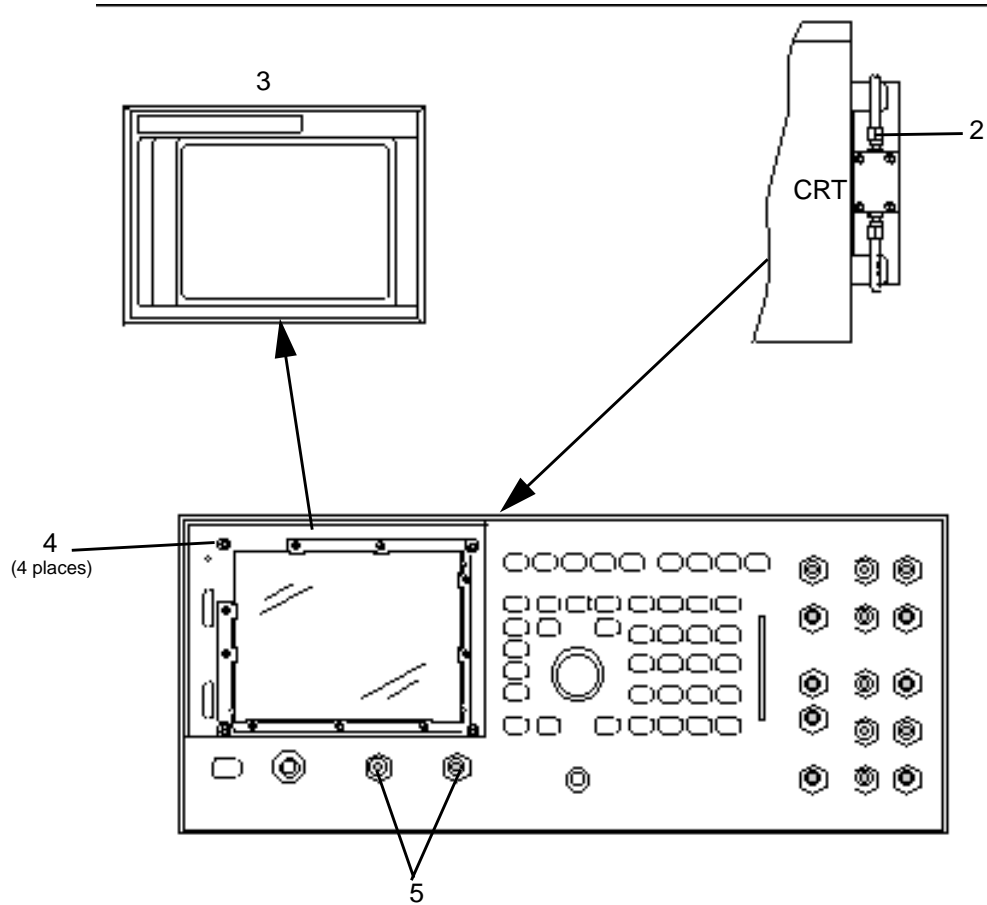
NOTE

The front panel assembly must be separated from the main chassis. Considerable pulling force is required to pull the front panel from the chassis.

2. Disconnect RF cable. (5/16-inch SMC connector.)
3. Remove front bezel. (Slide a flat-blade screw driver under the left bottom corner of the bezel and pry it forward until it pops loose.)
4. Remove four TX-15 front panel mounting screws.
5. Remove two 5/18-inch hex nuts.
6. Pull the CRT assembly and the front panel apart. (Be careful not to damage RF cabling.)
7. Remove four TX-15 CRT bracket mounting screws.
8. Loosen two TX-15 input mounting screws.
9. Slide the monitor out of the CRT shield.

Tools Required

- TX-15 screw driver
- TX-10 screw driver
- 2-pt. Pozidriv
- 5/8-inch wrench
- 1/4-inch wrench
- 5/16-inch wrench
- flat blade screw driver



A23 Input Section Removal

Done with instrument top and bottom cover removed.

1. Do steps 1 through 11 of the A1 Front Panel removal instructions.

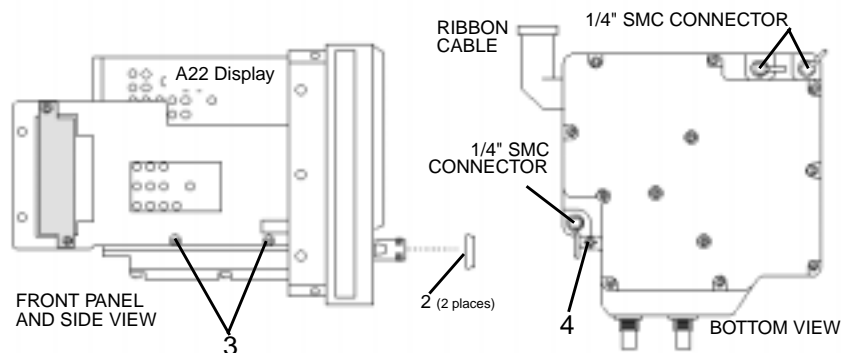
NOTE

The front panel assembly must be separated from the main chassis. Considerable pulling force is required to pull the front panel from the chassis.

2. Remove two 5/8-inch hex nuts.
3. Remove two TX-15 side mounting screws.
4. Remove one TX-15 bottom mounting screw.
5. Disconnect all cabling and remove input section assembly.

Tools Required

- TX-15 screw driver
- TX-10 screw driver
- 2-pt. Pozidriv
- 5/8-inch wrench
- 1/4-inch wrench



A24 Attenuator Removal

Done with instrument top and bottom covers removed.

1. Do steps 1 through 11 of the A1 Front Panel removal instructions.

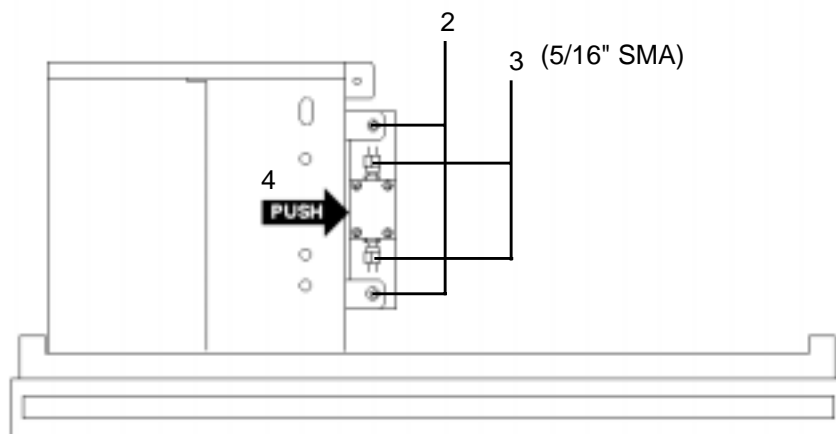
NOTE

The front panel assembly must be separated from the main chassis. Considerable pulling force is required to pull the front panel from the chassis.

2. Remove two TX-15 attenuator mounting screws.
3. Disconnect two RF cables. (5/16-inch SMA connectors.)
4. Push the top of the attenuator firmly away from the CRT until it becomes free.

Tools Required

- TX-15 screw driver
- TX-10 screw driver
- 2-pt. Pozidriv
- 5/8-inch wrench
- 1/4-inch wrench
- 5/16-inch wrench



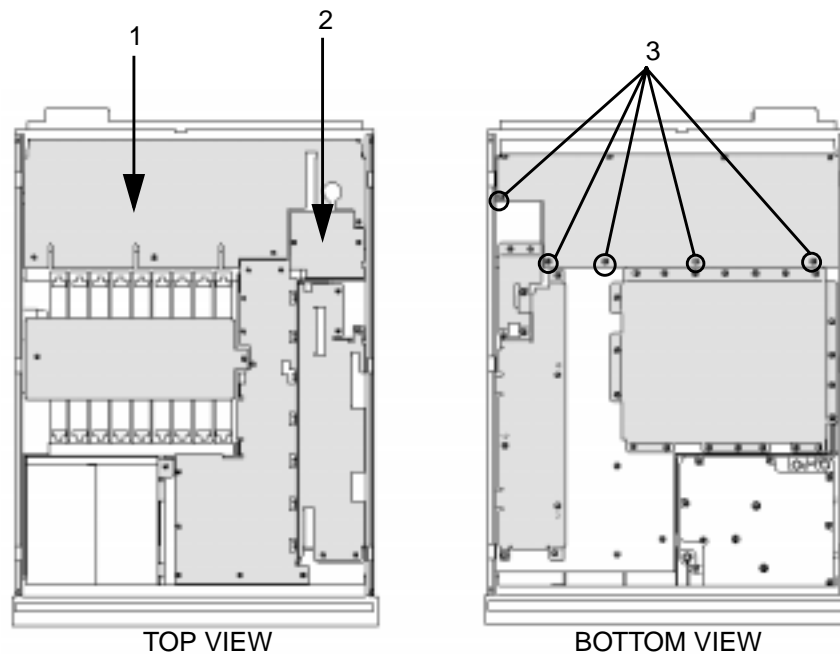
A28 Power Supply Removal

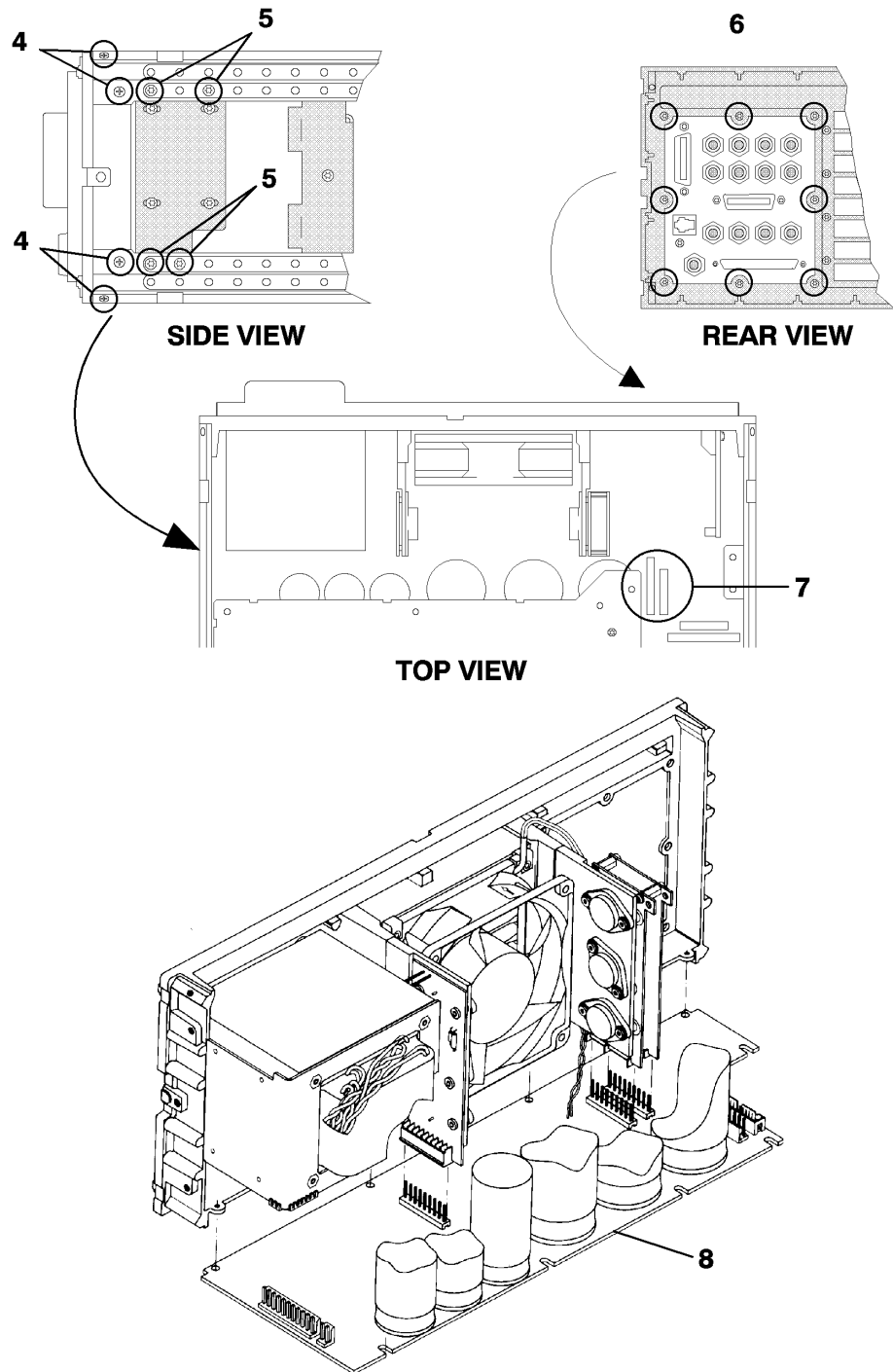
Done with instruments top and bottom covers removed.

1. Remove power supply cover.
2. Remove standard plate. If installed remove option 001.
3. Remove five TX-10 screws that attach power supply board to the main chassis.
4. Remove the eight 2-pt. Pozidriv rear panel mounting screws (four on each side).
5. Remove the four TX-10 transformer mounting screws.
6. Remove the eight TX-10 connector plate mounting screws.
7. Disconnect cables from connectors J1 and J2.
8. Carefully slide power supply away from instrument.

Tools Required

- TX-15 screw driver
- TX-10 screw driver
- 2-pt. Pozidriv





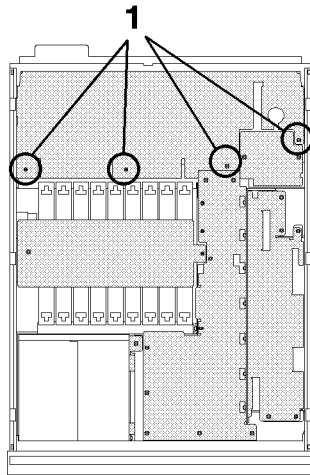
Fan Removal

Done with top cover removed.

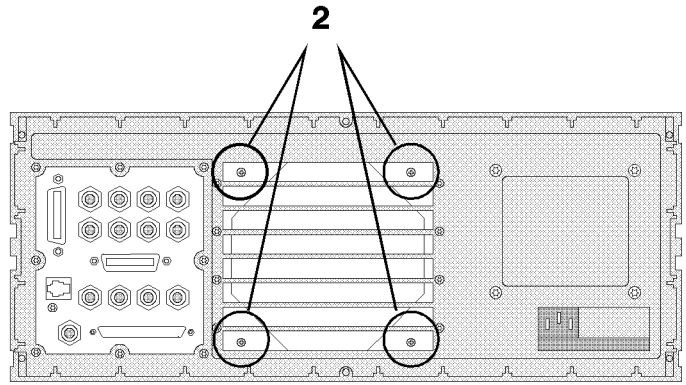
1. Remove four TX-15 power supply cover screws and remove cover.
2. Remove four 2-pt. fan mounting Pozidriv screws.
3. Disconnect cable and remove fan.

Tools Required

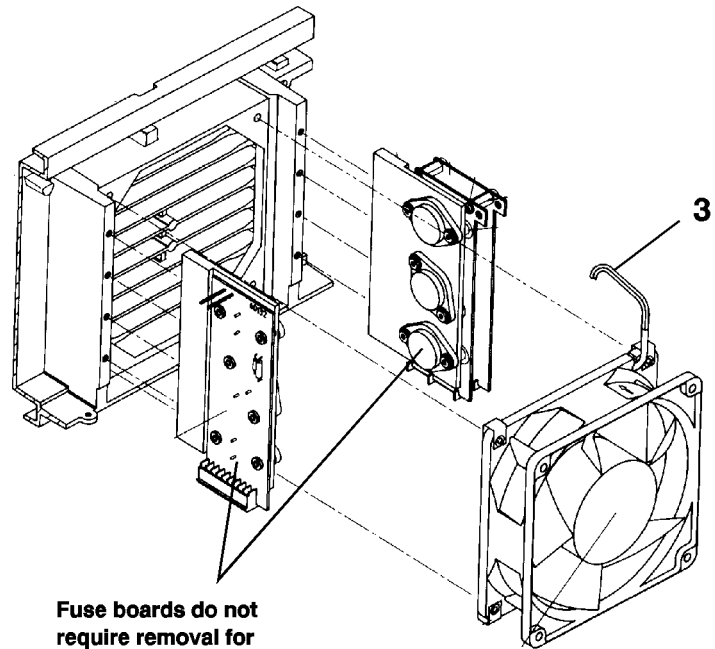
- TX-15 screw driver
- 2-pt. Pozidriv



TOP VIEW



REAR PANEL



**Fuse boards do not
require removal for
this procedure.**

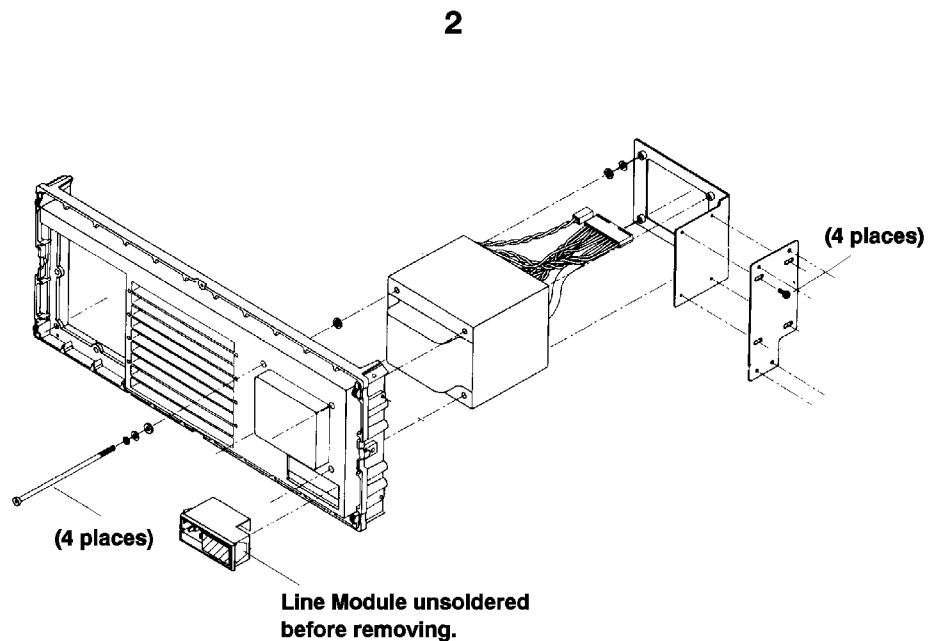
Transformer Removal

Done with top and bottom covers removed.

1. Do steps 1 through 8 of the A28 Power Supply Removal instructions.
2. Disconnect cables and remove transformer using illustration below.

Tools Required

- TX-15 screw driver
- 2-pt. Pozidriv
- Soldering equipment
- TX-10 screwdriver



Replacing a Part

Introduction

To order parts contact your local Agilent Technologies Sales and Service office.

Assembly Replacements

For most parts, you can either order a new assembly or an exchange assembly. Exchange assemblies are factory-repaired, inspected, and tested. If you order an exchange assembly you must return the defective assembly for credit.

With some assemblies you will receive a Memory Card that contains factory-generated calibration data for the assembly. There will also be an instruction sheet for loading the calibration data into the instrument after you replace the defective assembly. With exchange assemblies, you must return the Memory Card with the defective assembly to receive full credit.

Adjustments after Replacing Assemblies

The following table shows which adjustments should be performed after replacing assemblies. The adjustments and calibrations are described in chapter 8, “Assembly/Disassembly”.

Table 9-1

Adjustments After Replacement

Assembly Replaced	Calibration or Adjustment Required
A3	Periodic Self Cal
A4	Periodic Self Cal
A15	Timebase Adjustment (standard)
A19	Periodic Self Cal
A25	Sum Loop Adjustment
A26	Step Loop Adjustment

Replaceable Parts

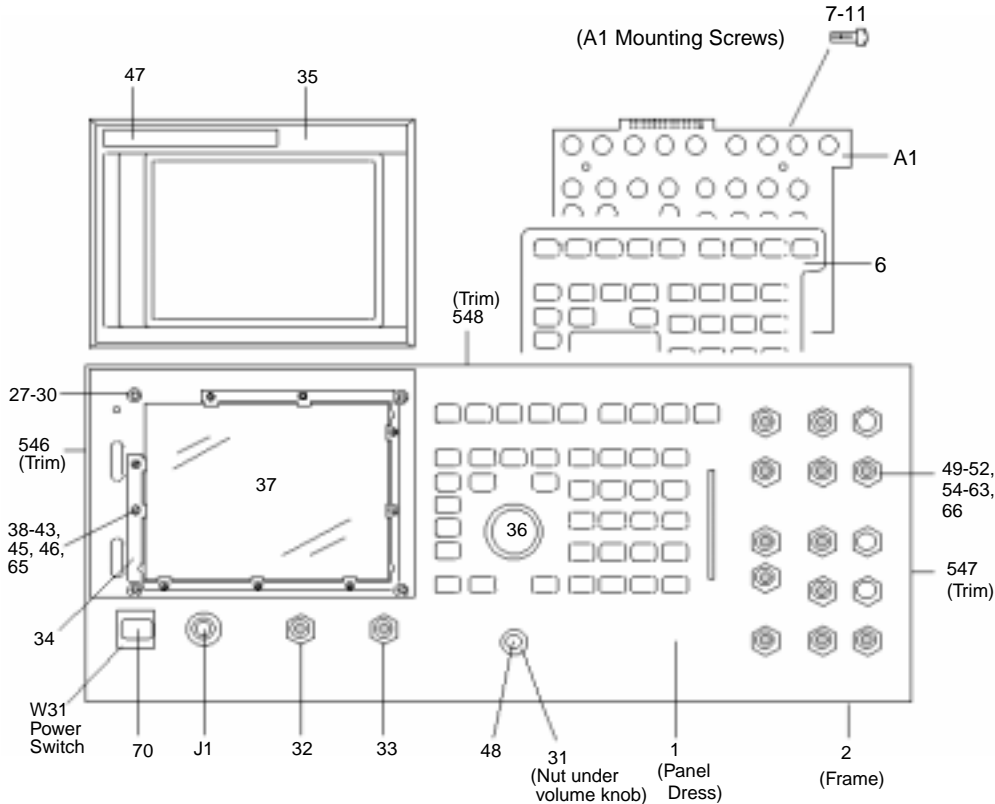
The following tables and figures list part numbers for replaceable parts. For more information or details of replaceable parts, contact your local Agilent Technologies Sales and Service Office.

Replacing a Part Replaceable Parts

Table 9-2

Replaceable Parts

Item	Agilent Part Number	C D	Qty.	Description	Mfr. Code	Mfr.Part Number
A1	08920-60201	3	1	BD AY KEY	28480	08920-60201
J1	1250-1811	5	1	ADAPT FN F SMA (CONN, TP N)	00000	ORDER BY DESCRIPTION
W31	08922-61037	8	1	SWITCH/SPKR HARNESS ASSY (G/H/M Only)	28480	08922-61037
W31	08922-61085		1	SWITCH/SPKR HARNESS ASSY (E/F/S Only)	28480	08922-61085
1	08922-00009	6	1	PANEL DRESS (A/B Only)	28480	08922-00009
1	08922-00079		1	PANEL DRESS (E/F/S Only)	28480	08922-90079
1	08922-00053	0	1	PANEL DRESS (G/H/M Only)	28480	08922-00053
2	08922-21002	2	1	MACH FRAME (FRONT DIE)	28480	08922-21001
6	08922-40002	3	1	KEY PAD (A/B Only)	28480	08922-40002
6	08922-40003	4	1	KEY PAD (E/F/G/H/M/S Only)	28480	08922-40003
7-11	0515-2126	8	5	SMM3.0 6SEMPNTX	28480	ORDER BY DESCRIPTION
27-30	0515-0380	2	4	SMM4.0 10SEMPNTX	00000	ORDER BY DESCRIPTION
31	2950-0196	2	1	NUT HEX 1/4-36	00000	ORDER BY DESCRIPTION
32,33	2950-0054	1	2	NUT HEX 1/2-28 THD	00000	ORDER BY DESCRIPTION
34	08922-00056	3	1	CLIP WINDOW	28480	08922-00056
35	08922-40001	2	1	BEZEL - CRT	28480	08922-40001
36	0370-2110	2	1	KNOB BASE .250 JG	00000	ORDER BY DESCRIPTION
37	08920-21023	4	1	CRT WINDOW	00000	ORDER BY DESCRIPTION
38-43, 45,46,65	0515-1940	2	9	SMM2.5 6PCHPNTX	00000	ORDER BY DESCRIPTION
47	08922-00041	6	1	NAME PLATE (A Only)	28480	08922-00041
47	08922-00042	7	1	NAME PLATE (B Only)	28480	08922-00042
47	08922-00080		1	NAME PLATE (E Only)	28480	08922-00080
47	08922-00082	1	5	NAME PLATE (F Only)	28480	08922-00082
47	08922-00038	1	1	NAME PLATE (G Only)	28480	08922-00038
47	08922-00083	1	6	NAME PLATE (H Only)	28480	08922-00083
47	08922-00086	1	6	NAME PLATE (M Only)	28480	08922-00086
47	08922-00085	1	6	NAME PLATE (S Only)	28480	08922-00085
48	0370-1001	8	1	KNOB RND .125 GY	00000	ORDER BY DESCRIPTION
49-52, 54-63, 66	2950-0035	8	15	NUT-HEX 15/32-32 THD.	00000	ORDER BY DESCRIPTION
70	5041-0944	4	1	KEY CAP "POWER"	00000	ORDER BY DESCRIPTION
546-547	5001-0540	2	2	TRIM SIDE, 177H	00000	ORDER BY DESCRIPTION
548	5041-8802	9	1	TRIM, TOP FM	00000	ORDER BY DESCRIPTION

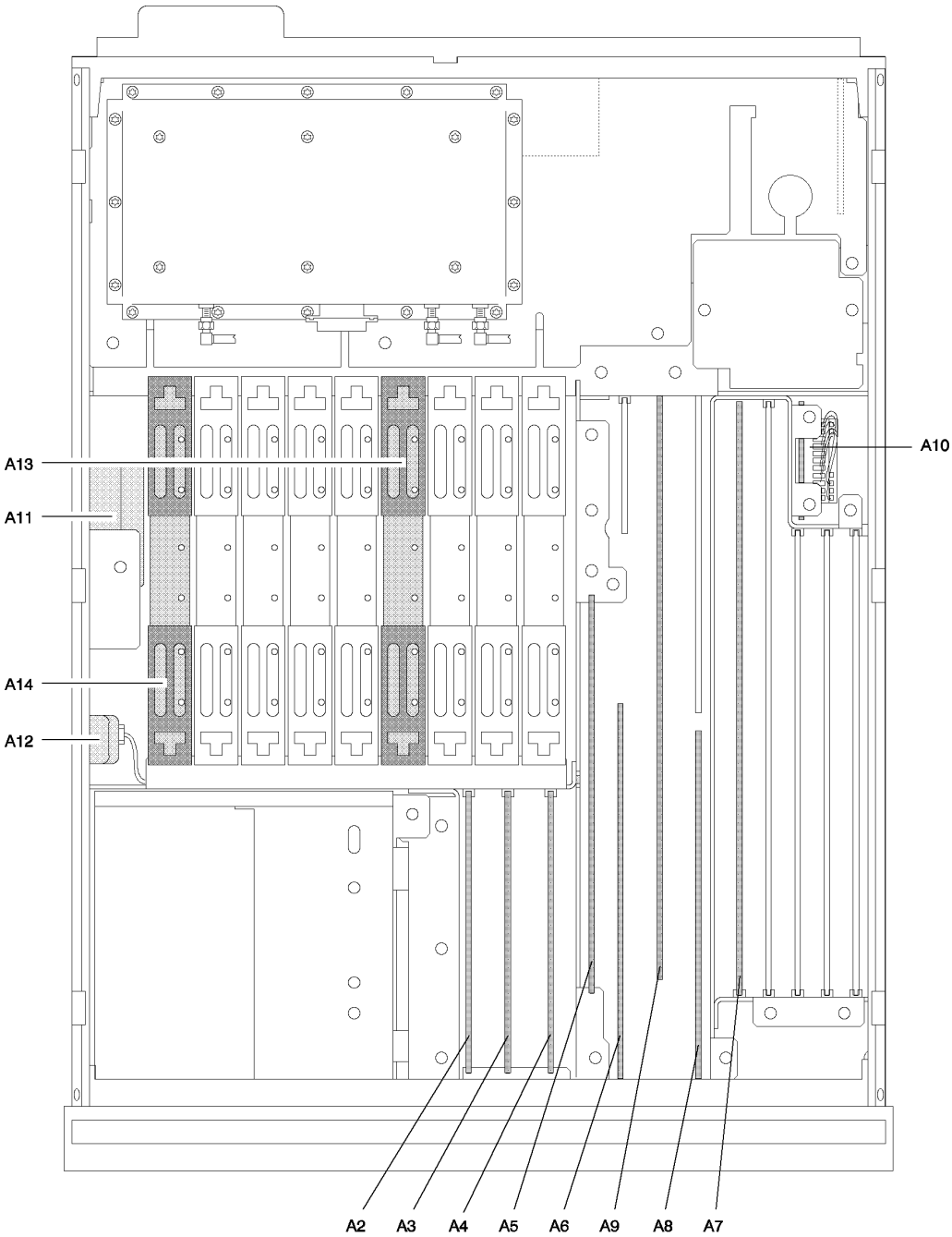


Replacing a Part Replaceable Parts

Table 9-3

Replaceable Parts

Item	Agilent Part Number	C D	Qty.	Description	Mfr. Code	Mfr.Part Number
A2	08920-60212	7	1	AUDIO ANALYZER 2 (Order 08920-61812)		
A3	08920-60171	6	1	AUDIO ANALYZER 1		
A4	08920-60209	1	1	MODULATION DISTRIBUTION (Order 08920-61809)	28480	08920-60209
A5	08922-60105	9	1	PREMOD FILTER / NSM BOARD	28480	08922-60105
A6	08920-60208	2	1	SIGNAL SOURCE/ANALY (Order 08920-61849)		
A7	08920-60307	0	1	CONTROLLER (DCU) (A,B,E,F,G) (Order 08922-61811)		
A7	08920-60395	5	1	CONTROLLER (DCU) (H) (Order 08922-61812)		
A7	08920-60395	5	1	CONTROLLER (DCU) (S) (Order 08922-61813)		
A7	08920-60395	5	1	CONTROLLER (DCU) (M) (Order 08922-61814)		
A7U65	08920-87168			Order this BOOT ROM with above DCU (M only)		
Note: New HOST Firmware must be downloaded to the Agilent 8922M DCU Assembly by an external controller. Contact your local Agilent Technologies Sales and Service Office for more information						
A8	08922-60156		1	8922A/B MEMORY (Order 08922-60175)		
A8	08922-60163	9	1	8922E MEMORY (Order 08922-60175)	28480	08922-60163
A8	08922-60158	2	1	8922G MEMORY (Order 08922-60175)	28480	08922-60158
A8	08922-60165	2	1	8922F MEMORY (Order 08922-60175)	28480	08922-60165
A8	08922-60166	2	1	8922H MEMORY (Order 08922-60279)	28480	08922-60166
A8	08920-60279		1	8922H/S/M MEMORY Without EPROM's	28480	
A8	08922-60175		1	8922A/E/F/G MEMORY BOARD Without EPROM's	28480	08922-60175
A9	08922-60121	9	1	GLOBAL TEST/DEMOD BOARD (A,B,E,F,G,H,M,S)	28480	08922-60121
A10	08920-60256	8	1	POWER SUPPLY REGULATOR (Order 08920-61856)		
A11	08922-61007	2	1	RECEIVER MIXER (Order 08922-61807)		
A12	08922-61044	7	1	PULSE ATTENUATOR (Order 08922-61844)		
A13	08920-61031	0	1	OUTPUT (Order 08920-61831)		
A14	08922-61023	2	1	GSM TIMING GEN / PULSE DRIVER	28480	08922-61023



