Motorola AMPS/NAMPS Cell Site Test Software

HP 11807B Option 040 Software User's Guide for the HP 8921A

Software Version **B.01.00 and above**

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Rev A

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Product Description

About the Test Software

The HP 11807B Option 040 Motorola AMPS/NAMPS Cell Site Test Software is used with the HP 8921A Cell Site Test Set, and various ancillary equipment, to test the functionality of Motorola cellular telephone base stations. The Test Software package, as shipped, contains the following items:

- HP 11807B Option 040 Cell Site Test Software Card, part number HP 11807-10012
- HP 11807B Option 040 Test Software User's Guide, part number HP 11807-90153
- Software licensing agreement, part number 5180-1566
- 128-kilobyte Memory (SRAM) Card (part number HP 85702A) for storing customized test programs and results.
- Cable and adaptor for serial connection to the base station
  - 6-Conductor RJ11 (m) — RJ11 (m) cable, part number 08921-61015
  - RJ11 (f) — DB25 (m) adaptor, part number 08921-61016

The following features of the Test Software simplify testing:

- The Test Software sends base station control commands automatically from the Test Set via the RS-232 interface. The Test Software also displays responses from the base station.
- The Test Software displays the location of an adjustment whenever adjustment is required.
- The Test Software displays a large meter on the Test Set screen and provides variable auditory feedback while adjustments are being made.
- The Test Software displays system interconnects on the Test Set screen whenever cable connections must change.
- The Test Software displays results of tests and pass/fail indications on the Test Set screen, and supplies the results and indications for printing or collecting in an HP Palmtop computer, a PC, a disk drive, or a memory (SRAM) card.
- The Test Software controls switches that select the external RF or audio signal paths.
- The Test Software allows you to change the order of TESTs, pass/fail limits, parameters, and external device configurations.
- The Test Software provides that base station control commands can be selectively sent as the tests proceed.
- The Test Software provides that RF path losses can be determined and accommodated.

About the Test System

When the Test Software is used with the HP 8921A Test Set and the various other equipment, the combined system is called the Test System. The following items make up the Test System:

- HP 11807B Option 040 Motorola AMPS/NAMPS Cell Site Test Software.
- HP 8921A Cell Site Test Set.
- Accessories:
  - HP 83202A Option 040 Base Station Accessory Kit.

    or
  - Other switch and interconnect arrangements.

In addition, it would be helpful to have available the RF Tools in the HP 11807A,E Option 100 System Support Tests software package. The Option 100 software package offers a range of tests that may be used as adjuncts to those in the Test Software.

Note that the following three tests that were in previous versions of the Test Software were removed for this version (B.01.00):

- VSWR Swept Return Loss.
- VSWR Discrete Channel Return Loss.
- VSWR vs Distance (cable fault)

These tests are now included the RF Tools section of Option 100 software package.

This system performs tests that determine the quality of the RF and audio performance of several types of Motorola AMPS and AMPS/NAMPS cellular base stations. Most of the measurement methods and specifications used for these tests are derived from Electronic Industries Association standards and procedures recommended by Motorola.

Testable Cell Site Equipment

The Test System allows you to test Motorola HDII, HDII/NAMPS, and LD Base Stations. The firmware revision of the base station to be tested must be 4.3.2.1 or higher.

Specific equipment that you can test includes voice transceivers, scan receivers, signaling transceivers, combiners, power amplifiers, and universal reference distribution modules. The Test Software includes major adjustment procedures.

Using the Test Software

This Test Software can be used during routine cell site verification and after the installation or repair of cell site equipment. Base stations can be tested while in the In-Service Optimization Mode or in the Manual Mode. The Manual Mode must be used for some of the TESTs. There are instances in which it may be advantageous to choose one of these modes over the other.

IMPORTANT CAUTION:

Before you connect the Test Set to a base station, you should understand the potential results of your actions. Dropped calls, accidental modification of base station calibration data, and other undesirable effects can occur.

The next two sections will get you started learning to use the Test Software. The first of the two, “Getting Started”, contains steps to follow if you have not run Test Software on a Test Set. The second of the two, “Learning to Use the Test Software”, describes steps that you should follow in continuing to learn to use the Test Software.

Firmware Differences

Firmware revision A.14.00 in the HP 8921A,D Cell Site Test Set introduced several enhancements to the TESTS menus. With the enhancements were changes to the menu structure used in the TESTS (Main Menu) screen and its sub-screens.

This manual is written for instruments with firmware revision A.14.00 and higher. To assist users with instruments with older firmware, this section summarizes the changes and shows the correspondence between revision A.14.00 screens and those of the earlier versions.

NOTE: If you are unsure of the firmware revision of your unit, press and release the SHIFT key then press the DUPLEX key. A configuration screen will be displayed and the firmware revision is shown in the upper right of the screen. Contact Hewlett-Packard at 1-800-922-8920 for details on upgrading your instrument if desired.

Using the TESTS Menu Comparison

NOTE: The information in * and ** are for users of Test Sets with firmware revisions below A.14.00. Please disregard this material if your Test Set has a firmware revision of A.14.00 or higher.

The next two figures show the TESTS (Main Menu) screens for the latest TESTS menu (figure 1) and the TESTS menu used in older firmware revisions (figure 2). The illustrations are intended to help you find the corresponding functions if you are working with older firmware revisions.

To use the comparison, follow these steps:

1. When you encounter a procedure or diagram referring to a TESTS (Main Menu) field selection or name that does not appear on your TESTS (Main Menu) (or may appear in a different location on the display), refer back to these figures.
2. Look for the selection description or name in figure 1 and note the corresponding letter.
3. Look for the same letter in figure 2 and note which field (or sub-menu) is used in the older firmware to access the screen or field.
4. Once in the sub-menus, the old and new screens are very similar and you should be able to use the documentation as-is.

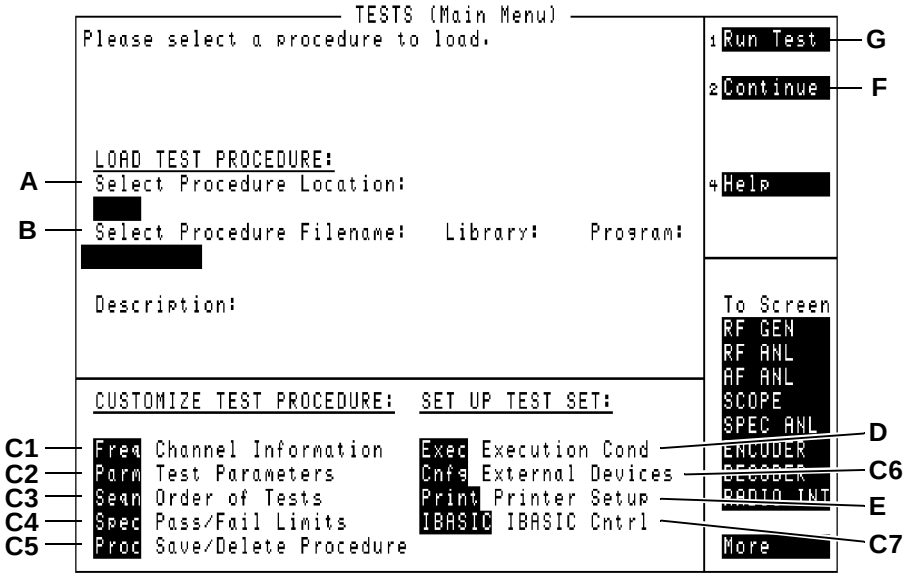


Figure 1 **TESTS Main Menu for Firmware Revisions of A.14.00 and greater.**

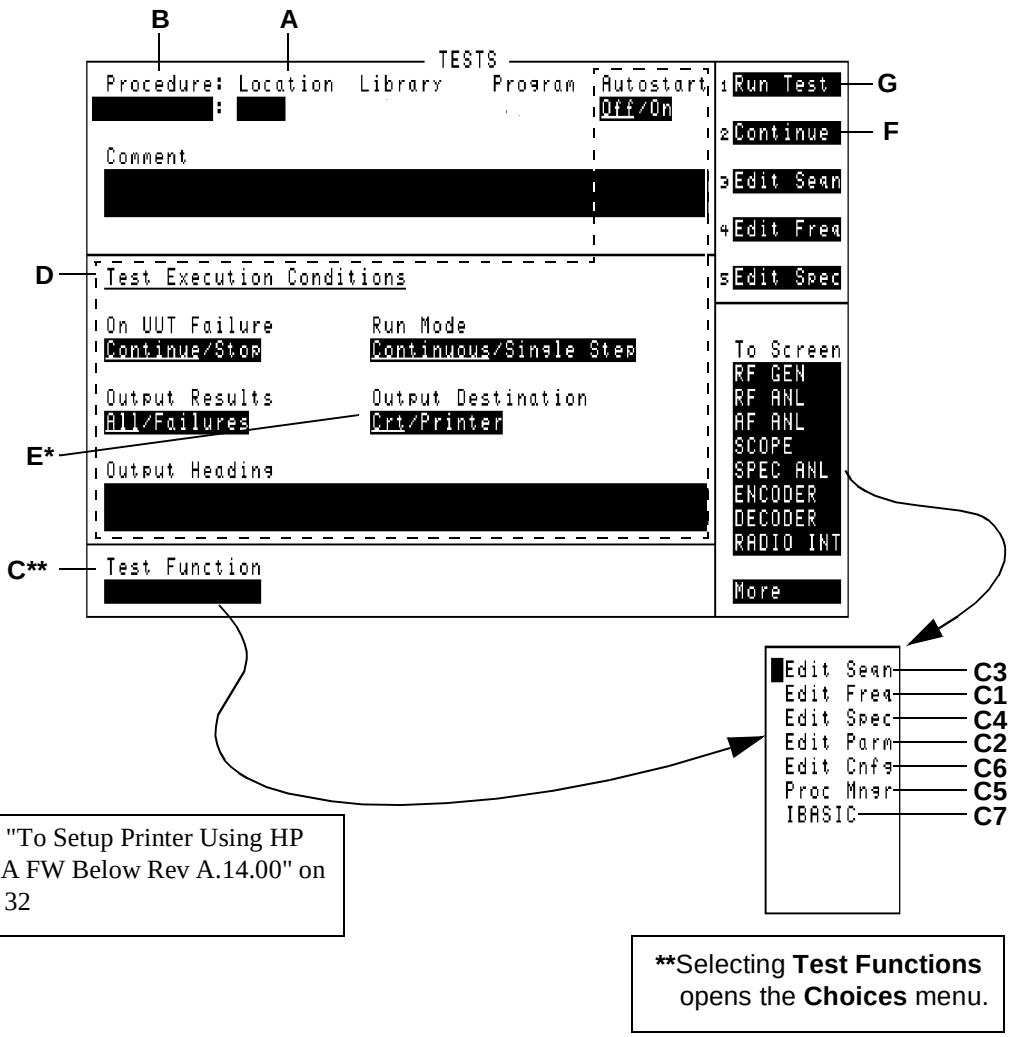


Figure 2 **TESTS Main Menu for Firmware Revision Below A.14.00**

To Setup Printer Using HP 8921A FW Below Rev A.14.00

1. Press the TESTS key.
2. Select **Edit Cnfg** from the **Test Function** field.
3. Position the cursor to the **Inst#** field and select it.
4. Rotate the knob until an empty **Calling Name** field appears, and select it.
5. Position the cursor to the **Calling Name** field and select it.
6. Using the list of characters in the **Choices** menu, enter the word **PRINTER**. Select **Done** when complete.
7. Position the cursor to the **Addr** (address) field and select it.
8. Using the DATA keypad, enter **9** for serial printers, **15** for parallel printers, or **70X** for HP-IB printers, then press ENTER.
9. Position the cursor to the **Options** field (directly under **Calling Name**) and select it.
10. Using the list of characters from the **Choices** menu, the following commands may be entered. Separate the commands with commas (example; **LN=60,START,END**)
    - **LN** equals the number of printed lines per page.
    - **START** causes a form feed at the start of each printout.
    - **END** causes a form feed at the end of each printout.
11. From the **To Screen** menu, select **More**.
12. From the **Choices** menu, select **IO CONFIG**.
13. For Serial Printers:
    - Set the **Serial Baud** field and other serial communications fields listed under it to correspond to your printer's configuration.
14. For HP-IB Printers:
    - Position the cursor to the **Mode** field and select it.
    - From the **Choices** menu, select **Control**.
    - Position the cursor to the **Print Adrs** field and select it.
    - Rotate the knob and select the HP-IB address of your printer.
    - Position the cursor to the **Print To** field. Pressing the knob will toggle the underlined selection. Select to underline **HP-IB**.
15. Press the TESTS key to return to the TESTS screen.

To print test results

1. Make sure that your printer is properly connected and configured as explained earlier in this section.
2. Press the TESTS key.
3. Position the cursor to the **Output Results To:** field (or the **Output Destination** field). Pressing the knob will toggle the underlined selection. Select to underline **Printer**.
4. Position the cursor to the **Output Heading** field and select it.
5. Using the list of characters in the **Choices** menu, enter a printout heading (optional). Select **Done** when the heading is complete.

Getting Started

If you have not run Test Software on a Test Set, follow the procedures shown in the following 11 illustrations to get started.

To perform this procedure, you will use an HP 8921A Cell Site Test Set and the HP 11807B Option 040 Test Software Card. If you wish to perform the steps with a base station connected, you will require the RJ-11 cable and RJ-11/DB25 adaptor to connect the base station RS-232 connector to the Test Set.

The procedure will guide you in running “TEST_01 - Laptop Emulator”, then in stopping TEST_01, and then in selecting and running another TEST.

Specifically, the procedure will guide you to:

- Turn-on and set up the Test Set.
- Insert a Test Software card.
- Load and run TEST_01 - Laptop Emulator.
- Stop TEST_01.
- Select and run another TEST.

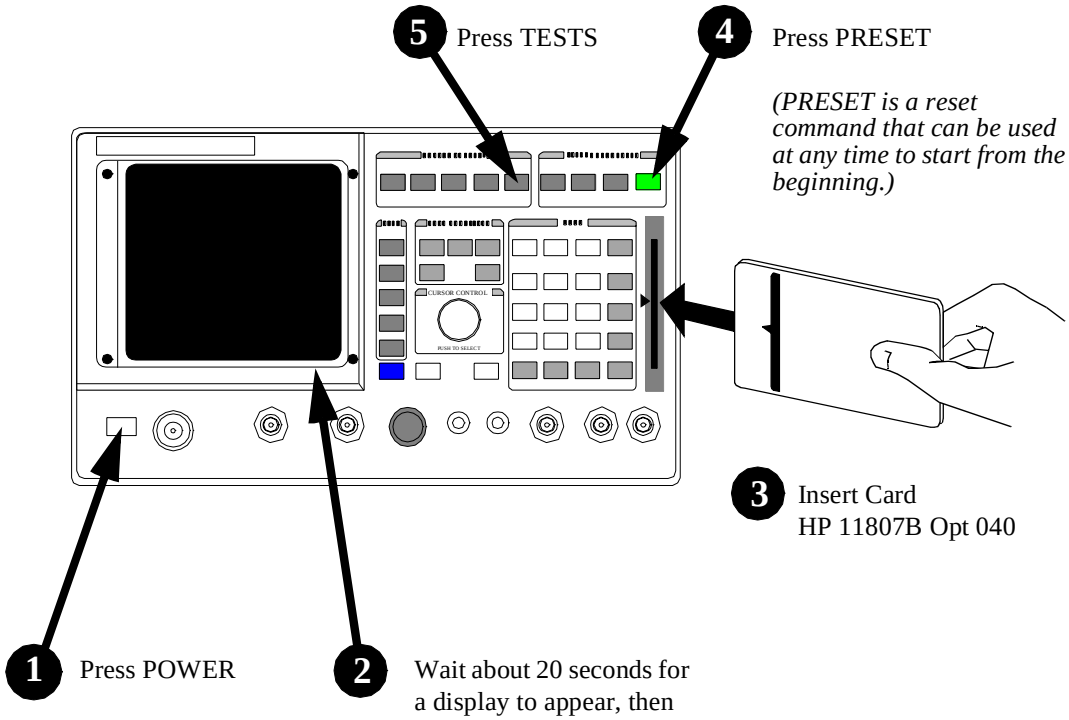
If you wish to perform these steps with a base station connected, you must connect the Test Set RJ-11 Serial B port to the TTYMP #8 CSC Network Address Connection. Do this before starting the steps. *See "Connection for RS-232 Base Station Control," in chapter 3, on page 75*.

For a description of TEST_01, see *"TEST_01 - Laptop Emulator" on page 149*.

When you have completed these steps and feel that you understand the operation, continue with the next section, “Learning to Use the Test Software”.

To Turn On and Set Up the Test Set:

Do steps 1-5 in numbered order.

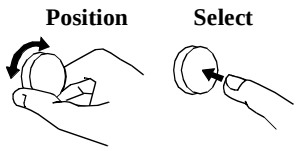


Turn page to list procedures on the memory card

To Select Test Software Procedure Location:

Follow Numbered Steps

Use the cursor control knob on the front panel to position the cursor and make selections.



Use figure on opposite page for reference.

1 Note; cursor is positioned at **Select Procedure Location**.

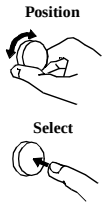
Select Procedure Location:

If previous entries appear disregard them.

2 Press the knob to select **Select Procedure Location**.

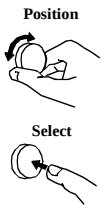
Select Procedure Location:

3 Position the cursor at **Card** and select it.



Choices:
- Card
- ROM
- RAM
- Disk

4 Position cursor at **Select Procedure Filename:** and select it.



Select Procedure Filename:

5 The **Choices:** menu should now appear as shown.

Choices:
- MOT_CS

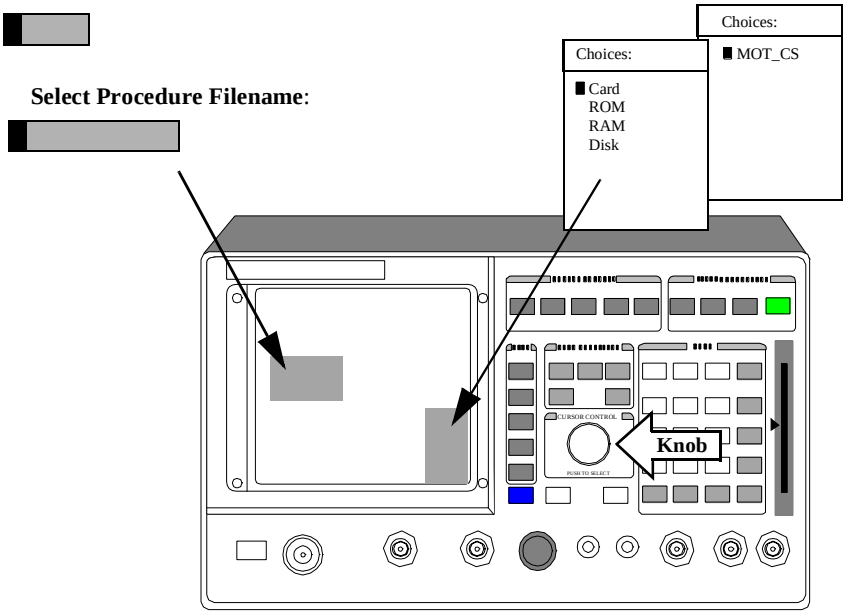
Turn page to load software

To Select Test Software Procedure Location: (Continued)

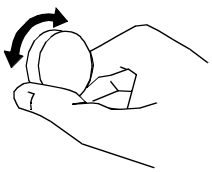
Reference Page

Select Procedure Location:

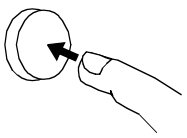
Select Procedure Filename:



Rotate knob to position cursor.

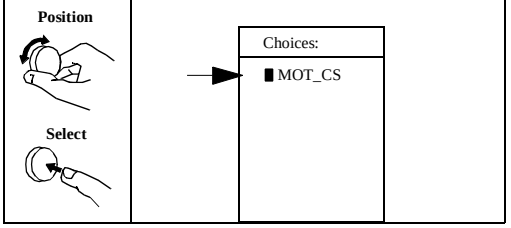


Press knob to select a field.

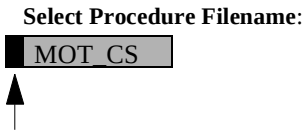


To Load and Run Test Software:

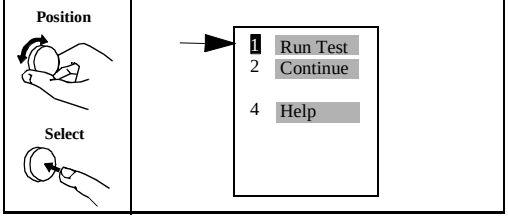
1 Position cursor at **MOT_CS** and select it.



2 Note; MOT_CS is now the selected procedure filename.



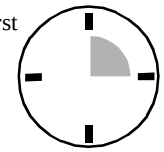
3 Position cursor at **Run Test** and select it.



4 The MOT_CS program is loading.

Loading program first time: 2 min. 30 sec.

After first time: 20 sec.

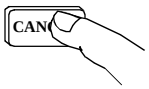


After MOT_CS is loaded, TEST_1 - Laptop Emulator begins running.

If the base station is connected, you should see characters on your display in the box labeled “Base Station Response”. See"Serial Port Connections for Data Collection" on page 75, and "TEST_01 - Laptop Emulator" on page 149.

If the base station is not connected, or if you want to exit this TEST and run a new TEST, continue to step 5.

5 Press **<CANCEL>** to stop the program.



Turn page to select a new TEST

To Load and Run Test Software: (Continued)

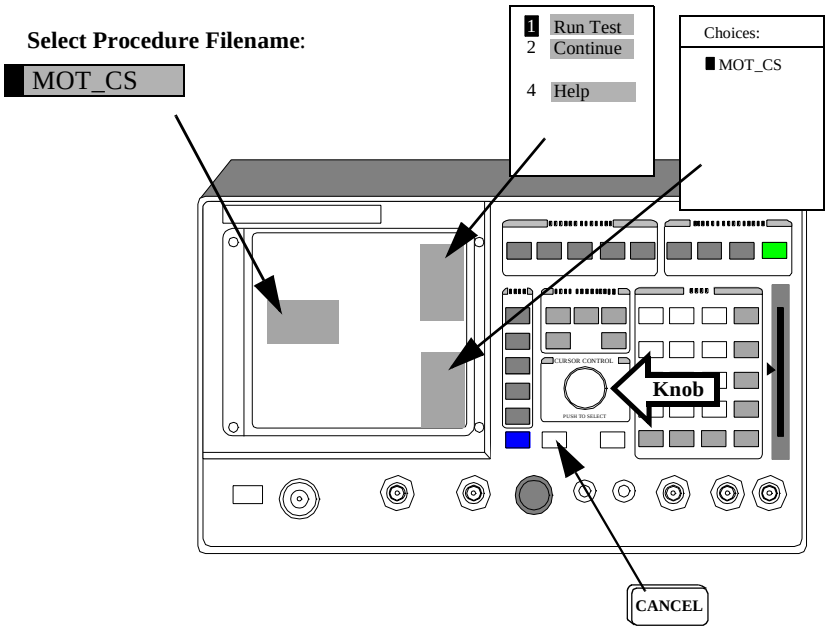
Reference Page

Select Procedure Location:

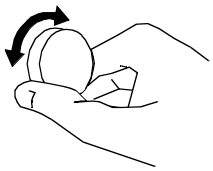
Card

Select Procedure Filename:

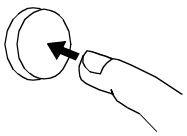
MOT_CS



Rotate knob to position cursor.