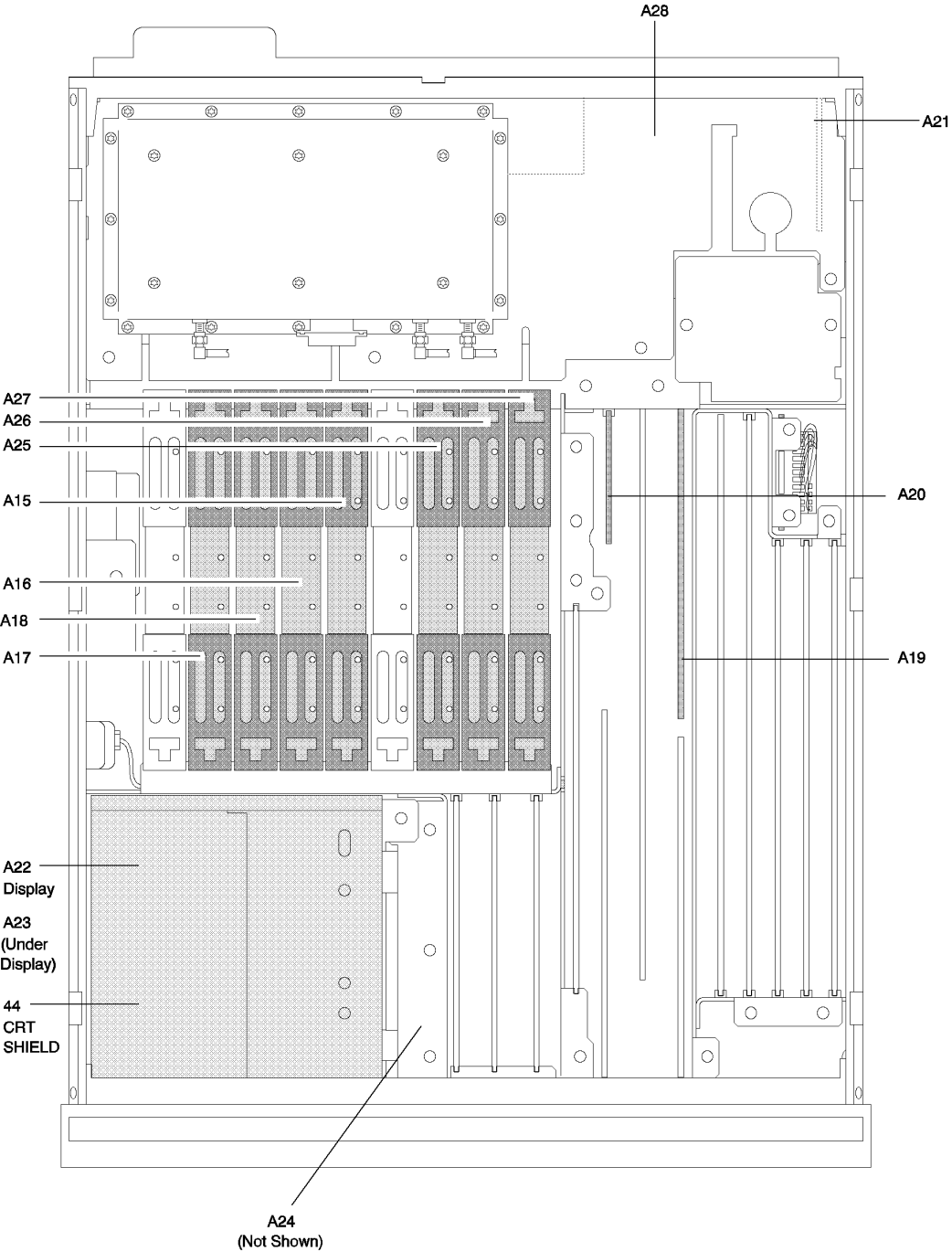
Replacing a Part Replaceable Parts

Table 9-4

Replaceable Parts

Item	Agilent Part Number	C	Qty.	Description	Mfr. Code	Mfr. Part Number
A15	08922-61019	6	1	MOD-PCB REF SECTION	28480	08922-61019
A16	08922-61004	9	1	RECEIVER (Order 08922-61804)		
A17	08922-61013	0	1	STEP LOOP B MOD	28480	08922-61013
A18	08922-61045	8	1	SPECTRUM ANALYZER (Order Replacement Below)		
A18	08922-61845	6	1	SPECTRUM ANALYZER Replacement (New)	28480	08922-61845
A18	08922-69845	6	2	SPECTRUM ANALYZER Replacement (Exchange)	28480	08922-69845
A19	08920-60331	0	1	MEASUREMENT BD (Order 08920-61836)		
A20	08920-60224	1	1	CRT DRIVER (New A/B/E/G Only)		
A20	08920-60192	2	1	CRT DRIVER (New F/H/M/S Only)		
A21	08922-60259	3	1	GPIB INTERFACE	28480	08922-61859
A22	08920-61005	8	1	DISPLAY Assembly	28480	08920-61005
44	08922-00096	6	1	CRT SHIELD	28480	08922-00096
A23	08922-61001	6	1	INPUT SECTION (Order Replacement Below) (A,B,E,G,F,H)		
A23	08922-61801	4	1	INPUT SECTION Replacement (New) (A,B,E,G,F,H)	28480	08922-61801
A23	08922-69001	2	1	INPUT SECTION Replacement(Exchange) (A,B,E,G,F,H)	28480	08922-69001
A23	08922-61133	6	1	INPUT SECTION (Order Replacement Below) (M,S)		
A23	08922-61897	4	1	INPUT SECTION Replacement (New)(M,S)	28480	08922-61801
A23	08922-69097	4	1	INPUT SECTION Exchange (M,S)	28480	08922-61801
A24	08920-61010	5	1	HIGH POWER ATTENUATOR (Order Replacement Below)		
A24	08920-61810	3	1	HIGH POWER ATTENUATOR Replacement (New)	28480	08920-61810
A24	08920-69010	2	1	HIGH POWER ATTENUATOR Replacement (Exchange)	28480	08920-69010
	High Power Attn. for:			A, B, E, G, G option R10, G option R11		
A24	08922-61101	2	1	8dB LOW POWER ATTENUATOR (Order Replacement Below)	28480	08922-61101
A24	08922-61808	2	1	8dB LOW POWER ATTENUATOR Replacement (New)	28480	08922-61808
A24	08922-69101	2	1	8dB LOW POWER ATTENUATOR Replacement (Exchange)	28480	08922-69101
	Low Power Attn. for:			E option R71, E option R73, G option R72, G option R74, F, H, M, S		
A25	08922-61010	7	1	SUM LOOP (Refer to ADJUSTMENT, Chapter 7)	28480	08922-61010
A26	08922-61013	0	1	STEP LOOP A (Refer to ADJUSTMENT, Chapter 7)	28480	08922-61013
A27	08922-61006	1	1	DAC/UPCONVERTER	28480	08922-61006

Replacing a Part
Replaceable Parts

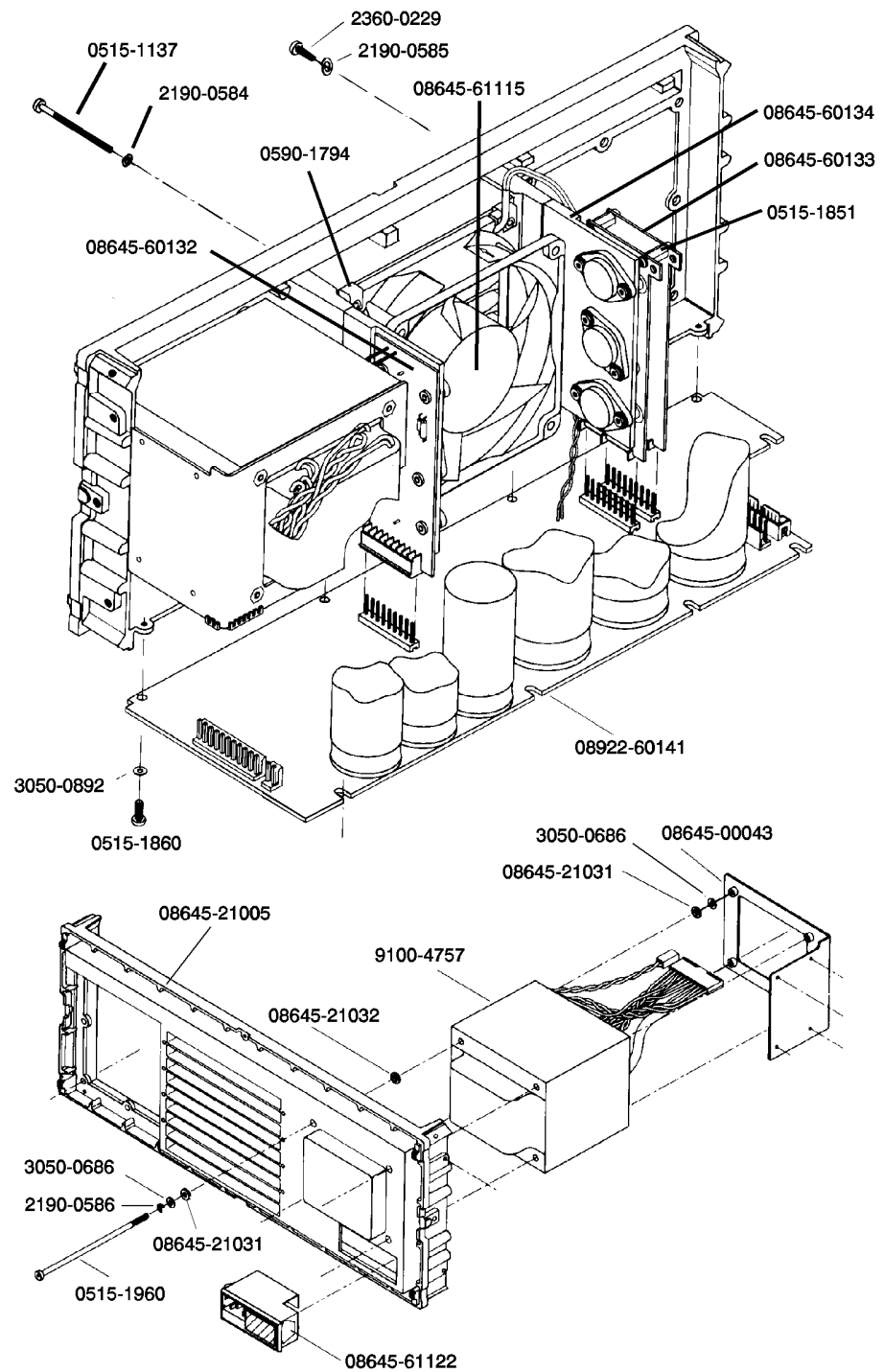


Replacing a Part Replaceable Parts

Table 9-5

Replaceable Parts

Item	Agilent Part Number	C	D	Qty.	Description	Mfr. Code	Mfr.Part Number
A28	08922-61043	6	1	1	POWER SUPPLY	28480	08922-61043
	08645-60132	6	1	1	BD AY-PWR S STBD	28480	08645-60132
	08645-60133	7	1	1	BD AY-FUSE	28480	08645-60133
	0515-1860	5	4	4	SCREW 1.5FM 3.5 TX	00000	ORDER BY DESCRIPTION
	08645-60134	0	1	1	BD AY-PWR Q PORT	28480	08645-60134
	08645-61155	7	1	1	FAN ASSY 2 CKT	28480	08645-61155
	08645-61122	6	1	1	PWR LN MDL ASSY	28480	08645-61122
	08922-60141	3	1	1	BD AY-POWER SPLY	28480	08922-60141
	0515-1137	9	8	8	SMM3.0 50 PN TX	00000	ORDER BY DESCRIPTION
	0515-1851	4	2	2	SMM3.0 6SEMPTX	00000	ORDER BY DESCRIPTION
	0515-1960	6	4	4	SMM4.0127 PN TX	00000	ORDER BY DESCRIPTION
	0590-1794	2	4	4	NUT-SHMET U 6-32	00000	ORDER BY DESCRIPTION
	2110-0010	9	1	1	FUSE 5A 250V F	00000	ORDER BY DESCRIPTION
	2190-0584	0	8	8	WSHR-LK HLCL	00000	ORDER BY DESCRIPTION
	2190-0585	1	4	4	WSHR LK 3.5ID	00000	ORDER BY DESCRIPTION
	2190-0586	2	4	4	WSHR LK M4.OID	00000	ORDER BY DESCRIPTION
	2360-0229	1	4	4	SM 632 .562PNPD	00000	ORDER BY DESCRIPTION
	3050-0686	8	8	8	WSHR FL .156ID 6	00000	ORDER BY DESCRIPTION
	3050-0892	8	4	4	WSHR FL M3.5 ID	00000	ORDER BY DESCRIPTION
	9100-4757	5	1	1	XFMR PWR100/240V	00000	ORDER BY DESCRIPTION
	08645-21005	0	1	1	PANEL REAR MCHND	28480	08645-21005
	08645-21031	2	8	8	WSHR-SHLDR, INSUL	28480	08645-21031
	08645-21032	3	4	4	WSHR-SHLDR, INSUL	28480	08645-21032

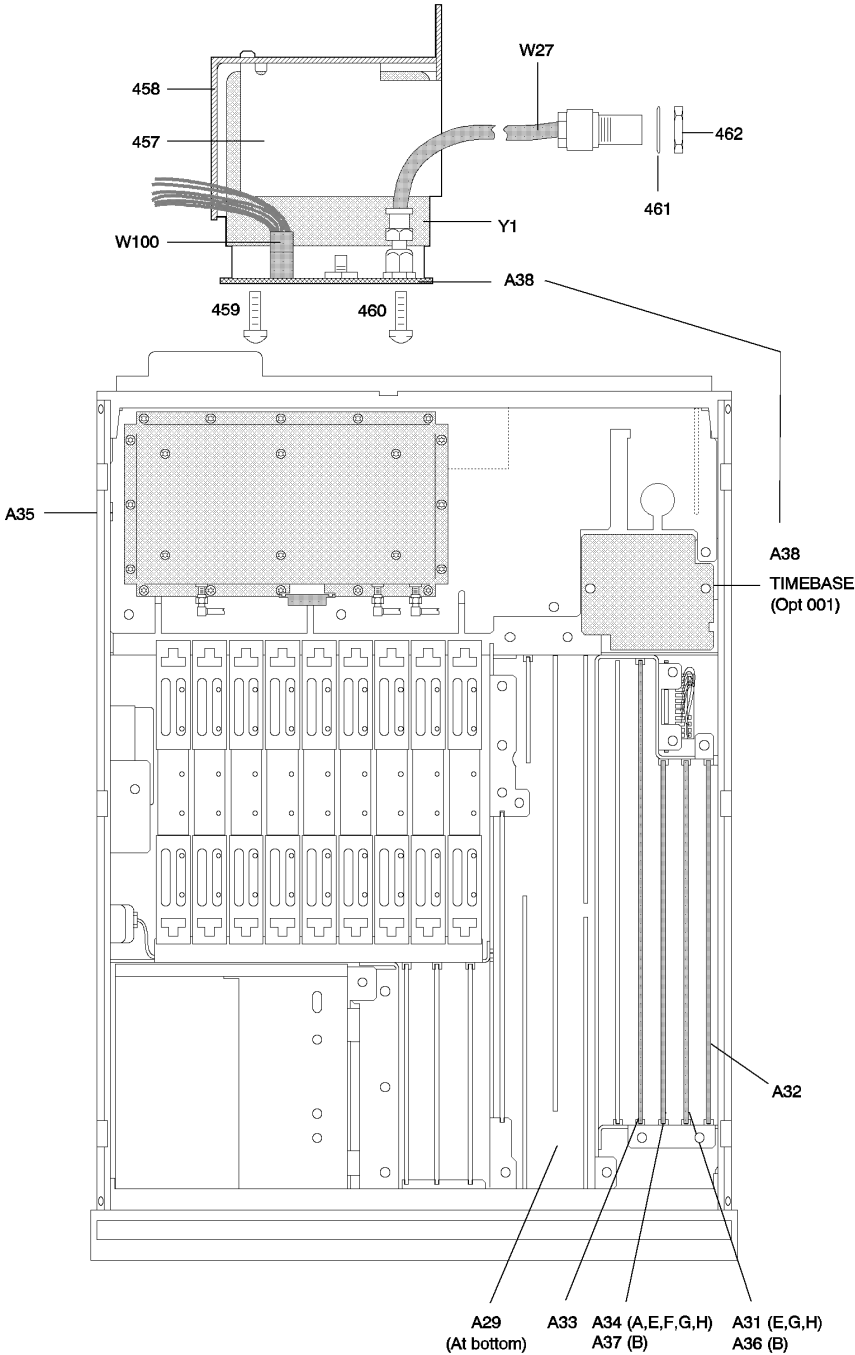


Replacing a Part Replaceable Parts

Table 9-6

Replaceable Parts

Item	Agilent Part Number	C D	Qty.	Description	Mfr. Code	Mfr.Part Number
A31	08922-60247	9	1	MGSM / CODEC (E/F/G/H/M/S Only)	28480	08922-60147
A32	08922-60146	8	1	GSM CONTROLLER (Order 08922-60176)	28480	08922-60146
A32	08922-60162	8	1	GSM CONTROLLER (Order 08922-60176)	28480	08922-60162
A32	08922-60167	8	1	GSM CONTROLLER (Order 08922-60176)	28480	08922-60167
A32	08922-60176	8	1	GSM CONTROLLER Without EPROMS	28480	08922-60167
A33	08922-60202	7	1	HOP CONTROLLER	28480	08922-60202
A34	08922-60142	4	1	RTI BYPASS 8922 (A Only)	28480	08922-60142
A34	08922-60244	6	1	GSM RTI 8922 (E/F/G/H/M/S Only)	28480	08922-60144
A35	08922-60160	6	1	PROTOCOL INTERFACE (G/H Opt 003 Only)	28480	08922-60160
A35	08922-60152	6	1	"B" REFERENCE (B Only)	28480	08922-60152
A36	08922-60154	8	1	FIFO GPIO 8922B (B Only)	28480	08922-60154
A37	08922-60151	5	1	SEQ CONTROLLER (B Only)	28480	08922-60151
A38	08645-60137	1	1	BD-AY-TIMEBASE (Opt.001 Only)	28480	08645-60137
457	08922-00017	6	1	BRACKET-TIMEBASE	28480	08922-00017
458	08922-00018	7	1	COVER-TIMEBASE	28480	08922-00018
459,460	2360-0195	0	2	SM 632 .312PNPD	00000	ORDER BY DESCRIPTION
461	2190-0102	8	1	WSHR LK .472ID	00000	ORDER BY DESCRIPTION
462	2950-0035	8	1	NUT-HEX 15/32-32	00000	ORDER BY DESCRIPTION
W27	08922-61056	1	1	CX F SMC-BNC (CABLE)	28480	08922-61056
W100	08645-61089	4	1	CA MCNDCT 6CKT (RIBBON CABLE)	28480	08645-61089
Y1	10811D	4	1	XTAL OSC-10 MHZ	28480	10811D



Replacing a Part Replaceable Parts

Table 9-7

Replaceable Parts

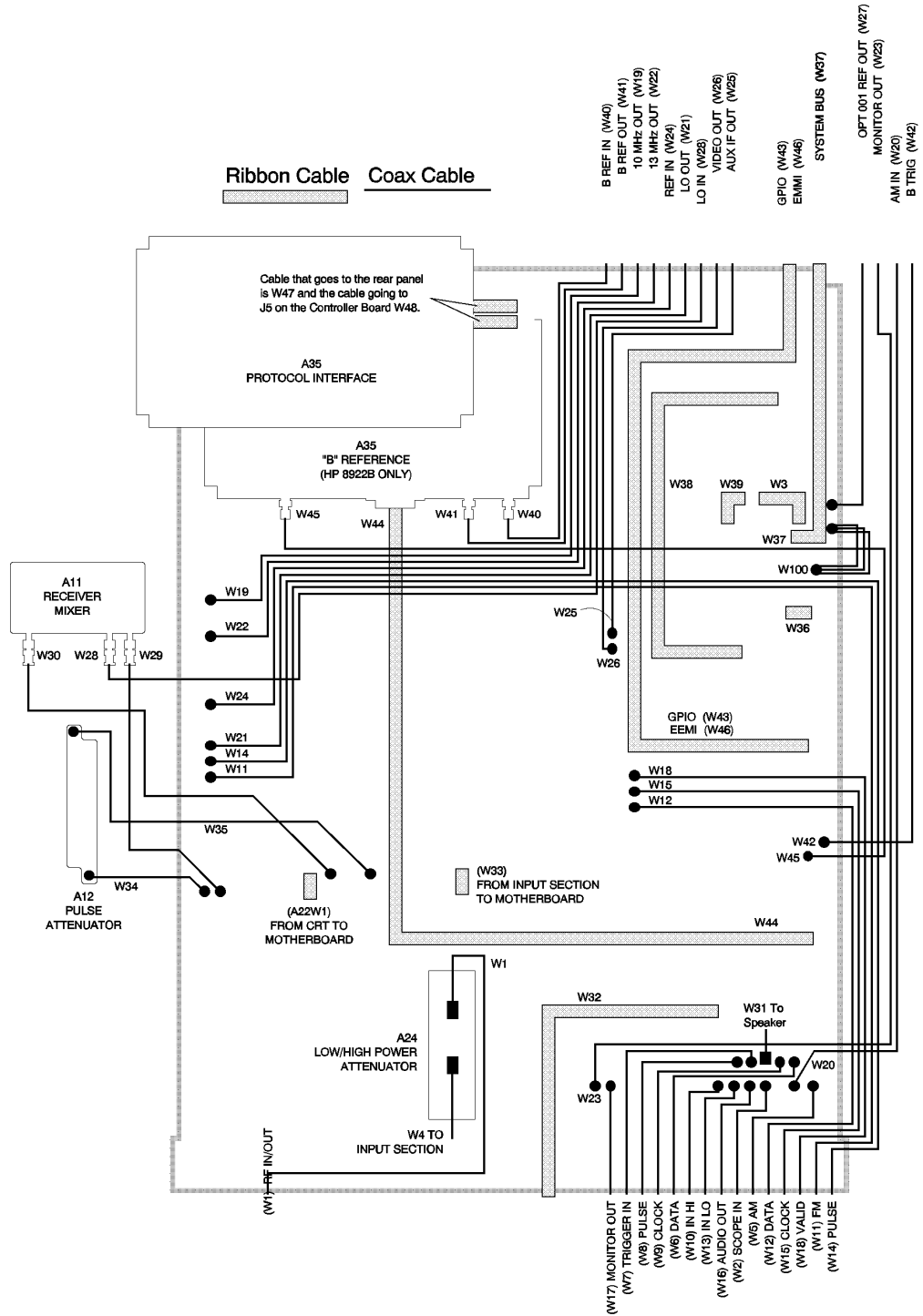
Item	Agilent Part Number	C	D	Qty.	Description	Mfr. Code	Mfr.Part Number
A22-W1	08920-61020	7		1	CABLE (RIBBON) CRT-MBOARD	28480	08920-61020
W1	08920-61012	7		1	CABLE RF OUT ATTEN	28480	08920-61012
W2	08922-61028	7		1	CABLE M-BD J14 TO SCOPE IN	28480	08922-61028
W3	08920-61016	1		1	CABLE (RIBBON) INPUT CONTROL	28480	08920-61016
W4	08920-61013	8		1	CABLE ATTEN INPUT/HEATSINK	28480	08920-61013
W5	08922-61027	6		1	CABLE M-BD J11 TO MOD AM	28480	08922-61027
W6	08922-61033	4		1	CABLE M-BD J58 TO MOD DATA	28480	08922-61033
W7	08922-61035	6		1	CABLE MBD J83 TO MEAS TRIG	28480	08922-61035
W8	08922-61036	5		1	CABLE M-BD J84 TO MOD PL5	28480	08922-61036
W9	08922-61034	5		1	CABLE M-BD J59 TO MOD CLK	28480	08922-61034
W10	08922-61024	3		1	CABLE M-BD J2 TO AUD IN H	28480	08922-61024
W11	08922-61016	6		1	FM DEMOD CABLE	28480	08922-61016
W12	08922-61018	5		1	DEMODO DATA CABLE	28480	08922-61018
W13	08922-61026	5		1	CABLE M-BD J3 TO AUD IN L	28480	08922-61026
W14	08922-61017	4		1	PULSE DEMOD CABLE	28480	08922-61017
W15	08922-61020	9		1	DEMODO CLOCK CABLE	28480	08922-61020
W16	08922-61025	4		1	CABLE M-BD J4 TO AUD OUT	28480	08922-61025
W17	08922-61022	1		1	MONITOR CABLE	28480	08922-61022
W18	08922-61021	0		1	DEMODO VALID CABLE	28480	08922-61021
W19	08922-61015	2		1	CABLE M-BD J61 TO 10M OUT	28480	08922-61015
W20	08922-61032	3		1	CABLE M-BD J85 TO AM IN	28480	08922-61032
W21	08922-61008	3		1	CABLE M-BD J63 TO E LO OUT	28480	08922-61008
W22	08922-61014	1		1	CABLE M-BD J62 TO 13M OUT	28480	08922-61014
W23	08922-61031	2		1	CABLE M-BD J78 TO MONITOR	28480	08922-61031
W24	08922-61009	4		1	CABLE M-BD J60 TO REF IN	28480	08922-61009
W25	08922-61029	8		1	CABLE M-BD J68 TO AUX IF	28480	08922-61029
W26	08922-61030	1		1	CABLE M-BD J64 TO VIDEO	28480	08922-61030
W27	08922-61056	1		1	CABLE SMC TO BNC OPT. 001	28480	08922-61056
W28	08922-61057	2		1	CABLE SMC TO BNC	28480	08922-61057
W29	08922-61059	4		1	CABLE SMC TO SMC	28480	08922-61059
W30	08922-61058	3		1	CABLE SMC TO SMC 8	28480	08922-61058
W31	08922-61037	8		1	SPEAKER HARNESS ASSY	28480	08922-61037
W32	08922-61061	8		1	RIBBON CBL 26 CONDUCTOR	28480	08922-61061
W33	08922-61055	0		1	RIBBON CBL 16 CONDUCTOR	28480	08922-61055
W34	08922-61041	4		1	SR CABLE PULSE TO OUT	28480	08922-61041
W35	08922-61040	3		1	SR CABLE M-BD TO PULSE	28480	08922-61040
W36	08922-61054	9		1	POWER SUPPLY CABLE	28480	08922-61054
W37	08922-61039	0		1	RIBBON CBL 37 CONDUCTOR	28480	08922-61039
W38	08922-61060	7		1	RIBBON CBL 34 CONDUCTOR	28480	08922-61060
W39	08922-61005	0		1	POWER SUPPLY CABLE ASSY	28480	08922-61005
W40	08922-61067	4		1	COAX SMC-BNC (B Only)	28480	08922-61067
W41	08922-61068	5		1	COAX SMC-BNX (B Only)	28480	08922-61068
W42	08922-61069	6		1	COAX SMC-BNC (B Only)	28480	08922-61069
W43	08922-61051	6		1	RIBBON CABLE 50 CND (B Only)	28480	08922-61051
W44	08922-61052	7		1	B REF RIBBON 16 CND (B Only)	28480	08922-61052
W45	08922-61053	8		1	COAX SMC-SMC (B Only)	28480	08922-61053