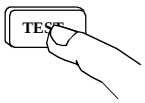
Press knob to select a field.



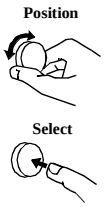
To Change the Order of Tests:

1 Press **TESTS** to display the **TESTS (Main Menu)** screen.

If you are in IBASIC, press SHIFT, CANCEL before pressing TESTS.



2 Position cursor at **Seqn** **Order of Tests** and select it.



Freq	Channel Information
Parm	Test Parameters
Seqn	Order of Tests
Spec	Pass Fail Limits
Proc	Save/Delete Procedure

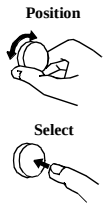
The Order of Tests screen is now present on your CRT.

3 Note; cursor is located in the **Step #** field.

Example

1 TEST_02
URDM or RDM frequency

4 Use the **Order of Tests** screen to edit the **TEST** sequence, select a new **TEST**, or delete a **TEST**.



Test shown is an example, actual test name may be different.

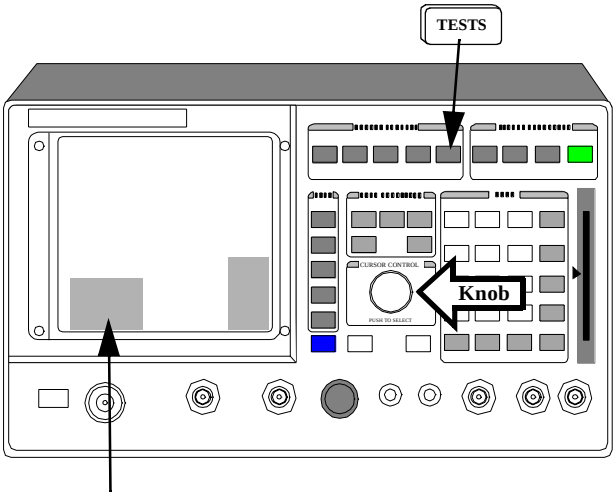
1 TEST_02
URDM or RDM frequency/level

Yes/No

Turn page to select a TEST

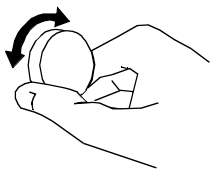
To Change the Order of Tests: (Continued)

Reference Page

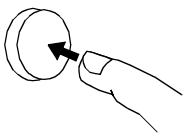


Freq	Channel Information
Parm	Test Parameters
Seqn	Order of Tests
Spec	Pass Fail Limits
Proc	Save/Delete Procedure

Rotate knob to position cursor.



Press knob to select a field.



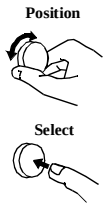
To Select URDM or RDM Frequency/Level test:

1 Note; cursor is located in the **Step #** field.

TEST shown is an example only, actual test may be different.

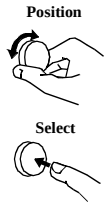
1 TEST_01
Laptop Emulator

2 Position cursor at **TEST_01** and select it.



1 TEST_01
Laptop Emulator

3 Position cursor at **TEST_02** and select it.



Choices:
TEST_01
TEST_02
TEST_03
TEST_04
TEST_05
TEST_06
TEST_07

4 Note; **TEST_02** is now entered.

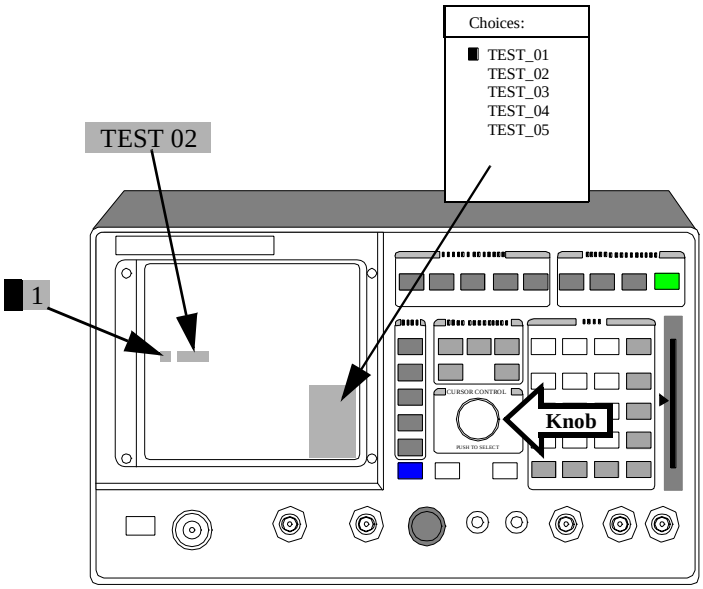
1 TEST_02
URDM or RDM frequency/level

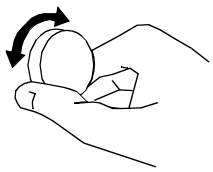
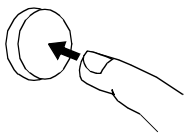
TEST_02 URDM or RDM frequency/ level is now selected and ready to run.

To run TEST_02, turn page

To Select URDM or RDM frequency/level test: (Continued)

Reference Page



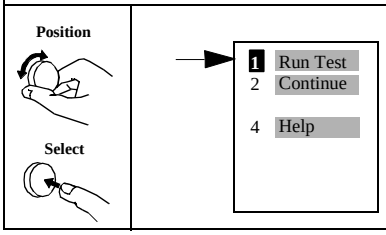
Rotate knob to position cursor. 	***Press knob to select a field.*** 

To run TEST_02 URDM or RDM Frequency/Level:

1 Press **TESTS** to display the **TESTS (Main Menu)** screen.

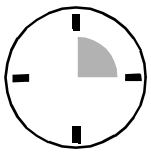
If you are in IBASIC, press SHIFT, CANCEL before pressing TESTS.

2 Position cursor at **Run Test** and select it.



3 The TEST is loading.

Wait 20 seconds.



TEST_02 begins running.

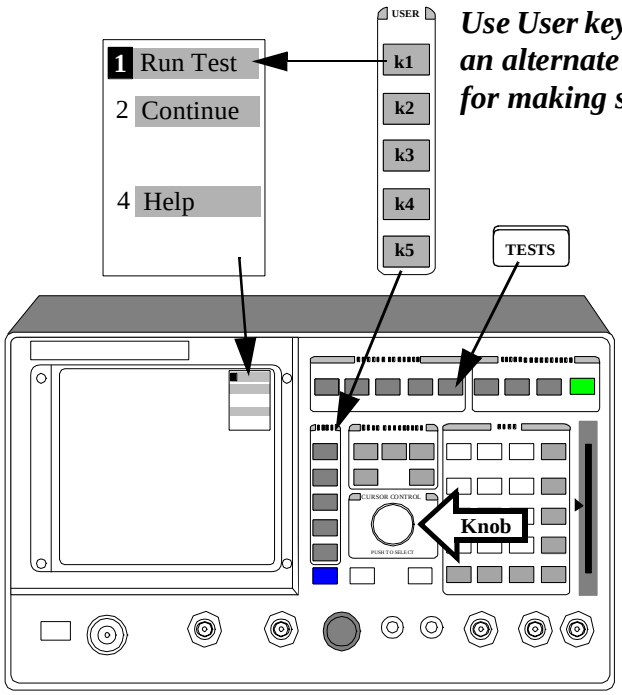
If the Test Set is connected to the base station, see TEST_02 - URDM or RDM frequency/level in chapter 5.

If the Test Set is not connected, the program will stop automatically when it is unable to continue.

4 Press <Shift> <CANCEL> to stop the program.

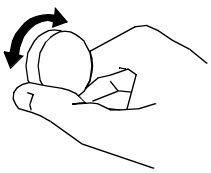
To run TEST_02 URDM or RDM Frequency/Level: (Continued)

Reference Page

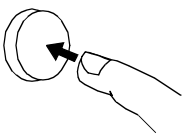


Use User keys k1-k5 as an alternate method for making selections.

Rotate knob to position cursor.



Press knob to select a field.



Learning To Use the Test Software

To learn to use the Test Software:

1. Become familiar with the steps in “Getting Started”
2. Become familiar with the following terms:
   - Memory Card and SRAM Card - *See "Memory Cards," in chapter 2, on page 53*.
   - TESTS (Main Menu) Screen - See *See "What are Tests?," in chapter 4, on page 120* and *see "TESTS (Main Menu) Screen," in chapter 4, on page 122*.
   - Procedures - *See "Procedures," in chapter 3, on page 91*.
   - TEST_01 through TEST_11 - See *chapter 5, "TESTs - Reference," on page 143*.
   - Order of Tests - *See "Entering the Order of TESTs," in chapter 4, on page 132.*
   - Parameters - See *chapter 6, "Parameters - Reference," on page 187*.
   - Pass/Fail Limits (Specifications) - See *chapter 7, "Pass/Fail Limits (Specifications) - Reference," on page 197*.
3. Become familiar with the tests available in the HP 11807A,E Option 100 System Support Tests software package (commonly referred to as RF Tools).
4. If necessary, calibrate system components, and produce one or more Procedures with your parameters. *See "Determining Calibration Parameters," in chapter 3, on page 81* and *See "Procedures," in chapter 3, on page 91*.
5. Make the required connections to the base station. *See "Equipment Connections," in chapter 3, on page 70*.
6. Then, begin performing tests. See *chapter 4, "Running Tests," on page 119*.
7. If you need detailed information as you are running tests, see *chapter 5, "TESTs - Reference," on page 143*, for descriptions of the TESTs.

In this Manual

This manual describes the setup and use of the Test Set when running the HP 11807B Option 040 Motorola AMPS/NAMPS Cell Site Test Software. Test Set features not described in this manual are documented in the *HP 8921A User's Guide* (HP part number 08921-90022).

The chapters in this manual are arranged to help you to refer to specific information for the task that you are performing.

Manual Contents

Chapter 1 - -*Product Description* describes the Test Software and helps you to get started with the Test Software package.

Chapter 2 - *Equipment* describes the items that you either will require, or might require, before you can begin testing. Some of the items might be installed permanently at the cell site. Skip this chapter if you are certain that necessary items are present and installed correctly.

Chapter 3 - *Setting Up* describes installing and connecting equipment, determining calibration factors, and entering parameters, pass/fail limits, and external device configuration. The chapter also describes Procedures and data collection. If tests have been performed previously at the cell site, you might be able to refer to *figure 3 on page 71* to verify connections, and then skip the rest of this chapter.

Chapter 4 - *Running Tests* describes selecting a TEST to put into a procedure, and starting the program.

Chapter 5 - *TESTs - Reference* describes important aspects of each TEST available in the Test Software.

Chapter 6 - *Parameters - Reference* describes all parameters available in the Test Software.

Chapter 7 - *Pass/Fail Limits (Specifications) - Reference* describes all pass/fail limits available in the Test Software.

Chapter 8 - *Problem Solving* describes some of the problems that might be encountered in using the Test Software and Test Set.

Appendix A - *Using the HP 3488A Switch/Control Unit* describes various connection factors in use of the Switch/Control Unit.

Appendix B - *Test Set Measurement Settings* lists the more important Test Set settings used in manual testing.

Appendix C - *Cable Wiring Diagrams for Data Collection to PC and Printer* includes information required to construct PC and printer interface cables.

The **Glossary** describes terms that are used in cell site and test descriptions.

Conventions Used

Special presentations of text in this manual reflect the appearance of the item being referenced.

Examples of these special presentations are:

TESTS	A key on the Test Set.
`Procedure`	Characters displayed on the Test Set display.
`USER (Run Test)`	A USER key in the key column next to the Test Set display. `Run Test` appears on the display.
`0.00000`	A field on the Test Set display in which entries may be made.

Titles of documentation are printed in italics.

The term **Test Set** refers to the HP 8921A.

In the steps in this manual the following words are used to describe cursor and entry actions:

- **`select`** means to rotate the cursor control knob to position the cursor in front of a field (inverse video area), and then press the knob.
- **`enter`** means to use the numeric keypad and the `ENTER` key or measurement units keys to make entries to fields. In some procedures, **`enter`** is used to describe the action of entering characters into a field.

2

Equipment

This chapter describes items that you might require before you begin testing. Some items might become permanent test accessories, installed at the cell site.

Cell Site Equipment

A Motorola HDII, HDII/NAMPS, NAMPS-II, or LD Cellular Base Station is required. Equipment to be tested must be located at an active cell site. All firmware and downloadable software must be installed. The base station firmware revision must be 4.3.2.1 or later. Also, a powered-up base station controller and cell site controller are required.

Memory Cards

Memory cards are PC cards that are used for data storage. These cards are approximately the same length and width as credit cards, but somewhat thicker, and contain integrated circuit storage devices.

There are two overall types of memory cards: Epson card and PCMCIA card. The principal difference between the cards is the interface connector. The Epson card is designed to meet Epson Corporation specifications. The PCMCIA card is designed to meet Personal Computer Memory Card International Association specifications. Both are called PC cards.

For each overall type, there are two sub-types: one-time programmable (OTP), and static random-access memory (SRAM). Once programmed, OTP cards are read-only devices. SRAM cards are random-access devices from which data may be read and to which data may be written multiple times.

In the Test System, memory cards are used to store the following:

- HP 11807B Option 040 Test Software code
- An HP-supplied Procedure, containing:
  - A default testing order
  - Default parameter values
  - Default pass/fail limits
- A Library file
- Procedures that you produce, and that are optimized for your application
- Data collection files

An Epson OTP card serves as the local source medium for the Test Software. When the OTP card is inserted into the slot on the Test Set front panel, the card receives power from the Test Set, and the Test Set, upon operator command, loads the Test Software into the Test Set memory. Arrows printed on the card and Test Set front panel indicate the card direction and orientation for insertion.

SRAM cards are available for use in storing application oriented Procedures and other application information.

Test Software Memory Cards

The HP 11807B Option 040 Motorola AMPS/NAMPS Cell Site Test Software is ordinarily supplied on an Epson OTP card (HP part number 11807-10012). However, the version that you receive might be supplied on an SRAM card. Determine the difference between the two types by looking for a write-protect switch on the top edge of the card. If there is a switch, the card is an SRAM card. If not, it is an OTP card.

CAUTION

If your Test Software is resident on an SRAM card, it is possible to delete it accidentally from the card. To prevent the loss of your program, check the write protect switch on the SRAM card and verify that the card is write protected. Leave the switch set toward the outside of the card except while you are writing to it.

The Test Software OTP card may be removed after the program is loaded into the Test Set memory. The program will remain in memory after a power-down/ power-up cycle.

SRAM Cards

An SRAM card may be used to store test results and Procedures that you produce. The SRAM cards listed in table 1 may be used.

Table 1 **SRAM Card Part Numbers**

Capacity	Part Number
32 kilobytes	HP 85700A
128 kilobytes	HP 85702A
256 kilobytes	HP 85704A
512 kilobytes	HP 85705A

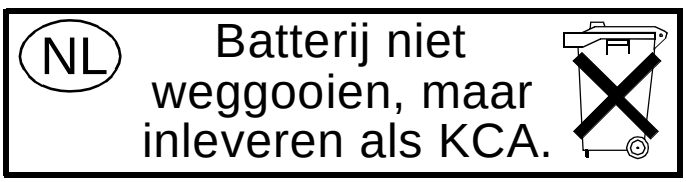
The SRAM card must be initialized before its first use. *See "Initializing an SRAM Card," in chapter 3, on page 115*.

NOTE: SRAM cards use a battery to retain data while the card is not inserted into a powered-up Test Set. The life of the battery depends on the card capacity and the average temperature of its environment. See the next paragraph.

Each SRAM card uses a lithium battery (part number CR 2016 or HP part number 1420-0383). Programs and data will be retained for more than one year if the card is stored at 25 degrees Celsius. The card is powered by the Test Set while it is inserted. When it becomes necessary to replace the battery, do so while the card is inserted into a powered-up Test Set. To retain data and procedures, the battery should be replaced annually. If you store SRAM cards in a warm environment, replace the battery more often.

A procedure to replace the battery is described in the *HP 8921A User's Guide*.

The write protect switch on a SRAM card will write-protect the card when it is set toward the outside of the card.



Memory Card Storage Space

Regarding storage space, the following characteristics apply:

- A record is 256 bytes.
- A procedure uses 12 to 16 records.
- A library typically uses 20 to 35 records.
- Only one library is permitted on a card.
- Overhead of approximately 11 kilobytes is required on each card.

Use the following formula to estimate the required storage space:

```
Storage Space(in kilobytes) = (Number of Procedures × 4.1) + 17
```

For example, if you are testing ten cell sites and the procedure is different for each site, you will use ten procedures, and 58 kilobytes of memory. Thus, the 128-kilobyte card is sufficient.

The storage space that you will require for data collection depends on the number of test results to be saved. You will require approximately 4 kilobytes per page of test results that you save. A page of test results is approximately 57 lines of CRT or printer output. See "Data Collection" on page 113 for a discussion of memory card storage space and file types.

In applications in which large quantities of data will be collected, the storage capacity of smaller SRAM cards is reached quickly. In such instances, data collection using a PC or printer might be advisable.

HP 8921A Cell Site Test Set

The HP 11807B Opt 040 Test Software runs on the HP 8921A Cell Site Test Set.

In this manual, the term Test Set refers to the HP 8921A.

The HP 8921A Cell Site Test Set is an optimized collection of instrument hardware and firmware, designed to test cellular base stations extensively. Most of the required hardware and all of the firmware to test cellular base stations has been included in the standard instrument. Several options may be added, depending on your application.

Test Set Firmware

The HP 8921A firmware revision number must be A.06.09 or later. At the time this manual was revised, firmware revision A.16.00 was being shipped.

Identify the revision of the firmware by pressing the Test Set SHIFT, CONFIG keys. The Test Software will display the revision number in the CONFIGURE screen.

An internal switchable 600-ohm load is supported in firmware revisions A.06.11 and later. If this load is not installed in your instrument, you must place an external load in line with the connection from the RCV LINE JK to the Test Set AUDIO IN connector. *See "Audio Connections," in chapter 3, on page 75.*

Testing a base station with NAMPS capability requires revision A.06 or later (but not including revision A.06.12).

After the Test Software has been loaded into Test Set memory, a pre-run operation takes place after **`Run Test`** is pressed. The pre-run will be performed in much less time if the Test Set firmware revision is A.08.02 or later.

Test Set Option

Depending on your application, the Radio Interface Card, Option 020, to the Test Set might be required.

This option is used to control RF and audio switches that route signals from the base station to HP 8921A connectors. If the application will use another switching arrangement, this option is not required. See *"RF and Audio Switches" on page 61*.

Other Software Tools

As an adjunct to the tests included in the Test Software, Hewlett-Packard offers the HP 11807A,E Option 100 System Support Tests software package. This software package is contained on an OTP card and includes a variety of tests to enhance the testing efficiency of the Test System.

The RF Tools in this package include the following tests:

- Swept Gain
- Swept Insertion Loss
- Swept Return Loss
- AMPS Channel Return Loss.
- Cable Fault.
- ERP Calculator
- Replot Data Files
- Transfer Stored Data
- SA Self Calibration ON/OFF
- Catalog Memory Card
- Create/Edit Data Collection Labels

Of particular interest to users of the HP 1807B Option 040 Test Software in maintaining cellular telephone base stations are the Swept Insertion Loss, Swept Return Loss, AMPS Channel Return Loss, and Cable Fault tests.

In addition, the Option 100 package includes a Field Strength test that performs field strength measurements, an Intermodulation Products test that calculates intermodulation products, and a Scanner test that performs discrete and swept frequency scanning on the system under test.

Peripheral Items

This section describes items required to interconnect the major components of the Test System. An HP-supplied solution is described in this section. Individual switch and interconnect items from other suppliers are also described. See *figure 3 on page 71*, *figure 4 on page 72*, and *chapter 3, "Setting Up," on page 69*.

HP Supplied Peripheral Items

A Base Station Accessory Kit is available from Hewlett-Packard (HP 83202A Opt 040). The kit contains the following items:

Table 2 **Motorola Cables/Adapters**

Description	Purpose	Q	Part Number
Directional couplers	See *figure 4 on page 72* in HP 11807B #040 User's Guide	4	0955-0711
50-Ohm SMA(m) termination	Terminates coupler port	4	0960-0053
N(f) to N(f) Adapter	For VSWR and cable calibration	1	1250-0777
N(m) to N(m) Adapter	For VSWR and cable calibration	1	1250-0778
N(m) to BNC(f) Adapter	To adapt HP 8921A RF IN/OUT for RDM/URD Measurements	1	1250-0780
SMA(f) to N(m) Adapter	Connects to HP 8921A RF IN/OUT	1	1250-1250
Phone jack to BNC(f) Adapter	For measuring RDM and URDM power	1	1250-1853
BNC(m) to SMA(f) Adapter	Connects to HP 8921A DUPLEX OUT	2	1250-2015
BNC(m) to Banana(f) Adapter	Connects to HP 8921A AUDIO IN HI/LO	2	1250-2164
Banana(m) to BNC(f) Adapter	Connect across HP 8921A AUDIO IN HI/LO	1	1251-2277
SMA(m) to SMA(m) 20 ft. cable	From couplers to switch and to HP 8921A RFIN/OUT	5	08921-61006
BNC(m) to BNC(m) 15 ft. cable	HP 8921A AUDIO OUT to switch and HP 8921A RF IN/OUT to phone jack	1	08921-61007
Bantam 309 to BNC(m) 15 ft. cable	From transceiver to HP 8921A and to switch	2	08921-61008
DB37 to DB37 10 ft. ribbon cable	From HP 8921A to switch	1	08921-61013

Table 2 **Motorola Cables/Adapters**

Description	Purpose	Q	Part Number
RJ11(m) to RJ11(m) 6 wire25 ft. twisted cable	Connects to dual port splitter and to RJ(11)to DB(25) Adapter	1	08921-61015
RJ11(f) to DB25(m) Adapter	Connects to TTYMP #8	1	08921-61016
RJ11(m) to RJ11 (f) dual port, 6 wire splitter	Connects to HP 8921A rear panel serial port	1	08921-61031
DB9(f) to RJ11(m) 4-wire cable	For data collection	1	08921-61038
DB25(m) to RJ11(m) 4-wire cable	For data collection	1	08921-61039
Dual miniphone cable	From switch box to base station (RCV & TEST jacks)	2	08921-61040
Switch Matrix	Automates switching between receive antennas and audio paths	1	HP 83202A K02

RF and Audio Switching Arrangements

The Test Software supports two methods for switching RF and audio paths. The first uses the optional Test Set Radio Interface Card and external switches. The second uses an HP 3488A Switch/Control Unit with optional internal switches. The main part of this manual describes the method that uses the Radio Interface Card. Appendix A describes the method that uses the HP 3488A Switch/Control Unit.

It is highly recommended that you select one of these two automatic switching methods. Manually switching signal paths is cumbersome and can result in time consuming troubleshooting.

RF and Audio Switches

A single-pole six-throw (SP6T) RF switch may be used to route one of the receiver-coupled ports to the Test Set DUPLEX OUT connector. It is preferable that the switch have TTL control inputs. The HP 87106A Opt 050 SP6T switch is

appropriate. The RLC Electronics Model S-1519A also has the necessary characteristics. This switch has SMA connectors. (A TTL buffer should be used with this switch. See *"Switch Control Input Buffer" on page 62*.)

The Test Set Radio Interface Card has TTL and CMOS compatible outputs that control switches external to the Test Set. The switches are activated automatically by the Test Software.

CAUTION: Damage to the Test Set can result if the RF or audio switches generate transients that are conducted into the Test Set via the Radio Interface connector. It might be necessary to install diodes on the Radio Interface control lines to suppress transients caused by the switches. Refer to the switch manual for the proper interface to TTL or CMOS control lines.

An SPDT switch must be installed so that the Test Software can select either the transmitter TEST JK or the EQUIP RCV to be applied to the Test Set Audio In. A miniature SPDT printed-circuit- board-mounted relay provides the necessary characteristics.

You might wish to route the Test Set AUDIO OUT through the Switch Unit, and then to the EQUIP XMT LINE JK. Cables from the Test Set to the Switch Unit can then be the same length.

Switch Control Input Buffer

Depending on the loading of the switch control inputs, a buffer might be required between the Radio Interface connector and the Switch Unit.

If a buffer is required, a 7407 non-inverting TTL buffer may be used. The buffer outputs must be pulled up to the 5-volt supply. This should be done using 1000-ohm resistors.

See "Radio Interface Connections," in chapter 3, on page 79 for connector pinouts.

RF Couplers

A directional coupler with low through-path loss is ordinarily installed in each of the RX and TX transmission lines leading to antennas. The RLC Model M3020A has the necessary characteristics. Refer to the Motorola cell site manual for another recommended model.

50-Ohm Terminations

It might be necessary to place a termination on the RX RF coupler port leading to the antenna to prevent received signals from affecting base station receiver tests.

While testing the SIG unit, a high-power load must be placed on the RF coupler output leading to the antenna. It must be capable of handling at least 30 watts. The load is required to prevent the SIG transmitter signal from being radiated to mobile stations. A 150-watt load is available from Lucas Aerospace (part number M1428).

Cables, Adapters, and Connectors

You might also require some of the following items:

RS-232 Base Station Control Cable

A DB-25 to RJ-11 cable may be assembled. Alternatively, the adapters described in the following paragraphs may be used with RJ-11 cables.

6-pin Modular-to-DB-25 Adapter

The following parts may be used:

- Hewlett-Packard part number 08921-61016
- Radio Shack part number 276-1405

RJ-11 Cable

You will require an RJ-11 cable (6-wire, HP part number 08921-61015) to connect the adapter to the Test Set. If you use a different RJ-11 cable, make certain that it has six conductors.

Single-to-Dual RJ-11 Adapter

The other parts described above will provide a single RJ-11 to DB-25 adapter. If you add a single-RJ-11-to-dual-RJ-11 adapter, you will be able to connect simultaneously the Serial B port to the base station and the Serial port to a serial printer, PC, or other device.

An adapter is available from Black Box (part number FMO-11 or HP part number 08921-61031). In addition to the dual-to-single adapter, you will require two Modular-to-DB-25 adapters and two RJ-11 cables.

RF IN/OUT Cables

Connection from the RF IN/OUT connector to the coupled port of the TX coupler may be made with a cable with SMA connectors on both ends, and a Type N(m)-to-SMA(f) adapter (Pomona part number 4297, HP part number 1250-1250).

The connection to the 3-MHz RDM/URDM output may be made using adapters and a coaxial cable with SMA connectors. Phono(m)-to- BNC(f) (Pomona part number 5319, HP part number 1250-1853) and BNC(m)-to-SMA(f) (Pomona part

number 4289, HP part number 1250-2015) adapters on the 3-MHz end, and an SMA(f)-to-N(m) (Pomona part number 4297, HP part number 1250-1250) adapter on the RF IN/OUT end may be used.

Cable lengths should be as short as possible so that losses are minimized. Low loss cable should be used. To improve accuracy, you might wish to have a set of calibrated standard test cables.

DUPLEX OUT Cable

Connection from the DUPLEX OUT to the common port of the RF switch may be made with a cable with SMA connectors on both ends. A BNC(m)-to-SMA(f) adapter (Pomona part number 4289, HP part number 1250-2015) is required on the Test Set.

Cable lengths should be as short as possible so that losses are minimized. Low loss cable should be used. To improve accuracy, you might wish to have a set of calibrated standard test cables.

RX Coupler-to-Switch Cables

Connection from the RX RF coupler to the RF switch ports may be made with cables with SMA connectors on both ends.

Cable lengths should be as short as possible so that losses are minimized. Low loss cable should be used. To improve accuracy, you might wish to have a set of calibrated standard test cables.

Audio Cables

Bantam 309-to-BNC cables may be used for audio interconnections. Three cables are required, unless the RF switch is used. In that case, two Bantam 309 to Bantam 309 cables and two Bantam 309 to BNC cables are required.

Two BNC(m)-to-banana(f) adapters (Pomona part number 3430-0 black, 3430-2 red, HP part number 1250-1263 gray), may be used to convert the AUDIO IN HI and LO connectors to banana type connectors. A banana(m)-to-BNC(f) adapter (Pomona part number 1269, HP part number 1251-2277) is also required.

RF Switch Control Cable

A cable is required between the Radio Interface Card and the RF and audio switches. One end must have a 37-pin D-Submin connector (AMP Inc. part number 747306-1). The other end will connect to the switches. Refer to the switch documentation for required connectors. A 50-foot ribbon cable with a DB-37 connector is available from Hewlett-Packard Company (HP part number 1252-1682).

HP-IB Cables

If an HP-IB printer or disk drive is part of the system, those units must be connected to the Test Set using HP-IB cables. See the *HP Direct Catalog*

HP Supplied Connector Kit

If you are assembling your own switching and interconnect arrangement, you might wish to have the Connector Kit (HP part number 08920-61061). It contains the RS-232 to RJ-11 adapter and Radio Interface, Mic/Acc, and DC power connectors.

VSWR and Cable Fault Ancillary Equipment

If you expect to perform the VSWR or cable fault tests that are included in the RF Tools section of the HP 11807A,E Option 100 System Support Tests software package, you will require additional items.

VSWR measurements require a return loss bridge and a 6-dB pad.

A return loss bridge with the necessary characteristics is available from Hewlett-Packard Company (P/N HP 86205A) or Eagle (P/N RLB150N3B). See *"Vendor Information" on page 67*.

A 6-dB pad with BNC connectors is available from Hewlett-Packard Company (HP P/N 0955-0698). See *"Vendor Information" on page 67*.

For cable fault tests, a resistive power splitter is required. It is important to note that some power splitters isolate the outputs from each other, and may not be used for VSWR tests using this Test Software. The HP 11850C Power Splitter (P/N HP 0955-0733) is a resistive type that does not isolate the outputs; it may be used with the Test Software. See *"Vendor Information" on page 67*.

High Accuracy Frequency Reference

To verify the performance of the URDM and the frequency accuracy of NAMPS signals, a highly accurate 10-MHz reference source is required. The Electronic Research Co. Model 130 has the required characteristics.

Documentation

After you have learned to use the Test Software, you will be able to run the tests without documentation. However, if you wish to change Procedures or if you expect to perform troubleshooting, you will require this manual. In addition, it might be appropriate to have available the *HP 8921A User's Guide* (HP part number 08921-90022) if you are using the Test Set manually. Motorola base station documentation might be required if you expect to perform troubleshooting or module replacement. It might also be helpful to have your own documentation describing the particular procedures that you follow when performing testing.

Vendor Information

AMP Inc.
PO Box 3608
Harrisburg, PA 17105
(800) 526-5142

Black Box Corporation
1000 Park Drive
Lawrence, PA 15055
(412) 746-5500 (800) 321-0746 FAX

Eagle
P. O. Box 4010
Sedona, AZ 86340
(602) 204-2597 FAX (602) 204-2568

Electronic Research Co.
7618 Wedd St.
Overland Park, KS 66204
(913) 631-6700

Hewlett-Packard Company. See the list of sales offices in chapter 1 of the *HP 8921A User's Guide*.

ITT Pomona Electronics
P.O. Box 2767
Pomona, CA 91769
(714) 469-2900 (714) 629-3317 FAX

Lucas Aerospace Communications and Electronics Inc.
P.O. Box 6001
Gaithersburg, MD 20884-6001
(800) 638-2048

RLC Electronics, Inc.
83 Radio Circle
Mt. Kisco, NY 10549
(914) 241-1334

3

Setting Up

This chapter describes:

- Making connections to the equipment in the Test System.
- Measuring or determining calibration parameters.
- Making, loading, deleting, copying, and securing Procedures.
- Entering pass/fail limits, parameters, and external device configuration.
- Setting up data collection.

Equipment Connections

CAUTION: The Test Set and other equipment in this Test System can be damaged by transient RF power, continuous RF power, high voltage, electrostatic discharge from cables and other sources, and transients caused by lightning. Connections to equipment, switch settings, and power-on conditions must be chosen to reduce the risk of damage to the equipment.

Many arrangements of test equipment and base station equipment are possible. In this manual, some of these possibilities are presented. Radio Interface control of the RF and audio switches is described in this section. Refer to this section and *"Appendix: Using the HP 3488A Switch/Control Unit" on page 219* if you are using an HP 3488A Switch/Control Unit.

Figure 3 on page 71, is an overall Test System block diagram.

After you have set up your Test System, you will be calibrating some system components. Tests should be run with the equipment connected in the same way it was when it was calibrated.

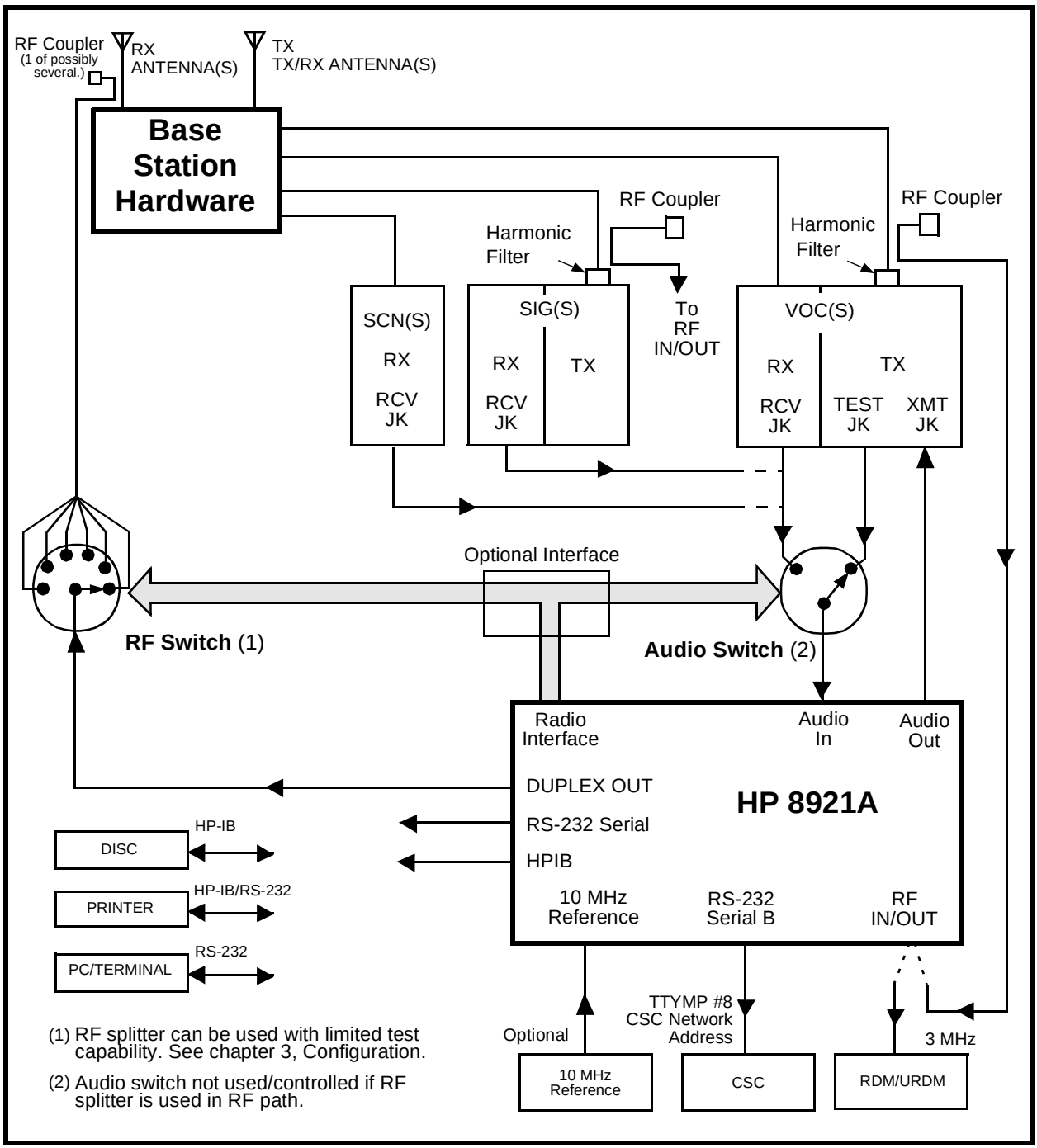


Figure 3 **Overall Test System Block Diagram**

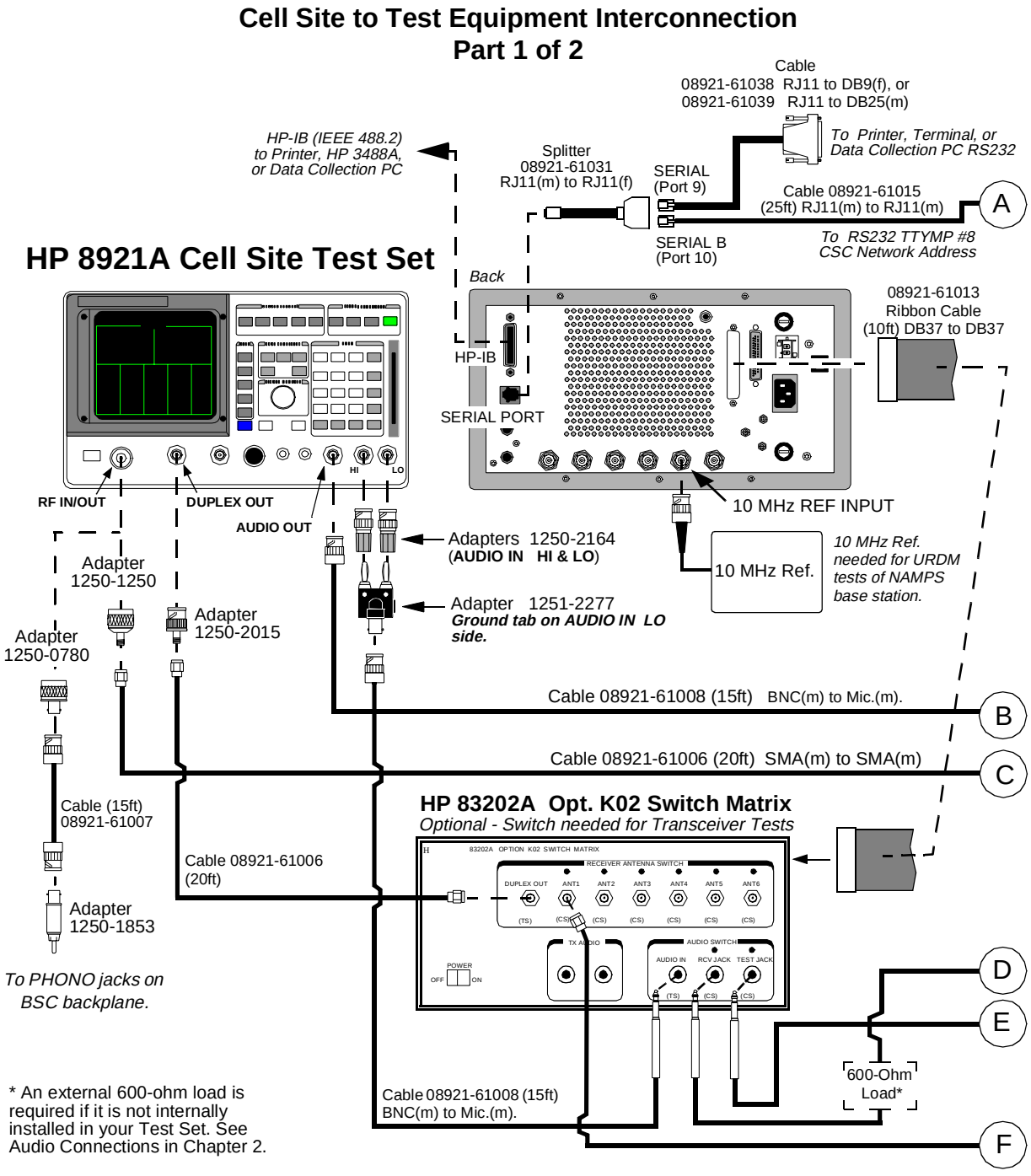
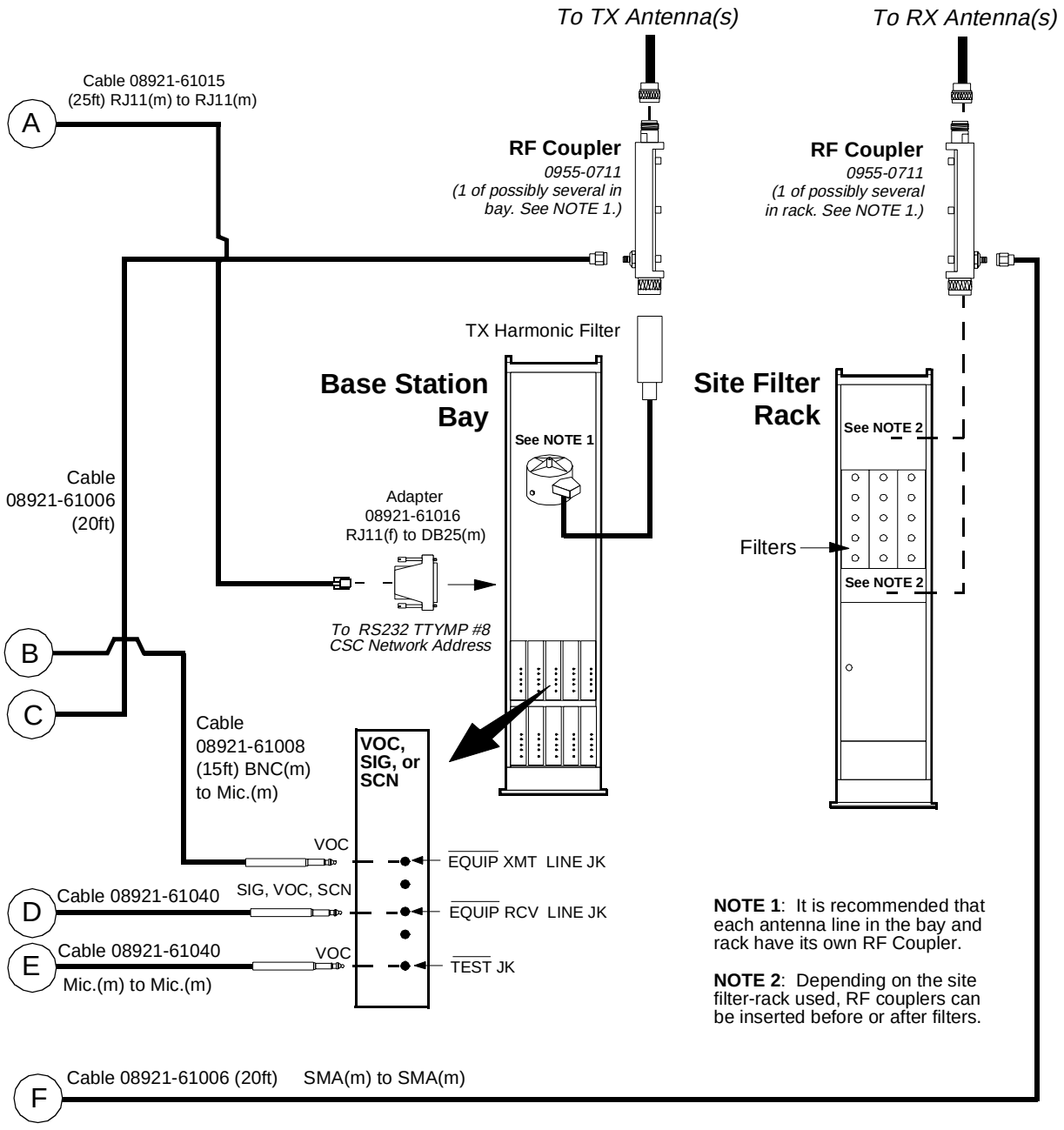


Figure 4 **Cell Site to Test Equipment Interconnections**

Cell Site to Test Equipment Interconnection
Part 2 of 2



NOTE 1: It is recommended that each antenna line in the bay and rack have its own RF Coupler.

NOTE 2: Depending on the site filter-rack used, RF couplers can be inserted before or after filters.

Receiver RF Connections

An RF coupler must be installed between each of the receive antennas and base station receiver inputs. See *figure 4 on page 72* for a description of these connections. RF cables connect each of the coupled ports to an RF N-way switch or splitter. The switch will have two selected ports if the site is an omni site, and six if it is a sectored site. The common port of the switch or splitter is connected to the Test Set DUPLEX OUT connector. See *"Radio Interface Connections" on page 79* for details of the connection of the Radio Interface to the RF N-Way switch.

CAUTION: The application of RF power greater than 200 milliwatts (mW) (or +23 dBm) can damage the Test Set DUPLEX OUT port. Make certain that signals applied to this port are less than 200 mW. If an RF power higher than 200 mW is applied, an overpower relay will trip. Disconnect the RF signal, or turn it off, press MEAS RESET or turn the Test Set power off and then on to reset it, and then reconnect the RF signal, or turn it on again.

Signals that affect the equipment being measured can be picked up by the RX antennas. To prevent this, terminate the RF coupler when performing tests of the SIG unit and scan receivers.

In measurements on voice channel receivers, antennas ordinarily may be left connected to the RF couplers. Interference may be detected by turning up the speaker volume of the Test Set. The interfering signal might be the result of a problem in the frequency plan. If it is impossible to proceed with measurements, terminate the RF coupler port leading to the antenna using a 50-ohm load.

Transmitter RF Connections

An RF coupler must be installed between each cell site transmit antenna and its associated harmonic filter if you wish to perform any test in the In-Service Optimization state. See *figure 4 on page 72* for a description of these connections. A small amount of power is available at the coupled port and is applied to the Test Set RF IN/OUT connector.

While testing the SIG unit, a high-power load must be placed on the RF coupler output leading to the antenna. It must be capable of handling at least 30 watts. The load is necessary to prevent the SIG unit transmitter signal from being radiated to mobile stations.

Audio Connections

An SPDT switch must be installed so that the Test Software can automatically apply either the TEST JK of the transmitter or the EQUIP RCV of the receiver to the Test Set AUDIO IN. See *figure 4 on page 72* for a description of these connections. A 600-ohm load must be connected across the EQUIP RCV, if your Test Set does not have a built-in switchable 600-ohm floating load. This internal load is included in all Test Sets shipped after October 1992. Determine if it is built-in by looking for its control field on the AF ANALYZER screen. The field is labelled **`Audio In Lo`** and has three choices: **`Gnd`**, **`Float`**, and **`600 to HI`**. If the screen includes these three choices, the switchable load is installed.