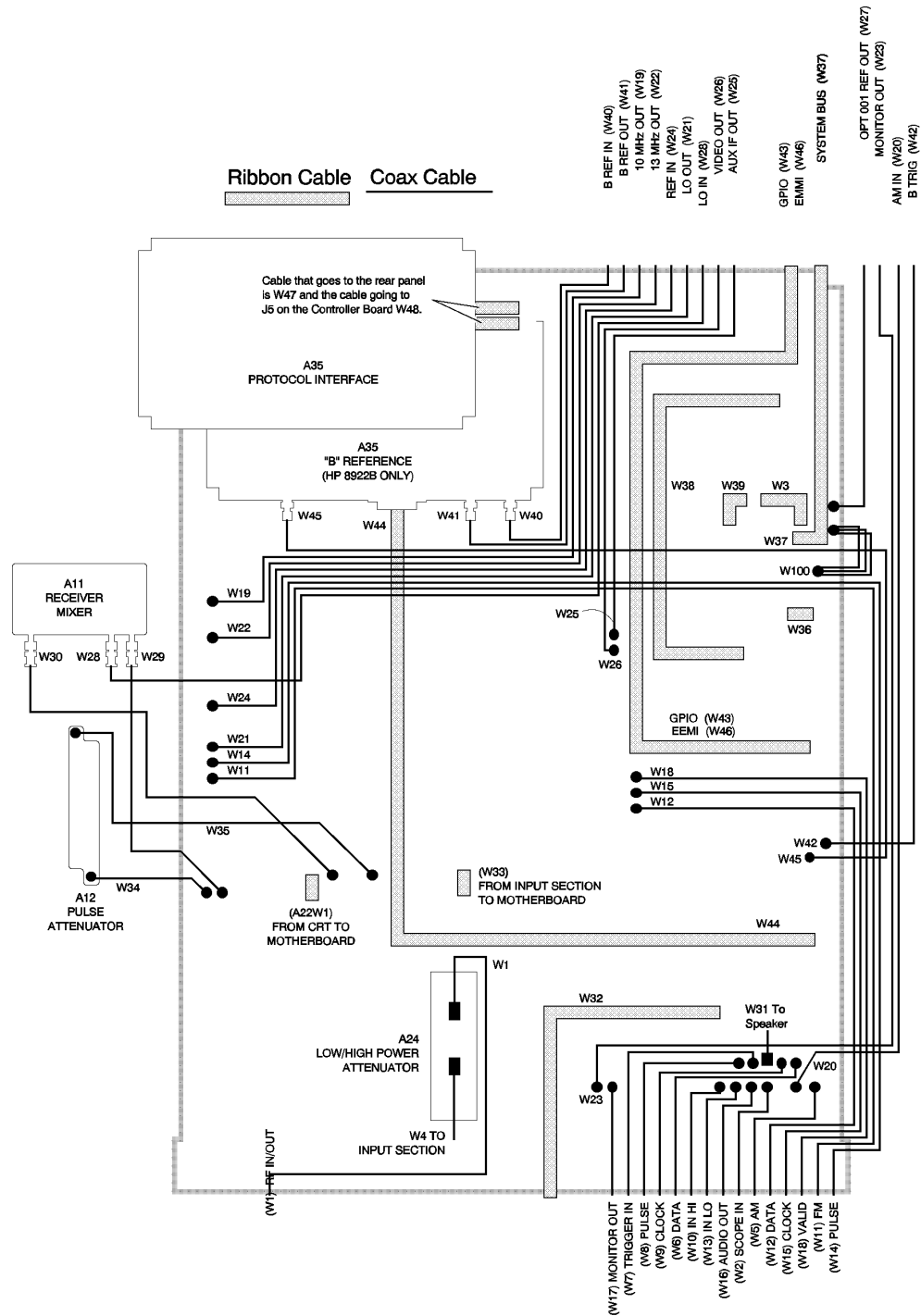
Table 9-7

Replaceable Parts

Item	Agilent Part Number	C	D	Qty.	Description	Mfr. Code	Mfr.Part Number
W46	08922-61050	5		1	EMMI CABLE (G Only)	28480	08922-61050
W47	08922-61077	6		1	RIBBON 16 CND	28480	08922-61077
W48	08922-61078	7		1	RIBBON 26 CND	28480	08922-61078
W49	08922-61080	1		1	CABLE	28480	08922-61080
W50	08922-61081	2		1	CABLE	28480	08922-61081
W51	08922-61082	3		1	CABLE SMC TO SMC	28480	08922-61081
W52	08922-61077	6		1	RIBBON CABLE 16 CND	28480	08922-61077

Replacing a Part Replaceable Parts



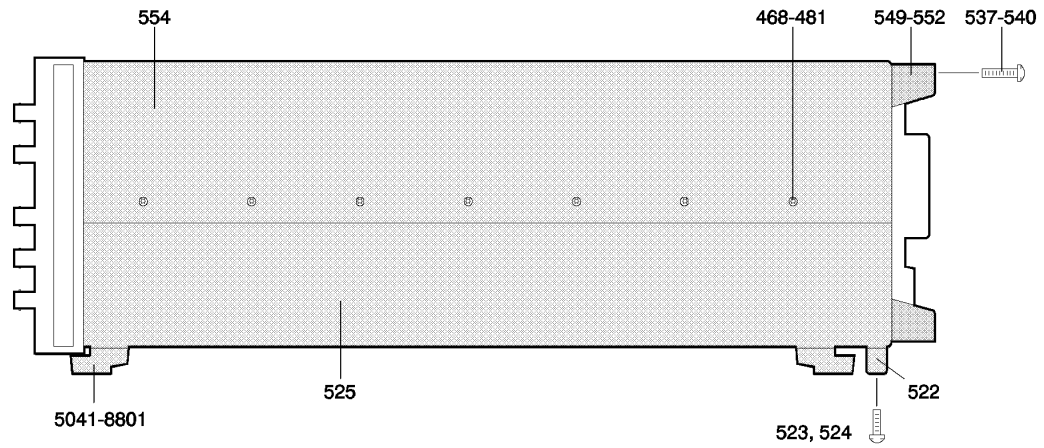


Replacing a Part Replaceable Parts

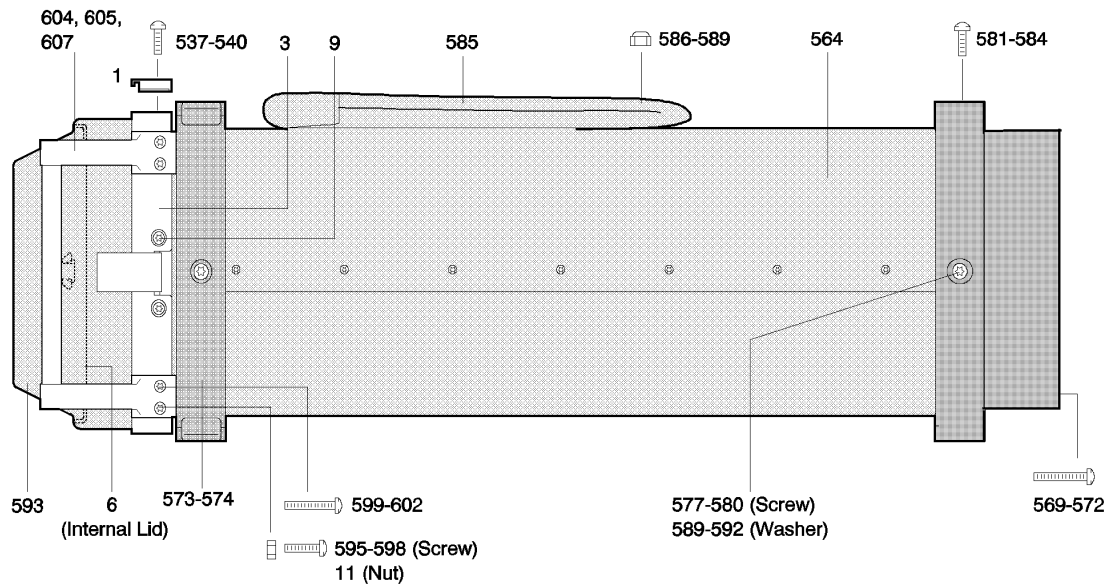
Table 9-8

Replaceable Parts

Item	Agilent Part Number	C	Qty.	Description	Mfr. Code	Mfr.Part Number
1	5040-3881	2	1	TOP FLANGE	00000	ORDER BY DESCRIPTION
3	5060-4475	4	2	SIDE FLANGE	00000	ORDER BY DESCRIPTION
6	5001-8663	6	1	INTERNAL LID	00000	ORDER BY DESCRIPTION
9	0515-1114	2	4	SCREW (M4X10)	00000	ORDER BY DESCRIPTION
11	0535-0023	2	1	NUT + HEX DBL-CHAN	00000	ORDER BY DESCRIPTION
522	08645-40015	2	1	FOOT-REAR	28480	08645-40015
523,524	0515-1860	5	2	SCREW 1.5 FM 3.5TX	00000	ORDER BY DESCRIPTION
525	08922-00065	4	1	COVER BOTTOM	28480	08922-00065
537-540	0515-1232	5	4	SCREW, MM 3.5 X 6.8 MM	00000	ORDER BY DESCRIPTION
549-552	5041-8821	2	4	STNDOFF-REAR PNL	00000	ORDER BY DESCRIPTION
554	08922-00066	5	1	TOP COVER	28480	08922-00066
	5041-8801	8	4	FOOT FULL MOD	00000	ORDER BY DESCRIPTION
569-572	0515-1444	1	4	SCR-MACH 3.5 X .60	00000	ORDER BY DESCRIPTION
573-576	08922-40004	5	4	BUMPER	28480	08922-40004
577-580	0515-0419	8	4	SMM5.0 16PN P2	00000	ORDER BY DESCRIPTION
581-584	0515-0380	2	4	SMM4.0 10SEMPNTX	00000	ORDER BY DESCRIPTION
585	01650-84502	7	1	POUCH ACCESORY	00000	ORDER BY DESCRIPTION
586-589	0590-0025	0	4	NUT HEX	00000	ORDER BY DESCRIPTION
589-592	3050-0894	0	4	WSHR FL MS.OID	00000	ORDER BY DESCRIPTION
593	5060-4479	8	1	COVER-ASSY KIT	00000	ORDER BY DESCRIPTION
595-598	0515-0899	8	4	SMM4.0 20PL PNPD	00000	ORDER BY DESCRIPTION
604-605	08922-61076	5	2	Order 08922-21008	28480	08922-61076
607	5062-3990	0	1	FRONT HANDLE KIT	00000	ORDER BY DESCRIPTION
	08922-21008	5	2	HANDLE ASSY (Option 002)	28480	08922-61076



Option 002



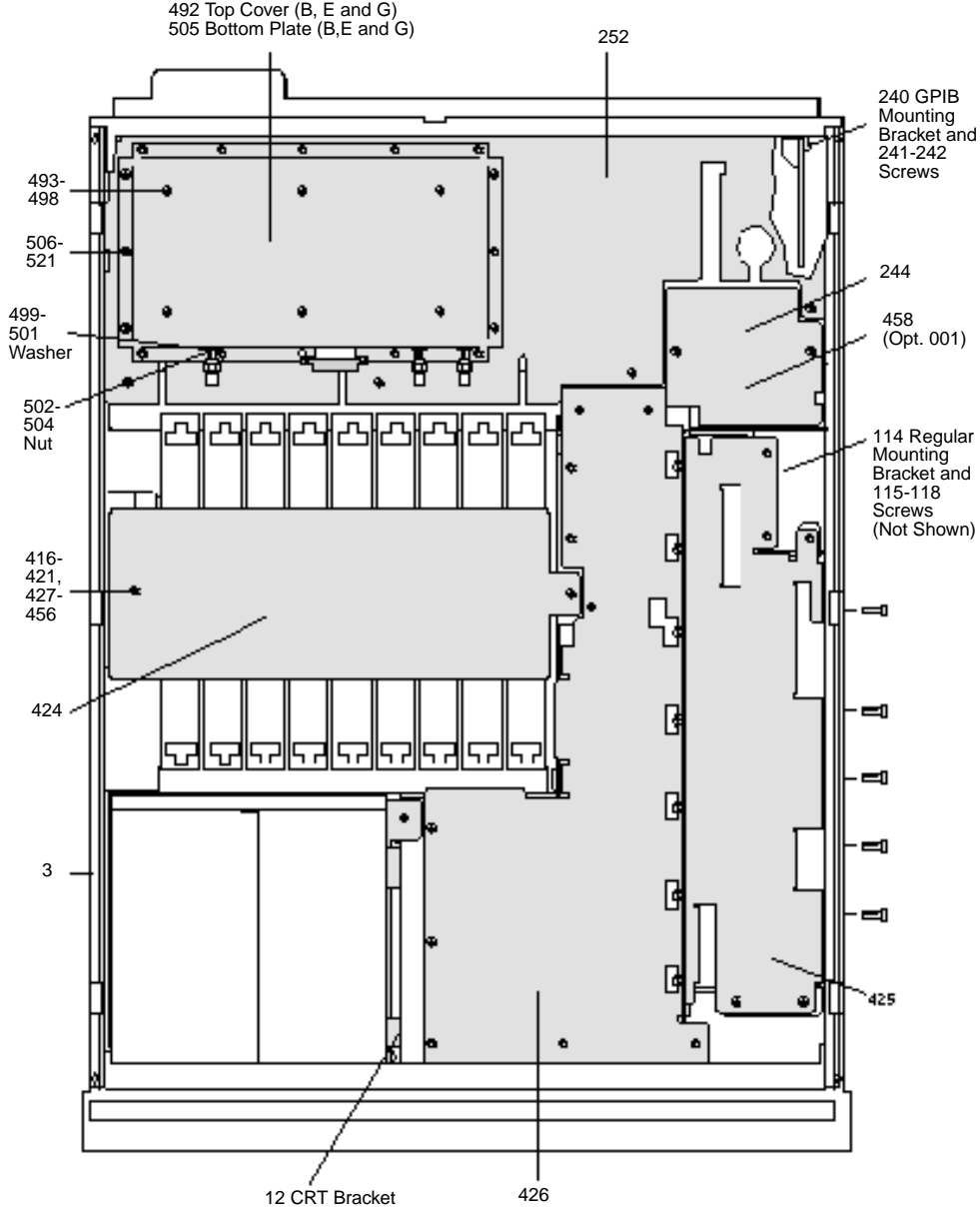
Replacing a Part Replaceable Parts

Table 9-9

Replaceable Parts

Item	Agilent Part Number	C D	Qty.	Description	Mfr. Code	Mfr.Part Number
3	08922-61011	8	1	AY-FRAME, (CHASSIS).	28480	08922-61011
12	08922-00004	1	1	CRT BRACKET	28480	08922-00004
114	08922-00030	3	1	BRACKET-REG, PCA	28480	08922-00030
115-117	0515-1950	4	3	SCREW MACH M3 X .5	00000	ORDER BY DESCRIPTION
118	0515-0380	2	1	SMM4.0 10SEMPNTX	00000	ORDER BY DESCRIPTION
240	08922-00028	9	1	BRACKET HP-IB	28480	08922-00028
241,242	0515-1950	4	2	SCREW M3 X .5	00000	ORDER BY DESCRIPTION
244	08922-00055	2	1	PLATE STANDARD	28480	08922-00055
252	08922-00007	4	1	COVER, POWER SUPPLY	28480	08922-00007
416-421	0515-0380	2	6	SMM4.0 10SEMPNTX	00000	ORDER BY DESCRIPTION
424	08922-00032	5	1	RF COVER	28480	08922-00032
425	08922-00015	4	1	COVER, AIR DIGITAL	28480	08922-00015
426	08922-00031	4	1	COVER-AIR,AUDIO	28480	08922-00031
427-456	0515-0380	2	29	SMM4.0 10SEMPNTX	00000	ORDER BY DESCRIPTION
458	08922-00018	7	1	TIMEBASE COVER (Opt. 001)	28480	08922-00018
492	08922-00044	9	1	COVER (B Only)	28480	08922-00044
492	08922-00072	3	1	COVER (G/H Opt. 003 Only)	28480	08922-00072
493-498	0515-1950	4	6	SCREW MACH M3 X .5	00000	ORDER BY DESCRIPTION
499-501	2190-0124	4	3	WSHR-LK .1941D	00000	ORDER BY DESCRIPTION
502-504	2950-0078	9	3	NUT-HEX 10-32	00000	ORDER BY DESCRIPTION
505	08922-00043	8	1	PLATE	28480	08922-00043
506-521	0515-1950	4	15	SCREW MACH M3 X .5	00000	ORDER BY DESCRIPTION

Replacing a Part
 Replaceable Parts

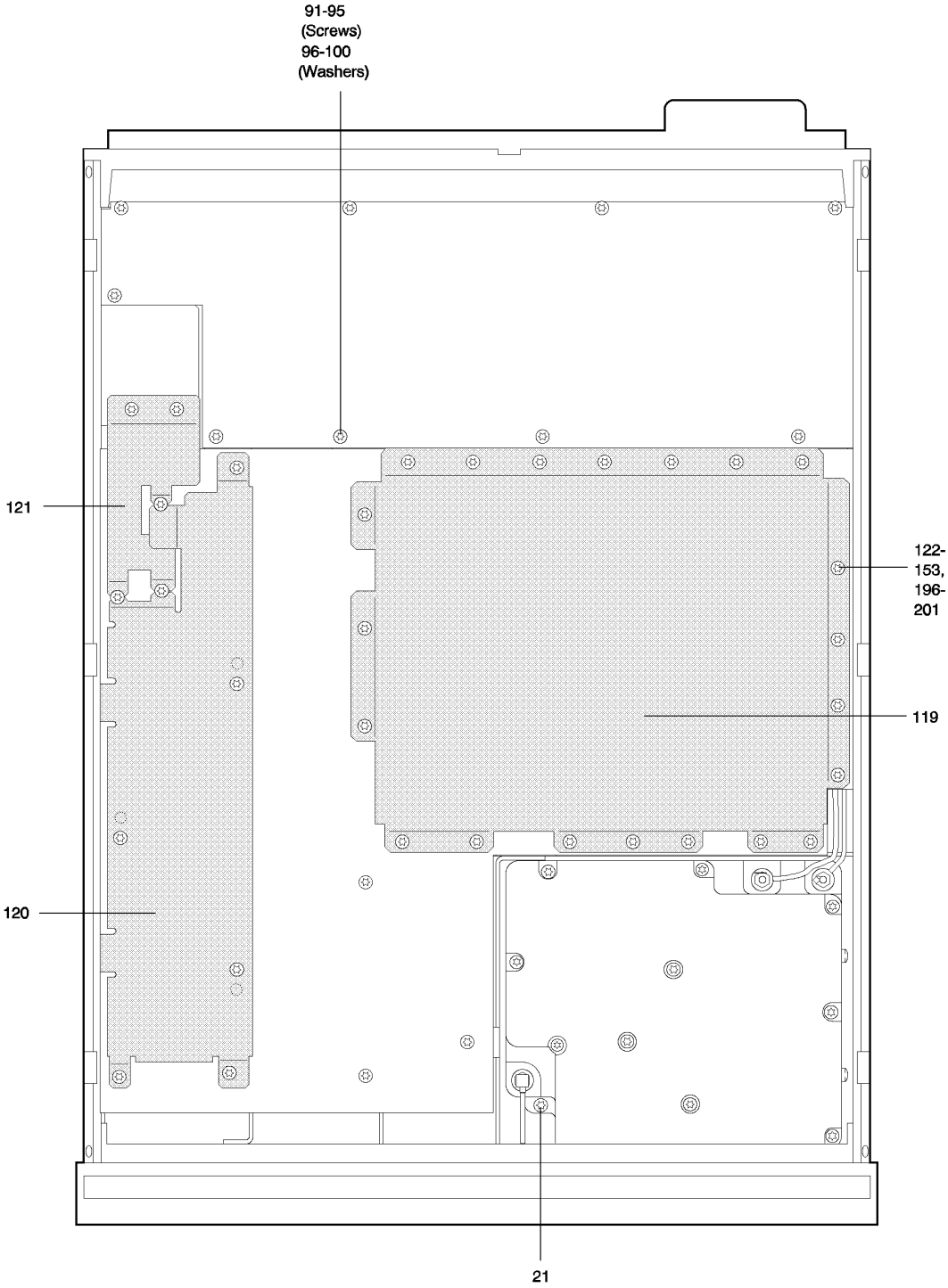


Replacing a Part Replaceable Parts

Table 9-10

Replaceable Parts

Item	Agilent Part Number	C	D	Qty.	Description	Mfr. Code	Mfr.Part Number
21	0515-0456	3	1		SMM4.0 20MML	00000	ORDER BY DESCRIPTION
91-95	0515-1860	5	1		SCREW 1.5 FM 3.5 TX	00000	ORDER BY DESCRIPTION
96-100	3050-0227	3	5		WASHER .375 OD	00000	ORDER BY DESCRIPTION
119	08922-00014	3	1		RF COVER (ON MOTHERBOARD)	28480	08922-00014
120	08922-00022	3	1		MBD COVER-DGTL	28480	08922-00022
121	08922-00050	7	1		COVER-MTHR, SYS BUS	28480	08922-00050
122-153	0515-0380	2	32		SMM4.010SEMPNTX	00000	ORDER BY DESCRIPTION
196-201	0515-0380	2	6		SMM4.010SEMPNTX	00000	ORDER BY DESCRIPTION



Replacing a Part

Replaceable Parts

Table 9-11

Replaceable Parts

Item	Agilent Part Number	C	D	Qty.	Description	Mfr. Code	Mfr.Part Number
22,23, 112,113	0515-0380	2	4	4	SMM4.0 10SEMPNTX	00000	ORDER BY DESCRIPTION
24,25	0515-2126	8	2	2	SMM3.0 6SEMPNTX	00000	ORDER BY DESCRIPTION
83-86, 104-107	0515-1331	5	8	8	SCREW M4 X 6	00000	ORDER BY DESCRIPTION
87-90	0515-1860	5	4	4	SCREW 1.5 FM 3.5 TX	00000	ORDER BY DESCRIPTION
268-270	0515-1950	3	4	4	SCREW M3 X .5	00000	ORDER BY DESCRIPTION
560	0515-0380	2	1	1	SMM4.0 10SEMPNTX	00000	ORDER BY DESCRIPTION

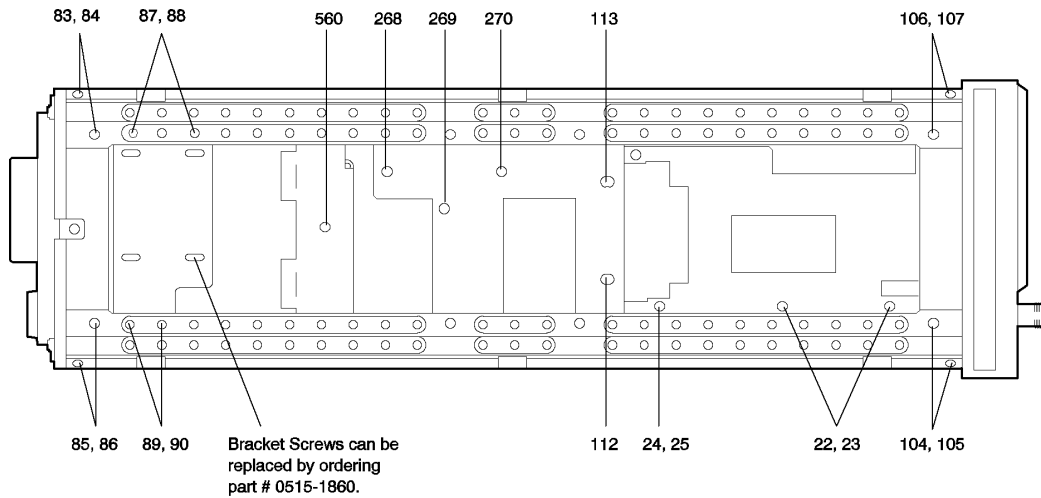
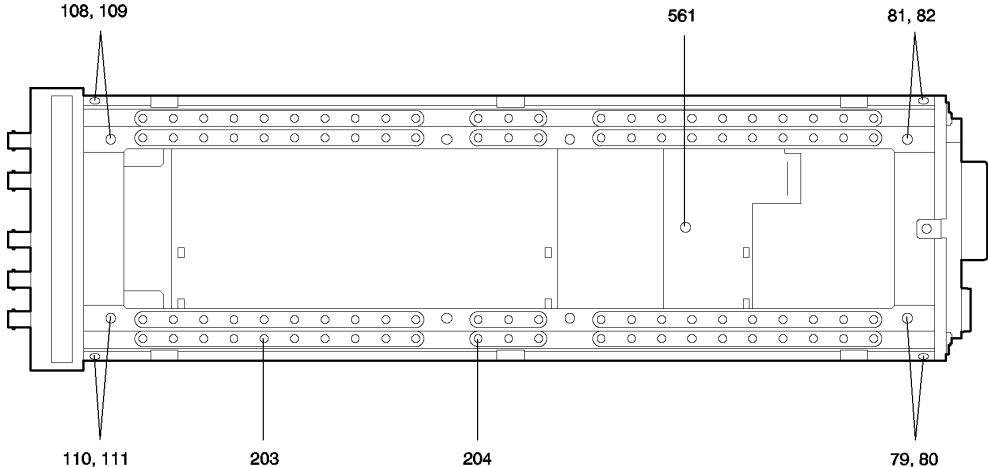


Table 9-12

Replaceable Parts

Item	Agilent Part Number	C D	Qty.	Description	Mfr. Code	Mfr.Part Number
79-82, 108-111	0515-1331	1	8	SCREW M4 X 6	00000	ORDER BY DESCRIPTION
203,204	0515-0380	2	2	SMM4.0 10SEMPNTX	00000	ORDER BY DESCRIPTION
561	0515-0380	2	1	SMM4.0 10SEMPNTX	00000	ORDER BY DESCRIPTION

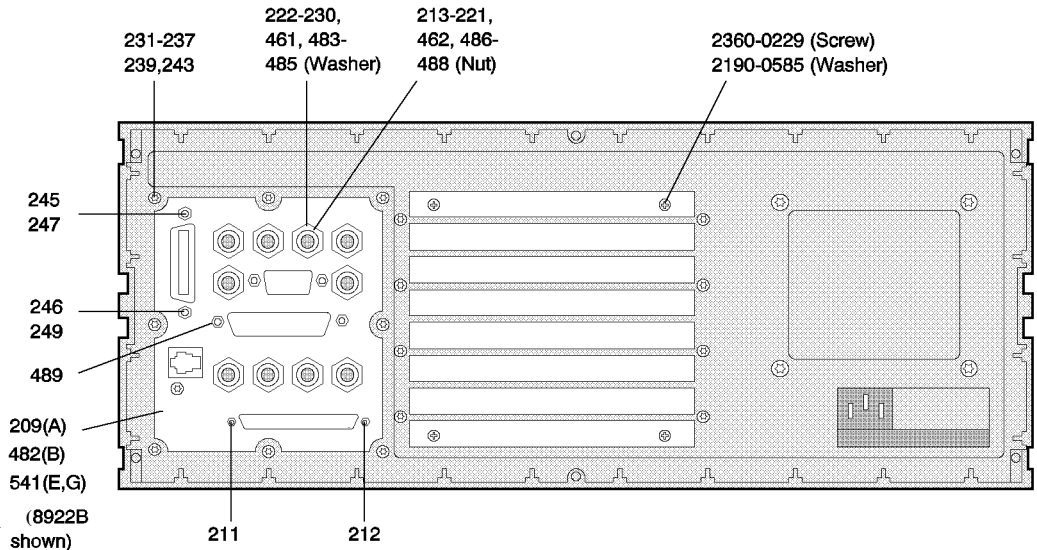


Replacing a Part Replaceable Parts

Table 9-13

Replaceable Parts

Item	Agilent Part Number	C	Qty.	Description	Mfr. Code	Mfr.Part Number
Serial Prefix 3216A and Below						
209	08922-00005	2	1	PLATE REAR PANEL (A Only)	28480	08922-00005
Serial Prefix 3217A and Above						
209	08922-00073	4	1	PLATE REAR PANEL (A Only)	28480	08922-00073
211,212	0380-2079	3	2	CONN SCREWLOCK	00000	ORDER BY DESCRIPTION
213-221	2950-0035	8	9	NUT-HEX (A/G Only)	00000	ORDER BY DESCRIPTION
222-230	2190-0102	8	9	WASHER LK.	00000	ORDER BY DESCRIPTION
231-237, 239,243	0515-1950	4	9	SCREW M3 X .5	00000	ORDER BY DESCRIPTION
245-246	0380-0644	4	2	STANDOFF, METRIC (For G/H Opt.003 Only)	00000	ORDER BY DESCRIPTION
247,249	2190-0577	4	2	WSHR LK .1941D	00000	ORDER BY DESCRIPTION
461	2190-0102	8	1	WASHER LK.(A/G/H Only)	00000	ORDER BY DESCRIPTION
462	2950-00035	8	1	NUT HEX (A/G/H Only)	00000	ORDER BY DESCRIPTION
Serial Prefix 3216A and Below						
482	08922-00048	3	1	PLATE-REAR PANEL (B Only)	28480	08922-00048
Serial Prefix 3217A and Above						
482	08922-00074	5	1	PLATE-REAR PANEL (B Only)	28480	08922-00074
483,485	2190-0102	8	2	WASHER LK (A/G/H Only)	00000	ORDER BY DESCRIPTION
486-488	2950-0035	8	3	NUT-HEX	00000	ORDER BY DESCRIPTION
489	1251-0218	6	1	POST CONNECTOR, LOCK (B Only)	00000	ORDER BY DESCRIPTION
Serial Prefix 3235A and Below						
8922E All Prefixes						
541	08922-00075	6	1	PLATE REAR PANEL (E/F/G/H/M/S Only)	28480	08922-00075
8922G Prefix 3240A00250 and Above						
541	08922-00049	4	1	PLATE REAR PANEL (G Only)	28480	08922-00049

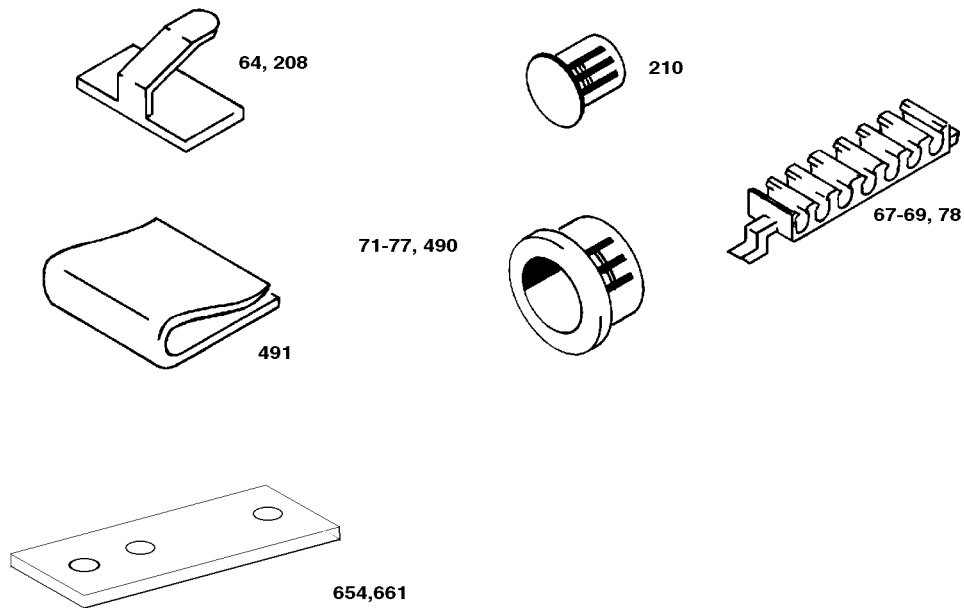


Replacing a Part Replaceable Parts

Table 9-14

Miscellaneous Replaceable Parts

Item	Agilent Part Number	C D	Qty.	Description	Mfr. Code	Mfr.Part Number
26,205-207	1400-0249	0	4	CABLE TIE	00000	ORDERBY DESCRIPTION
53	08590-80007	0	1	LBL WARNING-CRT	00000	ORDER BYDESCRIPTION
64,208	1400-1391	5	3	CLAMP CABLE	00000	ORDER BY DESCRIPTION
67-69,78	5041-7250	9	4	CABLE CLIPS	00000	ORDER BY DESCRIPTION
71-77	0400-0112	5	7	GROMMET, SNAP-IN	00000	ORDER BY DESCRIPTION
238	08920-00063	0	1	CAUTION LABEL	28480	08920-00063
534-536	1400-0249	0	3	CABLE TIE	00000	ORDERBY DESCRIPTION
490	0400-0112	5	1	GROMMET, SNAP-IN	00000	ORDER BY DESCRIPTION
491	1400-0611	0	1	CLAMP CABLE	00000	ORDER BY DESCRIPTION
210	6960-0132	1	9	PLUG	00000	ORDER BY DESCRIPTION
544	2110-0083	9	1	FUSE 2.5A MED	00000	ORDER BY DESCRIPTION
544	2110-0055	2	1	FUSE 4A MED	00000	ORDER BY DESCRIPTION
545	9230-0260	2	1	ENV VOLT WARNING	00000	ORDER BY DESCRIPTION
553	08642-00138	3	1	LBL-2 PERSONLIFT	28480	08642-00138
654,661	08922-00076	7	1	PLATE BLOCK	28480	08922-00076
	5180-1871	2	2	LBL-BLK SERIAL	00000	ORDER BY DESCRIPTION



Firmware Upgrades

In The Agilent 8922M

HOST and GSM Firmware are upgraded using an external controller or Personal Computer.