The HP 11807B Option 040 Test Software selects a floating AUDIO IN LO if the Test Set does not have an internal 600-ohm load.

See *"Radio Interface Connections" on page 79* for details of the connection of the Radio Interface to the audio path switch.

The transmitter EQUIP LINE JACK is connected to the Test Set AUDIO OUT connector with a coaxial cable. You might wish to route this connection through the switch box.

Connection for RS-232 Base Station Control

The HP 11807B Option 040 Test Software supports RS-232 control of the base station via the TTYMP #8 CSC Network Address connection. Other connections are not supported. The Test Set has a rear-panel RJ-11 connector for serial communication. See *figure 5 on page 76*. It has two serial ports on it, Serial A port and Serial B port. Serial B port is used for base station control and messaging.

CAUTION: RJ-11 cable and adapters might be wired in several ways. Verify the connections between the Test Set RJ-11 connector and the DB-25 base station connector.

The connections between the Test Set RJ-11 connector and the DB-25 TTYMP #8 CSC Network Address connector are shown in *figure 6 on page 77*

Serial Port Connections for Data Collection

The Test Software is capable of uploading test results to an external computer. One way to accomplish this is by running a terminal program on a laptop or other computer and using terminal logging to save the information sent to the Test Set Serial port. See *figure 5, "Connector on Test Set Rear Panel," on page 76* and *figure 6, "Adapters for Base Station Control," on page 77*.

Printer Connection

A serial printer may be connected to the Test Set Serial port. An HP-IB printer may be connected to the Test Set rear-panel HP-IB connector.

See *"Serial Port Configuration" on page 109* for information on how to set the Test Set Serial port settings to match the printer settings. (See also*"Appendix: Cable Wiring Diagrams for Data Collection to PC and Printer" on page 233).*

Serial Port Location

A serial printer may be attached to the Serial port. Use the following figure for pin information and the next figure for adapter information.

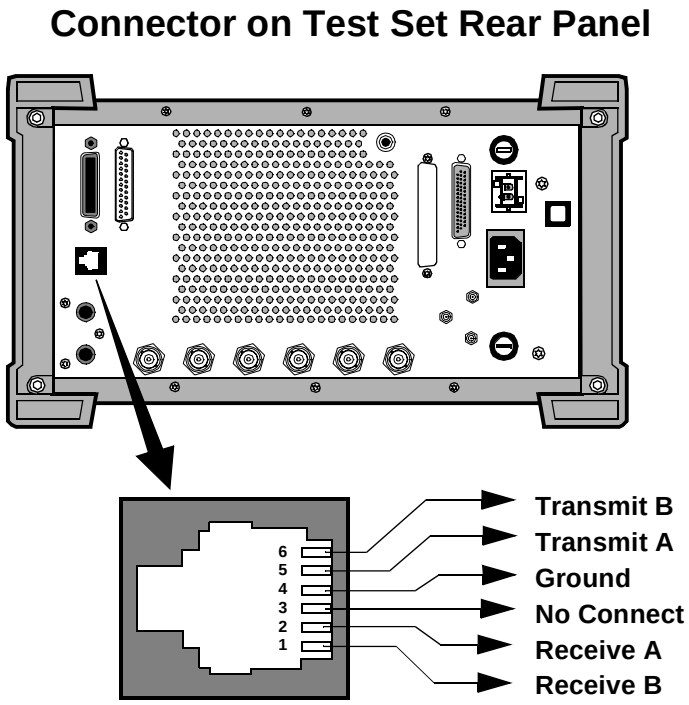


Figure 5 **Connector on Test Set Rear Panel**

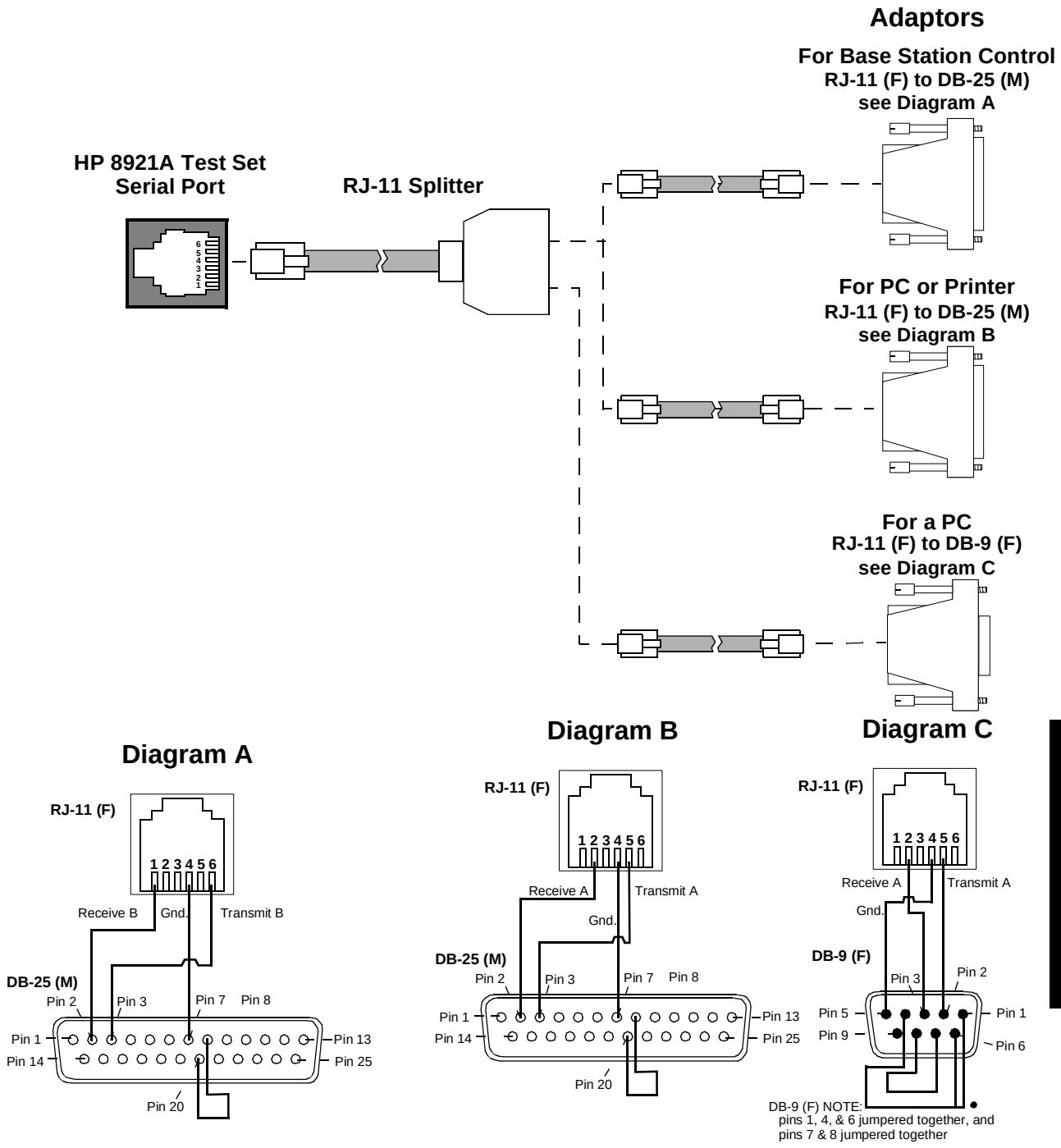


Figure 6 **Adapters for Base Station Control**

Parallel Port Location

A parallel printer may be attached to the parallel port. Use the following figure for pin information.

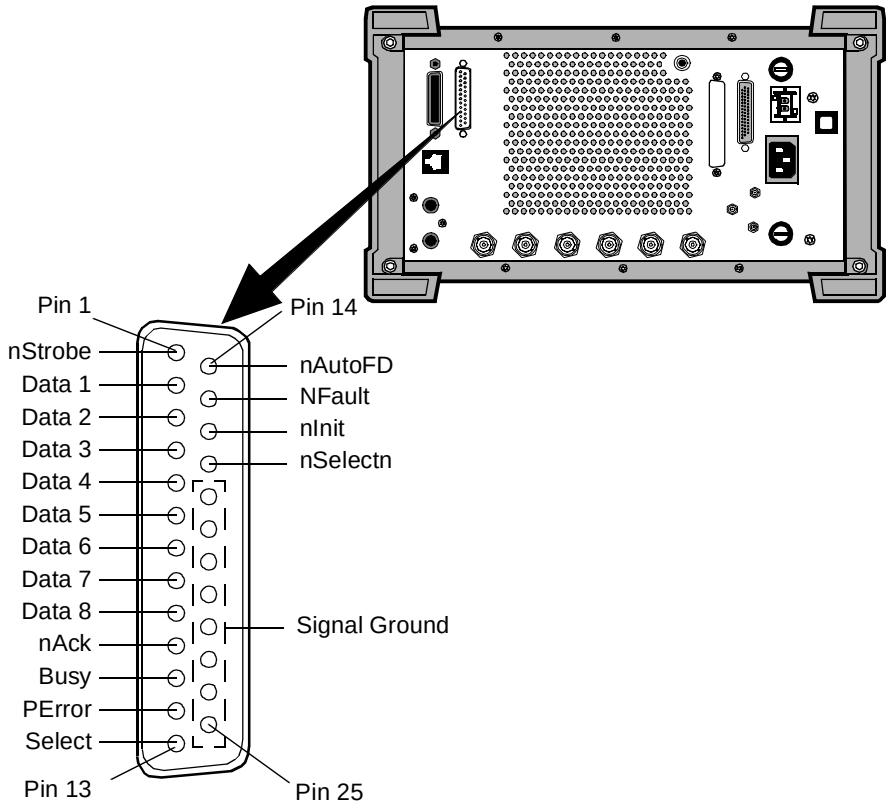


Figure 7 **Test Set Parallel Port Connections**

Disk Drive Connections

A disk drive may be attached to the rear-panel HP-IB connector. See *"Data Collection" on page 113*.

Radio Interface Connections

The following pins on the Radio Interface connector are used to control switches:

1 - GND

19 - Parallel Data Out - D0 - Pos. 1 on the RF switch

20 - Parallel Data Out - D1 - Pos. 2 on the RF switch

21 - Parallel Data Out - D2 - Pos. 3 on the RF switch

22 - Parallel Data Out - D3 - Pos. 4 on the RF switch

23 - Parallel Data Out - D4 - Pos. 5 on the RF switch

24 - Parallel Data Out - D5 - Pos. 6 on the RF switch

25 - Parallel Data Out - D6 - DPDT audio relay

26 - Parallel Data Out - D7 - DPDT audio relay (opposite polarity as pin 25)

CAUTION: Damage to the Test Set can result if the RF or Audio switches generate transients that are conducted into the Test Set via the Radio Interface connector. It might be necessary to install diodes on the Radio Interface control lines to suppress transients caused by the switches. Refer to the switch manual for the proper interface to TTL or CMOS control lines.

There are Radio Interface connector pins that are used for other purposes not listed above. If you plan to connect to these lines, see “Connector, Key, and Knob Descriptions” in the Test Set *User’s Guide.*

A buffer might be required between the switch and the Radio Interface connector. *See "Switch Control Input Buffer," in chapter 2, on page 62.*

The Radio Interface Card provides either a 5.1-volt or user selectable high state logic output voltage.

The Parallel Data Out lines are open collector outputs with 3.16-kilohm internal pull-up resistors. The resistors are connected between the collectors of the drive transistors and a logic voltage that may supplied either internally or externally. The internally supplied voltage is approximately 0.6 volt less than the externally supplied voltage. The external voltage is applied to pin 9 of the Radio Interface connector, and may be between 5.1 volts and 20 volts. The maximum loading on the voltage is 145 ohms to ground. If no voltage is applied, an internal 5.1-volt source is used as the logic voltage. The characteristics of the parallel lines are:

High state output: 3.16-kilohm pull-up to the logic voltage. See the previous paragraph.

Output sink current (low state, output voltage ≤ 1.5 volts): 6 mA minimum, 16 mA typical

Series chokes: 4.6 μ H for RFI control on all lines.

Clamp diodes for ESD protection: The applied voltage must not exceed the logic voltage plus 0.6 volt, or be less than – 0.6 volt.

DC Power to the RF and Audio Switches

DC power must be supplied to the RF and audio switches from a separate source. The Radio Interface Card cannot supply such power. Refer to the switch documentation for power requirements.

Determining Calibration Parameters

Methods of measurement in this section determine RF losses and inaccuracies in your Test System. You must record the resulting calibration factors and enter those as parameters in the fields of the TESTS (Test Parameters) screen. The Test Software will then use these calibration factors when the tests are run.

If you are using a switch to automatically change RF paths, you must make entries into the TESTS (External Devices) screen before you begin these methods. Entries are required for the Test Software to control the switch in "TEST_08 - Manual Switch and Calibration Aid". See *"Determining Calibration Parameters" on page 81*.

Transmitter Path Loss Calibration

This procedure is used to obtain values for the parameter(s) *TX path loss to harmonic filter 1 (to) 8*.

See "Conventions Used," in chapter 1, on page 49 for descriptions of the terms select and enter. The terms are used in the steps in these procedures that make entries to the Test Software.

When making a transmitter power measurement with the Test Set power meter or spectrum analyzer, the following losses or inaccuracies will be present in the measured results:

a) Cable losses.

b) Directional coupler losses.

c) Spectrum analyzer or power meter absolute accuracy.

d) Spectrum analyzer or power meter flatness accuracy.

The following procedure uses an external, highly accurate, power meter to determine a calibration factor that will correct for the errors listed in a through c above. A single factor for each TX path loss is obtained. No correction is provided for changes in loss versus frequency. If the RF coupler coupling is low enough to allow the use of the power meter in the Test Set, this calibration factor will cover Test Set power meter errors. Otherwise, the spectrum analyzer error will be covered.

To determine this calibration factor:

1. See *figure 8* . Zero the power meter and set the calibration factor if necessary. Place a. high-power attenuator at the output of the TX harmonic filter. Connect a power meter sensor to the output of the attenuator. The attenuator might not be required if the power meter and sensor range is correct for the power being measured. Make certain that there are no extra cables in the setup. The attenuator should have a 50-ohm input and output impedance, with a VSWR less than 1.1:1. Record the value of the attenuation as ATTVALUE in dB.

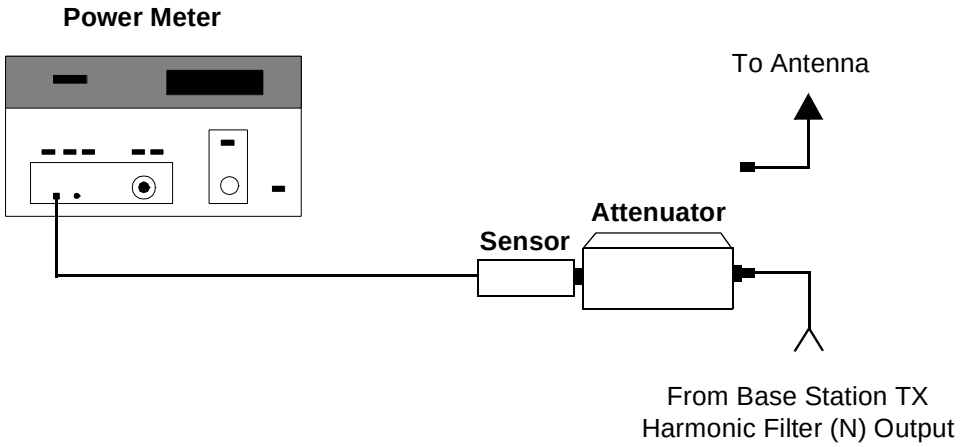


Figure 8 **Transmitter Path Loss - POWERREF Measurement**

2. Key a single transmitter, with no modulation, and measure the power on the power meter. Record this reading as POWERREF in dBm.
3. De-key the transmitter.

4. See *figure 9* . Connect the TX harmonic filter output to the RF coupler input. Connect the Test Set RF IN/OUT, using a standard test cable, to the coupled port of the RF coupler in the TX antenna line.

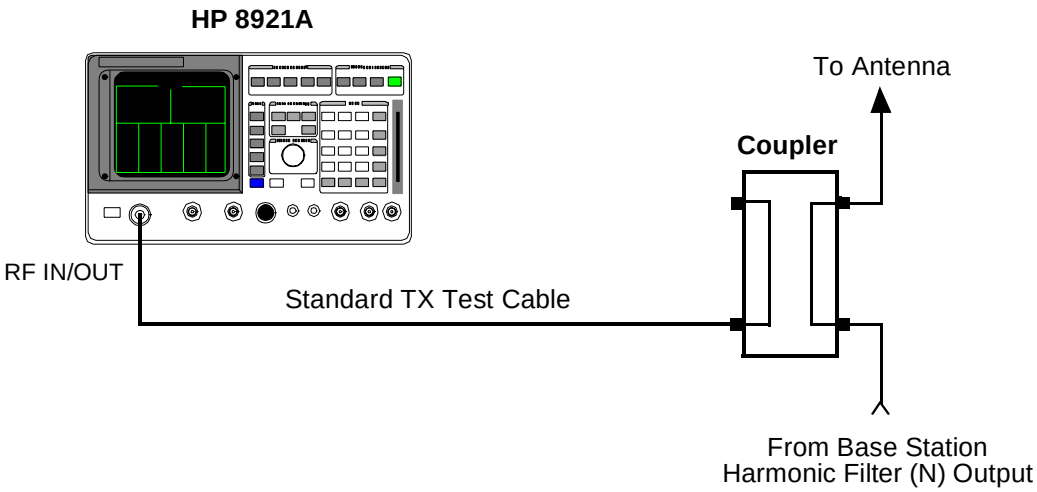


Figure 9 **Transmitter Path Loss - POWER8921 Measurement**

5. Re-key the same transmitter that was keyed in step 2.
6. If the parameter *TX voice/signal pwr use* is set to 0, transmitter power will be measured on the spectrum analyzer. If the parameter is set to 1, measure the transmitter power on the Test Set power meter, record it as POWER8921, and proceed to step 7.

NOTE: The steps a through r listed below, may be performed automatically by running "TEST_08 - Manual Switch and Calibration Aid" and selecting **`Read the spec. analyzer TX path calibration`**.

a. Press the PRESET key.

b. From the **`To Screen`** menu, select **`SPEC ANL`**. The SPECRUM ANALYZER screen will appear.

c. From the **`Controls`** menu, select **`Main`**. The Main menu will appear at the bottom of the screen.

d. Select **`Center Freq`**. Enter a value equal to the transmitter frequency.

e. Select **`Span`**. Enter **`50`** kHz.

f. From the **`Controls`** menu, select **`Marker`**. The Marker menu will appear at the bottom of the screen

g. Under the first **`Marker To`** field, select **`Peak`**.

h. Under the second **`Marker To`**, select **`Ref Level`**.

i. From the **`Controls`** menu, select **`Auxiliary`**. The Auxiliary menu will appear at the bottom of the screen.

j. Under **`Sensitivity`**, select the lower field and choose **`2 dB/div`**.

k. From the **`Controls`** menu, select **`Marker`**.

l. Under the first **`Marker To`**, select **`Peak`**.

m. Under the second **`Marker To`**, select **`Ref Level`**.

n. From the **`Controls`** menu, select **`Main`**. The Main menu will appear at the bottom of the screen.

o. Select **`Ref Level`**.

p. Under **`Ref Level`**, select the field and enter a value to increase the reference level on the spectrum analyzer by 8 dB. Use the numeric keypad or the cursor control knob. You may change the resolution of the reference level adjustment by pressing the INCR ÷ 10 key or the INCRx10 key.

q. Verify that the peak of the signal is close to the center of the spectrum analyzer display.

r. From the **`Controls`** menu, select **`Marker`**. The Marker menu will appear at the bottom of the screen

s. Under the first **`Marker To`** field, select **`Peak`**.

t. Record the **`Marker Lvl`** (in the upper right corner of the screen) as POWER8921 in dBm.

7. De-key the transmitter.
8. Calculate the calibration parameter using the following formula:

   Calibration parameter = POWERREF + ATTVALUE – POWER8921
9. Enter the value(s) of the calibration parameter(s) into the parameter(s) *TX path loss to harmonic filter 1 (to) 8*.

Receiver Path Loss Calibration

This procedure is used to obtain values for the parameter(s) *RX path loss to antenna 1 (to) 6*.

When making a receiver sensitivity measurement with the Test Set, the following losses or inaccuracies will be present in the measured results:

a) Cable losses.

b) Directional coupler losses.

c) Test Set output level accuracy.

The following procedure will use an external, highly accurate power meter to determine a calibration factor that will correct for the errors a and b listed above. A single factor for each RX antenna is obtained. No correction is provided for changes in loss versus frequency.

To determine this calibration factor:

1. See *figure 10.* Zero the power meter and set the power meter calibration factor if required. Connect the power meter sensor to the Test Set DUPLEX OUT.

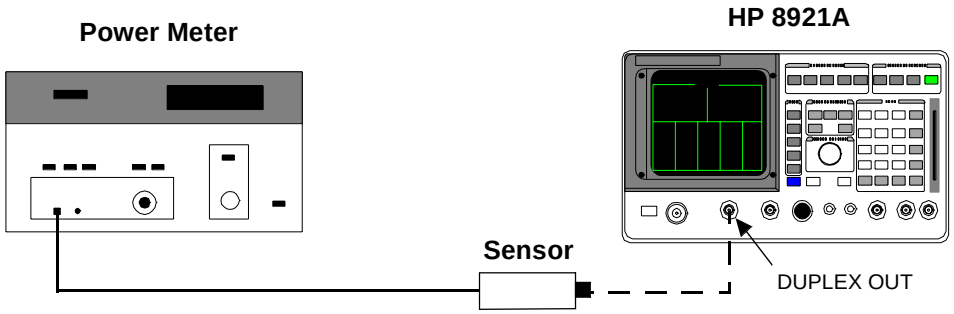


Figure 10 **Receiver Path Loss - POWERREF Measurement**

2. Set the Test Set to generate an unmodulated RF signal at an amplitude sufficient to measure the path and coupler loss with the power meter and power sensor being used. Do this by performing the following steps.

NOTE: Steps a through f below may be performed automatically by running "TEST_08 -Manual Switch and Calibration Aid" and selecting **`Set the HP 8921A for RX path calibration`**.

   a. Press PRESET.

   b. From the **`To Screen`** menu, select **`RF GEN`**. The RF GENERATOR screen will appear.

   c. Under **`RF Gen Freq`**, select the field and enter **`834.5`** MHz.

   d. Under **`AF Gen1 To`**, select the lower field and press the Test Set ON/OFF key to set it to OFF.

   e. Under **`Output Port`**, select the field and press the cursor control knob to make **`Dupl`** underlined. (This selects the DUPLEX OUT port.)

   f. Under **`Amplitude`**, select the field and enter the value as required by the coupler loss and sensor sensitivity. You must not change this amplitude for the remainder of this procedure.

3. Record the power meter reading as POWERREF in dBm.

4. See *figure 11* . Connect the Test Set DUPLEX OUT to the common port of the RX antenna switch. Terminate the RF coupler port leading to the antenna. Connect the power meter sensor to the RF coupler port that normally attaches to the receiver input.

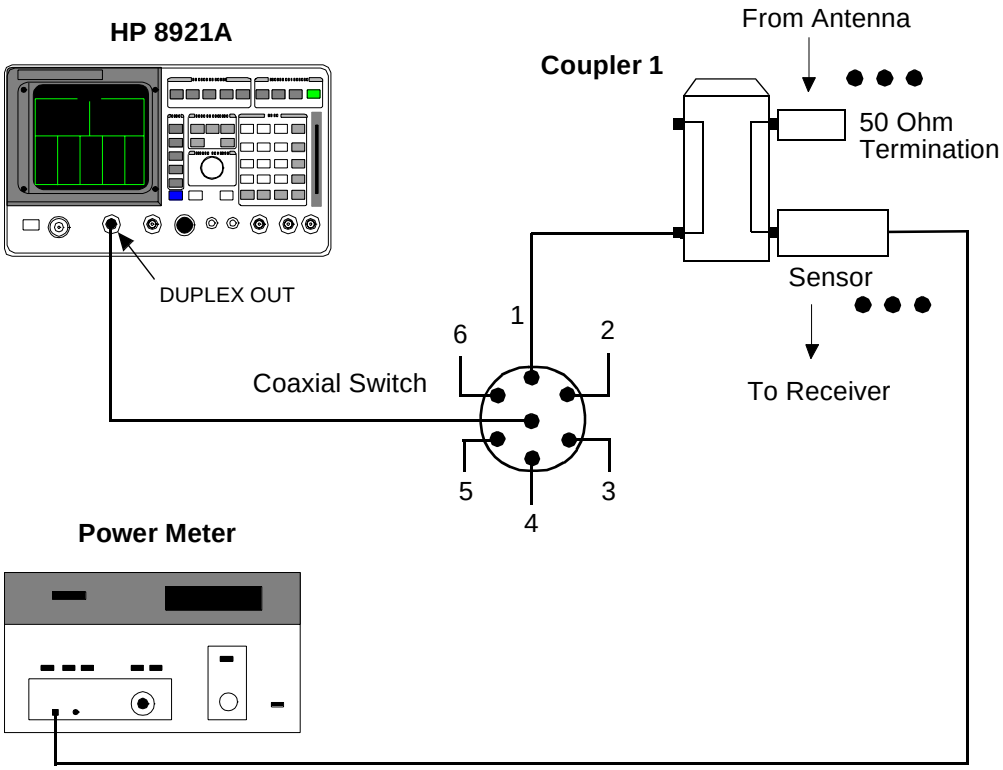


Figure 11 **Receiver Path Loss - POWERRERCEIVER Measurement**

5. Switch the coaxial switch to the desired position, either manually or by using "TEST_08 - Manual Switch and Calibration Aid". If you are using TEST_08, verify that the switch is properly configured, with the right entries made to the TESTS (External Devices) screen.
6. Record the power meter reading as POWERRECEIVER in dBm.
7. Calculate the calibration parameter using the following formula: Calibration parameter = POWERREF – POWERRECEIVER
8. Repeat steps 5 through 7 for the other antenna paths.
9. Enter the values resulting from these steps into the parameter(s) *RX path loss to antenna 1 (to) 6*.

Reference Distribution Module Level Correction Factor

The method of measurement described here may be used to obtain a value for the parameter *RDM level correction factor*. The Test Software will use this correction factor to enhance the accuracy of 3-MHz level measurements using the Test Set spectrum analyzer.

In the procedure, you will measure the level of the 3-MHz RDM/URDM signal using a power meter. You will then measure it on the Test Set spectrum analyzer. The spectrum analyzer will center the 3-MHz signal on the display. Then you will determine the difference between the power meter reading and the spectrum analyzer reading.

To determine this calibration factor:

1. Zero the power meter if required.
2. Set the power meter calibration factor if required.
3. Remove the 50-ohm load that is on the URDM/RDM Phono #2 jack.
4. See *figure 12* . Connect the power meter sensor to an adapter that is attached to the URDM/RDM Phono #2 jack.

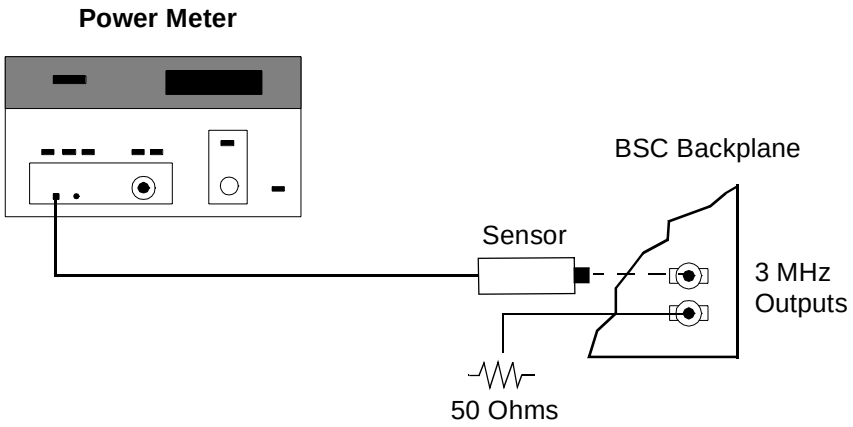


Figure 12 **RDM Level Correction - POWERREF Measurement**

5. Record the power meter reading in dBm as POWERREF.
6. Disconnect the power meter sensor.

7. See *figure 13*. Connect a standard test cable between the 3 MHz Phono #2 jack, and the Test Set RF IN/OUT connector.

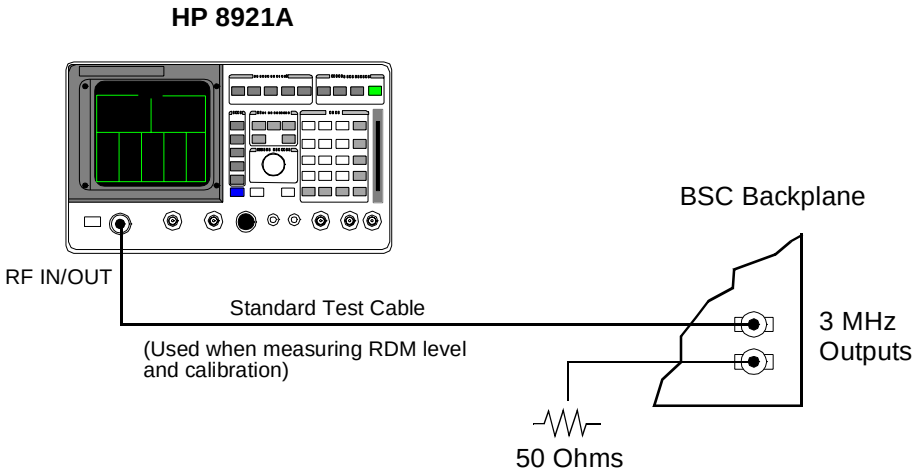


Figure 13 **RDM Level Correction - POWER8921 Measurement**

8. Perform the following steps:

NOTE: The steps a through r, listed below, may be performed automatically by running "TEST_08 - Manual Switch and Calibration Aid" and selecting **`Read the spec. analyzer RDM calibration`**.

   a. Press PRESET.

   b. From the **`To Screen`** menu, select **`SPEC ANL`**. The SPECRUM ANALYZER screen will appear.

   c. From the **`Controls`** menu, select **`Main`**. The Main menu will appear at the bottom of the screen.

   d. Select **`Center Freq`**. Enter 3 MHz.

   e. Select **`Span`**. Enter **`50`** kHz.

   f. From the **`Controls`** menu, select **`Marker`**. The Marker menu will appear at the bottom of the screen

   g. Under the first **`Marker To`**, select **`Peak`**.

   h. Under the second **`Marker To`**, select **`Ref Level`**.

i. From the **Controls** menu, select **Auxiliary**. The Auxiliary menu will appear at the bottom of the screen.

j. Under **Sensitivity**, select the lower field and enter **2 dB/div**.

k. From the **Controls** menu, select **Marker**

l. Under the first **Marker To**, select **Peak**.

m. Under the second **Marker To**, select **Ref Level**.

n. Select **Ref Level**.

o. Under **Ref Level**, select the field and enter a value to increase the reference level on the spectrum analyzer by 8 dB. Use the numeric keypad or the cursor control knob. You may change the resolution of the reference level adjustment by pressing the INCR ÷ 10 key or the INCRx10 key.

p. Verify that the peak of the signal is close to the center of the spectrum analyzer display.

q. Under the first **Marker To**, select **Peak**.

r. Record the **Marker Lvl** (in the upper right corner of the screen) as POWER8921 in dBm.

9. Calculate the calibration parameter using the following formula: Calibration parameter = POWERREF – POWER8921

10. Enter the value obtained into the parameter *RDM level correction factor*. Make certain to enter also the sign of the value. The value obtained in step 9 is added to spectrum analyzer readings made by the Test Software, thus improving accuracy.

Combiner to Test Set Path Loss Factor

This calibration factor is used in “TEST_06 - Combiner Adjustment”. It is the value entered into the parameter *TX path loss to combiner for adjustment*.

If you leave an RF coupler in the measurement path, you may obtain the value of the parameter by copying it from the value of the parameter *TX path loss to harmonic filter (n)*, where “n” is the harmonic filter that you are using. You must use the same measurement method, power meter or spectrum analyzer, for calibration and testing.

If you do not use the RF coupler, the calibration factor must cover the loss in the cable used between the harmonic filter output and the Test Set RF IN/OUT connector. You must measure the loss of this cable. One way to do this is to use the method in *"Receiver Path Loss Calibration" on page 85*, replacing the RX antenna switch, RF coupler, and cables with the cable that you are measuring. Enter the loss value into the parameter *TX path loss to combiner for adjustment*.

Procedures

A Procedure is a collection of parameters, pass/fail limits, and a test sequence, all saved in a file that can be run to customize the Test Software to a specific application. The application, for instance, might be a particular cell site or base station. After you have created a Procedure, store the file on an SRAM card or disk.

This section describes the use of such Procedures to save and retrieve files.

You should identify any Procedure that you wish to save with a name that refers to a particular application. In use, you select the Procedure for the application after you connect the Test Set. It would probably be appropriate to have a Procedure, or perhaps a set of Procedures, for each of the cell sites that you maintain.

You are not required to save a TEST sequence in a Procedure. Each of the TESTs, TEST_01 through TEST_11, is a stand-alone TEST. After you select a Procedure, you may select which of the TESTs that you wish to run.

When you save a Procedure, you save only parameters, pass/fail limits, and a test sequence. The SRAM card or disk must also contain a Library file. A Library file contains the names of all of the parameters, pass/fail limits and TESTs that are in the Test Software. Ordinarily, the Library that you use will be the Library that is supplied with your Test Software. It is named **`MOT_CS`**. When you save your Procedure, the Library will be saved automatically on the same SRAM card or disk.

The Procedure supplied with your Test Software will be the first procedure that appears in the **`Choices:`** menu when you select the **`Select Procedure Filename:`** field. It is named **`MOT_CS`** and will be displayed if your Test Software OTP card is inserted.

Procedures do not contain actual program steps or code. These software steps are contained in a code file. The code file **`MOT_CS`** is on the Test Software OTP card.

Saving a Procedure

After you have set up the Test Software for a particular application and thereby created a Procedure, you may save the Procedure to an SRAM card, the internal RAM disk, or an external disk drive.

NOTE: The SRAM card or disk that you use must be initialized before its first use. See *"Initializing an SRAM Card" on page 115* or *"Initializing a Disk" on page 114* in *"Data Collection" on page 113*. If you are using a disk drive, you might be required to enter the **`External Disk Specification`** into the TESTS (External Devices) screen. It will be used when the **`Select Procedure Location:`** field on the TESTS (Main Menu) screen is **`Disk`**.

See "Conventions Used," in chapter 1, on page 49 for descriptions of the terms select and enter.

To Save a Procedure:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. On the TESTS (Main Menu), screen verify that the Library is the one that was shipped with your Test Software. The first or only item under **`Choices:`** should be **`MOT_CS`**. If it is not, load the **`MOT_CS`** Procedure. *See "Getting Started," in chapter 1, on page 34*.
3. From the **`CUSTOMIZE TEST PROCEDURE:`** menu, select **`Proc Save/Delete Procedure`**. The TESTS (Save/Delete Procedure) screen will appear.
4. Select **`Select Procedure Location:`**. The **`Choices:`** menu will appear in the lower right-hand area of the screen.
5. From the **`Choices:`** menu, select the desired location. If the card or disk has not been used before, it must be initialized before a file can be saved. See *"Initializing an SRAM Card" on page 115* in *"Data Collection" on page 113*. To initialize a RAM disk, see “Memory Cards/Mass Storage” in the Test Set *User’s Guide*.
6. Select **`Enter Procedure Filename:`**. The **`Choices:`** menu will remain in the lower right-hand area of the screen.
7. Using the list of characters in the **`Choices:`** menu, enter a filename. The filename must be nine characters or less.
8. When filename is complete, select **`Done`** from the menu.
9. If you selected **`Card`**, insert an initialized SRAM card into the slot on the Test Set front panel.
10. Verify that the card or other medium is not write-protected. *See "Memory Cards," in chapter 2, on page 53*.
11. Select **`Enter Description for New Procedure:`**. The **`Choices:`** menu will remain in the lower right-hand area of the screen.
12. Using the list of characters in the **`Choices:`** menu, enter comments.
13. When the comments are complete, select **`Done`** from the menu.
14. Under **`Procedure Library:`**, select **`Current`** (Current underlined). The name of the Library will be displayed on the TESTS (Main Menu) screen. If you wish to check this, press k5 (**`Main Menu`**).
15. Under **`Code Location:`**, select memory **`Card`**, **`RAM`** disk, or external **`Disk`**. When a procedure is run, the TESTS subsystem will check this location for a code file if it is not resident in the Test Set battery-backed-up memory. This location will usually be the Test Software OTP card.
16. Press k1 **`(Save Proc`**). A Procedure will be saved at the location that you selected.

Loading a Procedure

If you have saved a Procedure on some storage medium, you may retrieve it and load it into the Test Set battery-backed-up memory.

To load a Procedure:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. Select **`Select Procedure Location:`**. The **`Choices:`** menu will appear in the lower right-hand area of the screen.
3. From the **`Choices:`** menu, select the location where the Procedure is stored: memory **`Card`**, **`RAM`** disk, or external **`Disk`** drive.
4. Select **`Select Procedure Filename:`**. The **`Choices:`** menu will remain in the lower right-hand area of the screen.
5. From the **`Choices:`** menu, select the Procedure file that you wish to load.
6. Read the **`Description:`** field to ensure that the loaded Procedure file is the correct one.

Deleting a Procedure

If there is a Procedure on an SRAM card, RAM disk, or external disk drive that you no longer need, you may delete it.

To delete a Procedure:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. From the **`CUSTOMIZE TEST PROCEDURE:`** menu, select **`Proc Save/Delete Procedure`**. The TESTS (Save/Delete Procedure) screen will appear.
3. Select **`Select Procedure Location:`**. The **`Choices:`** menu will appear in the lower right-hand area of the screen.
4. From the **`Choices:`** menu, select the desired location.
5. Select **`Select Procedure Filename:`**. The **`Choices:`** menu will remain in the lower right-hand area of the screen.
6. From the **`Choices:`** menu, select the name of the procedure that you wish to delete.
7. Press k2 (**`Del Proc`**).
8. Answer the prompt by pressing the SHIFT key and then the YES key if the entries are correct. The Procedure will be deleted.

Securing a Procedure

After you have set up your Test Software with a testing order, channel information, test parameters, and pass/fail limits, thereby creating a Procedure, you may wish to secure it. This will prevent the viewing and changing of those functions. In this process, you may select the items that you wish to secure. The IBASIC SECURE_IT program is provided in the Test Set firmware to do this.

You may secure the Procedure that is supplied with the Test Software. It is shipped un-secured.

To secure a Procedure:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. Select **`Select Procedure Location:`**. The **`Choices:`** menu will appear in the lower right-hand area of the screen.
3. From the **`Choices:`** menu, select **`ROM`**.
4. Select **`Select Procedure Filename:`**. The **`Choices:`** menu will remain in the lower right-hand area of the screen.
5. From the **`Choices:`** menu, select **`IB_UTIL`** (or **`SECURE_IT`**).
6. Press k1 (**`Run Test`**).
7. Select the location of the Procedure that you wish to secure: k1 (memory **`Card`**) or k2 (**`RAM`**.)

NOTE: RAM refers to the RAM disk memory within the test set. Before selecting RAM, you must initialize the RAM as a disk. See *"Initializing an SRAM Card" on page 115*.

8. Proceed with the on-line instructions. You may wish to secure only one of the items, such as pass/fail limits.
9. When you are prompted to enter the **`pass number`**, enter any sequence of numerals 0 through 9 using the DATA keypad. Enter 9 digits or less.

Un-Securing a Procedure

After you have secured a Procedure, you may un-secure it. In this process, you may select the items that you wish to un-secure. The IBASIC SECURE_IT program is provided in the Test Set firmware to do this. To un-secure a procedure, you must know the **`pass number`**.

To un-secure a Procedure:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. Select **`Select Procedure Location:`**. The **`Choices:`** menu will appear in the lower right-hand area of the screen.
3. From the **`Choices:`** menu, select **`ROM`**.
4. Select **`Select Procedure Filename:`**. The **`Choices:`** menu will remain in the lower right-hand area of the screen.
5. From the **`Choices:`** menu, select **`IB_UTIL`** (or **`SECURE_IT`**).
6. Press k1 (**`Run Test`**).
7. Select the location of the procedure that you wish to un-secure: k1(memory **`Card`**) or k2 (**`RAM`**.).
8. Enter the name of the procedure that you wish to un-secure.

NOTE: If the procedure includes any item that is secured, you will be prompted for the **`pass number`**.

9. Proceed with the on-line instructions. Select the items that you wish to un-secure.
10. When you are prompted, enter the **`pass number`** using the DATA keypad.

Copying a Procedure

If you wish to have more than one copy of Procedures that you use often, you may copy these at any time.

Using the COPY_PL ROM Program

The program **COPY_PL** in Test Set ROM copies Procedure and Library files onto an SRAM card. It may also be used to initialize an uninitialized SRAM card. This program does not copy executable program (code) files. The memory card used must be of the SRAM (Static Random-Access Memory) type, not the OTP (One Time Programmable) type.

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. Select **Select Procedure Location:**. The **Choices:** menu will appear in the lower right-hand area of the screen.
3. From the **Choices:** menu, select **ROM**.
4. Select **Select Procedure Filename:**. The **Choices:** menu will remain in the lower right-hand area of the screen.
5. Select **IB_UTIL** (or **COPY_PL**).
6. Press k1 (**Run Test**) to start the program.
7. Follow the displayed instructions.

Copying Files Using IBASIC Commands

You may copy files from one storage device to another using IBASIC COPY commands. For example, to copy a file from an inserted memory card to the left drive of an external dual-disk drive with HP-IB address 700, enter the following command into the TESTS screen IBASIC command line:

```
COPY “MU_TEST:INTERNAL” TO “MYFILE:,700,0”
```

You may copy a file from another memory card to an SRAM card by loading the program from the first memory card into the Test Set, inserting an initialized SRAM card, and then using the IBASIC SAVE command. Enter the following:

```
SAVE “MY_TEST:INTERNAL”
```

You may list the names of the files stored in a memory card or disk catalog by using the IBASIC CAT command. To display the file names on a memory card, enter the following:

```
CAT “:INTERNAL” or CAT
```

If the storage medium is already defined to be the memory card, then **”:INTERNAL”** is optional. If you are entering many characters into the IBASIC command line, it would be more efficient to connect a terminal to the Test Set. See *"Serial Port Configuration" on page 109*. The same applies if you have many files to list. File names displayed with the **CAT** IBASIC command scroll up past the top of the Test Set screen and cannot be scrolled down.

Detailed descriptions of IBASIC commands are contained in *HP Instrument BASIC* (HP part number E2083-90000).

Entering Parameters, Pass/Fail Limits, and External Device Configuration

Parameters, pass/fail limits, and external device configuration entries offer flexibility in the way that you use the Test Software. Default values for parameters and pass/fail limits are included in the Test Software. This section describes the process for changing those values.

NOTE: The Channel Information test function is not used by the Test Software. Base station frequencies are coded into the Test Software, or are determined by messages sent by the base station to the Test Set. Entries in the fields in the TESTS (Channel Information) screen will not affect the operation of the base station Test Software.

Parameters

Parameters are values that you enter to optimize the Test Software for your use. Many of the parameters are determined by examining your test needs. An example of this is the parameter *GN site has LNAs*. Other parameters are determined by performing measurements to calibrate items in your Test System. An example of this is the parameter *RX path loss to antenna 1*.

See "Conventions Used," in chapter 1, on page 49 for descriptions of the terms select and enter.

To edit a parameter value:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. From the **`CUSTOMIZE TEST PROCEDURE:`** menu, select **`Parm Test Parameters`**. The TESTS (Test Parameters) screen will appear.
3. Select **`Parm#`**.
4. Select the desired parameter number.
5. Select **`Value`**.
6. Enter the desired value using the DATA keypad, then press ENTER.
   - Use the ⇐ key to backspace.
   - Press CANCEL to cancel entries and retain the old value.
7. Press k5 (**`Main Menu`**) (or TESTS) to return to the TESTS (Main Menu) screen.

Default values are set into the Test Software. Some of these are derived from standard methods of measurement and some are derived from Motorola requirements. Load the **MOT_CS** Procedure and select the TESTS (Test Parameters) screen to see the default values.

You should verify that parameters are set properly after you select the TESTs to be placed in your sequence. Lists of the parameters used by each of the TESTs are contained in *See chapter 5, "TESTs - Reference" on page 143*.

Some parameters are designed to provide flexibility in the way tests are run. For example, the parameter GN auto exit adj allows you enter the number of measurements that must be within specification before the program automatically exits an adjustment procedure.

There are ten general parameters that affect the operation of many of the tests in the Test Software. Those are listed below:

GN always cal sig/scan [0=no 1=yes]

GN auto exit adj [0=no xx=times in spec]

GN perform adj [0=no 1=on fail 2=always]

GN perform extended tests [0=no 1=yes]

GN site [0=non-wireline 1=wireline]

GN site average voice level [AVL]

GN site has LNAs [0=no 1=yes]

GN test state of [0=INS-OPT 1=MANUAL]

GN type of site [0=omni 1=sec .skip ant]

GN verify all selections [0=no 1=yes]

Refer to the section *"Determining Calibration Parameters" on page 81* for details on how to obtain values for parameters that require a measurement.

Refer to *chapter 6, "Parameters - Reference," on page 187* for a description of each parameter.

Refer to *chapter 5, "TESTs - Reference," on page 143* for lists of the parameters that are used in each TEST.

Parameters remain in battery-backed-up memory until you select a Procedure to run. If you wish to prevent the parameters from being lost when a new Procedure is selected, save the parameters in a Procedure. See *"Saving a Procedure" on page 92*.

Pass/Fail Limits (Specifications)

Pass/fail limits (specifications) are values that you enter to set acceptance limits for tests. Default values are available in the Test Software. These values have been derived from standard methods of measurement or from Motorola requirements.