In The HP/Agilent 8922A, B, E, G, F, H, S

The firmware for the HP/Agilent 8922A,B,E,G,F,H,S is grouped in single ROM sets. These sets are listed below. It is recommended that a complete set is used each time a firmware upgrade needs to be made.

HP Part Number	Description
08922-61087	8922A/B ROM Upgrade
08922-61088	8922E ROM Upgrade
08922-61089	8922G ROM Upgrade
08922-61116	8922F ROM Upgrade
08922-61117	8922H ROM Upgrade
08922-61149	8922S ROM Upgrade

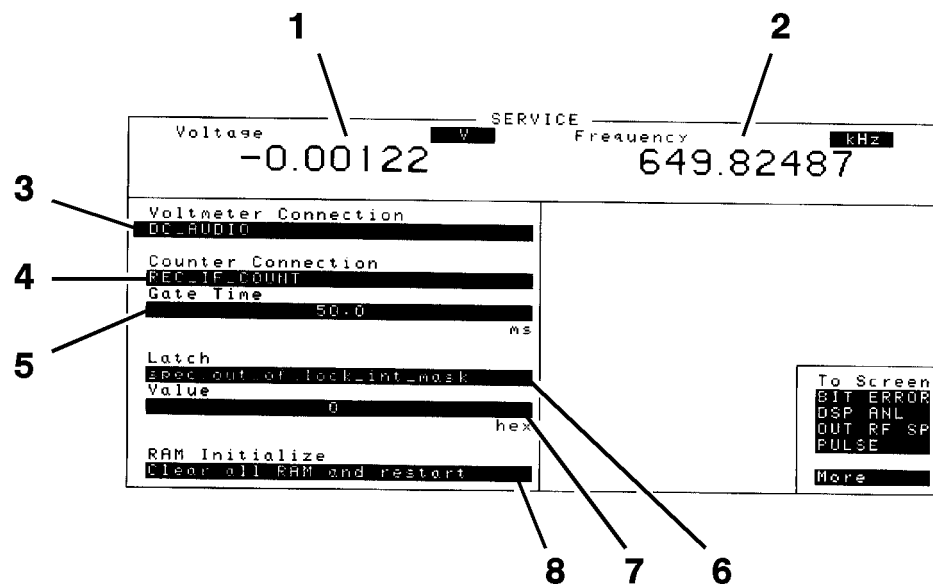
Replacing a Part
Firmware Upgrades

This Page Intentionally Left Blank

Service Screen

Introduction

This chapter describes the fields on the service screen. The service screen is intended to support component level repair and the features are of greatest use with component level documentation. Component level documentation is beyond the scope of this book and Agilent Technologies does not currently support component level support for the HP/Agilent 8922 product family outside of the factory.



1. Voltage

This field displays the voltage measured at the selected voltmeter connection.

2. Frequency

This field displays the frequency measured at the selected counter connection.

3. Voltmeter Connection

This field selects the voltage test point. The voltage will be measured and displayed in the voltage field.

4. Counter Connection

This field selects the frequency test point. The frequency will be counted and displayed in the frequency field.

5. Gate Time

This field selects the gate time used by the frequency counter.

6. Latch

This field selects the data latch to be read or written to.

7. Value

This field displays the present value of the selected latch. This field is also used to set the latch value of writable latches.

8. RAM Initialize

This field clears all RAM memory. RAM memory contains recall registers and test programs.

A quick RAM initialize can be carried out by holding in the **LOCAL** and **Hz** keys while powering on the HP/Agilent 8922. Release the keys after the self test beep.

Service Screen
Introduction

This Page Intentionally Left Blank

10-4

Self-Test Error Messages

Introduction

This chapter lists the error messages that appear on the status line of the display and on the message screen when the self-tests are run on power-up. This list does not include all of the messages that can appear under all circumstances.

"Battery Backed RAM Initialized. Structures corrupt."

"Battery Backed RAM Initialized. Option RAM not maintained."

"Battery Backed RAM Initialized. Optional RAM not found."

"Battery Backed RAM Initialized. Standard RAM not maintained."

"All host processor self-tests passed."

"PANIC - UNKNOWN ERROR OCCURRED."

"Attempt to write EEPROM failed."

"Communication failure with the Rcvr Step Loop Board."

A serial communications failure occurred with the A17 Step Loop assembly.

"Communication failure with the Sig Gen Step Loop Board."

A serial communications failure occurred with the A26 Step Loop A assembly.

"Communication failure with the NSM/PMF Board."

A serial communications failure occurred with the A5 Premod Filter and NSM assembly.

"Hop Controller communication channel Failure."

"Self-test failure in Hop Controller."

The A33 Hop Controller assembly failed its self-test.

"Hop Controller did not post self-test results."

"DSP Analyzer communication Channel Failure."

"Self-test failure in DSP Analyzer."

The A9 Global Test and Demod assembly failed its self-test

"DSP Analyzer did not post self-test results."

"Protocol Processor Communication Channel Failure."

"Self-test failure in Protocol Processor."

The A32 GSM Controller assembly failed its self-test.

Module I/O Specifications

Introduction

This chapter contains tables of module input/output specifications.

These do not include tables for some of the digital boards due to complexity. In most cases it will be quicker to verify digital failures using board swap than to verify through measurement.

This chapter is used with the Using the Service Kit, Instrument Block Diagram and Block Diagram Theory chapters to verify a specific module or assembly failure when diagnostics and performance tests do not provide a high level of certainty.

A2 Audio Analyzer 2

Use extender card 08920-60142

Power Supplies

+5 V	J1(21,22)	200 mA
+12 V	J1(19)	80 mA
-12 V	J1(20)	80 mA
GND (Analog)	J1(6,7,10,13,14,17,18)	
GND (Digital)	J1(23,24,25,27)	

Inputs

AUDIO INPUT MUX

From A3 Audio Analyzer 1

Selected Input — FIL_AUD J1(12)	
Input Z	1 M Ω DC Coupled
Voltage Range	± 5 Vp

From Modulation Distribution Board

Selected Input — MOD_MON J1(16)	
Input Z	100 k Ω DC Coupled

DC AUDIO INPUT

From A3 Audio Analyzer 1

DC_AUD J1(15)	
Input Z	100 k Ω
Voltage range	± 5.0 Vp

Outputs

AUDIO OUT MEAS MUX

To A19 Measurement Board

AUD2_VM J1(11)	
Selected path = POS/NEG peak detectors. Input = FILT_AUD	
Response Time	< 1 ms (Rise time)
DC Offset	< ± 15 mV
Detector Range	0.424 to 5 V Peak
Selected path = Pre Notch RMS detectors. Input=FILT_AUD	
Specified Meas. Range	0.296 to 1.67 V _{rms}
Selected path = Post Notch RMS detectors. Input FILT_AUD	
RMS detector settling time	Slow (<= 200 Hz) < 673 μs Fast (> 200 Hz) < 93 μs
Specified Meas. Range	0.200 to 1.67 V _{rms} Gain < 40 dB 0.095 to 1.67 V _{rms} Gain = 40 dB
3 dB Bandwidth	> 160 kHz 70 dB total Gain
Notch Attenuation	> 40 dB 1 kHz ± 20 Hz > 65 dB 1 kHz ± 5 Hz
Selected path = DC_AUDIO Input =FILT_AUD	
Input Impedance	100 kΩ
DC Offset	16 mV Over Temp
Selected path = Pre Notch Audio Input = FILT_AUD	
DC Offset	< ± 16 mV Over Temp
Available Gain	30 dB
Selected path = Post Notch Audio Input = FILT_AUD	
DC Offset	< ± 16 mV Over Temp
Available Gain	70 dB

SPEAKER

SPK1 J1(2)	
Max Output (8 Ω)	250 mW Input = FILT_AUD
Amp Gain Adjust Range	0 to 20
ALC circuit output level	0.25 V _p ALC Mode

A3 Audio Analyzer 1

Use extender card 08920-60142.

The Primary function of Audio Analyzers 1 and 2 is to provide oscilloscope functions.

Power Supplies

+5 V	J1(21,22)	20 mA
+12 V	J1(19)	60 mA
-12 V	J1(20)	60 mA
GND (Analog)	J1(3,4,8,12,13,17,18)	
GND (Digital)	J1(23,24,26,27)	

Inputs

AUDIO INPUT MUX

DEMOD_AUD J1(6) From A16 Receiver MOD_MON J1(10) From Mod Distribution EXT_SCOPE J1(11) From Front Panel AUX_IN2 J1(5) DET_LO J1(7) From Input Section AUD_IN_HI J1(1) From Front Panel AUD_IN_LO J1(2) From Front Panel		
Input Z	1 M Ω	DEMOD_AUD, MOD_MON
	100 k Ω	EXT_SCOPE, AUX_IN2, DET_LO
	= 1 M Ω	AUD_IN_HI
	< 65 pF to GND. (Non-Floating GND input).	
Ground AUD_IN_LO		
Floating	= 1 M Ω	
	65 pF to GND.	
GND	< 200 Ω	
Maximum Input (Hardware Limit)	12 V _p	DEMOD_AUD, MOD_MON
	9.8 V _p	EXT_SCOPE, AUX_IN2, DET_LO
	98 V _p	AUD_IN_HI, AUD_IN_LO

Outputs

To Audio Analyzer 2

FIL_AUD J1(15)		
Output Z	< 1 Ω	Unit Gain Opamp
Selected Inputs (DEMOD_AUD,MOD_MON,EXT_SCOPE, AUX_IN2, DET_LO)		
Total Path Accuracy	0.02 to 10 kHz \pm 0.45 % 0.02 to 25 kHz \pm 1.05 % 0.02 to 75 kHz \pm 7.7 %	0,20,40 dB, No Filters
DC Offset	< 13 mV	0 dB Gain
	< 1.3 V	40 dB Gain
THD + Noise	< .07%	1 kHz Rate, 15 kHz BW.
Selected Inputs (AUD_IN_HI,AUD_IN_LO)		
Total Path Accuracy	.02 to 12 kHz \pm 0.704 % .02 to 25 kHz \pm 1.3 % .02 to 75 kHz \pm 7.95 %	-20,0,20 dB, No Filters
3 dB Freq, Thru Path	-20 dB 0.0 dB +20 dB	< 1 Hz and > 200 kHz < 1 Hz and > 200 kHz < 1 Hz and > 100 kHz

To A19 Measurement Board

AUD1_VM J1(16)		
Output Z	> 1 Ω	Unity Gain buffer
DC Offset	< ± 9 mV	
Selected input =Range/Over-voltage detector		
Response Time		< 1 ms (Rise time)
DC Offset		± 15 mV
Specified input range		.29 to 5 Vp
Accuracy	$\pm 2\%$	20 Hz to 50kHz
B.W. (3 dB)		20 Hz to >200 kHz.
Selected input = DC Audio Path		
Filter 3 dB BW	2.1 Hz	
Step Response (1%)	<400 ms	
DC Offset	± 21 mV	Uncalibrated
DC Offset	$\pm .1$ mV	Calibrated
DC Offset drift	± 3 mV	OverTemperature
DC path gain accuracy		

To Audio Analyzer 2

DC_AUDIO J1 (14)		
DC Offset	Front Panel Input	± 15 mV
	Other Inputs	± 6.3 mV

A4 Modulation Distribution

Use extender card 08920-60141

Power Supplies

+12 V	J1(29)	120 mA + Audio Output Drive
+5 V	J1(33,34)	12 mA
-12 V	J1 (30)	120 mA + Audio Output Drive
GND (Analog)	J1(27,28)	
GND (Digital)	J1(35,36,37)	

Inputs

From Front Panel BNC input

EXT_MOD J1(1)	
Input Z	600 Ω
Max Input Level	15 V _p
Full Scale Input	1 V _p

From A6 Signal Source/Analyzer

AFG1 J1(11), AFG2 J1(13), AFG_GND J1(12)	
Input Z	13.36 k Ω
GND Input Z	46.7 k Ω
Full Scale Input	3.5 V _p 1.3 V _{rms}

AFG1 and AFG2 are both sine wave signals with the audio frequency set on the RF Generator page, the attenuation takes place on the modulation distribution board. To obtain a signal for measuring AFG2, select TEST MENU, then AF_diags. From the AF diags submenu, select MODULATION DISTRIBUTION INTERNAL TEST, using single step, stop on test #1. AFG1 will measure at >500 mV_{rms} and > 1.8 V_{p-p}

Outputs

To Front Panel BNC

AUDIO_OUT_HI J1(7)		
Output Z	< 1 Ω	
Maximum Output Voltage	5 V _{rms}	OpenCircuit
Max Output Current	40 mA Peak	Hardware spec.
	20 mA peak	Spur Requirements
Full Scale Gain (Uncal)	5.953 \pm 1.51%	LFS1/2 to FP, DAC=255, 600 Ω Load.
Attenuator Accuracy	\pm 0.02 dB	(DC) (20,40,60 dB)

The output of AUDIO_OUT_HI can be set on the RF Analyzer page.

AM_MOD J1(20)		
AM MOD Ouput Z	< 400 Ω	Load 100 k Ω /4000 pF
Full Scale output	4 Vp	
Uncalibrated Path Gain	2.37 \pm 1.5%	DAC=255, 1 kHz Gain (AFG1 Path)
Gain (F.P. Input)	5.12 \pm 2.5%	DAC=255 , 1 kHz
Attenuator Accuracy	\pm 0.02 dB	(1 kHz) (20 dB)
High Freq roll off	< 3 dB	150 kHz
Low Freq roll off	< 1 dB	20 Hz AM port EXT AC Standard AM load.

To route the input signal AFG1 to the output AM_MOD, access the SERVICE Screen. Select the latch 'dstr_mod_destination' and change the value to any odd number (for example '3'). Select 'dstr_afg1_to_mod' and change the value to any even number (for example '2') and measure.

MOD_MON J1(18)	
Output Z	< 1 k Ω

MOD_MON can also be accessed using the SERVICE Screen. Use latch 'dstr_monitor_select'.

- '2' signal at un-attenuated values of AFG1.
- '3' use external source connected to 'Modulation_In_AmSpeech'
- '4' signal at levels set up at RF Generator page.

A5 Premodulation Filter and NSM

Use extender card 08922-60132.

Power Supplies

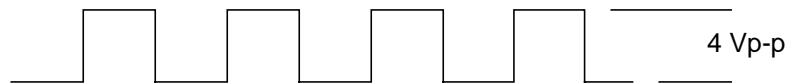
+15 V	J1(12) J2(20)	TP 2	15 mA
-15 V	J1(11) J2(23,24)	TP 3	15 mA
+5 V	J1(15,16) J2(23,34)	TP 1	1.1 A
-5 V	J1(19)	TP 4	5 mA
Ground	J1(2-4,6-10,13-14,17-18,20-21,23-40) J2(2-4,17-18,21-22,25-26,28-32,34-37)	TP 5	

Inputs

From A34 GSM-RTI Assembly

PMF_CLK J1(5)	
Level:	TTL
Frequency:	270.833 \pm 2 kHz

Clock signal input is a square wave of duty cycle 50% and approximately 4.4Vp-p when measured on an oscilloscope. To view on a spectrum analyzer, set centre frequency to 270 kHz and span to 540 kHz, the peak marker should read approximately +12dBm.



From A34 GSM-RTI Assembly

PMF_DATA J1(1)	
Level:	TTL
Rate:	270.833 kbps
Format:	Non-differential data encoded

The PMF_DATA signal is difficult to measure accurately without a high speed oscilloscope or logic analyzer. Using a Spectrum Analyzer, an increased noise floor can be seen when probed about the centre frequency of 270 kHz. Using an oscilloscope, the signal can be measured at 4.4 Vp-p. On a DVM, 2.25 Vdc.

From A15 Reference GSM-RTI Assembly

10 MHz Ref B J2(33)	
Frequency:	10 MHz \pm 500 Hz
Wave Shape:	Sine
Level:	>10 dBm
Harmonics:	< -25 dBc

The 10 MHz Reference signal can be measured on an oscilloscope at 880 mV_{rms} and 2.6 Vp-p. On a Spectrum Analyzer, the marker will be approximately +10dBm.

NOTE:

The Premodulation Filter and NSM assembly are used to convert User Digital Data and clock signals into GMSK.

Outputs

To A27 DAC/Upconverter

NSM_IF_CLK J2(1)	
Frequency:	17.3333 MHz \pm 250 Hz
Level:	TTL

The NSM_CLK signal can be sensed on the SERVICE Screen using the 'nsm_pmf_clk_pres_int_sense' latch, a value of 1 for lock and '0' for OOL (Out Of Lock) state. An OOL condition can cause high phase and frequency error problems. See Figure 4-1 on page 12-12 for typical oscilloscope readings. On a Spectrum Analyzer, the peak marker should be >+6 dBm.

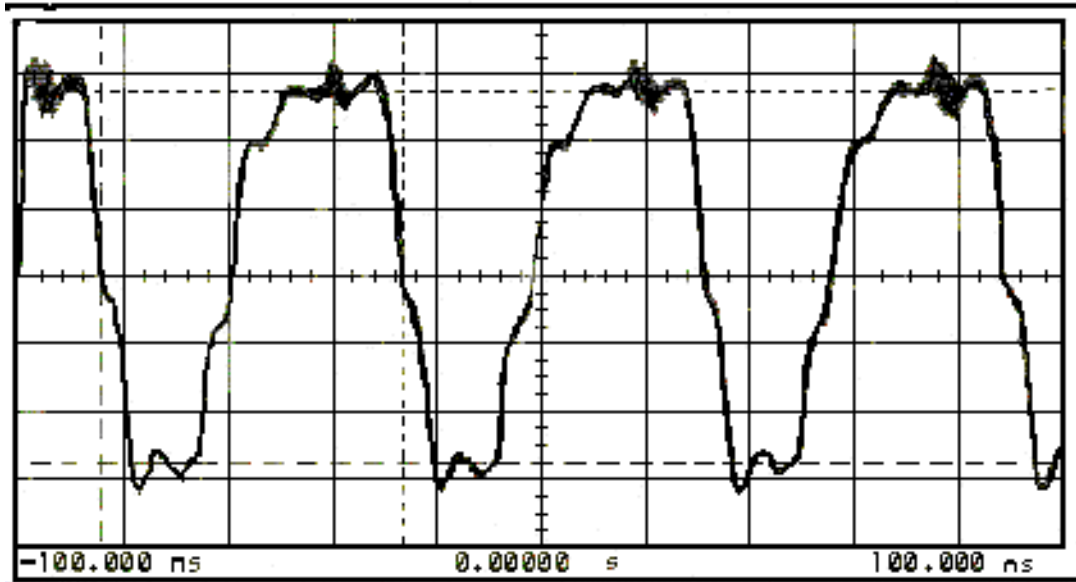


Figure 4-1 Typical Oscilloscope Display

Channel 1	= 500.0 mvolts/div	Offset	= 1.810 volts	Trigger mode:	Edge on positive edge on Chan1
Timebase	= 20.0 ns/div	Delay	= 0.000 s	Trigger Levels	
Ch. 1 Parameters		P-P Volts	= 3.187 volts	Chan1	= 1.810 volts
Rise Time	= 13.660 ns	Fall Time	= 7.540 ns	Holdoff	= 70.000 ns
Frequency	= 17.3310 MHz	Period	= 57.700 ns		
+ Width	= 32.710 ns	- Width	= 24.990 ns		
Overshoot	= 250.0 mvolts	Preshoot	= 187.5 mvolts		
RMS Volts	= 2.343 volts	Duty Cycle	= 56.68%		

Serial I/O

From A34 RTI Assembly

Hop Control	E/I_NSM J2(38) CLK_NSM J2(39) DAT_NSM J2(40)
Levels:	TTL
Clock Rate:	≅ 100 kHz (bursted) non-hopping generator ≅ 1 MHz (bursted) hopping generator

The HOP CONTROL lines can be measured at +5Vdc

A6 Signaling Source/Analyzer

Use extender card 08920-60140.

Power Supplies

+12 V	J1(9)	21 mA
+5 V	J1(37,39,40)	650 mA
-12 V	J1(10)	41 mA
D_Ground	J1(13,14,31,32)	
A_Ground	J1(2,7)	

Inputs

From A2 Audio Analyzer 2

PROC_AUD J1(11)	
Input Impedance	41.6 k
Minimum Input Level	0.2 Vpk
Maximum Input Level	5 Vpk
Analyzer timebase	12 MHz \pm 0.01%

Outputs

To A4 Modulation Distribution Assembly

AFG1 J1(3), AFG2 J1(5)	
Freq Range	DC to 25 kHz
Freq Resolution	0.1 Hz
Freq Accuracy	0.01 % of setting
Output level (Max)	2.5 Vpk
Output Lvl Resolution	12 Bits (LSB = 5V/4096)
Output Lvl Acc (Uncal)	± 0.0183% F.S.
Output Channel Clock	838.8608 kHz
Output Impedance	1.336 k Ω (680 pF Shunt)
THD+Noise (Sine)	0.10% (Output = 2.5 Vpk) (Meas BW 80 kHz) (20 Hz to 25 kHz)

For levels and setting up signals for measuring,
see "A4 Modulation Distribution", page 12-8.

A9 Global Test and Demod

Use extender card 08922-60133.

Power Supplies

+15 V	J2(29,30) - TP 15	140 mA
-15 V	J2(25,26)	80 mA
+5 V	J2(23,24)	1.0 A
-5 V	J2(21,22)	20 mA
Ground	J1(1,33,4,17,18,20) J3(1-4,6-14,16-20) - TP 14/16	

Inputs

From A16 Receiver

10.7M_IF J1(7)	
Frequency:	10.7 MHz \pm 50 kHz
Level:	3 dBm \pm 1 dB
Harmonics:	<- 40 dBc

The 10.7 MHz is originated from the A16 Receiver. It is down converted to 700 kHz \pm 50 kHz within the Global Test and Demod assembly. To obtain a reading either with an oscilloscope (See Figure 4-2 on page 12-16) or spectrum analyzer, the signal needs to be looped back. This can be done using the RF diagnostics and pausing on test #1 for Receiver Down converters (with spectrum analyzers).

If the generator path is in doubt, use a known working reference signal into a port, remembering to check settings on RF analyzer page for frequency and port settings.

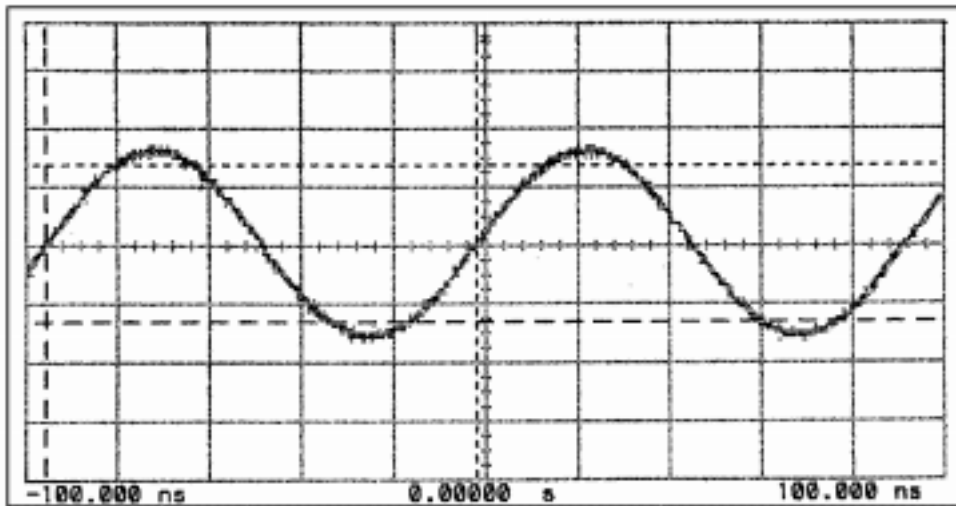


Figure 4-2

Expected Output

Channel 1	= 500.0 mvolts/div	Offset	= -50.00 volts	Trigger mode:	Edge on positive edge on Chan1
Timebase	= 20.0 ns/div	Delay	= 0.0000 s	Trigger Levels	
Ch. 1 Parameters		P-P Volts	= 1.468 volts	Chan1	= -50 mvolts
Rise Time	= 27.540 ns	Fall Time	= 27.000 ns	Holdoff	= 70.000 ns
Frequency	= 10.6998 MHz	Period	= 93.460 ns		
+ Width	= 46.790 ns	- Width	= 46.670 ns		
Overshoot	= 31.25 mvolts	Preshoot	= 93.75 mvolts		
RMS Volts	= 482.0 volts	Duty Cycle	= 50.06%		

From A15 Reference Section

20M_REF_A J1(11)	
Wave Shape:	Sine
Frequency:	20 MHz \pm 1 ppm Requires Ext Ref of 1 ppm
Level: >	0 dBm (500 mV _{rms})
Harmonics:	< -25 dBc
Spurs (> 5 kHz offsets):	< -110 dBc

Figure 4-3 on page 12-17 shows the expected oscilloscope reading. This signal can also be clearly seen on a spectrum analyzer.

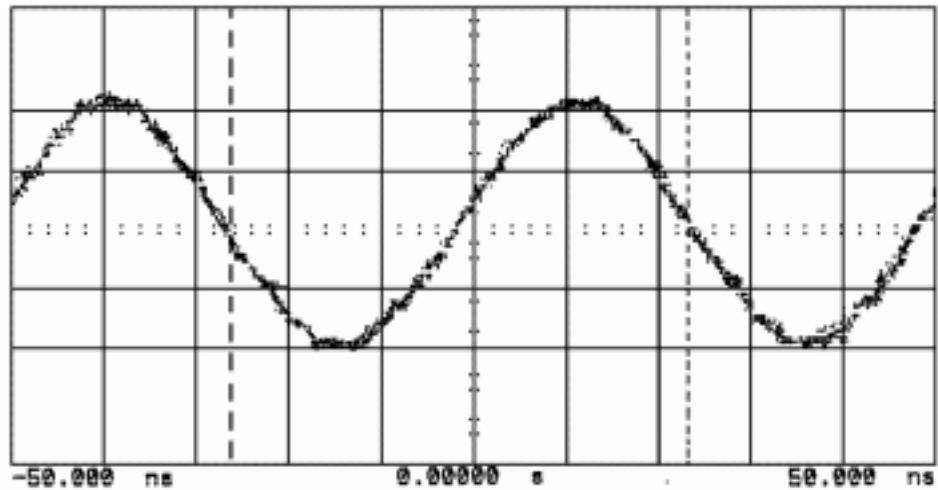


Figure 4-3

Expected Display

Channel 1	= 200.0 mvolts/div	Offset	= -24.00 volts	Trigger mode:	Edge on positive edge on Chan1
Timebase	= 10.0 ns/div	Delay	= 0.0000 s	Trigger Levels	
Ch. 1 Parameters		P-P Volts	= 887.5 volts	Chan1	= -24.00 mvolts
Rise Time	= 14.810 ns	Fall Time	= 16.770 ns	Holdoff	= 70.000 ns
Frequency	= 20.2347 MHz	Period	= 49.420 ns		
+ Width	= 25.510 ns	- Width	= 23.880 ns		
Overshoot	= 0.0000 mvolts	Preshoot	= 50.00 mvolts		
RMS Volts	= 290.6 mvolts	Duty Cycle	= 51.67%		

Output to Rear Panel System Bus

F_CNT J1(21)	
Waveshape:	Sine
Levels:	100 mV minimum, +5 dBm
Frequency:	700 kHz

To set up this signal for measuring, follow the same procedure as for "10.7M_IF J1(7)", page 12-15, by running the RF Diagnostics. The signal can be seen on a spectrum analyzer or measured on an oscilloscope, see Figure 4-4 on page 12-18 for a typical reading.