To edit a pass/fail limit value:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. From the **`CUSTOMIZE TEST PROCEDURE:`** menu, select **`Spec Pass/Fail Limits`**. The TESTS (Pass/Fail Limits) screen will appear.
3. Select **`Spec#`**.
4. Select the desired pass/fail limit number.
5. Select **`Lower Limit`** or **`Upper Limit`**, as appropriate.
6. Enter desired value using the DATA keypad and press ENTER.
   - Use the ⇐ key to backspace.
   - Press CANCEL to cancel entries and retain the old value.
7. Select **`Check`**. The **`Choices:`** menu will appear in the lower right-hand area of the screen.
8. From the **`Choices:`** menu, select the combination of upper and lower limits to be checked.

A lock is provided to prevent access to the pass/fail limits (specifications). See *"Securing a Procedure" on page 95*.

Pass/fail limits (specifications) are not required to be changed when you select a TEST or change the TESTs in your sequence. Each TEST includes applicable pass/fail limits.

You should verify that pass/fail limits are set properly after you select the TESTs to be placed in your sequence. Lists of the pass/fail limits used by the TESTs are contained in *chapter 5, "TESTs - Reference," on page 143*.

See *chapter 7, "Pass/Fail Limits (Specifications) - Reference," on page 197* for a description of each pass/fail limit.

Pass/fail limits remain in the Test Set battery-backed-up memory until you select a Procedure to run. If you wish to prevent the pass/fail limits from being lost when a new Procedure is selected, save the pass/fail limits in a Procedure. See *"Saving a Procedure" on page 92*.

External Device Configuration

Configuration defines the equipment arrangement that you use for data collection, RF and audio switching (or use of a splitter), printing, and logging of base station messages.

See *figure 14* for a typical TESTS (External Devices) screen.

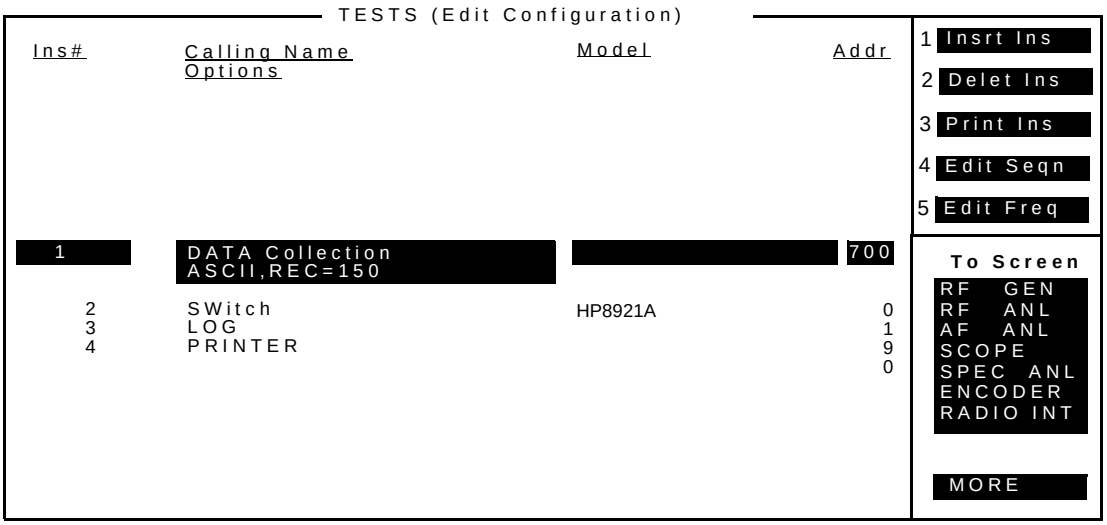


Figure 14 **A Typical TESTS (External Devices) Screen**

The entries shown in figure 12 set the Configuration to do the following:

- Collect data in an ASCII file using an HP-IB disk drive with address 700. 150 records are allocated.
- Use the Test Set Radio Interface Card to control switches.
- Print test results to a serial printer.
- Log base station commands and messages to the Test Set display.

See "Conventions Used," in chapter 1, on page 49 for descriptions of the terms select and enter.

To enter a configuration item:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. From the **`SET UP TEST SET:`** menu, select **`Cnfg External Devices`**. The TESTS (External Devices) screen will appear.
3. Select **`Inst#`**.
4. Select the desired **`Inst`** number (the next available field).
5. Press k1 **`Insrt Ins`** or k2 **`Delet Ins`** to insert or delete instruments as appropriate.
6. Select **`Calling Name`**. The **`Choices:`** menu will appear in the lower right-hand area of the screen.
7. Using the characters available in the **`Choices:`** menu, enter the desired **`Calling Name`**. (See *table 3, "Configuration Table Entries" on page 106*)
   - Use the ⇐ key to backspace.
   - Press CANCEL to cancel entries and retain the old entry.
8. When the entry is complete, select **`Done`** from the menu.
9. Repeat for **`Options`**, **`Model`**, and **`Addr`** fields as appropriate.

Default configuration entries are not included in the Test Software. You must enter the RF and audio switch or splitter arrangement that you wish to use. Messages will be displayed if you do not make necessary entries into the TESTS (External Devices) screen. If a switch is specified, the Test Software will initially display the necessary connections and then automatically control RF and audio switching during test.

If a splitter is specified, the Test Software will display the necessary connections and prompt you to change the audio connections manually. A calling name of SPLitter configures the Test Set to not display connectivity information each time an antenna connection must be changed. Each time an audio connection must be made (Test Jack or RCV out) to the Test Set audio in, the Test Software will prompt you to make the connection. This allows you to use the Test Set without a mechanical switch box. The splitter, cable losses, and coupler to the antenna ports (if used) must be calibrated and the RX path loss factors entered into the Test Set TESTS (Test Parameters) screen. The major disadvantage with using a splitter instead of a mechanical switch is that, if the base station under test has a miss-wired antenna selection, the test will not fail because the RF signal is applied to all antennas simultaneously.

If neither switch nor a splitter is specified, the Test Software will display connections and prompt you for manual changes.

The external device configuration remains in the Test Set battery-backed-up memory. The external device configuration used after power-up is the same one that was in the Test Set memory when the last power-down occurred.

The external device configuration is not saved with a Procedure to a memory card, RAM disk, or external disk drive.

The key words in *table 3, "Configuration Table Entries" on page 106* are used by the Test Software to provide information about the particular disk drive, signal path switches, and printers in your Test System.

The uppercase characters in the calling names, options, and model numbers are required. The lower case characters are optional.

See *"Configuration for Data Collection" on page 110* for examples of information that you can enter into the TESTS (External Devices) screen.

Table 3 Configuration Table Entries

Purpose	Inst#	Calling Name Options	Model	Addr	Description
Data Collection	1[1]	DATA collection		7xx[2]	To HP-IB disk drive.
		Options:[3]			
		ASCII[4]			LIF format[5]
		or BDAT[4]			LIF format[5]
		or (EXT)[6]			DOS file type
		or blank[7]			DOS or HP-UX file type[7]
		REC=xxxxx[8]			Number of records
	1	DATA collection		1	To memory card
		Options:[3]			
		ASCII[4]			LIF format[5]
		or BDAT[4]			LIF format[5]
		or (EXT)[6]			DOS file type
		or blank[7]			DOS or HP-UX file type[7]
		REC=xxxxx[8]			Number of records
	1	DATA collection		9	Serial to external computer (laptop)
RF & Audio Switching	2[1]	SWITCH	HP 8921A		Test Set Radio Interface
		Options:[3]			
		LOW[9]			Inverts polarity
		SWitch	HP 3488A		HP 3488A Switch Control Unit
		SWitch	DUPLEXER /PAD		Duplexer/Pad Switch Unit
		SPLitter			RF Splitter in RX path
		T1 module			External T1 Module

Table 3 Configuration Table Entries (Continued)

Purpose	Inst#	Calling Name Options	Model	Addr	Description
Printing Test Results	3[1]	PRINTER		7xx[2]	HP-IB Printer
		PRINTER		9	Printer, Serial
		PRINTER		15	Printer, Parallel
		Options:			
		LN=*xx*			xx
		START[10]			Form feed at the start of each TEST in the sequence
		END			Form feed at the end of each TEST in the sequence
	4[1]	ESCAPE SEQuence		7xx[2]	Printer options to HP-IB printer
				9	Printer options to Serial Printer
				15	Printer options to Parallel Printer
		Options:			Options to control printing features
Logging Commands/ Messages	4[1]	LOGging		0	Logging Off
		LOGging		1	Log to screen
		LOGging		7xx[2]	HP-IB Printer
		LOGging		9	Serial Printer

1. The instrument numbers may be in any order. For example. DATA Collection might include Inst#-3.
2. xx = Last two digits of HP-IB address.
3.These options apply to disk drive and memory card data collection, but do not apply when collecting data with Addr=9.
4. A file type. *See "Data Collection" on page 113*.
5. *See "Data Collection" on page 113*
6.A DOS file name extension. For example, the file name might be CELL1.EXT.
7. DOS is used if the disk format is DOS. HP-UX is used if the disk format is LIF.
8. Number of records. *See "Data Collection" on page 113*.
9. LOW results in a TTL/CMOS low-state drive selecting a switch position.
10.Multiple options may be separated by a comma or space.

Making Entries in a Test Set Configuration Screen

Three screens are used in the Test Set to configure the various aspects of the Test System operation. These are:

- CONFIGURE -- This screen defines general settings for making measurements; screen intensity; beeper volume; and RF signal parameters such as RF generator/analyzer offset, channel standards and characteristics, and signal loss/gain compensation. Access the screen by pressing SHIFT, then CONFIG. See the Test Set *User's Guide* for more detailed information.
- I/O CONFIGURE -- This screen defines settings for HP-IB and serial communications. Depending on your use of the HP-IB and Serial ports, you might be required to use this screen to set up communication and protocol characteristics. Access the screen by selecting **`More`** from the **`To Screen`** menu in the TESTS (Main Menu) screen, then selecting **`IO CONFIG`** from the list. See the Test Set *User's Guide* for more detailed information.
- TESTS (External Devices) -- This screen defines settings for external devices such as printers and switches that use the HP-IB and the serial ports. (Most external devices use the HP-IB port for control; a serial printer can use the serial port for printing test results.) Access the screen by selecting **`Cnfg External Devices`** from the **`SET UP TEST SET:`** menu in the TESTS (Main Menu) screen. See the Test Set *User's Guide* for more detailed information.

Serial Ports

There are two serial ports on the Test Set: Serial and Serial B.

The Serial port is available when you use the instrument manually. It allows you to print screens or connect a terminal to operate the Test Set remotely. The Serial port may also be used to print test results or for data collection when tests are being run. You must make entries to the I/O CONFIGURE screen if you use the Serial port.

The other serial port, Serial B, can be controlled only from IBASIC. It is used by the Test Software to send commands to, and receive messages from, the base station. The setup conditions for this port are set automatically by the Test Software and cannot be entered manually.

Serial Port Configuration

Setting up the serial port consists of configuration for printing test results, for data collection, and for terminal or PC operation. These are described in the following sections.

Configuration for Printing Test Results

The characteristics of the Serial port are determined by settings in the I/O CONFIGURE screen. The Test Software sets some of the fields on this screen, but it does not set the following serial configuration items:

- **`Serial Baud`**
- **`Parity`**
- **`Data Length`**
- **`Stop Length`**
- **`Rcv Pace`**
- **`Xmt Pace`**

You must make entries manually into these fields. Determine the characteristics of your printer and enter those into the I/O CONFIGURE screen. The entries will be retained after a power-down/ power-up cycle.

You must make entries into the TESTS (External Devices) screen to use the serial port for printing test results. *See "Configuration for Data Collection" on page 110* for the key words that you must enter.

Configuration for Data Collection

The characteristics of the Serial port, when used for data collection, are determined by settings on the I/O CONFIGURE screen. The Test Software sets some of the fields on this screen, but it does not set the following serial configuration items:

- **`Serial Baud`**
- **`Parity`**
- **`Data Length`**
- **`Stop Length`**
- **`Rcv Pace`**
- **`Xmt Pace`**

You must make entries manually into these fields. Determine the characteristics of your computer and enter those into the I/O CONFIGURE screen. The entries will be retained after a power-down/ power-up cycle.

You must make entries into the TESTS (External Devices) screen to use the serial port for data collection. *See "HP-IB Port Configuration" on page 112* for the key words that you must enter.

Configuration for Terminal or PC Operation

It is preferable and more efficient to enter long strings of characters into fields using a terminal. The characteristics of the Serial port, when used for instrument control from a terminal or terminal emulator, are determined by settings on the I/O CONFIGURE screen.

Set the following:

- **`Serial In`** to **`Inst`**
- **`IBASIC Echo`** to **`On`**
- **`Inst Echo`** to **`On`**

Set the remaining configuration entries to match the settings of your terminal or PC program.

See the Test Set *User's Guide* for lists of characters that will control the Test Set.

Configuration for Printing Screens

You may use a compatible serial printer to print what is currently displayed on the Test Set screen. This will require that you switch to the TESTS (Printer Setup) screen, and select **`Serial`** under **`Printer Port:`** in the **`PRINT SETUP: list`**.

You may also enter a title under **`Output Heading:`** in the TESTS (Printer Setup) screen. The will appear at the top of the printout.

HP-IB Port Configuration

If you use an HP-IB printer, you are not necessarily required to make entries into the I/O CONFIGURE screen. The **Mode** field in the I/O CONFIGURE screen must be set to **Control**. If it is not, the Test Software will do so for you if you answer **Yes** to the prompt. The setting will be retained after power-down.

If you wish to use an HP-IB printer to print test results, you must enter the keyword “PRINTER” and the 3-digit HP-IB address into the TESTS (External Devices) screen. *See "Configuration for Data Collection" on page 110.* You must also select **Printer** under **Output Results To:** in the TESTS (Execution Conditions) screen. *See "Test Execution Conditions," in chapter 4, on page 135*.

If you wish to use an HP-IB printer to print what is currently displayed on the Test Set screen, you must select or enter the following information:

- In the I/O CONFIGURE screen set **Mode** to **Control**
- In the TESTS (External Devices) screen, enter the last two digits of the HP-IB address of your printer into the **Addr** field.
- In the PRINT (Printer Setup) screen, select **HP-IB** under **Printer Port:**.

You may also enter a title under **Output Heading:** in the TESTS (Printer Setup) screen. The will appear at the top of the printout.

Data Collection

The Test Software has the capability to save test results to an SRAM card, to an external disk drive, or to a PC.

Collection to an SRAM Card or Disk

You must make entries into the TESTS (External Devices) screen to describe the type of data collection that you wish to use.

To make External Devices entries:

1. See the procedure *"To enter a configuration item:"* in *"Entering Parameters, Pass/Fail Limits, and External Device Configuration" on page 99*.
2. Enter DATA C into the **`Calling Name`** field next to **`Inst# 1`**. The entry will look like:

```
1  DATA  C
```

3. Enter a number into the **`Addr`** field, depending on the type of storage medium that you wish to use:

If you wish to use an SRAM card, enter **`1`** into the **`Addr`** field:

```
1  DATA C     1
```

If you wish to use an external disk drive, enter the HP-IB disk address. For example, if the drive you are using is set to 700, the display should look like:

```
1  DATA C     700
```

In this example, DATA C was entered into **`Inst#`**=**`1`**. The calling names may be ordered in other ways. DATA C might be in **`Inst#`**=**`2`**; **`PRINTER`** might be in **`Inst#`**=**`1`**. The Test Software supports data storage on Logical Interchange Format (LIF) and Disk Operating System (DOS) disk formats. Storage may be to any of the following file types:

- ASCII files under LIF
- BDAT files under LIF
- HP-UX files under LIF
- DOS files under DOS

The file types under LIF can be used by the Test Set IBASIC controller and some HP workstations. The DOS format is required if you wish to use the disk with a PC. You will specify the file type with the entry that you make into the **`Options`** field immediately below DATA C. If no file type is entered, and the disk format is

LIF, the Test Software will select an HP-UX file type. If no file type is entered, and the disk format is DOS, the Test Software will select a DOS file type. For example, if you are using a DOS file and you are not using an extension on the file name, the entry in the TESTS (External Devices) screen will look like:

```
1 DATA C         700
```

If you wish to use an ASCII, BDAT, or HP-UX file, you may specify the number of records allocated to the file. The DOS file is automatically updated as data are stored, so record allocation is not required. If you wish to use HP-UX files, you must enter **REC=** to establish a usable number of records. **REC=20480** sets the size to be the same as the default number of 256-byte records used for ASCII files (80 × 256). Enter the **REC=** after the file type. For example, to use an ASCII file with 200 records of 256 bytes each, enter **REC=200** into the **Options** field. The display will appear as follows:

```
1 DATA C        700
     ASCII REC=200
```

The default number of records, used when no **REC=** entry is made, is 80.

Items in the **Options** field may be separated by a comma or a space.

Initializing a Disk

If you are starting with a blank disk, you must initialize it to the format that you have selected. Disk drives require specific commands to perform initialization. Test Set IBASIC commands to initialize some disks are described here. You should verify that the drive that you wish to use can be controlled by the Test Set, and that you are initializing a disk using a drive or PC that has a compatible format.

To initialize a disk to LIF in an HP-IB disk drive:

1. Verify that the Test Set **Mode** on the I/O CONFIGURE screen is set to **Control**.
2. Enter the following into the TESTS (IBASIC Controller) screen IBASIC command line:

```
INITIALIZE ":,7XX,Y"
   where:
   XX=the HP-IB address of the disk drive, and
    y=the unit number of the drive
```

To initialize a disk to DOS in an HP-IB drive:

Follow the procedure for the LIF format, replacing the INITIALIZE statement with.

```
INTIALIZE "DOS:,7xx,y:"
```

Initializing an SRAM Card

There are two ways to initialize an SRAM card. If you have a terminal emulator attached to the Test Set, you may type a command into the IBASIC command line. A second way to initialize a card is to run the ROM program RAM_MNG.

To initialize an SRAM card for use under the LIF format, type the following into the IBASIC command line in the TESTS (IBASIC Controller) screen:

INITIALIZE ":INTERNAL"

To run RAM_MNG, select the TESTS (Main Menu) screen, select **ROM** as the **Location:**, select **RAM_MNG** as the **Procedure:**, and press **Run Test**. Follow the displayed instructions.

CAUTION: Loading RAM_MNG will delete any procedure or program in memory.

To initialize an SRAM card for use under the DOS format, type the following into the IBASIC command line in the TESTS (IBASIC Controller) screen:

INITIALIZE "DOS:INTERNAL"

Collection to a PC

Test results may be supplied from the Serial port to a variety of devices. An HP 100LX Palmtop, PC, laptop, or terminal may be used. A terminal emulator can log the test results to a file. Examples of terminal programs are HP AdvanceLink and ProComm, a product of DataStorm Technologies, Inc. See the *HP 8921A Programmer's Guide* (HP part number 08921-90031) for information on setting up the AdvanceLink program.

To set up for data collection to a PC:

1. Access the TESTS (External Devices) screen.
2. Enter DATA C into the **`Calling Name`** field next to **`Inst# 1`**:

   ```
   1  DATA C
   ```

3. Enter **`9`** into the **`Addr`** field:

   ```
   1  DATA C   9
   ```

In this example, DATA C was entered into **`Inst#=1`**. The calling names may be ordered in other ways. DATA C might be in **`Inst#=2`**; **`PRINTER`** might be in **`Inst#=1`**.

The Test Set Serial port configuration must be set up. See *"Configuration for Terminal or PC Operation" on page 111*.

Retrieving Data from an SRAM Card

To retrieve the test results after those have been saved on an SRAM card, you must run an IBASIC program. A program to transfer data from a card to a terminal emulator is listed below. You may type the program into the IBASIC command line, in the TESTS (IBASIC Controller) screen, from a terminal emulator. See *"Configuration for Terminal or PC Operation" on page 111*.

Make certain that any previous program in program memory is saved, because it will be deleted in this operation.

To enter the data retrieval program:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. From the **`SET UP TEST SET:`** menu, select **`IBASIC IBASIC Cntrl`**. The TESTS (IBASIC Controller) screen will appear.
3. Move the cursor to the large field in the upper part of the display. Use this field to enter IBASIC program statements and commands.
4. Enter **`SCRATCH`** to delete the previous IBASIC program. Make certain that it is saved first.
5. Enter the following program:

```
10 DIM A$[120]
```

Sets the string length to 120.

```
20 ASSIGN @File TO ”RES:INTERNAL”;FORMAT ON
```

Opens a path to the SRAM card file called “RES” (for results).

```
30 ON ERROR GOTO 80
```

Exits at the end of the file.

```
40 LOOP
```

Sets up a loop to extract file contents.

```
50 ENTER @File;A$
```

Transfers part of the file to the string.

```
60 OUTPUT 9;A$
```

The string is output at the Serial port.

```
70 END LOOP
```

Goes back to get more of the file.

```
80 END
```

End of the program.

6. Enter RUN (or press k1 **Run**) to run the entered IBASIC program.

IMPORTANT NOTE: Remember! There is a difference between the k1 **Run** key and the k1 **Run Test** key. The k1 **Run** key is assigned as a default key on the TESTS (IBASIC Controller) screen. Pressing it will start an IBASIC program that is loaded into program memory. The k1 **Run Test** key is assigned as a default key on the TESTS (Main Menu) screen. Pressing it will load the program that results from the **Select Procedure Filename:** and **Select Procedure Location:** entries on the TESTS (Main Menu) screen.

Retrieving Data from a Disk

One way to retrieve the test results from a disk is to run an IBASIC program. A program to transfer data from a disk to a terminal emulator is given below. You may type the program into the IBASIC command line from the terminal emulator.

Make certain that any previous program in program memory is saved, because it will be deleted in this operation. The file name for this example is “RES”. The disk address is 700, and the drive number is 0. The entire file name is **RES:,700,0**.

To enter the data retrieval program:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. From the **SET UP TEST SET:** menu, select **IBASIC IBASIC Cntrl**. The TESTS (IBASIC Controller) screen will appear.
3. Move the cursor to the large field in the upper part of the display. Use this field to enter IBASIC program statements and commands.
4. Enter **SCRATCH** to delete the previous IBASIC program. Make certain that it is saved first.
5. Repeat step 5 of the procedure for *"Retrieving Data from an SRAM Card" on page 116*, except substitute the following for line 20:

```
20 ASSIGN @File TO ”RES:,700,0”
```

Opens a path to the file called “RES”(for results).

6. Enter RUN (or press k1 **Run**) to run the entered IBASIC program.

4

Running Tests

What are Tests?

The terms “TESTS”, “TESTs”, and “tests” have different meanings. The following paragraphs describe these meanings.

TESTS

The TESTS (Main Menu) screen is the user interface to the internal IBASIC controller. This screen is displayed when the TESTS key is pressed. The screen title “TESTS” is used to refer to the capability of the Test Set to perform sequential steps, comparing measurements to specifications. It does not refer directly to the HP 11807B Option 040 Test Software TESTs or to the tests described below. See *"TESTS (Main Menu) Screen" on page 122*.

Sub-screens may be called from the TESTS (Main Menu) screen. These are accessed by selecting the fields under the **`CUSTOMIZE TEST PROCEDURE:`** and **`SET UP TEST SET:`** headings on the TESTS (Main Menu) screen. These sub-screens allow you to edit pass/fail limits, parameters, and other items that optimize the application of the Test Software.

TESTs

Combinations of measurements, adjustments, commands to the base station, and other program operations are performed in a series of TESTs. These TESTs are included in the Test Software, and are numbered 1 through 11. Each of the TESTs performs a specialized task.