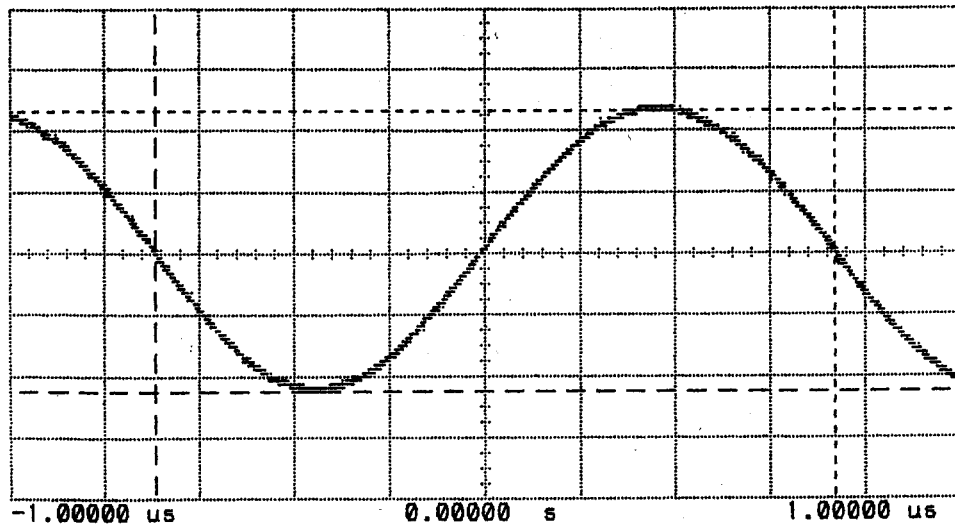


Figure 4-4 Typical Display

Channel 1	= 1.000 volts/div	Offset	= -280.0 mvolts	Trigger mode:	Edge on positive edge on Chan1
Timebase	= 2000 ns/div	Delay	= 0.0000 s	Trigger Levels	
Ch. 1 Parameters		P-P Volts	= 4.625 volts	Chan1	= -280.00 mvolts
Rise Time	= 423.590 ns	Fall Time	= 423.660 ns	Holdoff	= 70.000 ns
Frequency	= 699.580 kHz	Period	= 1.42943 ns		
+ Width	= 740.980 ns	- Width	= 688.450 ns		
Overshoot	= 0.0000 mvolts	Preshoot	= 62.49 mvolts		
RMS Volts	= 1.617 volts	Duty Cycle	= 51.83%		

A11 Receiver Mixer

No extender card required.

Power Supplies

+5 V	PC1	70 mA
GND	Chassis	

Inputs

From A23 Input Section

1st_MIX_IN J2	
Frequency Range	0.4 to 1000 MHz
Level - using known reference connected to RF IN/OUT	-20 dB compared to reference setting

NOTE:

Ensure the reference setting and RF Analyzer are set to the same frequency.

From A17 Step Loop B

EXT_REF_IN J1	
Frequency Range	500 to 1000 MHz
Input Level	3 ± 3 dBm

LO (Local Oscillator) Frequency will be 114.3 MHz or 614.3 MHz away from frequency set on RF Analyzer page depending on which one is furthest away from chosen analyzer frequency. See Figure 4-5 on page 12-20 for a typical display.

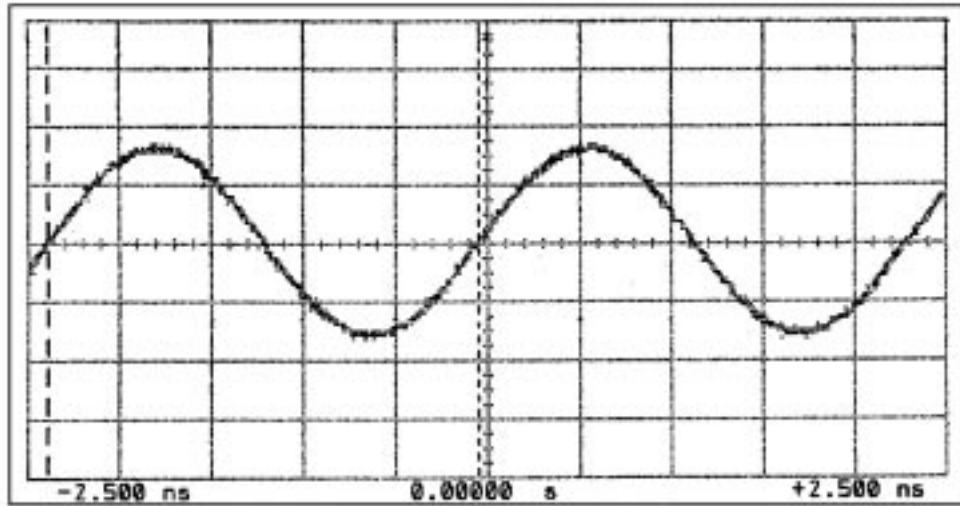


Figure 4-5

Typical Display

Channel 1	= 130.0 mvolts/div	Offset	= 0.000 volts	Trigger mode:	Edge on positive edge on Chan1
Timebase	= 875 ps/div	Delay	= 0.0000 s	Trigger Levels	
Ch. 1 Parameters		P-P Volts	= 387.5 mvolts	Chan1	= 0.000 volts
Rise Time	= 410 ps	Fall Time	= 420 ps	Holdoff	= 70.000 ns
Frequency	= 714.286 MHz	Period	= 1.40 ns		
+ Width	= 690 ps	- Width	= 710 ps		
Overshoot	= 0.0000 volts	Preshoot	= 0.000 volts		
RMS Volts	= 135.7 mvolts	Duty Cycle	= 49.28%		

Outputs

To A16 Receiver

RCVR_IN J3	
Typical Output Levels	
Normal	-27 to -37 dBm
Underrange	-37 to -60 dBm
Conversion Gain	-10 ± 2 dB Temp, .4 to 1000 MHz In.
Flatness Uncal (± 5 Mhz) (Referenced from I.F.center)	
614 MHz I.F.	± 1.5 dB
114.3 MHz I.F.	± 1.5 dB
IF Filter 114.3 MHz	
Center	114.3 ± 5 MHz
B.W. (1 dB)	40 MHz ± 5 MHz
Rejection	> 35 dB +885 MHz
IF Filter 614.3 MHz	
Center	614.3 ± 0.1 MHz Adjustable.
B.W. (1 dB)	10 MHz ± 0.1 MHz
Rejection	> 50 dB + 885 MHz

NOTE:

To measure RCVR_IN, the connection must T'ed and a DC blocking capacitor used on the measurement cable. This is to maintain the DC controlling voltage from A16 Receiver, which controls the filters within the receiver mixer. It also the blocking capacitor prvents the controlling voltage being loaded by measurement equipment.

Use a known working reference into RF IN/OUT port, or if in doubt, directly into RF socket on receiver mixer. Ensure frequency and port settings are correct on the RF Analyzer page. Reduce expected input level if oscilloscope or spectrum analyzer do not show a signal.

A13 Output

Use extender card 08922-90129.

Use coax jumpers on Plug 1, pins 3, 17 and Plug 3, pin 13.

Power Supplies

+5 V	J2(4)	50 mA
+12 V	J2(2)	310 mA
-12 V	J2(3)	80 mA
+38 V	J2(1)	10 mA
GND	J1(1,2,4,5,6,7,8,9,10,11,12,13,14,15,16,18,19,20)	
	J3(1,2,3,4,5,6,7,8,9,10,11,12,14,15,16,17,18,19,20)	

Inputs2

From Sum Loop A25 (Change frequency on RF Generator page)

(Coax jumper connection) SGS_500_10000M J1(17)	
Freq Range	480 - 1015 MHz
Input Level required	0 dBm \pm 2 dB
Spectral Purity required	
Harmonics	2nd < -10 dBc 3rd - 5th < -15 dBc
Spurs	< -70 dBc

From A15 Reference Assembly

(Coax jumper connection) OUT_1G_REF J1(3)	
Input Level	1 dBm \pm 3 dB
Harmonics	< -10 dBc
Spurs	< -80 dBc > 5 kHz offsets 500-1500 MHz < -40 dBc < 500 MHz and > 1500 MHz.

OUT_1G_REF only present for RF Generator frequencies from 0 to 291 MHz, used for frequency translation.

From A4 Modulation Distribution

AM_MOD J2(7)		
Input Z	25 k Ω	5000 pF parallel shunt.
Sensitivity	25% AM / V	

See "A4 Modulation Distribution", page 12-8 for measurement procedure.

Outputs

To A12 Pulse Attenuator

(Coax jumper connection) MAIN_RF_OUT J3(13)		
Freq	Main Band	501 to 1000 MHz
	Divide Band	249 to 500 MHz
	Heterodyne Band	0.25 to 248.9999999 MHz
Output Level		
Maximum Output Power	0.25 - 249 MHz	> 13 dBm
	249 - 500 MHz	> 15 dBm
	500 - 1000 MHz	> 16 dBm
Calibrated vernier rng	1 to 8 dBm	Normal
	0 tp 16 dBm	Overrange
Minimum Output Lvl(Off)	< -40 dBm	Modulator Rangefor AM.
Spectral Purity — (Only contributions of the outputmodule)		
Spurs	< -65 dBc	> 5 kHz Offset 5x4,3x2,RF D feed, and L.O. feedthrough.
Harmonics	< -36 dBc	Ampl < +1 dBm + atten loss (atten loss = 9 dB worst case)

A14 Pulse Driver

Use extender card 08922-60129.

Use coax jumpers on Plug 1, pins 3, 13 and 17. Plug 3, pins 3, 9 and 17.

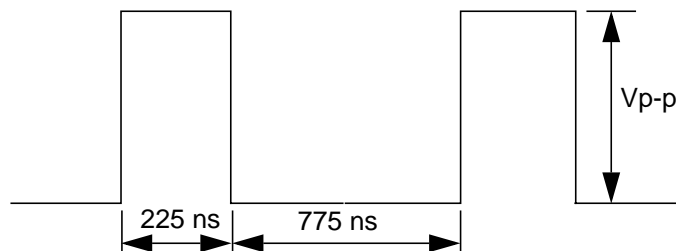
Power Supplies

+15 V	J2(2)
-15 V	J2(3)
+5 V	J2(4)
Ground	J3(1-2,4-8,10-16,18-20) J1(1,4,6-12,14,16,18-19)

Inputs

From A15 Reference Section

1M_REF_C P3(3)	
Frequency:	1 MHz \pm 5 Hz
Levels:	CMOS
Duty Cycle:	800 ns high, 200 ns low
Waveshape	Square Wave (Not a true square wave)
Duty Cycle	25%
Amplitude	4.4 Vp-p
Level	> 7 dBm



Outputs

To 13 MHz output on Rear Panel

13M_REF_OUT_A P3(17)	
Waveshape:	Sine
Level:	>7.5 dBm
Nominal Output Impedance:	50 Ω
Amplitude	3.75 V _{p-p} 1.7 V _{rms}

To A34 RTI Assembly

13M_REF_OUT_B	
Waveshape:	Frequency and Harmonics
Level:	>7.5 dBm
Amplitude	5.3 V _{p-p}

**HP/Agilent 8922E,G,H,
M Only**

To A12 Pulse Attenuator

ATTEN_SELECT P1 (11, 13, 15, 17, 20)	
Level	Pin 20 +5 vdc
	Pins 11-17 -12 Vdc

A15 Reference

Use extender card 08922-60129.

Use coax jumpers on Plug 1, pins 3, 9, 13 and 17. Plug 3, pins 9, 13 and 17.

Power Supplies

+15 V	J2(2)	90 mA
-15 V	J2(3)	60 mA
+5 V	J2(4)	400 mA
Ground	J3(3,6-8,10-12,14-16,18-19) J1(1-2,4-8,10-12,14-16,18-20)	

Inputs

From Rear Panel

EX_REF_IN J1(9)	
Frequency:	1,2,5,10, or 13 MHz ± 5 ppm to phase lock ± 1 ppm for accurate global phase measurements.
Nominal Impedance:	50 Ω
Signal Level:	Between -2.5 dBm and +23 dBm
Max DC voltage:	± 15 V

From A14 Pulse Driver

13M_OUT_LOCK J2(7)	
High Level:	(PLL is locked)
Low Level:	(PLL is unlocked)

To test, check for presence of 13 MHz out on BNC Rear Panel.

Hop Control

To A33 Hop Controller

J2(5,8,9)	
Levels:	TTL
Clock Rate:	\cong 180 kHz (bursts)
Amplitude	+5 Vdc

Outputs

To Rear Panel

EX_10M_REF_OUT J1(13)	
Waveshape:	Sine
Harmonics:	<-25 dBc
Signal Level:	>+7.5 dBm
Spurious at >5 kHz offsets:	<-110 dBc
Nominal Output Impedance:	50 Ω

To A26 Step Loop A

1M_REF_A P3(4)	
Frequency:	1 MHz \pm 5 Hz
Levels:	CMOS
Duty Cycle:	800 ns high, 200 ns low
Amplitude	+4 Vdc
Waveshape	square wave (not a true square wave)
Duty Cycle	80%

See
Figure 4-6 on
page 12-28

To A17 Step Loop B

1M_REF_B P3(1)	
Frequency:	1 MHz \pm 5 Hz
Levels:	CMOS
Duty Cycle:	800 ns high, 200 ns low
Amplitude	+4 Vdc
Waveshape	square wave (not a true square wave)
Duty Cycle	80%

See
Figure 4-6 on
page 12-28

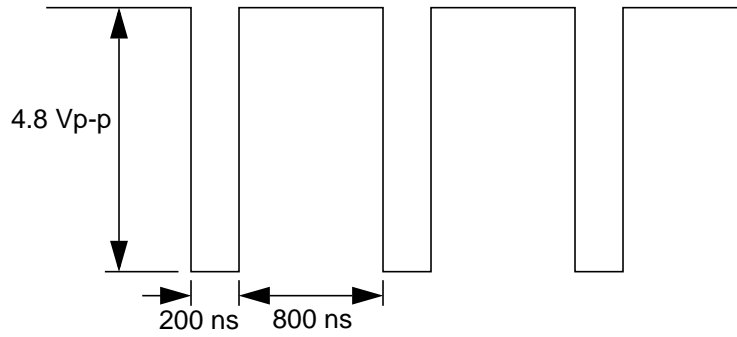


Figure 4-6 Typical Display

To A14 Pulse Driver

1M_REF_C J3(2)	
Frequency:	1 MHz \pm 5 Hz
Levels:	CMOS
Duty Cycle:	800 ns low, 200 ns high
Amplitude	\cong 1 Vdc
Waveshape	square wave (not a true square wave)
Duty Cycle	20%

See Figure 4-7 on page 12-28

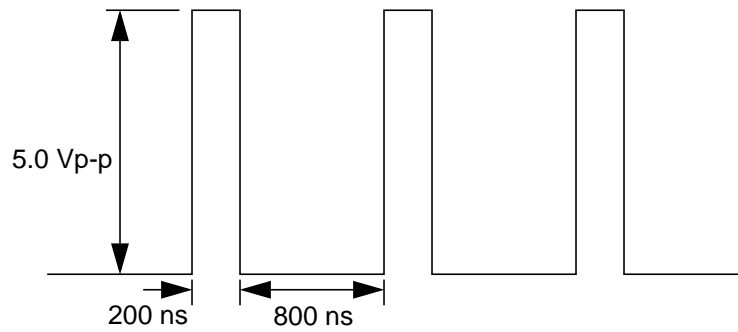


Figure 4-7 Typical Display

To A18 Spectrum Analyzer

SA_20M_REF J3(5)	
Frequency:	20 MHz \pm 100 Hz
Waveshape:	Sine
Harmonics:	<-25 dBc
Subharmonics:	<-30 dBc
Signal Level:	>+3 dBm (+10 dBm typical)
Spurious at >5 kHz offsets:	<-70 dBc
Amplitude	1 V _{rms}
	2.8 V _{p-p}

To A19 Measure Assembly (Readings same as SA_20M_REF)

MEAS_20M_REF J3(13)	
Frequency:	20 MHz \pm 100 Hz
Waveshape:	Sine
Harmonics:	<-25 dBc
Subharmonics:	<-30 dBc
Signal Level:	>+5 dBm
Spurious at >5 kHz offsets:	<-70 dBc

To A27 DAC Upconverter

10M_REF_C J3(9)	
Frequency:	10 MHz \pm 50 Hz
Waveshape:	Sine
Signal Level:	>+10 dBm
Harmonics:	<-25 dBc
Spurious at >5 kHz offsets:	<-70 dBc
Amplitude	1.2 V _{rms}
	3.75 V _{p-p}

To A5 Premodulation Filter and NSM

10M_REF_B J3(17)	
Frequency:	10 MHz \pm 50 Hz
Waveshape:	Sine
Signal Level:	>+10 dBm
Harmonics:	<-25 dBc
Spurious at >5 kHz offsets:	<-70 dBc

For measurement procedure and waveform, refer to "A5 Premodulation Filter and NSM", page 12-10.

To A9 Global Test and Demod Assembly

20M_REF_A J3(20)	
Frequency:	20 MHz \pm 20 Hz Requires 1 ppm reference in
Waveshape:	Sine
Signal Level:	>+5 dBm
Harmonics:	<-25 dBc
Subharmonics:	<-30 dBc
Spurious at >5 kHz offsets:	<-70 dBc

Refer to "A9 Global Test and Demod", page 12-15, for measurement procedure and waveform.

To A13 Output

OUT_1G_REF J1(3)	
Frequency:	1 GHz \pm 5kHz
Waveshape:	Sine
Signal Level:	1 dBm \pm 2 dB
Harmonics:	<-25 dBc
Spurious at >5 kHz offsets 500 MHz to 1500 MHz:	<-60 dBc
Phase Noise At 20 kHz offset:	<-105 dBc

OUT_1G_REF is only present for RF Generator settings up to 291 MHz. Used for frequency translation. Refer to "A13 Output", page 12-22, for readings.

To A16 Receiver Assembly

500M_REF J1(17)	
Frequency:	500 MHz \pm 2.5 kHz
Waveshape:	Sine
Signal Level:	0 dBm \pm 2 dB
Harmonics:	<-25 dBc
Spurious at >5 kHz offsets:	<-60 dBc
Residual FM 0.3 to 3 kHz BW:	<3 Hz
Phase Noise At 20 kHz offset:	<-110 dBc
Amplitude	164 mV _{rms}
	500 mVp-p

To A19 Measurement Assembly, Voltmeter MUX

1G_DIAG J2(1)	
Level if present:	>0.20 V
Level if not present or turned off:	<0.10 V

To A19 Measurement Assembly, Voltmeter MUX

500M_DIAG J2(6)	
Level if present:	0.20 V
Level if not present or turned off:	<0.10 V

A16 Receiver

Use extender card 08922-60129.

Use coax jumpers on Plug 1, pins 3, 7 and 13. Plug 3, pins 3, 9 and 13.

Power Supplies

+15 V	J2(2)	380 mA
-15 V	J2(3)	80 mA
+5 V	J2(4)	100 mA
Ground	J1(1-2,4-6,8,10-12,15-20) J3(1-2,4-8,10-12,14-20)	

Inputs

From A33 Hop Controller

Hop Control P(2,5,8)	
Levels:	TTL
Clock Rate:	\cong 180 kHz (burst)

From A15 Reference

500M_REF P3(3)	
Freq:	500 MHz \pm 2.5 kHz
Input Level:	0 \pm 2 dBm
Spurs at >5 kHz offsets:	<-110 dBc
Waveshape	sine
Amplitude	164 mV _{rms} 500 mV _{p-p}

From A11 Receiver Mixer

RCVR_IN J1(3)	
Frequency:	114.3 MHz or 614.3 MHz \pm 5 MHz
Input Level:	-14 dBm to -53 dBm

CAUTION

Connection must be T'ed and measurement line must have DC blocking capacitor. Refer to "A11 Receiver Mixer", page 12-19, for full measurement procedure.

Outputs

To A9 Global Test and Demod

UNMUTED_FM J1(14)	
Sensitivity into $\geq 100\text{ k}\Omega$ load:	20 $\mu\text{V}/\text{Hz}$
Max Deviation:	100 kHz peak
Amplitude	1.8 Vdc

See Figure 4-8 on page 12-33

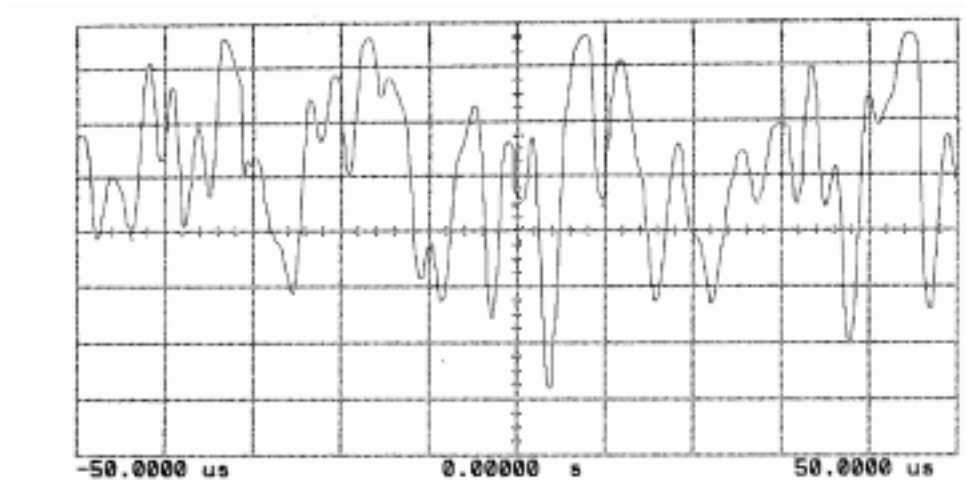


Figure 4-8

Typical Display

To Front Panel

PULSE_DEMOD J1(7)	
Level Pulse ON into open circuit:	+2 V
Level Pulse OFF:	0 V
Output Impedance:	600 Ω
10-90% Rise/Fall time:	<2.5 μs

To test Pulse Demod apply RF Carrier with AM modulation to RF Input, measure Pulse Demod Out on oscilloscope $\approx 180\text{ mV} \times \% \text{MOD}$

NOTE:

Ensure correct settings on RF Analyzer page (frequency/amplitude). If the RF Input level is greater than 5 dBm below RF Analyzer setting, the measurement will not register.

Module I/O Specifications
A16 Receiver

To Front Panel

FM_DEMOD J1(13)	
Sensitivity into open circuit:	20 μ V/Hz
Output Impedance:	600 Ω
Max Deviation:	100 kHz peak
Accuracy DC to 270 kHz:	\pm 5%
Sensitivity into oscilloscope	325 μ V/Hz

To test FM Demod apply RF Carrier with FM modulation to RF Input, measure FM Demod on oscilloscope.

NOTE:

Ensure correct settings on RF Analyzer page (frequency/amplitude). If the RF Input level is greater than 5 dBm below RF Analyzer setting, the measurement will not register.

To A3 Audio Analyzer

DEMODO_AUD J2(6)	
Output impedance:	<10 Ω
Maximum Voltage Output:	12 Vp
DC coupled AM	
Depth:	0 to 95%
Sensitivity:	0.01 V/% AM
DC coupled FM	
Max Deviation:	100 kHz
Sensitivity:	20 μ V/Hz

To A9 Global Test and Demod

10.7M_IF J3(9)	
Freq:	10.7 MHz \pm 50 kHz
Level:	+3 dBm \pm 0.2 dB
Output Impedance:	50 Ω
Global Phase Error:	< 0.8° RMS
	< 1.5° Peak
Global Freq Error:	< 1.5 Hz
Harmonics:	< -40 dBc

Refer to "A9 Global Test and Demod", page 12-15, for measurement procedure.

To A18 Spectrum Analyzer

SA_114.3_M J3(13)	
Frequency:	114.3 MHz \pm 5 MHz
Level	-20 dBm

To A19 Measurement Assembly Voltmeter MUX

AUX7_VM J2(7)	
Voltage range:	\pm 5 V

A18 Spectrum Analyzer

Use extender card 08922-60129.

Use coax jumpers on Plug 1, pins 3 and 17. Plug 2, pin 17.

Power Supplies

+12 V	J2(2)	165 mA
-12 V	J2(3)	300 mA
+5 V	J2(4)	225 mA
Ground	J1(1,2,4-20) J3(1-16,18-20)	

Inputs

From A16 Receiver (Needs Reference Input to obtain a reading)

SA_114.3M P3(17)	
Frequency:	114.3 MHz \pm 5 MHz
Max Ref Level -12 dBm	(Corresponds to -23 dBm input at 8922 Aux RF In with 20 dB RF attenuation and 20 dB Step Gain.) -20 dBm on Spectrum Analyzer with Reference signal connected, and expected input level set to same as reference signal on RF analyzer page
Max second harmonic:	< -48 dBc
.1 dB Compression:	> -12 dBm

From A15 Reference

SA_20MREF J1(3)	
Waveshape:	Sine
Level:	> +3 dBm on spectrum analyzer = +10 dBm Typical
Nominal input impedance:	50 Ω
Amplitude	1 V _{rms} 2.8 V _{p-p}

From A19 Measurement Assembly

SWP_STRT J1(6)	
Levels:	CMOS
High =	Sweep Start
Low =	Sweep Stop

CLK_REF_SA J2(8) Serial Bus E/I_SA J2(9) to/from A33 DAT_REF_SA J2(5) Hop Controller	
Levels:	TTL
Clock Rate:	≅ 80 kHz (bursts)

Outputs

To A19 Measurement Assembly

SA_SCPT J1(7)	
Output Impedance:	100 Ω
Detector Output (Max, Top of Screen):	1.532 V
Input:	-12 dB
Res BW:	100 kHz
Step Gain:	0 dB
Variable Gain	0 dB
Sensitivity:	17.6 mV/dB typical
Det Dynamic Range:	>80 dB
Det Linearity (Uncal):	± 1.5 dB
Log Amp output with no RF applied:	120 mV Typical

A19 Measurement

Use extender card 08920-60138.

Power Supplies

+5 V	J1(15,16) J2(21,24)	420 mA
+12 V	J2(26)	120 mA
-12 V	J2(25)	120 mA
+38 V	J3(17)	< 1 mA
+12 V Aux	J2(28)	0 mA

Inputs

Voltmeter Multiplexer	
	<p> +5 J2(24,21) J1(15,16) +12 J2(26) - FM Motherboard +38 J3(17) - FM Motherboard -12 J2(25) +12 AUX J2(28) IN_TEMP J3(4) IN_VOLT J3(5) DET_LO J3(7) DET_HI J3(6) AUD1_VM J3(8) - FM Audio Analyzer 1 AUD2_VM J3(3) - FM Audio Analyzer 2 RI_VM_ID J3(10) RI_VM J2(12) RSYN_DIAG J3(9) 1G_DIAG J3(11) - From Reference Section A15 500M_DIAG J3(13) - From Reference Section A15 LFS1_VM J3(21) - FM SIG Source/Analyzer A6 LFS2_VM J3(20) - FM SIG Source/Analyzer A6 OUT1_DIAG J3(15) - FM Output Section A13 PS_VM Internal CURRENT_SEN_VM J2(30) SGND Internal AUX1_VM J3(8) - From Step Loop A A26 AUX2_VM J3(30) - From Step Loop B A17 AUX3_VM J3(14) - From Sum Loop A25 AUX4_VM J3(16) - From DAC/Up Convertor A27 AUX5_VM J3(18) - FM Motherboard AUX6_VM J3(19) - FM Motherboard SCOPE_1 Internal SCOPE_2 Internal +VREF Internal -VREF Internal </p>
Input Z	> 1 M Ω // 1000 pF
Full scale input	± 5 V
DC Offset	< 100 mV Uncalibrated
Vref (-)	5 V \pm 3 mV Env (\pm .15 mV)
Vref (+)	-5V \pm 3 mV Env (\pm .15 mV)
Vref Aging	\pm 0.125 mV/1000 hrs

Scope Multiplexer

PROC_AUD J3(24) - FM Audio Analyzer 2 A2 SA_SCP J3(23) - From Spectrum Analyzer A18 RI_SCP J3(26) - From Spectrum Analyzer A18 AUX_SCP J3(21) DET_LO Internal DET_HI Internal GROUND Internal CALIBRATION REFERENCE Internal	
No Minimum Input	
Max Input	10 V
Input Z	> 1 M Ω (No capacitance)
DC Offset	< 100 mV Uncalibrated
AD Ref Voltage	2 \pm .10 V (Full 8 Bits)
Sample Rate	10 Mega Samples/S — in bursts
Max Input Voltage	10.0 V
3 dB Bandwidth	500 kHz

Counter Inputs

AUDIO1_CNT J1(6) - FM Audio Analyzer 1 A3 RI_CNT J1(8) IN_CNT J1(5) - From Input Section A23 IF_CNT J1(9) - From Global Board A9 TIME BASE REF 20 MHz J3(29) MIXED_IF Internal STRIG Internal GND Internal	
20 MHz Time Base Standard	The 20 MHz Sine wave drives a divide by 2 circuit which provides the 10 MHz reference for the counter.
Input Impedance	50 Ω
Input Level	> +5 dBm Sinewave
2nd Harmonics	< -25 dBc
IN_CNT	Input module prescaler count signal
Input Z	2.35 k Ω — .1 uF AC Coupling
Minimum input	100 mV Peak
Freq Range	10 kHz to 4 MHz
IF_CNT	Receiver Module I.F. Count
Input Z	2.35 k Ω — 100 pF AC Coupling
Minimum input	100 mV Peak
Freq	10.7 MHz
AUD1_CNT	HCMOS Vih > 4 V, Vil < 1 V
RI_CNT	HCMOS Vih > 4 V, Vil < 1 V
Maximum Count Time	25.6 μ S x 216 = 1.6777216 S
Minimum Count Time	25.6 μ S
Count time step size	25.6 μ S
Accuracy	same as 10 MHz Ref
Gate Time Jitter	< \pm 10 nS 100 mV Input
Resolution	0.01 ppm/gate time

Trigger Input

Scope Trigger Internal SIGN_SCP_TRIG J1(10) RI_SCP_TRIG J1(7) EXT_TRIG J1(4) INTERNAL TRIGGER Internal	
Trigger Logic	
SIGN_SCP_TRIG	HCMOS (Vih > 4 V, Vil < 1 V)
RI_SCP_TRIG	HCMOS
EXT_TRIG	HCMOS
Maximum Input	± 15 V EXT_TRIG

A23 Input (HP/Agilent 8922A.B,E,F,G,H) Only

NOTE: Applies to Mechanical Attenuator only.

No extender card required.

Power Supplies

+12 V	J6(9)	215 mA
+5 V	J6(12)	15 mA
-12 V	J6(10)	190 mA
+12 V Aux	J6(5)	206
	No relays	220 mA
	With relays	360 mA
	+ Prescaler	460 mA
43.5	20 mA	J6 (11)

Inputs

From Front Panel

AUX RF INPUT J3	
Freq Range	.4 to 1000 MHz
Max Meas Level	.10 Watts (+20 dBm)
Trip Level	+25 < Level < +28 dBm

From A12 Pulse Attenuator

SG IN J4	
Freq Range	.4 to 1000 MHz

To avoid removing bottom cover and motherboard covers, measure MAIN_RF_OUT on A13 output section.