The names of the TESTs are:

TEST_01 - Laptop emulator

TEST_02 - URDM or RDM frequency/level

TEST_03 - Voice transceiver

TEST_04 - Signaling transceiver MANUAL mode

TEST_05 - Scanning receiver MANUAL mode

TEST_06 - Combiner adjustment

TEST_07 - Wideband data on active voice chan

TEST_08 - Manual switch & calibration aid

TEST_09 - Calculate transmitter power

TEST_10 - Voice channel manual test mode

TEST_11 - Test Menu

Tests

A test is a series of steps, or measurements, that determines if some item of base station performance is acceptable. Within each TEST is one “test” or more. For example, some of the tests performed in ‘TEST_02 - URDM or RDM Frequency/ Level” are listed below:

URDM #1 frequency error

URDM #2 frequency error

URDM #1 level

URDM #2 level

Order of TESTs

You may run TEST_01 through TEST_11 in whatever order is best for your application. For example, you might wish to put “TEST_01 - Laptop Emulator” before a TEST requiring that the cell site be taken out of service.

The formal order of TESTs is entered by accessing the TESTS (Order of Tests) screen, selecting TESTs from a menu, and entering those TESTs into a sequence. For instances in which you might like to run TESTs in an impromptu sequence, or run multiple TESTs out of sequence, you may do so by using “TEST_11 -- Test Menu”. Both of these methods are described in this chapter.

TESTS (Main Menu) Screen

The TESTS (Main Menu) screen is the main screen of the “Tests Subsystem,” which is a group of screens that can be used to load, customize, and run automated test programs. Your HP 11807B Option 040 Test Software is an example of such a test program. Press TESTS, to access the TESTS (Main Menu) screen. See *figure 15* .

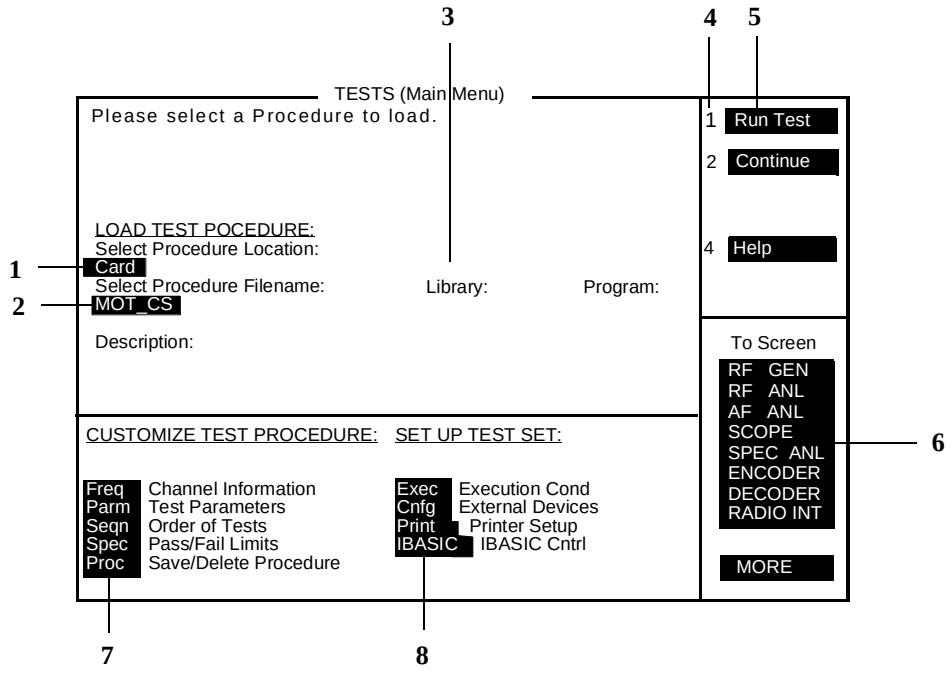


Figure 15 **A Typical TESTS (Main Menu) Screen**

The following list describes the fields in the TESTS (Main Menu) screen.

1. `Select Procedure Location:` -- Use this field to select the location from which the Procedure will be retrieved. When you select this field, the `Choices:` menu will appear in the lower right-hand area of the screen. Select the location (usually, `Card`) from the menu. *See "Procedures," in chapter 3, on page 91.*
2. `Select Procedure Filename:` -- Use this field to select the name of the Procedure file to be retrieved. When you select this field, the `Choices:` menu will appear in the lower right-hand area of the screen. Select the filename from the menu. *See "Procedures," in chapter 3, on page 91.*

3. `Library:` -- The Test Software displays the name of the library in this field. (The library is loaded from the Test Software OTP card. It contains the names of all available TESTs, parameters, and pass/fail limits.)
4. USER key labels -- The numbers correspond to the programmable USER keys, k1 through k5. Use the indicated key to perform the listed function quickly. Some or all of the five key labels will appear, dependent upon programming. The Test Software contains three default key assignments. You may assign or reassign these keys using the SHIFT, ASSIGN and SHIFT, RELEASE keys. *See "USER Keys," in chapter 5, on page 144.*
5. Functions fields -- Use these fields to access Help, run a TEST, or continue a TEST.

NOTE: You may select any of the above functions by either selecting the field or pressing the assigned USER key (k1 through k5), as identified by the label to the left of the field.

6. `To Screen` -- Use these fields to access the Test Set instrument screens. Selecting one of these fields or pressing one of the SCREEN CONTROL keys exits the TESTS (Main Menu) screen.
7. `CUSTOMIZE TEST PROCEDURE:` -- Use these fields to access the screens for channel information; for editing test parameters, order of tests, and pass/fail limits; and for saving and deleting TESTs. *See "Entering Parameters, Pass/Fail Limits, and External Device Configuration," in chapter 3, on page 99. See "Procedures," in chapter 3, on page 91.*
8. `SET UP TEST SET:` -- Use these fields to access the screens for setting execution conditions, for configuring external devices, setting up a printer, and for accessing IBASIC operations. *See "Entering Parameters, Pass/Fail Limits, and External Device Configuration," in chapter 3, on page 99.*

NOTE: The TESTS (Printer Setup) screen is not used by Test Software at this time. To set up a printer, you must access the TESTS (External Devices) and TESTS (Execution Conditions) screens. Also, *see "Configuration for Printing Test Results," in chapter 3, on page 109.*

Starting the Program

NOTE: If you are using this Test Software for the first time, *See "Getting Started," in chapter 1, on page 34*. That section describes loading and running the default Procedure, named **`MOT_CS`**, that is on the your Test Software OTP card.

This default Procedure shipped with your Test Software does not include the calibration parameters for each of your cell sites, so you must load and run Procedures that you have created for each of your cell sites. See *chapter 3, "Setting Up," on page 69*.

This section describes starting and running the Test Software after you have created the Procedures that contain your cell site calibration parameters and other conditions. Examples are included to describe the steps that you might take.

The steps that you perform will depend on:

- Whether the Procedure that you wish to run is loaded into the Test Set battery-backed-up memory.
- Whether the Test Software code file is loaded into the Test Set battery-backed-up memory.
- Where the Procedure and other files are stored.
- Whether the base station is locked.

To unlock the base station:

If the base station is locked, perform the following steps to unlock it.

1. Press the Test Set POWER switch.
2. Wait for completion of self-tests.
3. Insert the Test Software OTP card into the slot on the Test Set front panel.
4. Connect the Test Set to the base station. See *figure 4, "Cell Site to Test Equipment Interconnections," on page 72*.
5. Press TESTS. The TESTS (Main Menu) screen will appear.
6. From the `CUSTOMIZE TEST PROCEDURE:` menu, select `Seqn Order of Tests`. The TESTS (Order of Tests) screen will appear.
7. Select `TEST_01.`
8. Press TESTS.
9. Press k1 (`Run Test`).
10. Unlock the base station:
    a. Reset the controller boards.
    b. At the prompt from the base station (typically a "#"), type the unlock password. The base station prompt will change to a ">".
    c. If the CSC displays a red light, type MAN to enter the manual mode.

After unlocking the base station, select the operation that you wish to perform in a manner consistent with the following four examples.

NOTE: There are two methods for selecting a TEST. The first method uses the TESTS (Order of Tests) screen, and is described in Examples 1, 2, and 3. It is appropriate for typical testing. The second method uses TEST_11, and is provided for instances of running TESTs in an impromptu sequence. It is a simplified method for proceeding from a particular TEST to another particular TEST, in any order, and is described in Example 4.

Example 1: To load the Test Software and run a TEST

Assume the following:

You ran a program other than the HP 11807B Option 040 Test Software. Because of this, the Procedure and the program are no longer resident in the Test Set battery-backed-up memory. You wish to run “TEST_02 - URDM or RDM Frequency/Level”.

In this case:

1. Press the Test Set POWER switch.
2. Wait for completion of self-tests.
3. Connect the Test Set to the base station. See *figure 4, "Cell Site to Test Equipment Interconnections," on page 72*.
4. Insert the SRAM card that contains your Procedures into the front panel slot.
5. Press TESTS. The TESTS (Main Menu) screen will appear.
6. Choose `Select Procedure Location:`. The `Choices:` menu will appear in the lower right-hand area of the screen.
7. From the `Choices:` menu, select `Card`.
8. Choose `Select Procedure Filename:`. The `Choices:` menu will appear in the lower right-hand area of the screen.
9. From the `Choices:` menu, select the desired Procedure (that includes Test_02).
10. From the `CUSTOMIZE TEST PROCEDURE:` menu, select `Seqn Order of Tests`. The TESTS (Order of Tests) screen will appear.
11. Select `TEST_02`.
12. Remove the SRAM card and insert the Test Software OTP card.
13. Press TESTS. The TESTS (Main Menu) screen will appear.
14. Press k1 (`Run Test`).

Example 2: To run a different TEST

Assume the following:

You are at the same cell site and you wish to test a voice transceiver. “TEST_01 - Laptop Emulator” had been run previously and the base station had been unlocked, and then the Test Set was powered off. The Test Set was not used to run some other program, so the MOT_CS program is still in the Test Set battery-backed-up memory. Now, you wish to run “TEST_03 -Voice Transceiver”.

In this case:

1. Press the Test Set POWER switch.
2. Wait for completion of self-tests.
3. If it is not still connected, connect the Test Set to the base station. See *figure 4, "Cell Site to Test Equipment Interconnections," on page 72*.
4. Press TESTS. The TESTS (Main Menu) screen will appear.
5. From the `Customize Test Procedure:` menu, select `Seqn Order of Tests`. The TESTS (Order of Tests) screen will appear.
6. Select `TEST_03`.
7. Press TESTS. The TESTS (Main Menu) screen will appear.
8. Press k1 (`Run Test`.)

Example 3: To load and run a new Procedure

Assume the following:

You have left Cell Site #1 to test at Cell Site #2, and the Procedure **`CELL_1`** is in the Test Set battery-backed-up memory. You must replace it with the Procedure **`CELL_2`**. No other programs have been loaded, so the MOT_CS program is still in the Test Set battery-backed-up memory.

In this case:

1. Press the Test Set POWER switch.
2. Wait for completion of self-tests.
3. Connect the Test Set to the base station. See *figure 4, "Cell Site to Test Equipment Interconnections," on page 72*.
4. Insert the SRAM card that contains your Procedures into the front panel card slot.
5. Press TESTS. The TESTS (Main Menu) screen will appear.
6. Choose `Select Procedure Location:`. The `Choices:` menu will appear in the lower right-hand area of the screen.
7. From the `Choices:` menu, select `Card`.
8. Choose `Select Procedure Filename:`. The `Choices:` menu will appear in the lower right-hand area of the screen.
9. From the `Choices:` menu, select `Cell_2`.
10. From the `CUSTOMIZE TEST PROCEDURE:` menu, select `Seqn Order of Tests`. The TESTS (Order of Tests) screen will appear.
11. Select the TEST that you wish to run.
12. Press TESTS. The TESTS (Main Menu) screen will appear.
13. Press k1 (`Run Test`.)

Example 4: To run an impromptu TEST sequence

Assume the following:

You are at the same cell site and you wish to run an impromptu series of TESTs. “TEST_01 - Laptop Emulator” had been run previously and the base station had been unlocked, and then the Test Set was powered off. The Test Set was not used to run some other program, so the MOT_CS program is still in the Test Set battery-backed-up memory. Now, you wish to run “TEST_03 -Voice Transceiver” and several other tests, perhaps multiple times.

In this case:

1. Press the Test Set POWER switch.
2. Wait for completion of self-tests.
3. If it is not still connected, connect the Test Set to the base station. See *figure 4, "Cell Site to Test Equipment Interconnections," on page 72*.
4. Press TESTS. The TESTS (Main Menu) screen will appear.
5. From the `Customize Test Procedure:` menu, select `Seqn Order of Tests`. The TESTS (Order of Tests) screen will appear.
6. Select TEST_11. The name “Test Menu” will appear under the `Description` column.
7. Press the TESTS key again to return to the TESTS (Main Menu) screen.
8. Press k1 (`Run Test`) to begin. The TEST_11 screen will appear.
9. Select TEST_03. The TEST will run. Upon completion of TEST_03, the TEST_11 screen will appear again.
10. Select the next TEST that you wish to run. The selected TEST will run, and the TEST_11 screen will appear again.
11. Repeat step 8 as many times as required.
12. After you have completed running the TESTs, select Exit (the first item in the TEST_11 menu). The TESTS (Main Menu) screen will again be displayed.

When the Program Starts Running

The Test Software will start when you press k1 (`Run Test`).

When you select and load a Procedure, the Test Software enters into the Test Set memory the parameters, pass/fail limits, and testing order that were stored with that Procedure. (The Test Software uses the last sets of parameters, pass/fail limits, and testing order that were entered.) Subsequent changes to parameters, pass/fail limits, and testing order will be stored in the Test Set battery-backed-up memory.

NOTE: Soon after starting the program, you might see two types of display information that do not apply to the action you have taken.

A message in the second line of the display might have been in place before you started running the program.

Also, the main display area of the Test Set screen might contain information placed by a previously run program.

The Test Set display and message line will usually be cleared soon after the program starts.

The Test Software will produce a graphic display of connections at the time when these must be made. Do not make a connection to the Test Set RF IN/OUT connector until a prompt to do so appears on the Test Set screen. (The Test Software zeroes the Test Set power meter automatically as the Test Software is initializing; an error will be introduced if RF power is applied while zeroing is occurring.) The Test Software will display a message to prompt you to disconnect the RF IN/OUT connection before zeroing begins.

System initialization will begin after you press k1 (`Run Test`).

You might have to wait several minutes after pressing k1 (`Run Test`) for the initialization to be completed. If the program is stored in the Test Set battery-backed-up memory when you press k1 (`Run Test`), initialization will be performed in considerably less time.

If data collection is set up, you will be prompted for the name of your data collection file.

As TESTs are being run, a USER key is sometimes assigned to allow you to access the base station control program. Press the `Laptop` USER key to access the laptop emulator mode. Once you have finished with the base station control, you can return to the testing at the same point you left off. You can also run the laptop emulator as a test. See "TEST_01 - Laptop Emulator" on page 149.

Messages to and from the base station can be logged (to a printer or PC) as the tests proceed. *See "To enter a configuration item:" on page 103* for details on the calling name (`LOG`) that can be entered into the External Devices screen to enable logging.

Refer to *chapter 5, "TESTs - Reference," on page 143* for details about each of the TESTs in the sequence.

Entering the Order of TESTs

A Procedure may consist of one TEST or multiple TESTs. If a Procedure contains multiple TESTs, when the first TEST is finished, the next will run. For example, you might wish to put “TEST_01 - Laptop Emulator” before a TEST requiring the cell site to be taken out of service.

If you wish to run one of the TESTs in a Procedure, you may select that individual TEST and use it to create a Procedure with a single test. To do this, load the Procedure, then edit the order of TESTs and change the single TEST to the one that you wish to run. For example, if you are testing primarily voice transceivers, you might create a Procedure that consists of only “TEST_03 -Voice Transceiver”. See *"Starting the Program" on page 124* for examples of loading a Procedure and selecting a TEST.

If you are testing while the cell site usage is low, you should use the MANUAL mode for all TESTs. Tests might run faster because of the low level of base station activity. Fewer messages will be sent from the base station to the Test Set. If you are testing while the cell site usage is high, the In-Service Optimization mode may be used if care is taken to prevent measurement errors caused by off-air signals. Some TESTs are designed such that they must be run in the MANUAL mode. See *chapter 5, "TESTs - Reference," on page 143*.

The order of tests will remain in the Test Set battery-backed-up memory.

The order of tests may be secured. *See "Securing a Procedure," in chapter 3, on page 95*.

To edit the Order of Tests:

1. Press TESTS. The TESTS (Main Menu) screen will appear.
2. From the `Customize Test Procedure:` menu, select `Seqn Order of Tests`. The TESTS (Order of Tests) screen will appear.
3. If there is no TEST displayed in the top (or only) field in the column labelled `Test Name`, select the field in this column and select a TEST.
4. Press k1 (`Insrt Stp`) until the sequence includes as many steps as you wish. When you press this key, the TEST in the displayed sequence with the `Step#` highlighted (inverse video) will be copied into a new sequence location immediately after the highlighted one. The TESTs that follow in the sequence will be scrolled down by one step. This key does nothing if there are no items in the sequence.
5. Press k2 (`Delet Stp`) to delete a highlighted step in the sequence. When you press this key, the TEST in the displayed sequence with the `Step#` highlighted (inverse video) will be deleted. The TESTs that follow in the sequence will be scrolled up by one step.
6. If the sequence steps scroll past the bottom or top of the display: Select the field in the column labelled `Step #` and rotate the CURSOR CONTROL knob to display all or part of the sequence.
7. To change the TEST that is in a particular step in the sequence:
   - Select the highlighted (inverse video) field in the column labelled `Step#`.
   - Rotate the CURSOR CONTROL knob to move the cursor to the step number that you wish to change.
   - Press the CURSOR CONTROL knob.
   - Select the highlighted (inverse video) field in the column labelled `Test Name`.
   - Choose the TEST that you wish to place at this step number.
8. The `Yes/No` selection in the column labelled `All Chans?` on the TESTS (Order of Tests) screen is not used by the HP 11807B Option 040 Test Software. The channels to be tested are determined by the Test Software.

See "Starting the Program" on page 124 for examples of use of the TESTS (Order of Tests) screen.

TEST Configuration Settings

At the start of each TEST, the Test Software will display a TEST configuration menu. This menu contains a list of base station and Test System configuration items appropriate for the TEST. The list shows the default configuration, but you may set each item for a particular application. Some items offer numeric value selections; others offer text selections. After you have entered an application configuration, the Test Software will retain the settings until you select another TEST.

Set an item as follows:

1. Move the cursor to the selection field at the right-hand end of the item. The Test Software will highlight the selection field dimly.
2. Press the CURSOR CONTROL knob to select the field.
3. In the case of a numeric selection, rotate the knob to obtain the desired value. (If you turn the knob past the limit of the value in either direction, you will be notified by a Test Set “beep”).

   In instances in which there are a large number of values from which to select, you may press k4 (`Enter`) and input the value using the DATA keys.

   In the case of a text selection, rotate the knob to the desired selection.
4. Press the knob to enter the value or selection.

When you initiate the TEST, the Test Software checks the configuration first. If you have entered an inappropriate value or selection, the Test Software will display an error message that indicates the nature of the error and offers options for proceeding. Return to the TEST configuration menu to correct the problem.

After the Test Software checks the configuration, it displays a connection diagram so that you may check the equipment connections.

NOTE: Connection diagrams are normally displayed at the start of testing. Depending on your system configuration (whether or not you use a switch box), the connection diagrams may be shown only when you first run the test. Subsequent runs will skip the display of test connections.

Test Execution Conditions

In some situations, you might wish to change the way that the Test Software works when a test result is obtained. In the TESTS (Main Menu) screen, the `Cnfg Execution Cond` field in the `SET UP TEST SET:` menu accesses the TESTS (Execution Conditions) screen that allows you to do this.

NOTE: Test execution conditions are not retained after a power-down/power-up cycle.

The following test execution conditions may be set in the TESTS (Execution Conditions) screen as required:

If Unit-Under-Test Fails: You may select the action to be taken by the tests software on UUT failure as either:

`Continue/`

or

`/Stop`

The default is:

`Continue`

If you select `Stop` and a pass/fail result is `F`, the program will stop.

Test Procedure Run Mode: You may select the run mode as either:

`Continuous/`

or

`/Single Step`

The default is:

`Continuous/`

You may pause tests at certain times. If you select `Single Step`, the Test Software will pause after it compares a test determination and the expected result. For example, a test will pause after the Test Software compares the results to a pass/fail limit. You may continue from the paused state by pressing k2 (`Continue`).

Output Results For: You may select the class of results to be displayed as either:

`All/`

or

`/Failures`

The default is:

`All`

You may specify that only the failed results will be displayed or printed. This will be useful if you generally do not print test results, and wish to ensure that failed results will be displayed or printed.

Output Results To: You may select the output destination as either:

`Crt/`

or

`/Printer`

The default is:

`Crt`

You may specify the destination of the test results. If you select `Crt`, results will be displayed on the Test Set screen. If you select `Printer`, test results will be sent to the Test Set screen and to a printer. You must make entries in the TESTS (External Devices) screen to specify the address of your printer. If you are using a serial printer, you must also make entries to the I/O CONFIGURE screen to match the serial port characteristics to those of the printer.

If you print out the test time summary, the printout will be done for each unit under test, not at the end of an entire test sequence.

Output Heading: You may use this field to enter a heading that will be printed or displayed. Enter the heading information in the TESTS (Execution Conditions) screen as follows:

1. Select `Output Heading:`. The `Choices:` menu will appear in the lower right-hand area of the screen.
2. Using the list of characters in the `Choices:` menu, enter the characters that you wish to appear in the heading.
3. Select `Done` when the heading is complete.

HP-IB Control Annunciators

The words, letters, and symbols at the top right-hand corner of the Test Set display indicate these conditions:

- DE-KEYED or KEYED -- Displays the state of the line that controls transmitter RF power.
- R -- Indicates remote operation from an external controller or IBASIC program in the Test Set. This letter will be displayed while the Test Software is running.
- L -- Indicates that the Test Set is monitoring, and is ready to receive a manual or remote command.
- T -- Indicates that the Test Set is communicating another HP-IB device.
- S-- Indicates that a service request has been generated.
- C -- Indicates that the Test Set is currently an active controller. Control mode is set on the I/O CONFIGURE screen. The Test Set must be a controller if HP-IB peripherals are to be controlled.
- *-- Indicates that an IBASIC program is running, or that the IBASIC controller is executing a command.
- ? -- Indicates that an IBASIC program is waiting for a user response.
- - -- Indicates that the IBASIC program is paused.
- SHIFT -- Indicates that the SHIFT key was pressed, and that the next key entry will be shifted.

Pausing or Stopping a TEST

To pause a TEST, press CANCEL. With few exceptions, you should always stop the program by pressing CANCEL. This operation leaves the Test Software in a state that is ready to run. When you subsequently press k1 (`Run Test`), the program will run immediately. The Test Set firmware will not perform an unnecessary pre-run, and the TESTs will start quickly.

If the program is performing an input/output operation, the CANCEL key might not immediately pause the program. If the input/output operation is not successful, a time-out inserted into the Test Software will cause the program to pause in approximately ten seconds. Wait for this time-out to occur.