Module I/O Specifications
A23 Input (HP/Agilent 8922A,B,E,F,G,H) Only

From Front Panel

RF IN/OUT Output J1	
Freq Range	.4 to 1000 MHz

Outputs

From Front Panel

AUX RF OUT J2		
Freq Range	.4 to 1000 MHz	
Relative path loss with respect to siggen input, thru path (0 dB).		
.4 MHz	Loss < 1 dB	
1000 MHz	Loss < 6 dB	
Relative path loss with respect to siggen input, atten 5 to 125 dB.		
.4 MHz	Loss < 3 dB	
1000 MHz	Loss < 10 dB	

To A19 Measurement Assembly

DET LO J6(14)	
Meas Freq Range	.4 to 1000 MHz
Output level (Uncal)	
OFFSET VOUT (LOW)	100 mV +- 50 mV No input Power.
VOUT (LOW)	280 mV +- 50 mV + OFFSET (+10 dBm, 50 MHz)
VOUT (HIGH)	.53 * V(LOW)

To A11 Receiver Mixer

1st_MIX_IN J5	
Freq Range	.4 to 1000 MHz
Output Level Normal	-12 dBm to -22 dBm
Underrange	-22 dBm to -50 dBm

Measure using known reference signal, refer to "A11 Receiver Mixer", page 12-19, for procedure.

Module I/O Specifications
A23 Input (HP/Agilent 8922A.B,E,F,G,H) Only

To A19 Measurement Assembly

IN_VOLT J6(15)	
AUTO_RNG_DET	Prescaler AGC RF peak detector voltage.
Output Level	4.71 ± .5 V When AGC has active control.
AUTO_RNG_ALC	Prescaler AGC modulator control voltage.
Range	0 to + 4 V
TEMP_DET	Temperature sensor voltage.
Nominal Output	2.98 ± .1 Volts @ 25 Deg C
Sensitivity	10 mV / C
DUPLEX_DET	Duplex port RF peak detector Voltage.
Nominal	100 mV ± 20 mV @ +10 dBm
Trip Level	400 mV ± 10 mV with relay closed.
	785 mV ± 10 mV with relay opened.
ANT_DET	Antenna port RF peak detector voltage.
Nominal	100 mV ± 20 mV @ +10 dBm
Trip Level	400 mV ± 10 mV
FILTER_OUT_DET	Receiver Output Port RF peak det. Voltage.
Nominal	10 mV ± 5 mV @ -10 dBmOutput.
DET_HIGH	RF Power peak detector high level voltage.
Output	See DET HI/LO specs (RF Power Detector).
GND	Input Section Analog Ground.
Nominal	± 10 mV

A23 Input (Agilent 8922M/S Only)

NOTE: Applies to Electronic Attenuator only.

No extender card required.

Power Supplies

+12 V	J6(9)	226 mA max
+5 V	J6(12)	15 mA
-12 V	J6(10)	286 mA max
+12 V Aux	J6(5)	360 mA max
43.5	20 mA	J6 (11)

Inputs

From Front Panel

AUX RF INPUT J3	
Freq Range	20 to 1000 MHz
Max Meas Level	.10 Watts (+20 dBm)
Trip Level	+25 < Level < +28 dBm

From A12 Pulse Attenuator

SG IN J4	
Freq Range	20 to 1000 MHz

To avoid removing bottom cover and motherboard covers, measure MAIN_RF_OUT on A13 output section.

From Front Panel

RF IN/OUT Output J1	
Freq Range	20 to 1000 MHz

Module I/O Specifications
A23 Input (Agilent 8922M/S Only)

Outputs

From Front Panel

AUX RF OUT J2		
Freq Range	20 to 1000 MHz	
Relative path loss with respect to siggen input, thru path (0 dB).		
20 MHz	Loss < 6 dB	
1000 MHz	Loss < 8 dB	
Relative path loss with respect to siggen input, atten 5 to 125 dB.		
20 MHz	Loss < 3 dB	
1000 MHz	Loss < 3 dB	

To A19 Measurement Assembly

DET LO J6(14)	
Meas Freq Range	90 to 1000 MHz
Output level (Uncal)	
OFFSET VOUT (LOW)	100 mV +- 50 mV No input Power.
VOUT (LOW)	280 mV +- 50 mV + OFFSET (+10 dBm, 50 MHz)
VOUT (HIGH)	.53 * V(LOW)

To A11 Receiver Mixer

1st_MIX_IN J5	
Freq Range	20 to 1000 MHz
Output Level Normal	-12 dBm to -22 dBm
Underrange	-22 dBm to -50 dBm

Measure using known reference signal, refer to "A11 Receiver Mixer", page 12-19, for procedure.

To A19 Measurement Assembly

IN_VOLT J6(15)	
TEMP_DET	Temperature sensor voltage.
Nominal Output	2.98 ± .1 Volts @ 25 Deg C
Sensitivity	10 mV / C
DUPLEX_DET	Duplex port RF peak detector Voltage.
Nominal	100 mV ± 20 mV @ +10 dBm
Trip Level	785 mV ± 10 mV
ANT_DET	Antenna port RF peak detector voltage.
Nominal	150 mV ± 50 mV @ +10 dBm
Trip Level	400 mV ± 10 mV
FILTER_OUT_DET	Receiver Output Port RF peak det. Voltage.
DET_HIGH	RF Power peak detector high level voltage.
Output	See DET HI/LO specs (RF Power Detector).
GND	Input Section Analog Ground.
Nominal	± 10 mV

A25 Sum Loop

Use extender card 08922-60129.

Use coax jumpers on Plug 1, pin 3. Plug 3, pins 3, 17.

Power Supplies

+15 V	J2(2)	300 mA
-15 V	J2(3)	70 mA
+5 V	J2(4)	100 mA
Ground	J1(1-2,4-20) J3(1-2,4-16,18-20)	

Inputs

From A27 DAC/Upconverter

DAC_UP_OUT J3(3)	
Frequency:	13.4 MHz \pm 50 kHz + Modulation
Level:	0 dBm \pm 3dB - measured on spectrum analyzer
Waveshape	sine (no modulation)
Amplitude	4 V _{rms} \cong 12 Vp-p

From A26 Step Loop A

SUM_LP_PTUNE J2(7)	
Voltage	-12 Vdc to +12 Vdc - measured on spectrum analyzer 0 \pm 3 dBm at RF Generator frequency

From A26 Step Loop A

STEP_LP_OUT/A J3(17)	
Frequency:	486 - 1015 MHz
Resolution:	100 kHz
Level:	3 dB \pm 3 dB - on spectrum analyzer
Waveshape	sine

If difficulty is found measuring STEP_LP_OUT, set RF Generator to 250 MHz and use oscilloscope settings from list shown below.

Channel 1	= 200.0 mvolts/div	Offset	= -24.00 mvolts	Trigger mode:	Edge on negative edge on Chan2
Timebase	= 500 ps/div	Delay	= 0.0000 s	Trigger Levels	
Ch. 1 Parameters		P-P Volts	= 1.1 volts	Chan1	= -24.00 mvolts
Rise Time	= 590 ps	Fall Time	= 620 ps	Holdoff	= 70.000 ns
Frequency	= 483.092 MHz	Period	= 2.070 ns		
+ Width	= 1.060 ns	- Width	= 1.010 ns		
Overshoot	= 0.0000 mvolts	Preshoot	= 12.50 mvolts		
RMS Volts	= 1.617 volts	Duty Cycle	= 51.20%		

Outputs

To A26 Step Loop A

SUM_LOCK J2(1)	
Level:	TTL (High = Out of Lock)
High	Typically + 7 Vdc
Low	Typically < 0.3 Vdc

To A19 Measurement Board

AUX3_VM J2(6)	
Level:	-5 V to +5

Module I/O Specifications
A25 Sum Loop

To A13 Output

SGS_500_1000M J1(3)	
Frequency:	500 to 1015 MHz
Level:	0 dBm \pm 2 dB
Harmonics:	< -20 dBc
Spurious >5 kHz offset:	< -60 dBc

Change frequency on RF Generator page. Select modulation types on or off. On spectrum analyzer, GMSK Modulation can be seen between centre frequency and first harmonics by level of increased noise floor.

A17, A26 Step Loop

Use extender card 08922-60129.

Use coax jumpers on Plug 1, pin 3. Plug 3, pin 3.

Power Supplies

+15 V	J2(2)	250 mA
-15 V	J2(3)	100 mA
+5 V	J2(4)	450 mA
Ground	J1(1-2,4-20) J3(1-2,4-20)	

Inputs

From A15 Reference

1M_REF_A/B P3(3)	
Frequency:	1 MHz \pm 5 Hz
Level:	CMOS

For measurement procedure refer to "A15 Reference", page 12-26.

From A25 Sum Loop for A26 (Step Loop A) only

SUM_LOCK J2(1)	
Level:	TTL (High = Out of Lock)
High	Typically + 7 Vdc
Low	Typically < 0.3 Vdc

Module I/O Specifications
A17, A26 Step Loop

From A33 Hop Controller

Hop Control J2(5,8,9)	
Levels:	TTL
Clock Rate:	1 MHz (burst)
Levels	
Pin 5	5 Vdc
Pin 8	-1.25 Vdc
Pin 9	0 Vdc

Outputs

To A25 Sum Loop Assembly

SUM_LP_PTUNE J2(7)	
Level:	-12 Vdc to +12 Vdc

See "A25 Sum Loop", page 12-50, for measurement procedure.

To A25 Sum Loop (A26 Step Loop A), To A11 Receiver Mixer (A17 Step Loop B)

STEP_LP_OUT J1(3)	
Frequency:	486 - 1015 MHz
Resolution:	100 kHz
Level:	3 dB \pm 3 dB
Harmonics:	< -20 dBc
Spurs (>5 kHz offsets):	< -60 dBc
Waveshape	sine
Levels	350 V _{rms}
	1 V _{p-p}

Step Loop B(A17) To achieve lowest frequency from available range (to compensate for digital oscilloscope frequency range to measure higher RF frequencies), select 380.8 MHz from RF analyzer page (This uses 495.1 MHz from step loop and 114.3 MHz IF).

Step Loop A(A26) Levels same as Step Loop B, except for set frequency on RF Generator page. To obtain lowest frequency at step loop A, output set to 249.1 MHz.

To A19 Measurement Board

AUX1/2_VM J2(6)	
Voltage Range:	-5 V to +5 V - typically +5 Vdc for default/Preset settings

A27 DAC/Upconverter

Use extender card 08922-60129.

Use coax jumpers on Plug 1, pins 7, 9 and 13. Plug 3, pin 15.

Power Supplies

+15 V	J2(2)	20 mA
-15 V	J2(3)	50 mA
+5 V	J2(4)	25 mA
-5 V	J2(1)	150 mA
Ground	J1(1,3,4,17,18,20) J3(1-4,6-14,16-20)	

Inputs

From A5 Premod Filter and NSM

NSM_IF_CLK J1(2)	
Frequency:	17.3333 MHz \pm 250 Hz
Level:	TTL

See "A5 Premodulation Filter and NSM", page 12-10, for measurement procedure.

NSM_IF_DATA J1(5-16)	
Level:	TTL

The NSM_IF_DATA can be probed on SMC connectors Plug 1 (pins 7, 9 and 13). The NSM Data Stream is difficult to measure on a digital oscilloscope. The Table shown are typical settings for an oscilloscope. To obtain a reading the display persistence must be increased. Typically 1 bit of the data stream will be \cong 60 ns.

Channel 2	= 500.0 mvolts/div	Offset	= 1.450 volts	Trigger mode:	Edge on negative edge on Chan2
Timebase	= 50.0 ps/div	Delay	= 0.0000 s	Trigger Levels	
Delta T	= 1.880 ps			Chan1	= 1.450 volts
Start	= -248.380 ns	Stop	= -246.500 ns	Holdoff	= 70.000 ns
Delta V	= 2.470 volts				
Vmarker1	= 420.0 mvolts	Vmarker2	= 2.890 volts		

From A15 Reference

10 MHz Ref C J1(19)	
Waveshape:	Sine
Level:	>10 dBm
Harmonics:	< -25 dBc
Frequency:	10 MHz

See "A15 Reference", page 12-26, for measurement procedure.

Outputs

To A19 Measurement Board

AUX4-VM J2(6)	
13.4 MHz present level:	0.3 to 0.5 Vdc into 1M Ω
13.4 MHz not present level:	-0.3 to -0.5 Vdc into 1M Ω

To A25 Sum Loop A

DAC_UP_OUT J3(15)	
Frequency:	13.4 MHz \pm 50 kHz + Modulation
Resolution:	1 Hz
Level:	0 dBm \pm 3 dB
Harmonics:	< -30 dBc
Spurs >5 kHz offsets:	< -60 dBc

See "A25 Sum Loop", page 12-50, for measurement procedure.

A28 Power Supply

This spec is for the complete assembly which includes the transformer and plug-in boards.

Input

Nominal Line Voltages:	100, 120, 22, 240
Tolerance:	+7%, -14%
Frequency Range:	48 to 440 Hz

- Overvoltage protected.
- +21 Volts and +25 Volt supplies always on, all other supplies controlled with front panel power switch.
- Short circuit protected.
- Thermal shutdown capability.
- Two supply short protection (shorting +25 unregulated is protected only by fuse).
- Fan turns off with power down.
- Fan speed is a function of temperature.

Outputs

Supply Voltage	Tolerance incl. load	limit	Line Rel. Ripple RMS	Max CW Spur ^a RMS	Total noise 20 Hz-20 MHz	Noise nV/ $\sqrt{\text{Hz}}$ @ 20 kHz
+38 V	1%	.3A	.1 mV	1 μV	1mV	400
+15 V	1%	4.2 A	.1 mV	1 μV	.3 mV	150
-15 V	1%	2.6 A	.1 mV	1 μV	.3 mV	150
+5.2 V	1%	12.8 A	.1 mV	1 μV	.1 mV	50
-5/2 V	4%	3.0 A	.1 mV	1 μV	.1 mV	50
+12 Aux V	1%	2.0 A	.1 mV	1 μV	.2 mV	100
+25 Unreg	-10%	+60%	3A fuse	1V	10 μV	
+21 V	1%	1 A	Three terminal regulator			

- a. This is the spec for rates greater than 60 kHz. For rates less than 60 kHz the spec increases by 6 dB per octave until we reach a maximum of 100 μV at rates less than 600 Hz.

A33 Hop Controller

Power Supplies

+15 V	J21(100)	< 5 mA
-15 V	J21(40,59,60,61,91,92)	0 mA (not used)
+5 V	J21(99)J2(1)	< 1 A
Ground	J21(17,18,42,43,56,69,87,93,94)	

Inputs

Hop Control Input Bus

HOP_ADDR J21(5-15)	
Amplitude:	TTL levels
High drive requirement:	100 μ A
Low drive requirement:	-1 mA
Format:	unsigned binary, high = 1

From Rear Panel

TX_HOP J21(4)	
Amplitude:	TTL levels
High drive requirement:	100 μ A
Low drive requirement:	-2 mA
Triggered by:	Rising edge

Module I/O Specifications
A33 Hop Controller

From Rear Panel

RX_HOP J21(3)	
Amplitude:	TTL levels
High drive requirement:	100 μ A
Low drive requirement:	-2 mA
Triggered by:	Rising edge

From Rear Panel

SEQ_HOP J21(2)	
Amplitude:	TTL levels
High drive requirement:	100 μ A
Low drive requirement:	-2 mA
Triggered by:	Rising edge

From Rear Panel

SEQ_HOP_RESET J21(1)	
Amplitude:	TTL levels
High drive requirement:	100 μ A
Low drive requirement:	-2 mA
Active Level:	Low

RESET_SELECT J21(19)	
Amplitude:	TTL levels
High drive requirement:	100 μ A
Low drive requirement:	-1 mA
Format:	high = reset to zero low = reset to table location specified by the HOP_ADDRESS

Front Panel Input

PULSE_MOD_IN J21(68)	
ON latency:	$\cong 25 \mu\text{S}$
OFF latency:	$\cong 10 \mu\text{S}$
Amplitude:	TTL levels
High:	No attenuation of sig gen output
Low:	Attenuate sig gen output
High drive requirement:	100 μA
Low drive requirement:	-1 mA

Host Processor Interface

GADDR	J21(57,58,62-66,80,81,78,79)
GDATA	J21(83-86,88-90,95)
GLDS	J21(76)
G-R/W	J21(77)
IO_INT	J21(97)

Outputs

SEQ_TRIG_OUT J21(21)	
Amplitude:	TTL levels

EA60_SW0/2 J21(71,72,73)	
Amplitude:	TTL levels

Fast Hop Busses I/O

Clock, Data, and Enable

INPUT SECTION J21(40,46,44) STEP LOOP/A J21(29,27,30) STEP LOOP/B J21(37,35,36) PREMOD FILTER & NSM J21(25,23,26)	
Amplitude:	TTL Levels
Clock Rate:	1 MHz (burstst)

Slow Busses

Clock, Data, and Enable

RECEIVER J21(41,39,34) OUTPUT SECTION J21(41,39,28) (Clock and data shared with Rcvr) REFERENCE SECTION J21(31,33,32) SPECTRUM ANALYZER J21(31,33,38) (Clk & data shared with ref) MODULATION DISTRIBUTION J21(53,54,52) AUDIO 1 J21(53,54,49) AUDIO 2 J21(53,54,50) INPUT SECTION J21(53,54,51) (Clk & data shared between MOD, AUD1,AUD2, INPUT2)	
Amplitude:	TTL Levels
Clock Rate:	Approximately 180 kHz (burstst)

Instrument Block Diagrams

Introduction

This chapter contains the block diagrams for the HP/Agilent 8922A/B/E/F/G/H/M/S. Additional information for troubleshooting to the block diagram level can be found in the following chapters.

Chapter 4, Using the Service Kit, explains how to use the HP/Agilent 83210A Service Kit to extend the modules and make signal measurements.

Chapter 5, Troubleshooting the Controller/Display, gives procedures for troubleshooting display problems or problems with the HP/Agilent 8922 Controllers.

Chapter 6, Troubleshooting the Power Supply, contains information about the power supply and regulator circuits as well as test points and power distribution.

Chapter 12, Module I/O Specs, contains detailed descriptions of the input and output signal characteristics for most RF and Audio modules.

Chapter 14, Block Diagram Theory, has a detailed technical discussion of the function of each assembly in the block diagrams.

Reading the Pin Numbers

The signal names and pin numbers are shown on the diagrams, the pin numbers are numbered according to the plug number found on the module, the jack number found on the mother board, and the pin number.

For example: P2/J23(14)

P2 indicates that the signal is found on the module at Plug 2.

J23 indicates the signal is found on the mother board on Jack 23.

(14) indicates that pin number 14 (On plug 2 and Jack 23) carries the signal.

Block Diagram 1

Block Diagram 1 contains the RF and Audio Analyzer circuits in the HP/Agilent 8922. These are the primary circuits used to make measurements. The Spectrum Analyzer is an option in the HP/Agilent 8922F/H/M/S. The 14 dB input attenuator is replaced with an 8 dB attenuator in the HP/Agilent 8922F/H/M/S.

Block Diagram 2

Block Diagram 2 contains the RF and Audio Generator circuits. This block diagram contains the generator hardware that is common to all three models of HP/Agilent 8922.

Block Diagram 3

Block Diagram 3 contains circuits found only in the HP/Agilent 8922B. These circuits are used with the RF Generator circuits (BD2) to generate GSM signals. These circuits can only be controlled with the rear-panel GPIO connector on the HP/Agilent 8922B.

Block Diagram 4

Block Diagram 4 illustrates the modules that are primarily digital and are used to generate the digital information and control signals required to set up a call with a GSM mobile radio. These are not found in the the HP/Agilent 8922A or B.

Block Diagram 5

Block Diagram 5 is an overall block diagram. It illustrates the interconnecting control signals and busses between the modules. This block diagram also shows detailed pin labels for the A19 Measurement board and A33 Hop Controller. The A19 board measures voltages and frequencies from most of the analog modules. It is the primary tool used for the internal diagnostic measurements and many other measurements. The A33 Hop Controller contains the circuits that communicate with the analog analyzer and generator modules.

Instrument Block Diagrams
Introduction

This Page Intentionally Left Blank

Block Diagram Theory of Operation

Introduction

The HP/Agilent 8922 is a specialized instrument designed to test GSM and PCN mobile radios and base station transmitters. The HP/Agilent 8922A contains the analog audio and RF hardware necessary to generate 0.3 Gaussian Minimum Shift Key (GMSK) signals. Digital hardware has been added to the HP/Agilent 8922B to allow it to buffer digital data from a computer and properly format it for the GSM protocol. The HP/Agilent 8922E/F/G/H/M/S adds complete digital control and allows it to test a mobile radio by simulating a calibrated base station. For more information on the capabilities of the HP/Agilent 8922 family of test sets, refer to the appropriate technical data sheets.

The complexity of the HP/Agilent 8922 circuits combined with the convenient modular architecture, allows the HP/Agilent 8922 to be repaired more quickly and economically with Assembly Level Repair (ALR). This is the recommended repair strategy, and this manual is focused to support this type of repair. The block diagram discussion provides sufficient technical detail to understand the overall hardware of the HP/Agilent 8922 and allows in-depth troubleshooting to isolate failures to a single assembly.

The primary troubleshooting method for the HP/Agilent 8922 is to use the memory card diagnostics supplied with this manual. This section is important reading for anyone trying to understand the overall hardware of the HP/Agilent 8922, and should be used as a tutorial or when the diagnostics cannot correctly locate a faulty assembly.

Technical Discussion

The HP/Agilent 8922 can be divided into two instruments, a signal generator and a signal analyzer. This discussion is intended to follow the block diagrams in chapter 13. The assemblies in Block Diagrams 1 and 2 are covered first. These are the primary assemblies where it is possible to do assembly level measurement and troubleshooting. All the hardware in Block Diagrams 1 and 2 are common to all HP/Agilent 8922 instruments. Block Diagrams 3 and 4 illustrate hardware that is unique to the HP/Agilent 8922B and HP/Agilent 8922E/F/G/H respectively. Because these modules are primarily digital, the discussion on this hardware is limited to a high level functional description. Often troubleshooting these boards is difficult at the module level without sophisticated logic or signature analysis. Module swap is the fastest way to troubleshoot hardware problems for these assemblies. The final discussion focuses on the modules in Block Diagram 5. More information about troubleshooting display and controller problems is also included in chapter 5.

When important, the input and output specifications for most assemblies are tabulated in chapter 12, Module I/O Specs. For additional details on the exact signal levels and frequencies for assembly inputs and outputs, refer to chapter 12, Module I/O Specs.

Block Diagram 1

RF Analyzer
Audio Analyzer
Spectrum Analyzer

A23 Input **A24 High Power Attenuator**

The A23 Input assembly is both the input for the RF Analyzer section and the final output from the RF Generator section. Additional information on how the A23 Input assembly is used in the signal generator is covered in the Block Diagram 2 discussion.

The RF input signal is input to the HP/Agilent 8922 using either the RF IN/OUT connector (for high power applications > 20 dBm) or using the AUX RF IN connector for lower power input signals. The input signal on the front panel RF IN/OUT connector is first sent to the A24 High Power Attenuator. This attenuates the signal by approximately 14 dB (8 dB on the HP/Agilent 8922F,H,M,S) where it can be directly used by the A23 Input assembly.

The A23 Input assembly has an RF power detector that converts the power on the RF IN/OUT connector to a dc voltage. This dc signal is sent to the A19 Measurement assembly where it is measured. These dc signals are sent to the A19 Measurement assembly using the det_lo and det_hi inputs to the A19 Measurement assembly. The det_lo signal is lower sensitivity (for the highest power signals) and det_hi is high sensitivity (for lower power signals). Accurate RF power measurement can only be made using the RF IN/OUT connector on the HP/Agilent 8922. These circuits are used to measure both CW and Pulsed RF power. For accurate RF power measurements it is necessary to zero the power meter and enter the frequency of the RF input signal. These two functions will cause the power meter to use the proper correction factors to compensate for temperature changes and frequency losses.

After the power detector, the RF IN/OUT connector is routed to a power splitter and then an RF switch. This switch selects between the RF IN/OUT signal or the AUX RF IN signal.

Selectable input attenuators in the A23 Input assembly are switched in and out, manually or automatically. This keeps the input level within a range that works best for the mixers, IF amplifiers, and detector in the remainder of the HP/Agilent 8922. Filters are automatically switched in to remove images and other interfering signals. The frequency ranges of the 4 different filters are shown on Block Diagram 1.

The A23 Input assembly contains a voltage multiplexer (mux) to route internal diagnostic voltages to the A19 Measurement assembly. Diagnostics individually check that all the input attenuator switches provide attenuation, although the accuracy of this measurement

is limited. The diagnostics also verify the input filters and a connectivity check is provided to verify the connections going into and out of the A23 Input assembly. This section is a likely cause of power measurement problems, especially if the diagnostics pass indicating that the measurement board is responding correctly.

A17 StepLoop B

This assembly creates RF reference signals from 500 to 1000 MHz. These signals are derived from a 1 MHz output from the A15 Reference section assembly and digital inputs from the A33 Hop Controller assembly. The HP/Agilent 8922 has the ability to change RF frequencies very quickly; to “frequency Hop”. This is necessary because the radios and base stations change frequencies and the HP/Agilent 8922 must be able to change along with them. The A33 Hop Controller assembly controls which frequency the A17 Step Loop assembly will create. Most radio and base station testing is done at carrier frequencies near 900 MHz. For these frequencies, A17 STEP LOOP B is approximately 114.3 MHz lower than the RF input signal that was entered. Unlike some RF analyzers, the HP/Agilent 8922 cannot automatically “tune” to the RF input signal. This information must be entered for the 8922 to set up the proper filters and LO frequencies.

A26 Step Loop A assembly and A17 Step Loop B assembly have exactly the same hardware and can be interchanged if necessary. **IMPORTANT:** The A25 Sum Loop assembly is adjusted to match the Step Loop A assembly. If either the A25 Sum Loop or A26 Step Loop A assembly is changed, it is necessary to readjust the A25 Sum Loop assembly using the instructions in chapter 7 section of this manual.

Early versions of the HP/Agilent 8922 provided the A17 Step Loop B assembly output to the rear panel, which was then normally routed back into the instrument using an external coax cable. Newer instruments now route the signal directly from the A17 Step Loop B assembly to the A11 Receiver Mixer assembly.

The diagnostic procedures check the A17 Step Loop B assembly at various frequencies but can only verify operation during static (non-hopped) operations. If the instrument meets its specifications during static operation but fails during frequency hopping, it may be that the A17 Step Loop B assembly is slow to lock-up to the correct new frequency. The error would appear as a high phase or frequency error at the beginning of the frequency hop.

A11 Receiver Mixer

This module mixes the input signal from the A23 Input assembly with the LO signal from the A17 Step Loop B assembly (or rear panel signal on early versions). The sum or difference signal will always be within ± 50 kHz of 114.3 MHz or 614.3 MHz. This signal is then filtered by the A11 Receiver Mixer assembly and passed onto the receiver section. The control voltage to select the filter is provided by the A16 Receiver assembly. This control voltage is fed into the A11 Receiver Mixer assembly (as a dc voltage) on the same cable that is used for the RF output to the A16 Receiver assembly.

To measure this signal it is necessary to “tee” the connection so that the dc control voltage is always available to the A11 Receiver Mixer assembly from the A16 Receiver assembly. It is then possible to measure the dc voltages with an external voltmeter or using a blocking capacitor, a spectrum analyzer can be connected to view the RF signal from the mixer. Failure to use a blocking capacitor will cause the switch in the A11 Receiver Mixer assembly to be indeterminate and accurate measurements cannot be made. Although the A11 Receiver Mixer assembly does not contain any diagnostic test points, it is used extensively during diagnostics to route RF test signals into the A16 Receiver and A18 Spectrum Analyzer assemblies.

A16 Receiver

The A16 Receiver assembly input signal from the A11 Receiver Mixer assembly is either 114.3 MHz or 614.3 MHz. If the signal is 614.3 MHz it is immediately downconverted to an IF of 114.3 MHz by a 500 MHz reference signal from A15 Reference assembly.

This signal at 114.3 MHz is then filtered and split. It is routed to the A18 Spectrum Analyzer assembly and to another mixer where it is further downconverted for demodulation. The LO for the next downconversion is 125 MHz which is derived from the same 500 MHz reference signal that was used earlier. The signal is now at 10.7 MHz \pm 50 kHz. This signal is a duplicate of the input signal except the frequency has been translated. It still contains the pulse and modulation information. The primary signal path for this signal is to the A9 Global Test and Demod assembly where frequency and phase accuracy are measured.

The 10.7 MHz signal also drives an FM discriminator and pulse detector that demodulate the signal. The demodulated waveforms are then routed to the front panel, A3 Audio Analyzer 1 assembly, or A9 Global Test and Demod assembly depending on the switch settings. These connections are detailed in Block Diagram 1.

The A16 Receiver assembly has extensive diagnostics which test the internal filters, switches, and demodulators. The most critical signals from the A16 Receiver assembly are the 114.3 MHz signal for the A18 Spectrum Analyzer assembly and the 10.7 MHz to the A9 Global Test and Demod assembly. The signal to the A9 Global Test and Demod assembly should be near +3 dBm for good signal to noise ratio (and no compression) in the A9 Global Test and Demod assembly.

A9 Global Test and Demod

The first function of the A9 Global Test and Demod assembly is to downconvert the 10.7 MHz signal from the receiver to 700 kHz \pm 50 kHz. This signal is then routed to a counter on the A19 Measurement assembly. The frequency of this signal is measured and is used to calculate the RF input signal frequency. Measuring an RF input signal frequency is a good method of determining if the frequency translation hardware up to the A9 Global Test and Demod assembly is functioning properly.

The primary measurements of the A9 Global Test and Demod assembly are phase, frequency, and amplitude information of the 0.3 GMSK modulation signals. The A9 Global Test and Demod assembly measures these by digitizing the 700 kHz IF signal and using high speed DSP hardware and algorithms. The DSP hardware must be “armed” and then “triggered” to synchronize with the incoming modulation signal. These various trigger signals are shown on Block Diagram 1 and the operation of these is described in the HP/Agilent 8922 Users Guide.

The results of these measurements are displayed using the DSP ANL screen on the HP/Agilent 8922. The digital data information is also used by the HP/Agilent 8922E/F/G/H to setup and maintain a call with a GSM mobile phone. This is done in “real time” as the HP/Agilent 8922E/F/G/H and mobile phone simultaneously send and receive from each other.

A18 Spectrum Analyzer

The A18 Spectrum Analyzer assembly receives the 114.3 MHz signal from the A16 Receiver assembly. The analyzer can only view frequency spans up to 4 MHz due to the bandwidth of this input signal. A phase lock loop inside the spectrum analyzer is used to downconvert the 114.3 MHz signal which is then amplified, filtered, and detected. The synchronization signal for the display is controlled by the A19 Measurement assembly. This causes the PLL signal to sweep across the frequency span selected. In addition to normal spectrum analysis, the HP 8922 spectrum analyzer is used to help measure the amplitude profile of the pulsed GSM signal. The upper 30 dB of the pulse envelope is accurately determined by the A9 Global Test and Demod assembly, however, the lower level portions of the pulse amplitude is measured with the wide dynamic range of the A18 Spectrum Analyzer assembly.

This internal spectrum analyzer is a useful tool to view the incoming RF signal and verify that the A23 Input and A11 Receiver Mixer assemblies are working correctly. The A18 Spectrum Analyzer assembly contains diagnostic test points to verify gain, attenuation, and bandwidth controls. Because of the wide dynamic range of the A18 Spectrum Analyzer assembly it is used by the diagnostics to measure pulse on/off ratio of the A12 Pulse Attenuator assembly.

A2 Audio Analyzer 2 A3 Audio Analyzer 1

These modules are leveraged from an earlier product, the HP/Agilent 8920A, which is primarily an analog communications test set. Many of the audio circuits in these assemblies are not used by the HP/Agilent 8922 and will not be covered in this discussion. Refer to the HP/Agilent 8920A Assembly Level Repair manual if further detail on these modules is required.

For the HP/Agilent 8922, the primary function of these assemblies is to provide the oscilloscope functions. The HP/Agilent 8922 contains no specialized oscilloscope module, only these two analyzer assemblies and the A19 Measurement assembly. These

Block Diagram 1

two analyzer modules provide gain, attenuation, and distribution functions of the audio signals. The A19 Measurement assembly does the actual voltage measurement. The interconnection of these modules is shown on Block Diagram 1.

The diagnostics for these modules are extensive. Like the hardware, the diagnostics have been leveraged from the HP/Agilent 8920A and test more of the circuits than are actually used in the HP/Agilent 8922. The diagnostic output from these modules documents the exact circuits in the modules which are tested.

Block Diagram 2

RF Generator

AF Generator

A15 Reference

The A15 Reference assembly contains the circuits necessary to generate reference signals for the other assemblies in the HP/Agilent 8922. The A15 Reference assembly can be locked to an external signal of 1, 2, 5, 10 or 13 MHz or can operate without an external reference by using its own 10 MHz TCXO.

An optional high stability oscillator (Option 001) is available for the HP/Agilent 8922 that provides a more accurate and stable reference. The output from this oscillator is routed to the rear panel, where it must be connected to the Reference Input for the HP/Agilent 8922 to lock onto this signal. The frequency of the (optional) high stability timebase is adjusted with a screwdriver while the (standard) internal Temperature-Compensated Crystal Oscillator (TCXO) is adjusted by setting internal DAC values. Both of these adjustments are thoroughly explained in chapter 7, Adjustments and Calibration.

If the A15 Reference assembly is replaced, an error message “Frequency Reference Calibration Lost” will be seen during instrument power-up. It is necessary to perform the adjustment for the internal TCXO to remove the error message and restore calibrated operation.

A special feature of the A15 Reference assembly is the ability to offset all reference signals in the HP/Agilent 8922. The amount of offset can be set by the user by changing the A15 Reference assembly DAC value. The primary screen to control operation of the A15 Reference assembly is the Configure Screen; refer to the Users Guide for a more complete discussion on the operation of the Reference section.

Diagnostic procedures for the A15 Reference assembly check lock detectors to make sure that the internal loops are locked, and level detectors to check if RF power is available on key reference signals. The diagnostics cannot check the frequency accuracy of the internal oscillators.

A5 Premod Filter and NSM

The A5 Premod Filter and NSM assembly contains the necessary circuits to convert the user’s digital input data and clock signals into a GMSK waveform. The inputs to the module are a very accurate 270.833 kHz clock signal and digital TTL level data. On the HP/Agilent 8922A these two signals are provided directly by the user at the front panel; on the other HP/Agilent 8922’s, these signals are generated by other assemblies.

Compared to common modulation formats like AM, FM, and phase modulation, the 0.3 GMSK format is more complex and requires special equipment (like the HP/Agilent 8922) to generate and analyze signals. A brief explanation is included here as an overview of the format of 0.3 GMSK.

The 0.3 GMSK format was chosen because it is very efficient in terms of the amount of information that can be transmitted in a given amount of frequency spectrum. To understand 0.3 GMSK, it is necessary to first understand MSK (Minimum Shift Keying). MSK is phase modulation where the carrier is shifted + or - 90 degrees as each data bit is received. This instantaneous phase shift causes "splatter" in the frequency domain and appears as noise spikes on a spectrum analyzer. This is not a good system for digital communications because it would cause noise in adjacent communication channels. To eliminate this noise, the digital signals are first low-pass filtered to eliminate the instantaneous phase shifts. The filter cut-off frequency chosen was 0.3 times the data rate $270.833 \text{ kHz} = 81.25 \text{ kHz}$. The shape of the filter chosen was Gaussian, which explains where the "G" in "0.3 GMSK" was derived. The effect of the 0.3 Gaussian filter is to smooth out the sharp digital transitions and causes a more continuous phase modulation that has low spectral splatter.

To further reduce the frequency splattering in the frequency spectrum, the digital input data is "Differentially Encoded". This means that the modulation (either + or - 90 degrees) is determined by examining the current data input (1 or 0) and deciding if it is the same or different than the previous data bit. If the current data bit is different than the previous bit, the carrier is modulated -90 degrees; if the current data is the same as the previous bit, the carrier is modulated +90 degrees. For example, a series of data...01010101..., would cause the carrier to be continuously modulated -90 degrees each clock period. Similarly, a series of all 1's or all 0's would cause the carrier to be continuously modulated +90 degrees each clock period. This can be seen by viewing the HP/Agilent 8922 output with constant 1 or 0 data input. With modulation turned on, the carrier is "offset" +67.7 kHz. This is caused because the carrier is modulated at +90 degrees times $270.833 \text{ kHz} = 67.7 \text{ kHz}$. This also explains the common misunderstanding about why the carrier seems "offset" when no data is being applied.

Because of ISI (Inter Symbol Interference) caused by the low-pass filtering, the effects of previous data bits can be seen on the RF output. To generate this complex signal, the A5 Premod Filter and NSM uses a shift register to hold the current data bit, as well as the previous 6 data bits. These seven bits are used along with a look-up ROM to find the exact phase output that the HP/Agilent 8922 should generate, given the effects of ISI and 0.3 Gaussian filtering.

This information is given digitally to the NSM (Numerical Synthesis Machine) chip. This IC is a digital synthesizer that converts the digital input data into a digitally coded analog waveform that can be used to directly drive the A27 DAC/Upconverter assembly to get the correct analog waveform.

The diagnostics program checks the A5 Premod Filter and NSM assembly by making sure the internal loop can lock to an external 270.833 kHz signal. Since the HP/Agilent 8922B and HP/Agilent 8922G clock signals are generated internally in other modules, it may be

necessary to do manual troubleshooting to find out if the A5 Premod Filter and NSM assembly is correctly locking to these other clock signals. By using the service screen and viewing the latch (NSM_PMF_CLK), it can be determined if the loop is locked. A “1” on the latch indicates lock, while a “0” indicates no lock. If for some reason the loop is not locked, the generator will exhibit a high frequency and phase error.

A27 DAC/Upconverter

This assembly contains the circuits necessary to create a 0.3 GMSK waveform at 13.4 MHz. The inputs to this module are the digital signals from the A5 Premod Filter and NSM assembly, as well as a 10 MHz reference signal from the A15 Reference assembly. These two are combined together as shown in Block Diagram 2, to produce the output signal at 13.4 MHz.

An important characteristic of this signal is extremely low phase and frequency error. The output from this module can be accessed using the extender boards in the service kit and measured with either another HP/Agilent 8922 or a downconverter and HP/Agilent 11836A software. The HP/Agilent 11836A software method is recommended if it is necessary to have a highly accurate measurement.

The diagnostics procedure for this module only checks that an RF signal is present on the output. This output is fed into the A25 Sum Loop assembly where the signal is translated up to the RF frequency that was selected on the front panel.

A26 Step Loop A

This assembly creates RF reference signals from 486.6 MHz to 1016.6 MHz spaced 100 kHz apart. These signals are derived from a 1 MHz output from the A15 Reference assembly and digital inputs from the A33 Hop Controller assembly. The HP 8922 has the ability to change RF frequencies very quickly. This is necessary because the radios and base stations change frequencies and the HP/Agilent 8922 must be able to change along with them. The A33 Hop Controller assembly controls which frequency the A26 Step Loop A assembly will create. Most radio and base station testing is done at carrier frequencies near 900 MHz. For these frequencies, the A26 Step Loop A assembly output is approximately 13.4 MHz lower than the RF output that was selected.

A26 Step Loop A and A17 Step Loop B assemblies have exactly the same hardware and can be interchanged if necessary.

IMPORTANT

The A25 Sum Loop assembly is adjusted to match the A22 Step Loop A assembly. If either the A25 Sum Loop or A26 Step Loop A assembly is changed, it is necessary to readjust the A25 Sum Loop using the instructions in chapter 7, Adjustments and Calibration.

To speed up the operation during frequency changes, a Sum Loop pretune line is provided by the A26 Step Loop A assembly and drives the A25 Sum Loop assembly. This pretunes the VCO in the A25 Sum Loop assembly to allow it to lock more quickly as the A26 Step Loop A and A27 DAC/Upconverter assemblies change frequencies.

The diagnostics procedures check the A26 Step Loop A assembly at various frequencies but can only verify operation during static (non-hopped) operations. If the instrument meets its specifications during static operation but fails during frequency hopping, it may be that the A25 Sum Loop or A26 Step Loop A assemblies are slow to lock-up to the correct new frequency. The error might appear as a high phase or frequency error at the beginning of a new frequency hop, or the instrument may occasionally lose lock during a frequency hop. These might be symptoms of a mis-adjusted A25 Sum Loop or possibly a faulty A26 Step Loop A or A25 Sum Loop assembly.

A25 Sum Loop

This assembly contains the circuitry to add together the CW signal from the A26 Step Loop A assembly and the modulated signal from the A27 DAC/Upconverter assembly. A pretune line is provided from the A26 Step Loop A assembly to speed up the ability of the A25 Sum Loop A assembly to phase lock. The output from this assembly is a 0.3 GMSK modulated signal at 500 to 1000 MHz, depending on the frequency that was selected.

The A25 Sum Loop assembly is adjusted to match the tuning characteristics of the A26 Step Loop A assembly. Whenever either of these two assemblies are changed, it is necessary to re-adjust the A25 Sum Loop assembly using the procedures in chapter 7.

The diagnostic program checks the A25 Sum Loop assembly at various frequencies but can only verify operation during static (non-hopped) operations. Measurements are made to determine if the A25 Sum Loop assembly can phase lock and that RF power is available on the output. If the instrument meets its specifications during static operation but fails during frequency hopping, refer to the previous discussion about the A26 Step Loop A assembly.

A13 Output

The main purpose of this assembly is to provide the ability to translate the RF signal from the A25 Sum Loop assembly to different frequency bands and to amplify the RF level. For frequencies between 500 MHz and 1000 MHz, the path through the A13 Output assembly is "straight through" and the RF frequency remains constant. A "divide by 2" is used to create output frequencies from 250 MHz to 500 MHz. For frequencies below 250 MHz, a heterodyne section is used to mix the frequencies down to the desired output frequency.

In addition to frequency translation and level correction, the A13 Output assembly provides AM modulation capabilities. The connections into and out of the A13 Output assembly are shown on Block Diagram 2.

The diagnostic procedures verify the tracking filters, ALC loop controls and, DAC values, and measure RF output power at various frequency and power settings.

A12 Pulse Attenuator

In addition to 0.3 GMSK modulation, the RF signals must also be pulse modulated because the GSM system uses TDMA (time division multiplexing). The function of the A12 Pulse Attenuator assembly is to pass the RF output signal with 0 dB, 30 dB or > 80 dB of attenuation. The A12 Pulse Attenuator assembly allows “straight through” operation to simulate the RF carrier ON or it provides >80 dB of attenuation to turn the RF carrier OFF. In addition to these two functions, the A12 Pulse Attenuator assembly can provide a calibrated 30 dB of attenuation. This is used to test a radios ability to recover a weak signal with other high power signals in adjacent time slots.

The diagnostics procedures check this assembly by using the internal RF spectrum analyzer. The pulse attenuator itself is solid state and highly reliable. Diagnosing the attenuator requires many other assemblies in the HP/Agilent 8922. Diagnostic failures of the Pulse Attenuator could also be caused by the A23 Input, A11 Receiver Mixer, A16 Receiver, A17 Step Loop B, or A18 Spectrum Analyzer assemblies, or a missing LO cable on the rear panel (early instruments).

A23 Input A24 High Power Attenuator

The A23 Input assembly is both the input for the Signal Analyzer section and the final output from the Signal Generator section. For additional information on how the A23 Input assembly is used in the signal analyzer, refer to the Block Diagram 1 discussion.

The RF output signal is received from the A12 Pulse Attenuator assembly. The A23 Input assembly has a step attenuator (5 dB/step) that can attenuate the RF signal up to 125 dB. The A23 Input assembly also contains a switch to select the proper output port. For high output levels, the port AUX RF OUT is available. For most operations, the RF signal is routed to the RF IN/OUT port and connected directly to a radio or transmitter. The radios are “duplex”, meaning they simultaneously transmit and receive at different frequencies. The most common setup is to have the HP/Agilent 8922 Signal Generator routed to the RF IN/OUT connector to simulate a base station and is “transmitting” to the radio-under-test. At the same time, the radio-under-test is “transmitting” to the HP/Agilent 8922 Signal Analyzer at a frequency offset by 45 MHz. This signal comes in the HP/Agilent 8922 RF IN/OUT connector and is routed to the Signal Analyzer section.

The 14 dB (8 dB with the HP/Agilent 8922F,H,M,S) A24 High Power Attenuator assembly is shown on Block Diagram 1 inside the A23 Input block. It is actually external to the Input Module and provides 14 dB attenuation of all signals going into or coming out of the RF IN/OUT connector on the front panel.

Diagnostic procedures individually check that all the step attenuator switches provide attenuation, although the accuracy of this measurement is limited. A connectivity check is provided with the diagnostics to verify the connections going into and out of the A23 Input assembly. This section is the most likely cause of output level accuracy problems, especially “hard failures” where the output is incorrect by 5 to 20 dB (indicating an attenuator pad has failed).

A4 Modulation Distribution
A6 Signaling Source/Analyzer

These modules are leveraged from an earlier product, the HP/Agilent 8920A, which is primarily an analog communications test set. Many of the audio circuits in these assemblies are not used by the HP/Agilent 8922 and will not be covered in this discussion. Refer to the HP/Agilent 8920A Assembly Level Repair manual if further detail on these modules is required.

For the HP/Agilent 8922, the function of the A6 Signaling Source/Analyzer is simply to create sinusoidal audio signals. The analyzer capabilities of this module are not used in the HP/Agilent 8922. The A4 Modulation Distribution assembly provides gain, attenuation, and distribution functions of these audio signals as well as the AM/Speech input from the front panel. The interconnection of these modules is shown on Block Diagram 2.

The diagnostic procedures for these modules are extensive. Like the hardware, the diagnostics have been leveraged from the HP/Agilent 8920A and test more of the circuits than are actually used in the HP/Agilent 8922. The diagnostic output from these modules documents the exact circuits in the modules which are tested.

Block Diagram 3 HP/Agilent 8922B Only

The HP/Agilent 8922B contains 3 modules: A35 “B” Reference; A36 FIFO/GPIO; and A37 Sequence Controller assemblies that are not used in either the HP/Agilent 8922A or HP/Agilent 8922G. The function of these three modules can only be controlled using the rear panel GPIO connector (found only on the HP/Agilent 8922B) and the special control software that is supplied with the HP/Agilent 8922B. At power-up, the HP/Agilent 8922B appears to be an “A” version and should respond exactly the same as an HP/Agilent 8922A. The overall operation of the HP/Agilent 8922B is to buffer and synchronize data from an external computer. This data is then transmitted by the HP/Agilent 8922 Generator hardware. The internal connections of this hardware are illustrated in Block Diagram 3.

To the user at the front panel and for the memory card diagnostics, the instrument appears to be an HP/Agilent 8922A. Any signals that are generated by the HP/Agilent 8922B hardware appear as “external” for the control settings.

For diagnosing problems with these modules, it is necessary to use the HP/Agilent 8922B software. The software contains testing routines that load the buffers with data and read the data back. The software is also necessary to control the switches and circuits within the modules.

A35 “B” Reference

This module contains the VCO and divider circuits necessary to lock to most common reference frequencies used for GSM radio testing. These include 1, 2, 5, 10, and 13 MHz, as well as 270.833 kHz data rate clock and 216.667 kHz frame rate clock. The frequency must be selected using the software provided with the HP/Agilent 8922B.

This module provides a 10 MHz signal to the rear panel and a 270.833 kHz signal to the A37 Sequence Controller assembly.

A36 FIFO/GPIO

The A36 FIFO/GPIO assembly has 2 primary functions. The first is to communicate through the GPIO bus to an external controller and relay these control signals to the other HP/Agilent 8922B modules. To control any of the HP/Agilent 8922B modules it is necessary that the A36 FIFO/GPIO assembly communications are working correctly. The second function of the A36 FIFO/GPIO assembly is to store and send the digital data information that is “transmitted” by the RF Generator portion of the HP/Agilent 8922. The diagnostic software has a FIFO RAM test to verify that the hardware can send and receive data from the external computer.

A37 Sequence Controller

The A37 Sequence Controller assembly contains the switches which cause an HP/Agilent 8922B to function like an HP/Agilent 8922B instead of an HP/Agilent 8922A. Activating the switches causes the Clock, Data, Pulse Modulation, and Frequency Hop data to be generated using the HP/Agilent 8922B modules.

The 270.833 kHz clock and data signals, which are normally routed from the front panel, are now received from the A36 FIFO/GPIO assembly with the clock and data all properly synchronized. The pulse modulation and frequency hop information from the external computer is stored in the A37 Sequence Controller assembly, where it is synchronized and routed to the signal generator portion of the HP/Agilent 8922B to be transmitted.

Like the A36 FIFO/GPIO assembly, the HP/Agilent 8922B software also contains a Frame Control RAM test, and a HOP RAM test, to verify the ability of the external computer to read and write to the A37 Sequence Controller assembly.

Block Diagram 4

This block diagram illustrates the assemblies that are unique to the HP/Agilent 8922E/F/G/H. These modules are primarily digital and represent the hardware necessary to create the digital protocol to set up and maintain a phone call with a GSM mobile phone. A special diagnostics “loopback” program is included on the diagnostic memory card. This program causes the HP/Agilent 8922E/F/G/H to set up a phone call to itself (loopback), and measure the bit error rate. This exercises most of the digital hardware and gives a high confidence that the A31 CODEC, A32 GSM Controller, and A34 GSM RTI assemblies are operating correctly.

A31 CODEC

A32 GSM Controller

A34 GSM RTI

The A31 CODEC assembly provides the speech processing (coding and decoding) to convert the analog speech to and from the GSM format. This assembly also provides many of the real time channel processing functions that keeps the HP/Agilent 8922G synchronized with the mobile radio.

Overall control of the A31 CODEC, A32 GSM Controller, and A34 GSM RTI assemblies is provided by the A32 GSM Controller assembly. This A32 assembly interfaces with the main controller (A7) for communication with the remainder of the instrument. The A32 GSM Controller assembly also communicates with the Option 003 A35 Protocol Interface assembly.

The A34 GSM RTI (Real Time Interface) assembly provides the logic and switches to interface the data, clock and synchronization signals into the analog RF generator and RF analyzer hardware. This assembly replaces a jumper board (A34 in the HP/Agilent 8922A instrument) which allows it to access external signals from the front and rear panel, as well as provide key signals to the A33 Hop Controller assembly and A5 Premod Filter/NSM assembly.

A35 Protocol Interface (HP/Agilent 8922F/HM/S Option 003 Only)

This assembly buffers the digital signal from the A32 GSM Controller assembly to the rear panel where it can be connected to a protocol analyzer. This option allows a user to view the messages that are passed over the communication channel between the radio and the HP/Agilent 8922F/H.

Block Diagram 5

This block diagram illustrates the busses that interconnect the instrument controllers (A7 Controller, A32 GSM Controller, A34 GSM RTI, and A37 Sequence Controller) with the other assemblies. Chapter 5 “Troubleshooting the Controller/Display” contains information about troubleshooting and an explanation of the serial and parallel busses that interconnect the assemblies.

A19 Measurement

The A19 Measurement assembly contains the circuits necessary to measure voltage and count frequency. These circuits are interconnected throughout the instrument with a series of multiplexers. The measurement board also synchronizes the measurements for the spectrum analyzer and the oscilloscope display. The block diagram shows the pin numbers and signal names of most voltage and counter inputs to this assembly.

While there are no specific diagnostics for the A19 Measurement assembly, it is used extensively to diagnose other parts of the instrument. If the diagnostics incorrectly indicate a faulty assembly, the measurement board may be a likely cause. Use the pin number information to verify that the voltages and frequencies are properly transferred from the modules to the A19 Measurement assembly.

A33 Hop Controller

The A33 Hop Controller assembly controls the I/O to most analog and RF hardware in the instrument. Problems with this assembly will usually appear as multiple failures during the power up diagnostics (as indicated on the A7 LED's). The A33 Hop Controller assembly communicates to the main controller (A7 Controller) with a parallel bus, and through a serial bus to the other analog hardware. This illustration is included with pin numbers to allow troubleshooting the serial busses and communication failures to the modules. Again, no specific memory card diagnostics exist for this module. It is unlikely that memory card programs could be executed if the A33 Hop Controller assembly is defective.

To understand more about the serial and parallel busses connected to the A33 Hop Controller assembly, refer to the chapter 5 discussion.

Diagnostics Theory

Introduction

This chapter describes what is tested by the memory card based or ROM based diagnostics and how to interpret the level of certainty that is attached to failure reports. This chapter is broken into sections for each of the diagnostic tests and a section for how to interpret results.

This chapter uses the current diagnostic test names for firmware revision code A.03.00 and above. Memory card based diagnostic test names may differ from the current names.

AF_DIAGS

Audio Frequency Generators 1 and 2

This test checks the A6 Signaling Source/Analyzer assembly. As a test signal, a digital “1” exercises DACs on the output of the A6 Signaling Source/Analyzer assembly to verify voltage range, using the voltmeter at the LFS1_VM and LFS2_VM outputs.

Preliminary Audio Paths

This test checks the A4 Modulation Distribution assembly. The 9 possible paths through the A4 Modulation Distribution assembly are checked using signals from the A6 Signaling Source/Analyzer assembly, routing the signals to the voltmeter through the A3 Audio Analyzer 1 assembly at AUD1_VM, or the A2 Audio Analyzer 2 assembly at AUD2_VM, for path 9.

Modulation Distribution Internal Paths

This test checks the A4 Modulation Distribution assembly. Using the two inputs from the A6 Signaling Source/Analyzer assembly, the same paths as the Preliminary Audio Paths test are checked again. During the test the gain and attenuation of the paths are varied.

Modulation Distribution External Paths

This test checks the A4 Modulation Distribution assembly. Using the AFG1 output from the A6 Signaling Source/Analyzer assembly, the external MODULATION IN AM/SPEECH path through the A4 Modulation Distribution assembly is checked. The AFG1 input is checked first to verify that it can be used as a test signal. An external connection is used to route the AUDIO OUT connector on the front panel to the MODULATION IN AM/SPEECH connector. The gain and coupling of the path are varied. The signals are routed from the MOD_MON output of the A4 Modulation Distribution assembly to the A3 Audio Analyzer 1 assembly for routing to the voltmeter through the AUD1_VM output.

Audio Analyzer 1 Internal Paths

This test checks the A3 Audio Analyzer 1 assembly. Using the AFG1 output of the A6 Signaling Source/Analyzer assembly (through the A4 Modulation Distribution assembly), the 12 internal paths of the A3 Audio Analyzer 1 are checked. Two of the paths are not used in the HP/Agilent 8922 and will be shown as “No optional high(low)-pass filter sensed”. (Ignore this error message on this test.) Paths 1 through 4 are routed directly to the voltmeter through the AUD1_VM output, while paths 5 through 12 are routed to the peak detector in the A2 Audio Analyzer 2 assembly before being routed to the voltmeter through the AUD2_VM output. The gain and coupling are varied and each path is checked.

Audio Analyzer 1 External Paths

This test checks the A3 Audio Analyzer 1 assembly. The front panel AUDIO IN path is selected and de-selected while using an external connection from the front panel AUDIO OUT connector (which uses the AFG1 output from the A6 Signaling Source/Analyzer routed through the A4 Modulation Distribution assembly). The signal is routed to the voltmeter through the AUD1_VM output.

Audio Analyzer 2

This test checks the A2 Audio Analyzer 2 assembly. Using the AFG1 output from the A6 Signaling Source/Analyzer assembly routed through the A4 Modulation Distribution assembly to the MOD_MON output, the 14 paths through the A2 Audio Analyzer 2 are checked. Each of the measurements go directly to the voltmeter through the AUD2_VM output.

RF_DIAGS

Reference

This test checks the A15 Reference Section assembly.

10 MHz Lock Detector State

The 10 MHz VCO is measured using the counter; however, the counter uses the reference so the measurement is an indication that the counter is working. This verifies that both the reference and the count signal are reaching the counter.

1 GHz Oscillator Lock Detector State

The 1 GHz VCO lock detector is checked for lock.

1 GHz and 500 MHz Level Detectors

The 1 GHz and 500 MHz level detectors are checked to test for signals from these outputs.

10 MHz Fine and Coarse DACs State

The 10 MHz VCO is checked for locks at both ends of the tune DAC range.

NSM and Pre-Modulation Filter

This test checks the A5 Premod Filter and NSM assembly.

NSM Clock Detector State

The presence of a clock is checked.

Pre-Modulation Filter Clock Detector State

The Premod filter clock is checked for lock with both a clock present and not present. The front panel AUDIO OUT is used as a test clock. It is connected to the front panel MODULATION CLOCK input.

DAC and Up-Converter

This test checks the A27 DAC/Upconverter assembly.

Detector Output Level

This test checks for an output at several frequencies using the voltmeter at the AUX4_VM output.

RF Generator Step Loop

This test checks the A26 Step Loop A assembly.

RF Generator Loop 1 MHz Reference Detector

This test checks for the presence of a reference.

RF Generator Loop Lock Detector State

The lock detector is checked at several frequencies.

RF Generator Loop Output Detector

The level detector is checked at several frequencies.

Sum Loop

This test checks the A25 Sum Loop assembly.

RF Generator Sum Loop Lock Detector State

This test checks the lock detector at several frequencies.

RF Generator Sum Loop VCO Tuning Level

This test checks the VCO tune voltage at several frequencies.

Output Section

This test checks the A13 Output assembly.

Power Supplies and Amplifier Bias

The +8 Vdc supply generated by the A13 Output assembly is measured by the voltmeter at the OUT_POS_8V output. The -6 Vdc supply generated by the A13 Output assembly is measured by the voltmeter at the OUT_NEG_6V output. The bias voltage on the output amplifier is measured by the voltmeter at the OUT_AMP_BIAS output.

Carrier Level DAC

The carrier level DAC is checked first by turning on each bit one at a time and then with all the bits on, measuring with the voltmeter at the OUT_LEVEL_REF output. The limits are based on the value of the -6 Vdc measurement.

Filter Tune DAC

The filter tune DAC is checked the same way the carrier level DAC is checked at the OUT_TUNE_FILTER output.

Open Loop ALC Drive

This test opens the ALC loop and checks the voltage that appears on the output of the modulator with the DAC at full scale, measured at the OUT_ALC_DRIVE using the voltmeter referenced to the -6 Vdc measurement.

Output Detector, Detector Caps

The output capacitors are switched in and out and the output level is measured by the voltmeter at the OUT_OUTPUT_LEVEL output.

Output Detector, Low Level

When the carrier level DAC is set to 0, there should be no RF output detected by the voltmeter measuring at the OUT_OUTPUT_LEVEL output.

Output Frequency Range, Loop Closed

The frequency is varied and the detector voltage is measured by the voltmeter at the OUT_OUTPUT_LEVEL output.

Bandwidth Control

The bandwidth control bits are varied and the detected output is measured by the voltmeter at the OUT_OUTPUT_LEVEL output.

Tracking Filter Rejection

The ALC loop is opened and the tracking filters are checked by setting the RF frequency to the center of the two bands while changing the filter DAC to below the RF frequency and measuring the detected level with the voltmeter at the OUT_OUTPUT_LEVEL output.

Pulse Attenuator and Drive

This test checks the A14 Pulse Driver assembly.

Pulse Attenuator and Drive Test

A reference measurement is made and the signal is pulsed using the front panel AUDIO OUT to drive the front panel MODULATION IN PULSE input.

13 MHz Oscillator Lock Detector

The 13 MHz VCO lock detector is measured to check the 13 MHz VCO.

Input Section

This test checks the A23 Input assembly.

RF Detectors 1

The low and high sensitivity detectors are checked both with and without a signal present.

Step Attenuator

The step attenuator is checked by switching in one pad at a time.

RF Detectors 2

The filter output detector is checked with no signal present.

Filter Output Detector, Signal Present

The filter output detector is checked with a signal present at different frequencies.

Output Filter Rejection

Each filter is checked to see that it rejects frequencies outside its passband.

Output Variable Attenuator

The variable attenuator is checked by programming the DAC to full scale, then reading the voltage on the output detector. Then the DAC is programmed to values which turn on the 5 most significant bits one at a time, starting with the MSB and measuring the detector output each time.

Autorange Attenuator

The autorange attenuator is programmed to each of its possible values and the output detector is measured each time.

Counter With TTL Dividers

The signal from the RF generator is routed to the counter TTL prescalers. The frequency of the signal is set to all values between 10 and 250 MHz in 5 MHz steps.

Counter With ECL Dividers

The signal from the RF generator is routed to the counter ECL prescalers. The frequency of the signal is set to all values between 50 and 1000 MHz in 50 MHz steps.

Temperature Sensor

The temperature sensor produces a DC voltage proportional to the internal temperature.

RF Analyzer Step Loop

This test checks the A17 Step Loop B assembly.

RF Analyzer Loop 1 MHz Reference Detector

This test checks for the presence of the 1 MHz reference.

RF Analyzer Loop Lock Detector

This test checks the loop for lock at several frequencies.

Loop B Output Detector

This test checks the level detector at several frequencies.

Spectrum Analyzer

This test checks the A18 Spectrum Analyzer assembly.

Detector Output

The RF generator is routed externally to the spectrum analyzer through the AUX RF OUT and AUX RF IN front panel connectors. The level is set to a very low level (-100 dBm), and the spectrum analyzer detector is measured.

Stepped Gain

The stepped gain amplifiers are checked using a 0 dB measurement as a reference. The steps are then measured one at a time using the detector.

IF Bandwidth

The IF bandwidth is set to all possible values and the voltage is measured by the detector.

Filter Rejection

The LO frequency is set at 10 times the bandwidth away from the center frequency of each filter, then the detector is read.

Variable Gain IF Amplifier

The variable IF gain amplifier is checked by turning on one bit of the control DAC at a time, starting with the LSB. The detector is checked as each bit is turned on.

RF Input Signal

With the internal calibration signal disabled, the RF generator and RF analyzer are set to 100 MHz for an IF of 114.3 MHz at the input of the spectrum analyzer. The signal is routed internally through the coupler on the RF IN/OUT port of the A23 Input assembly and the level is measured.

Receiver

This test checks the A16 Receiver assembly.

Down Converters (With Spectrum Analyzer) Test

The RF generator is fed to the receiver IF through the A23 Input and A11 Receiver Mixer assemblies to the second mixer in the receiver. The signal is measured by the spectrum analyzer at three frequencies at the SA_114.3M output.

IF Counter Test

The signal is measured again after the third mixer and FM discriminator at the IF_CNT output by the counter.

AGC Open Loop (At AM Output) Test

The AGC open loop operation is checked at both high and low levels at three DAC level settings. The signal is measured after the pulse detector at the DEMOD_AUD output. This DC level represents the IF level.

AGC Closed Loop (At AM Output) Test

The AGC loop is closed and the level at the DEMOD_AUD output is measured again with both AM and Pulse selected.

AGC Reference DAC Test

The AGC loop is opened and the closed loop level DAC is measured by the voltmeter at the AUX7_VM output.

AGC Open-Loop Drive DAC Test

The AGC loop is opened and the open loop level DAC is measured by the voltmeter at the AUX7_VM output.

Temperature Test

The temperature sensor is measured by the voltmeter at the AUX7_VM output.

AM Demodulator Test

The AUDIO OUT source is routed to the MODULATION IN AM/SPEECH connector externally to produce an AM signal and the demodulated AM is measured at the DEMOD_AUD output by the voltmeter through the A3 Audio Analyzer 1 assembly.

FM Demodulator Test

The FM demodulator is measured statically by changing the RF generator frequency by a small amount and measuring the DC voltage change at the output of the FM demodulator at the DEMOD_AUD output by the voltmeter through the A3 Audio Analyzer 1 assembly.

MS_DIAGS

External Reference

Ext Reference Present Detector

The external reference detector is read.

Ext Reference Lock Detector

The 10 MHz loop lock detector is read. Ext Reference Lock Out; the external reference lock out is checked by locking out the external reference and checking the external reference lock detector.

RF Input/Output

RF In/Out to Aux RF Out Test

Using an external connection, the power is measured using the CW/AF Analyzer.

Aux RF Out to Aux RF In

Using an external connection, the filter output detector level is measured by the voltmeter through the voltmeter multiplexer.

Instrument Self Test

The power-up self tests are invoked internally.

Power Supplies On Measurement Board

The power supply sense points on the A19 Measurement assembly are read.

GSM and DCS Diagnostic Tests

Each of these tests performs a functional check on the instrument by generating a test signal and looping the signal back to the measurement hardware.

The tests with titles beginning with E are for use with an HP/Agilent 8922E. Tests with titles beginning with G are for use with an HP/Agilent 8922G. Tests without an E or G prefix are used with the HP/Agilent 8922F/H/M/S.

The HP/Agilent 8922E/G DCS tests, EDCSDIAG and GDCSDIAG check instruments that have an HP/Agilent 83220A installed. The HP/Agilent 8922E/G GSM tests EGSMADIAG and GGSMADIAG are used for instruments without an HP/Agilent 83220A installed. The HP/Agilent 8922F/H/M/S diagnostic test are also in two forms. GSMDIAG checks the HP/Agilent 8922F/H/M/S. The diagnostic test DCSDIAG tests either the HP/Agilent 83220A or the HP/Agilent 83220E, whichever instrument is installed.

Using internal routing and generation, a known bit pattern is modulated and sent to the AUX RF OUT port of either the HP/Agilent 8922E/F/G/H or the HP/Agilent 83220A. With an external connection made to the RF IN/OUT port the instrument demodulates the signal and performs a BER measurement and DSP measurement. This test provides a functional test of the assemblies that can not be checked directly as with the other diagnostic tests. The assemblies checked include the A31 CODEC, the A32 GSM CONTROLLER, and the A34 GSM RTI. The HP/Agilent 83220A can be further verified for failure by disconnecting it and running the appropriate GSM test on the HP/Agilent 8922E/F/G/H/M/S. This will show whether the instrument still fails without the HP/Agilent 83220A. The HP/Agilent 83220E diagnostic tests are less extensive.

Interpreting Results

When a failure occurs, a message is displayed showing the number of failures and the probability that the failure is caused by the assembly being tested. If the probability is not high, more measurements may be necessary to verify the failure.

The probability assigned is based on the following criteria:

Low: A failure occurred, but the signal being used for the measurement originates in another assembly and has not been previously tested on this assembly. Low probability is also assigned for the first measurement made to an assembly.

Medium: A failure occurred and the signal being used for the measurement originates in another assembly and has already been measured good, but the measurement mux (multiplex) point or digital detector has not previously been used.

High: A failure occurred and the signal being used for the measurement originated in another assembly and has already been measured good, and the measurement mux point or digital detector has already been used.

The RF diagnostics assign probability based on the first failure that occurs. The audio diagnostics assign probability based on a series of measurements.

Diagnostics Theory
Interpreting Results

This Page Intentionally Left Blank

Measurement Theory

Introduction

This chapter describes which blocks of the instrument are used in the various measurements. The measurements described include the following:

- BIT ERROR
- DSP ANL
- OUT RF SP
- PULSE
- CW MEAS/AF ANL
- SCOPE
- SPEC ANL

The descriptions are given in terms of which path the signal under test takes from the front panel to the measurement point. This chapter does not describe how a radio under test is stimulated to output the signals that are being measured.

BIT ERROR

- A23 Input
- A11 Receiver Mixer
- A16 Receiver
- A9 Global Test and Demod
- A31 CODEC

The bit error test is a test where a known data pattern is sent to the radio under test and is looped back to measure how many errors are generated by the radio under test through receiving and transmitting the same data. The Bit Error test signal is routed through the front-panel and through the RF hardware. The signal is demodulated at the A9 Global Test and Demod assembly. After the signal is demodulated the recovered clock and data signals are routed to the A31 CODEC assembly. The A31 CODEC assembly both generates the test data pattern and does the comparison after the data is recovered after being transmitted and received. After the measurement is done the measurement numbers are sent to the A7 controller to be sent to the display section.

DSP ANL

- A23 Input
- A11 Receiver Mixer
- A16 Receiver
- A9 Global Test and Demod

The DSP analyzer measurements digitally analyze the signal under test. The signal is leveled and converted to a 10.7 MHz IF and routed to the A9 Global Test and Demod assembly where the signal is digitized and the actual measurements are made. After the measurement is done the measurement numbers are sent to the A7 Controller to be sent to the display section.

OUT RF SP

- A23 Input
- A11 Receiver Mixer
- A16 Receiver
- A18 Spectrum Analyzer
- A19 Measurement

The output RF spectrum is a GSM required measurement that is a zero span spectrum analyzer measurement at specific offsets from the carrier frequency. Refer also to the SPEC ANL description.

PULSE

- A23 Input
- A11 Receiver Mixer
- A16 Receiver
- A18 Spectrum Analyzer
- A19 Measurement

The pulse measurement is used to measure the -70 dB point of a GSM pulse because the DSP analyzer will only measure to -30 dB. This is a spectrum analyzer measurement. Refer also to the SPEC ANL description.

CW MEAS/AF ANALYZER

- A23 Input
- A19 Measurement
- A11 Receiver Mixer
- A16 Receiver
- A3 Audio Analyzer 1
- A2 Audio Analyzer 2
- A4 Modulation Distribution

The CW measurements are power and frequency. For the power measurement, the detector is in the A23 Input assembly and is measured by the voltmeter in the A19 Measurement assembly. The AF analyzer measurements are either demodulated signals that pass through the A23 Input, A11 Receiver Mixer, and A16 Receiver assemblies or internal and external audio signals that pass through the A4 Modulation Distribution assembly before being routed to the A3 Audio Analyzer 1 assembly. The A3 Audio Analyzer assembly either passes the signals to the A19 Measurement assembly or to the A2 Audio Analyzer 2 assembly before routing to the A19 Measurement assembly. After the measurement is done the measurement numbers are sent to the A7 Controller to be sent to the display section.

SCOPE

The oscilloscope has the AF analyzer as a front end so the routing configurations that can be done for the AF ANALYZER are also possible for oscilloscope measurements. The A19 Measurement assembly makes the oscilloscope measurements. After the measurement is done the measurement numbers are sent to the A7 Controller to be sent to the display section.

SPEC ANL

- A23 Input
- A11 Receiver Mixer
- A16 Receiver
- A18 Spectrum Analyzer
- A19 Measurement

The spectrum analyzer signal receives its signal from the RF input stages after the signal is converted to a 114.3 MHz IF in the A16 Receiver assembly. The A18 Spectrum Analyzer assembly works together with the A19 Measurement assembly. The A18 Spectrum Analyzer receives sweep and trigger signals from the A19 Measurement assembly and returns analog level signals to the A19 Measurement assembly. The A19 Measurement

assembly digitizes the signals from the A18 Spectrum Analyzer assembly. After the measurement is done the measurement numbers are sent to the A7 Controller to be sent to the display section.

This Page Intentionally Left Blank

GSM Theory

Introduction

The HP/Agilent 8922 product family is designed to measure and generate signals for the GSM digital cellular telephone system. The HP/Agilent 8922 is both a signal generator and a measuring receiver.

This chapter describes GSM system signals that are generated and received by the HP/Agilent 8922. The GSM system is not described in detail due to complexity. This chapter is intended only to describe the system as it relates to servicing the HP/Agilent 8922, meaning the need to know the character of the signals generated and received.

The GSM System

The GSM system uses two frequency bands ranging from 890 to 915 MHz and 935 to 960 MHz. The bands are broken into 125 channels spaced 200 kHz apart.

The GSM system uses one band to transmit and one to receive. The lower frequency band (890-915 MHz) is used for the Mobile telephone to Base station link; the upper band is for Base to Mobile.

Channels from each band are used in uplink/downlink channel pairs. The channels in the channel pair are spaced 45 MHz apart.

The GSM system is time multiplexed, meaning that it is pulsed to allow multiple users access to the same channel. On each channel there are eight timeslots so that eight users can be on a channel at the same time. The pulses or timeslots are 576.9 μ S long.

The GSM system has the capability of being frequency hopped within the frequency bands. This allows the system to hop the telephone to another channel and possibly another timeslot during a telephone call.

The GSM system uses a 0.3 Gaussian Minimum Shift Keying modulation scheme to modulate the digital data onto the pulsed carrier.

The digital data for one pulse is made up of both voice data and predefined data that is used for synchronization. The voice data is coded to maximize speech quality and minimize errors.

For most of the characteristics mentioned above the GSM system contains many variables. These variables account for the many screens and fields in the HP/Agilent 8922.

E-GSM, DCS1800 and PCS1900 Systems

GSM900 is the original GSM system, using frequencies in the 900 MHz band and designed for wide area cellular operation. Mobiles with output powers from 1 to 8W are typical. DCS1800 is an adaptation of GSM900. The term GSM can be used collectively to describe the GSM900 and DCS1800 standards. Creating DCS1800 involved widening the bands assigned to GSM and moving them up to 1.8 GHz. The DCS1800 standard was created to allow PCN (Personal Communications Networks) to form.

To avoid confusion, the channel numbers (ARFCN) used for DCS run from 512 to 885. GSM900 channels run from 1 to 124. With wider frequency allocation, leading to more channels, DCS1800 is able to cope with higher user densities. DCS1800 mobiles are also designed for lower output powers (up to 1W), so cell sizes have to be smaller, meaning even higher densities. In all other respects, GSM900 and DCS1800 are the same.

The GSM phase 2 specifications brings the two systems even closer. GSM900 gets additional bandwidth and channels, called E-GSM (Extended band GSM) and lower power control levels for mobiles, allowing micro-cell operation. These two features allow increased user densities in GSM systems.

PCS1900 is in the band around 2 GHz for a PCS (Personal Communications System). This version of GSM is variously called DCS1900 or PCS1900. In technical terms PCS1900 is identical to DCS1800 except for frequency allocation.

Index

Symbols

"B" Reference
theory, 14-15

Numerics

1 GHz and 500 MHz Level Detectors
theory, 15-5
1 GHz Oscillator Lock Detector State
theory, 15-5
10 MHz Fine and Coarse DACs State
theory, 15-5
10 MHz Lock Detector State
theory, 15-5
13 MHz Oscillator Lock Detector
theory, 15-7

A

A1
part number, 9-4, 9-5
troubleshooting, 5-2
A1 Front Panel removal, 8-7
A10
part location, 9-7
A10 Power Supply Regulator Removal,
8-9
A11
part location, 9-7
part number, 9-6
specs, 12-19
theory, 14-5
A12
part location, 9-7
part number, 9-6
theory, 14-13
A12 Pulse Attenuator Removal, 8-12
A13
part location, 9-7
Service Kit, 4-5
specs, 12-22
theory, 14-12
A13 Output
diagnostics, 15-6
A14
part location, 9-7
part number, 9-6
Service Kit, 4-5
specs, 12-24

A14 Pulse Driver
diagnostics, 15-7
A15
part location, 9-9
part number, 9-8
Service Kit, 4-5
specs, 12-26
A15 Reference Section
diagnostics, 15-5
A16
part location, 9-9
part number, 9-8
Service Kit, 4-5
specs, 12-32
theory, 14-6
A16 Receiver
diagnostics, 15-9
A17
part location, 9-9
part number, 9-8
Service Kit, 4-5
theory, 14-5, 14-11
A17 Step Loop B
diagnostics, 15-8
A17,25
specs, 12-53
A18
part location, 9-9
part number, 9-8
Service Kit, 4-5
specs, 12-36
theory, 14-7
A18 Spectrum Analyzer
diagnostics, 15-9
A19
part location, 9-9
part number, 9-8
Service Kit, 4-5
specs, 12-38
theory, 14-18
A2
part location, 9-7
part number, 9-6
Service Kit, 4-5
specs, 12-3
theory, 14-7
A2 Audio Analyzer 2
diagnostics, 15-4

A20
part location, 9-9
part number, 9-8
Service Kit, 4-5
troubleshooting, 5-2
A21
part location, 9-9
part number, 9-8
troubleshooting, 5-2
A21 HP-IB Interface Removal, 8-14
A22
part location, 9-9
part number, 9-8
A22 Display Removal, 8-16
A23
part location, 9-9
part number, 9-8
theory, 14-4, 14-13
troubleshooting, 5-2
A23 (A,B,E,F,G,H)
specs, 12-43
A23 (M,S)
specs, 12-47
A23 Input
diagnostics, 15-7
A23 Input Section Removal, 8-18
A24
part location, 9-9
part number, 9-8
theory, 14-4, 14-13
A24 Attenuator Removal, 8-19
A25
part location, 9-9
part number, 9-8
Service Kit, 4-5
specs, 12-50
theory, 14-12
A25 Sum Loop
diagnostics, 15-6
A26
part location, 9-9
part number, 9-8
Service Kit, 4-5
theory, 14-11
A26 Step Loop A
diagnostics, 15-6
A27
part location, 9-9

Index

- part number, 9-8
 - Service Kit, 4-5
 - specs, 12-56
 - theory, 14-11
 - A27 DAC/Upconverter
 - diagnostics, 15-5
 - A28
 - part location, 9-9
 - part number, 9-8, 9-10
 - specs, 12-58
 - A28 Power Supply Removal, 8-20
 - A29
 - part location, 9-13
 - part number, 9-12
 - A3
 - part number, 9-6
 - Service Kit, 4-5
 - specs, 12-5
 - theory, 14-7
 - A3 Audio Analyzer 1
 - diagnostics, 15-4
 - A31
 - part location, 9-13
 - part number, 9-12
 - theory, 14-17
 - A32
 - part location, 9-13
 - part number, 9-12
 - theory, 14-17
 - A33
 - part location, 9-13
 - part number, 9-12
 - Service Kit, 4-5
 - specs, 12-59
 - theory, 14-18
 - A34
 - part location, 9-13
 - part number, 9-12
 - theory, 14-17
 - A35
 - part location, 9-13
 - part number, 9-12
 - theory, 14-15, 14-17
 - A36
 - part location, 9-13
 - part number, 9-12
 - theory, 14-15, 14-16
 - A37
 - part location, 9-13
 - part number, 9-12
 - A38
 - part location, 9-13
 - part number, 9-12
 - A4
 - part location, 9-7
 - part number, 9-6
 - Service Kit, 4-5
 - specs, 12-8
 - theory, 14-14
 - A4 Modulation Distribution
 - diagnostics, 15-3
 - A5
 - part location, 9-7
 - part number, 9-6
 - Service Kit, 4-5
 - specs, 12-10
 - theory, 14-9
 - A5 Premod Filter and NSM
 - diagnostics, 15-5
 - A6
 - part location, 9-7
 - part number, 9-6
 - Service Kit, 4-5
 - specs, 12-13
 - theory, 14-14
 - A6 Signaling Source/Analyzer
 - diagnostics, 15-3
 - A7
 - part location, 9-7
 - part number, 9-6
 - Service Kit, 4-5
 - theory, 14-18
 - troubleshooting, 5-2
 - A7 Step Loop B
 - theory, 14-5
 - A8
 - part location, 9-7
 - Service Kit, 4-5
 - troubleshooting, 5-2
 - A9
 - part location, 9-7
 - part number, 9-6
 - Service Kit, 4-5
 - specs, 12-15
 - theory, 14-6
 - Adjustments, 9-1
 - adjustments, 7-2
 - AF Generator
 - theory, 14-9
 - AF_DIAGS
 - theory, 15-3
 - AGC Closed Loop (At AM Output) Test
 - theory, 15-10
 - AGC Open Loop (At AM Output) Test
 - theory, 15-10
 - AGC Open-Loop Drive DAC Test
 - theory, 15-10
 - AGC Reference DAC Test
 - theory, 15-10
 - All Receiver Mixer Removal, 8-10
 - AM Demodulator Test
 - theory, 15-10
 - Assembly and Disassembly Procedures, 8-2
 - Audio Analyzer
 - theory, 14-4
 - Audio Analyzer 1
 - Service Kit, 4-5
 - specs, 12-5
 - theory, 14-7
 - Audio Analyzer 1 External Paths
 - theory, 15-4
 - Audio Analyzer 1 Internal Paths
 - theory, 15-4
 - Audio Analyzer 2
 - Service Kit, 4-5
 - specs, 12-3
 - theory, 14-7, 15-4
 - Audio Frequency Generators 1 and 2
 - theory, 15-3
 - Autorange Attenuator
 - theory, 15-8
 - Aux RF Out to Aux RF In
 - theory, 15-11
- B**
- Bandwidth Control
 - theory, 15-7
 - BIT ERROR
 - theory, 16-2
 - Block Diagram 1
 - theory, 14-4
 - Block Diagram 2

Index-2

Index

- theory, 14-9
 - Block Diagram 3
 - theory, 14-15
 - Block Diagram 4
 - theory, 14-17
 - Block diagram 5
 - theory, 14-18
 - Block Diagram Theory of Operation, 14-2
 - block diagrams, 13-2
 - C**
 - calibration data, 8-2
 - Calibration Lost, 14-9
 - calibrations, 7-2
 - Carrier Level DAC
 - theory, 15-6
 - CODEC Assembly
 - theory, 14-17
 - Controller
 - Service Kit, 4-5
 - troubleshooting, 5-2
 - controller
 - theory, 14-18
 - counter
 - theory, 14-18
 - Counter With ECL Dividers
 - theory, 15-8
 - Counter With TTL Dividers
 - theory, 15-8
 - CRT Driver
 - troubleshooting, 5-2
 - CRT Drives
 - Service Kit, 4-5
 - CW MEAS/AF ANALYZER, 16-4
 - CW MEAS/AF ANL
 - theory, 16-2
 - D**
 - DAC and Up-Converter
 - theory, 15-5
 - DAC/Upconverter
 - Service Kit, 4-5
 - specs, 12-56
 - theory, 14-11
 - DCS1800, 17-4
 - DCS1900, 17-4
 - Detector Output
 - theory, 15-9
 - Detector Output Level
 - theory, 15-5
 - Differentially Encoded
 - theory, 14-10
 - Display
 - troubleshooting, 5-2, 5-5
 - Down Converters (With Spectrum Analyzer) Test
 - theory, 15-10
 - DSP ANL
 - theory, 14-6, 16-2, 16-3
- E**
 - E-GSM, 17-4
 - error message, 14-9
 - error messages, 11-2
 - Ext Reference Lock Detector
 - theory, 15-11
 - Ext Reference Present Detector
 - theory, 15-11
 - External Reference
 - theory, 15-11
 - F**
 - FIFO/GPIO
 - theory, 14-15
 - Filter Output Detector, Signal Present
 - theory, 15-8
 - Filter Rejection
 - theory, 15-9
 - Filter Tune DAC
 - theory, 15-6
 - Firmware Location, 9-29
 - Flash Upgrades, 9-29
 - FM Demodulator Test
 - theory, 15-10
 - Frequency Reference, 14-9
 - fuse, 6-5
 - fuse board, 6-7
 - fuseboard, 6-7
 - G**
 - Global Test and Demod
 - Service Kit, 4-5
 - specs, 12-15
 - theory, 14-6
 - GMSK, 14-2
 - theory, 14-6, 14-9
 - GPIO Interface
 - troubleshooting, 5-2
 - GSM, 14-2
 - theory, 17-2
 - GSM Controller
 - theory, 14-17
 - GSM Phase 2, 17-4
 - GSM RTI Assembly
 - theory, 14-17
 - GSM Timing
 - Service Kit, 4-5
 - GSM900, 17-4
- H**
 - High Power Attenuator
 - theory, 14-4, 14-13
 - Hop Controller
 - specs, 12-59
 - theory, 14-18
 - troubleshooting, 5-2
 - Hop controller
 - Service Kit, 4-5
 - HP/Agilent 83201A Service Kit, 4-1
 - HP/Agilent 8922B
 - diagnostics, 2-7
 - theory, 14-15
 - HP/Agilent 8922G
 - theory, 14-17
 - HP/Agilent 8922M Memory Upgrade, 9-29
 - HP/Agilent 8922S Memory Upgrade, 9-29
 - I**
 - IF Bandwidth
 - theory, 15-9
 - IF Counter Test
 - theory, 15-10
 - Input
 - theory, 14-4, 14-13
 - Input (A,B,E,F,G,H)
 - specs, 12-43
 - Input (M,S)

Index

- specs, 12-47
- Input Section
 - theory, 15-7
- Instrument Block Diagrams, 13-2
- K**
- Keyboard
 - troubleshooting, 5-2, 5-6
- L**
- line cord, 6-3
- Line Fuse, 6-5
- line module, 6-5
- Line Voltage, 6-5
- Loop B Output Detector
 - theory, 15-9
- M**
- Measurement
 - Service Kit, 4-5
 - specs, 12-38
 - theory, 14-18
- Memory
 - Service Kit, 4-5
- memory card, 8-2
- diagnostics, 2-1
- Modulation Distribution
 - Service Kit, 4-5
 - specs, 12-8
 - theory, 14-14
- Modulation Distribution External Paths
 - theory, 15-3
- Modulation Distribution Internal Paths
 - theory, 15-3
- Module I/O Specs, 12-2
- MS_DIAGS
 - theory, 15-11
- N**
- NSM
 - theory, 14-10
- NSM and Pre-Modulation Filter
 - theory, 15-5
- NSM Clock Detector State
 - theory, 15-5
- O**
- Open Loop ALC Drive
 - theory, 15-7
- Option 001, 7-4
 - theory, 14-9
- Option 003
 - theory, 14-17
- oscillator, 14-9
- oscilloscope
 - theory, 14-18
- OUT RF SP
 - theory, 16-2, 16-3
- Output
 - Service Kit, 4-5
 - specs, 12-22
 - theory, 14-12
- Output Detector, Detector Caps
 - theory, 15-7
- Output Detector, Low Level
 - theory, 15-7
- Output Filter Rejection
 - theory, 15-8
- Output Frequency Range, Loop Closed
 - theory, 15-7
- Output Section
 - theory, 15-6
- Output Variable Attenuator
 - theory, 15-8
- P**
- Parallel Bus
 - troubleshooting, 5-3
- Parallel bus
 - troubleshooting, 5-2
- parallel bus
 - theory, 14-18
- PCN, 14-2, 17-4
- PCS, 17-4
- PCS1900, 17-4
- performance tests, 3-1
- performance verification, 3-1
- periodic calibration, 7-2
- periodic maintenance, 7-2
- Power Supplies
 - specs, 12-53
- Power supplies
 - specs, 12-50
- Power Supplies and Amplifier Bias
 - theory, 15-6
- Power Supply
 - specs, 12-58
- Power Switch, 6-6
- Power-up, 1-3
- Preliminary Audio Paths
 - theory, 15-3
- Premod Filter and NSM
 - Service Kit, 4-5
- Premod filter and NSM, 14-9
- Premodulation Filter and NSM
 - specs, 12-10
- Pre-Modulation Filter Clock Detector State
 - theory, 15-5
- Protocol Interface (Option 003)
 - theory, 14-17
- PULSE
 - theory, 16-2, 16-3
- Pulse Attenuator
 - theory, 14-13
- Pulse Attenuator and Drive
 - theory, 15-7
- Pulse Attenuator and Drive Test
 - theory, 15-7
- Pulse Driver
 - specs, 12-24
- R**
- Receiver
 - Service Kit, 4-5
 - specs, 12-32
 - theory, 14-6, 15-9
- Receiver Mixer
 - specs, 12-19
 - theory, 14-5
- Reference
 - Service Kit, 4-5
 - specs, 12-26
 - theory, 15-5
- Replacing a Part, 9-1
- RF Analyzer
 - theory, 14-4
- RF Analyzer Loop 1 MHz Reference Detector
 - theory, 15-9

Index-4

Index

- RF Analyzer Loop Lock Detector
 - theory, 15-9
 - RF Analyzer Step Loop
 - theory, 15-8
 - RF Detectors 1
 - theory, 15-8
 - RF Detectors 2
 - theory, 15-8
 - RF Generator
 - theory, 14-9
 - RF Generator Loop 1 MHz Reference Detector
 - theory, 15-6
 - RF Generator Loop Lock Detector State
 - theory, 15-6
 - RF Generator Loop Output Detector
 - theory, 15-6
 - RF Generator Step Loop
 - theory, 15-6
 - RF Generator Sum Loop Lock Detector State
 - theory, 15-6
 - RF Generator Sum Loop VCO Tuning Level
 - theory, 15-6
 - RF In/Out to Aux RF Out Test
 - theory, 15-11
 - RF Input Signal
 - theory, 15-9
 - RF Input/Output
 - theory, 15-11
 - RF_DIAGS
 - theory, 15-5
 - Running Memory Card Diagnostics, 2-1, 2-3
- S**
- SCOPE
 - theory, 16-2, 16-4
 - self-tests, 11-2
 - Sequence Controller
 - theory, 14-16
 - Serial Bus
 - troubleshooting, 5-2
 - Serial bus
 - troubleshooting, 5-3
 - serial bus
- theory, 14-18
- Service Screen, 10-2
- Signaling Source/Analyzer
 - Service Kit, 4-5
 - specs, 12-13
 - theory, 14-14
- SPEC ANL
 - theory, 16-2, 16-4
- Special Option H03, 14-17
- Spectrum Analyzer
 - Service Kit, 4-5
 - specs, 12-36
 - theory, 14-4, 14-7, 15-9
- Step Attenuator
 - theory, 15-8
- Step Loop A
 - Service Kit, 4-5
 - theory, 14-11
- Step Loop A Assembly (A26), 7-5
- Step Loop B
 - Service Kit, 4-5
 - theory, 14-11
- Stepped Gain
 - theory, 15-9
- Sum Loop
 - theory, 14-12, 15-6
- Sum Loop Assembly (A25), 7-5
- Summ Loop
 - Service Kit, 4-5
- T**
- Temperature Sensor
 - theory, 15-8
 - Temperature Test
 - theory, 15-10
 - theory of Operation, 14-2
 - Timebase Adjustments, 7-2
 - Top and Bottom Cover Removal, 8-3
 - torque, 8-2
 - Tracking Filter Rejection
 - theory, 15-7
 - Transformer, 6-6
 - Transformer, 6-6
- V**
- Variable Gain IF Amplifier
 - theory, 15-9
 - verifying performance, 3-1
 - Voltmeter
 - theory, 14-18

Index

Index-6

Free Manuals Download Website

<http://myh66.com>

<http://usermanuals.us>

<http://www.somanuals.com>

<http://www.4manuals.cc>

<http://www.manual-lib.com>

<http://www.404manual.com>

<http://www.luxmanual.com>

<http://aubethermostatmanual.com>

Golf course search by state

<http://golfingnear.com>

Email search by domain

<http://emailbydomain.com>

Auto manuals search

<http://auto.somanuals.com>

TV manuals search

<http://tv.somanuals.com>