If the Test Software does not pause after some time, it might be necessary to stop the program by pressing SHIFT then CANCEL. This performs an IBASIC RESET operation. Do this only when the program does not pause after you have pressed CANCEL and waited approximately ten seconds.

IMPORTANT NOTE: If you make changes to instrument settings while the Test Software is paused, subsequent operation might be unpredictable. Error messages may or may not be displayed. *See "Exiting the Program," in chapter 8, on page 210*.

After you have completed testing, use TEST_01 to send a command to the base station to lock access to it if locking is required.

Continuing a TEST

After pausing the program, you may continue it as follows:

1. If the TESTS (Main Menu) screen is not displayed, press TESTS. The TESTS (Main Menu) screen will appear.
2. Press k1 (`Continue`.)

Test Time Summary

The test time will be displayed when the test is completed. If you print out the test time summary, the printout will be done for each unit under test, not at the end of an entire test sequence.

The test time will include any time during which the program was paused and any time during which it was waiting for connection and inputs to be made.

NOTE: If testing runs through midnight, the test time will not display properly.

Saving Test Results

To save test results, you must make entries in the TESTS (External Devices) screen. Depending on your storage device, you might also be required to make entries into the I/O CONFIGURE screen. *See "Serial Port Configuration," in chapter 3, on page 109*, *"Data Collection" on page 113*, and *"Making Entries in a Test Set Configuration Screen" on page 108*.

5

TESTs - Reference

Important aspects of TEST_01 through TEST_11 are described in this chapter.

USER Keys

As you are running TEST_01 through TEST_11, you will see the following functions assigned, at times, to USER keys k1 through k5. These functions are assigned to the USER keys by the Test Software upon appropriate use, as indicated in the upper right-hand area of the Test Set display. USER keys are sometimes referred to as “softkeys”.

`All Cal` Press this key to cause the Test Software to download scan receiver calibration data.

`Clr Scr` Press this key to clear the Test Set display.

`Continue` Press this key to re-start the Test Software after it has been paused.

`Del Chan` Press this key to delete all voice channel controllers and voice channels not being tested. (This key appears only in TEST_03 and only in manual mode. See *"TEST_03 - Voice Transceiver" on page 156*.)

`Delet Stp` Press this key to delete TESTs during the editing of items in a TEST sequence. (When you press this key, the TEST in the displayed sequence with the **`Step #`** highlighted will be deleted. The TESTs that follow in the sequence will be scrolled up by one step.)

`Disp Data` Press this key to change the display of cable fault data from graphic form to tabular form.

`Done` Press this key to exit a TEST or when a task is completed. (The program will continue if there is a next TEST in the sequence or if there are additional program steps in the TEST being run.)

`HDII Loc`
`LD Loc`
`NAMPS Loc` Press one of these keys to display graphically on the Test Set display the location of the indicated adjustment.

Insrt Stp — Press this key to copy new items into a TEST sequence. (When you press this key, the TEST in the displayed sequence with the **Step #** highlighted will be copied into a new sequence location, immediately after the highlighted one. The TESTs that follow in the sequence will be scrolled down by one step. This key does nothing if there are no items in the sequence. Select a TEST before using this key to insert another.)

Key/Dekey — Press this key to turn the RF power of the transmitter on and off. (When a TX power test starts, you must press this key. If an output power adjustment cannot be made with the power amplifier installed, de-key the transmitter before you remove it. Key the transmitter after you have reinstalled the power amplifier.)

Laptop — Press this key to exit the TEST so as to exert some kind of control of the base station. (Selecting **Done** on the Laptop Emulator screen causes the program to continue execution from the exit point.)

LNA Offs — Press this key to determine the low noise amplifier offsets and to correct any that is not set according to the GN site has LNAs parameter. (This key appears only in TEST_04 and TEST_05. See *"TEST_04 - Signaling Transceiver MANUAL Mode" on page 163* and *"TEST_05 - Scanning Receiver MANUAL Mode" on page 169*.)

Next Wind — Press this key to move the cursor from its present window to another window. (The cursor can be used to change test conditions and send commands in different windows. For instance, in *"TEST_10 - Voice Channel Manual Test Mode" on page 181*, several windows are displayed on the Test Set display. The cursor will not move to a window unless a change is permitted in that window.)

Next Chan — Press this key to select the next channel in the scan receiver channel list. (This key appears at times in *"TEST_10 - Voice Channel Manual Test Mode" on page 181*. After you have selected **Tune test set** from the list in the **Measure** window, use this key to change the channel displayed above the parameters window. **Tune test set** is provided in this TEST so that you may use your laptop computer to check manually such messages as the RSSI of a scan receiver.)

Next Ant Press this key to select the next antenna. (This key appears at times in *"TEST_10 - Voice Channel Manual Test Mode" on page 181*. After you have selected **Tune test set** from the list in the **Measure** window, use this key to change the antenna displayed above the parameters window. **Tune test set** is provided in this TEST so that you may use your laptop computer to check manually such messages as the RSSI of a scan receiver.)

Page Up
Page Down Press these keys to move a selection list up and down in the Test Set display. (These keys are used to display items quickly in the list when some of the items will not fit on the screen.)

Prev Ant Press this key to select the previous antenna. (This key appears at times in *"TEST_10 - Voice Channel Manual Test Mode" on page 181*. After you have selected **Tune test set** from the list in the **Measure** window, use this key to change the antenna displayed above the parameters window. **Tune test set** is provided in this TEST so that you may use your laptop computer to check manually such messages as the RSSI of a scan receiver.)

Prev Chan Press this key to select the previous channel. (This key appears at times in *"TEST_10 - Voice Channel Manual Test Mode" on page 181*. After you have selected **Tune test set** from the list in the **Measure** window, use this key to change the antenna displayed above the parameters window. **Tune test set** is provided in this TEST so that you may use your laptop computer to check manually such messages as the RSSI of a scan receiver.)

Print All Press this key to print the parameters, pass/fail limits, configuration, and sequence that you have entered into the TESTS sub-screens. (The Serial Port or the HP-IB port may be used. *See "Making Entries in a Test Set Configuration Screen," in chapter 3, on page 108*.)

Prt Full Press this key to expand the display of the base station messages. (See *"TEST_01 - Laptop Emulator" on page 149*.)

Re-test Press this key to re-display the connection diagram so that another test may be started. (This key appears after a cable fault test has been performed.)

Run Press this key to start an IBASIC program that has been loaded into the Test Set memory.

Run Test — Press this key to load and run the program that results from the Procedure that has been entered into the TESTS (Main Menu) screen **Select Procedure Filename:** field. (If the Test Software is already loaded into Test Set memory, it will be started.)

Send ESC — Press this key to cause the Test Set to send an escape command to the base station. (This will terminate the display of information and messages from the base station. This key appears while TEST_01 is running. See *"TEST_01 - Laptop Emulator" on page 149*.)

Send FREE — Press this key to cause the Test Set to send a FREE command to the base site controller, so that a call is moved from a channel to be tested. (This key is used to free a channel before making a measurement of wide band data deviation on an active channel. A USE command must be sent after a FREE command. See *"TEST_07 - Wideband Data on an Active Voice Channel" on page 175*.)

Send TM — Press this key to cause the Test Set to send the base station a command that will result in a wideband data message being transmitted on a voice channel. (TX frequency deviation is measured while the message is being sent. See *"TEST_07 - Wideband Data on an Active Voice Channel" on page 175*.)

Send USE — Press this key to cause the Test Set to send a USE command to the base site controller so that a channel will be assigned to the next origination, handoff, or page operation. (This key must be pressed while originating a call before making a measurement of wideband data deviation on an active channel. See *"TEST_07 - Wideband Data on an Active Voice Channel" on page 175*.)

Show Log — Press this key to display a log of recent base station commands and messages that have been sent or received. (This key appears at times while TEST_10 is running. This key will appear only when the cursor is in the **BS commands sent** window. See *"TEST_10 - Voice Channel Manual Test Mode" on page 181*.)

Skip Sens
Skip SAT
Next Ant
Skp N SSI — Press these keys to cause the Test Software to skip over the indicated measurements in a scan receiver test. (These keys appear when the *SC skip items in scan test* parameter is set to **1**. The **N** in **Skp N SSI** refers to the antenna being tested.)

Sngl Step	Press this key to step the IBASIC program one line at a time. (This is different from **Continuous/Single Step** run mode. *See "Test Execution Conditions," in chapter 4, on page 135*).
Stop Test	Press this key to pause the Test Software operation.
Take It	Press this key to cause the program to accept the setting of an adjustment, cease testing to determine if the adjustment is within limits, and proceed with the program.
Tns off **Tns quiet** **Tns loud**	Press these keys to set the volume of tones that provide aural feedback during testing.
To Chan	Press this key to display a channel list so that a new channel may be selected.
Yes, No	Press these keys as responses when answering prompts displayed on the Test Set display.
Zoom	Press this key to expand the display of a measurement while *"TEST_10 - Voice Channel Manual Test Mode" on page 181* is running.
-60 dBm **-90 dBm** **-100 dBm**	Press these keys to set the RF generator to the level at which the calibration is performed. (These keys appear during the calibration of LD SIG units and LD scan receivers.)

TEST_01 - Laptop Emulator

This TEST allows you to send commands to the base station, and view messages sent from the base station by emulating the capabilities of a portable computer.

CAUTION: Commands that you send might have a profound effect on the operation of the cell site. Be certain of the effect of your command selection before you send it to the base station.

You might wish to place TEST_01 immediately before one or more TESTs that require the system to be taken out of service. You may use this TEST to send the MANUAL command to the base station. *See "Entering the Order of TESTs," in chapter 4, on page 132.*

Sending Commands

The column on the left side of the TEST_01 screen contains commands that may be selected and transmitted to the base station. Response messages are displayed in a window on the right-hand side of the screen. Move the cursor to the command that you wish to send to the base station, then press the CURSOR CONTROL knob to send it.

The base station generally echoes commands sent to it.

The USER (**`Page Up`**) key allows you to display quickly commands that might have scrolled off the top of the display. The USER (**`Page Down`**) key allows you to view commands that have scrolled down.

Some of the commands require that entries be made. For example, after you select the command **`Delete VCC`**, the following question prompt will be displayed:

```
Enter the VCC# [0-7]?
```

Verify that the cursor is in the upper left-hand corner of the large field in the upper part of the display. Then, use the CURSOR CONTROL knob or the numeric keypad to enter a value. Move the cursor to **`Done`** and select it to complete the entry.

If you wish to send a command that is not in the list provided in the Test Software, you may use the **`Enter Command`** selection (an alternative is to use the PC/Modem mode. See "Using the PC/Modem mode" on page 150). In some versions of base station firmware, the command syntax includes parameters that are not programmed into the commands in TEST_01. Examples are those that use NAMPS parameters. Determine the syntax and send these commands using the **`Enter Command`** selection.

The base station commands are described in the Main Monitor Commands section of the Motorola Base Station Instruction Manual.

As an example of command selections, assume that you wish to take the cell site out of service.

To take the cell site out of service:

1. Notify the switch personnel of your plan.
2. Verify that the voice channels have been handed off properly.
3. Verify that the switch will not be adversely affected when you power down, disconnect, or loopback the modems.
4. Power down, disconnect, or perform a local loopback to the modems connecting the switch to the base station.
5. Run **`TEST_01 - Laptop emulator`**.
6. Move the cursor to the Manual command using a combination of USER (**`Page Down`**) and CURSOR CONTROL knob rotation.
7. Press the knob.
8. If you are performing a SIG TEST, terminate the RF power from the SIG units, so that mobile stations do not attempt access. See *"TEST_04 - Signaling Transceiver MANUAL Mode" on page 163*.
9. If you are testing modules other than the SIG units, send SIG OFF 0 and SIG OFF 1 commands using this TEST. This will turn off the signaling transceivers RF power.

Using the PC/Modem mode

If you find that you are using the **`Enter Command`** function quite a lot you may find it more convenient to use the PC/Modem mode of the Laptop Emulator. This mode requires that you have a PC connected to the serial port as is shown in figure 4 on page 72.

When the PC/Modem mode is selected, commands that you type on the PC are sent to the base station via the HP 8921A's serial port. Responses from the base station can also be viewed on the PC.

Select the PC/Modem mode by scrolling to **`PC/Modem`** and pressing the CURSOR CONTROL knob. The screen of the Test Set will be cleared and you can now type commands and view responses from the base station on the PC.

Once in the PC/Modem mode, you cannot use any other Laptop Emulator functions until you exit. Exit the PC/Modem mode by pressing k3 (**`Return`**).

Messages

Messages from the base station will be displayed in the box labelled **`Base Station Response`**.

The first 27 characters sent by the base station may be displayed in the Base Station Response section of the display. If a message has more than 27 characters in it, press the USER (**`PrtFull`**) key to improve its readability. This will expand the responses to full screen. Pressing the USER (**`Continue`**) key will return the display to the reduced size. When many long reports are being sent from the base station, there is a possibility that a buffer overflow will occur in the Test Software. Some messages might not be displayed in this case. After you have pressed the USER (**`Prt Full)`** key, the possibility of overflow is greatly reduced, and the display will update faster.

Messages that have scrolled past the top of the message display cannot be retrieved by the Test Set for subsequent viewing.

Baud Rate

The Serial B port baud rate used by the Test Software is fixed at 1200 baud. Entries to the Test Set I/O CONFIGURE screen do not affect this value.

After TEST_01 starts, the Test Software will send an **`Autobaud`** command to the base station. Verify that a link exists by observing that a response appears on the Test Set display soon after the TEST starts. If response characters are not displayed, check the cables and connections from the Test Set to the base station, then send an **`Autobaud`** command using TEST_01 to match the baud rates and receive a response from the base station.

If the base station is disconnected from the Test Set after starting the Test Software, and connected to another RS-232 source, the baud rate might change. Send an **`Autobaud`** using TEST_01 to re-establish it.

Base Station Password

If the base station is locked and cannot be controlled, it will send a "#" to the Test Set for display each time a command is sent to it. You must send a password to the base station to allow access. Enter the characters of the password using the CURSOR CONTROL knob to select characters from a list. Always select **Done** after entering characters. After a password is entered, the Test Software will use it as a default entry.

Base Station Report

If you wish to know the status of the base station, send the REP VCC# GROUP# command it. The status of the channels under this Voice Channel Controller will be displayed on the Test Set. Verify the availability of the channel that you are testing by looking for INSOPT after the channel number. Use the status report to determine if the system is generally set up and operating properly. If you wish, the Test Software will display as you run voice transceiver tests. *See table 3, "Configuration Table Entries" on page 106* for ways to log base station messages.

Exiting TEST_01

Pressing USER (**Done**) causes the Test Set to begin running the next TEST in your sequence, or to complete the TEST if no additional TESTs have been entered.

TEST_02 - URDM or RDM Frequency/Level

This TEST verifies the performance of the URDM or RDM in the base station. It checks the frequency of the 3-MHz reference by measuring the transmitter frequency of a voice channel. In this process, it measures the level of the 3-MHz reference signal using the Test Set spectrum analyzer. It allows frequency and level adjustments if those are required.

You might wish to perform this TEST before testing transceivers so that you may be certain that the 3-MHz reference is operating properly.

If you plan to make adjustments to the frequency of the RDM or URDM 3-MHz frequency reference, you must first know the frequency error of the reference in the Test Set. Depending on when the Test Set was calibrated, its frequency error might be greater than that of the frequency reference in the cell site. Calibrate it if necessary.

Selecting the Test State

This TEST may be run in the In-Service Optimization mode or the MANUAL mode.

If the *GN test state of* parameter is set to **0**, the In-Service Optimization mode will be selected, and you will not be prompted to verify that the base station is set to In-Service Optimization mode. If the parameter has been set to **1**, you will be prompted to verify that the site is set to MANUAL mode. If you wish to change the mode, pause the program by pressing CANCEL, access the TESTS (Test Parameters) screen, and change the *GN test state of* parameter.

Calibration Factor

A calibration factor is used to enhance the accuracy of the Test Set spectrum analyzer when it measures the 3-MHz level. If the factor has not already been entered into the *RDM level correction factor* parameter, follow the procedure in *"Reference Distribution Module Level Correction Factor" in chapter 3, on page 88*.

Questions Displayed

If you are running a TEST for the second time, the Test Software will display the following question prompt:

```
Do you wish to continue testing?
```

The Test Software will use the frequency and channel information displayed on the screen if you press USER (**`Yes`**). The word "information" in the question does not refer to parameters, pass/fail limits, or other items that you enter into the Test Software. The Test Software always uses the items that you have recently entered or loaded with a procedure. If you press USER (**`No`**), you will be prompted to select the VCC, VOC, and RDM/URDM.

The Test Software will display the following question prompt before a frequency measurement is made:

```
Is channel free? If NO wait for a free channel for intracellhandoff
before continuing.
```

If the channel is not free, press USER (**`No`**) and the Test Software will send a FREE command to the base station. Wait until the channel is taken out of service by the switch, then press USER (**`Continue`**). The Test Software will then send a DELete command to the base station, and the channel will be available for testing.

Frequency Error Refers To

The RDM or URDM frequency error displayed is the error of the voice transceiver, not the frequency error referenced to 3 MHz.

Tests

TEST_02 performs the following tests:

- URDM (or RDM) #1 frequency error
- URDM (or RDM) #2 frequency error
- URDM (or RDM) #1 level
- URDM (or RDM) #2 level

Appendix B contains some of the Test Set settings used for these tests.

Pass/Fail Limits

TEST_02 uses the following pass/fail limits:

RDM frequency error (Hz)

RDM output level (Volts peak to peak)

Parameters

TEST_02 uses the following parameters:

GN auto exit adj [0=no xx=times in spec]

GN perform adj [0=no 1=fail 2=always]

GN test state of [0=INS_OPT 1=MANUAL]

GN type of site [0=omni 1=sec .skip ant]

RDM level correction factor (dB)

TEST_03 - Voice Transceiver

This TEST makes measurements and prompts for adjustments so that the performance of the transceiver used for voice communication may be verified and optimized.

Selecting the Test State

TEST_03 is ordinarily performed in the In-Service Optimization mode. If the *GN test state of* parameter is set to **0**, indicating that the base station set to the In-Service Optimization mode, the Test Software will not verify and display the status that the base station is in the In-Service Optimization mode. Otherwise, the Test Software will prompt you to verify that the base station is in MANUAL mode. If you wish to change the mode, pause the program by pressing CANCEL, access the TESTS (Test Parameters) screen, and change the *GN test state of* parameter. *See "Entering Parameters, Pass/Fail Limits, and External Device Configuration," in chapter 3, on page 99.*

If you elect to run the test in MANUAL mode, transmitter wideband data deviation will be measured. It cannot be measured in the In-Service Optimization mode using TEST_03. However, TEST_07 may be used to measure wideband data deviation if the cell site is not in the MANUAL mode (see *"TEST_07 - Wideband Data on an Active Voice Channel" on page 175*).

If you test receivers using a coupler connected to an antenna, you must verify that signals picked up by the antenna do not adversely affect measurements. If SINAD measurements are unstable, an extraneous signal might be the cause. Turn up the volume and listen until the co-channel or other interference subsides. You might wish to use what you learn to determine if there is a problem with the antenna or with the frequency plan.

You might find it preferable to take the cell site out of service when you are performing voice transceiver tests. In this way, you will be able to terminate antenna ports so that extraneous signals will not affect measurements. Also, you will be able to measure wideband data deviation without having to run TEST_07.

AMPS or NAMPS

At the start of the test, the Test Software will query the base station to determine whether it is an AMPS or an NAMPS site. If it is an NAMPS site, NAMPS adjustment locations are displayed. DST and DSAT will be measured. SAT and ST will not be measured if the site is NAMPS.

Calibration Parameters

Calibration parameters must be entered for the measurement path loss to each of the harmonic filters. *See "Transmitter Path Loss Calibration," in chapter 3, on page 81*.

Questions Displayed

If you are re-running a TEST, the Test Software will display the following question prompt:

```
Do you wish to continue testing?
```

If you select USER (**`Yes`**), you will return to the TEST_03 screen. There, you may update the values used in running TEST_03. The Test Software stores the previous test values; you must change them if you wish to use new values. Make any required changes and press USER (**`Continue`**) to begin testing.

If you select USER (**`No`**), you will return to the Test Menu. There, you can select another test to run or you may exit the Test Software.

Frequency Error

If you see a small frequency error when you are measuring the TX frequency, the cause of this error will usually be the RDM or URDM. This is because the frequency reference for the transceivers is in the RDM or URDM. Run TEST_02 at this time if you suspect that the RDM or URDM is the source of unacceptable frequency error (see *"TEST_02 - URDM or RDM Frequency/Level" on page 153*).

Keying the Transmitter

If you wish to make a power adjustment, you must press USER (**`Key/Dekey`**) to key the transmitter. You must press it again to de-key the transmitter before you remove the Power Amplifier module and make an adjustment to it. Key the transmitter again after you have installed the PA module.

Tests

For application situations in which you might wish to perform limited testing, such as testing only the receiver components, or testing only the transmitter components, the TEST_03 screen offers the menu options of selecting only the receiver tests, only the transmitter tests, or both sets of tests. Select the test sequence that meets your test objectives.

TEST_03 performs the following tests. This list includes the extended tests. See *"GN perform extended tests [0=no 1=yes]" on page 189* in *chapter 6, "Parameters - Reference"*. *See "Appendix: Test Set Measurement Settings" on page 223* for filter, detector and some other Test Set settings used.

Report from the base station

RX audio output (with adjustment)

RX SINAD for each antenna

RX audio distortion (extended test)

RX hum and noise (extended test)

RX expandor response (extended test)

RX audio response (extended test)

RX signal SAT/DSAT

RX no signal SAT/DSAT

RX signal ST/DST detect

RX no signal ST/DST detect

TX frequency error (The RDM/URDM adjustment is in TEST_02.)

TX power @level 0 (with adjustment)

TX SAT frequency error

TX SAT/DSAT peak deviation (with adjustment)

TX TEST JACK output (with adjustment)

TX loopback level (if parameter 43 (TX perform loopback test) is set to 1)

TX peak voice limiting (with adjustment)

TX voice deviation (with adjustment)

TX audio distortion (extended test)

TX hum and noise (extended test)

TX compandor track error (extended test)

TX audio frequency response (extended test)

TX peak data deviation (in MANUAL mode)(with adjustment)

Pass/Fail Limits

TEST_03 uses the following pass/fail limits:

RX audio distortion (percent)

RX audio output level (dBm)

RX audio response dev from -6 dB/oct R1 (dB)

RX audio response dev from -6 dB/oct R2 (dB)

RX expandor track error <0 dB (dB)

RX expandor track error >0 dB (dB)

RX hum and noise (dB)

RX sensitivity with LNA (dBm)

RX sensitivity without LNA (dBm)

RX sensitivity without LNA narrow mode (dBm)

RX SINAD at sensitivity spec (dB)

TX audio distortion (percent)

TX audio response dev from - 6 dB/oct (dB)

TX compressor track error %<0 dB (dB)

TX compressor track error >0 dB (dB)

TX data deviation (kHz)

TX FM hum and noise (dB)

TX frequency error (ppm)

TX output power error at level 0 (percent)

TX output power error at level 1 (percent)

TX output power error at level 2 (percent)

TX output power error at level 3 (percent)

TX output power error at level 4 (percent)

TX output power error at level 5 (percent)

TX output power error at level 6 (percent)

TX output power error at level 7 (percent)

TX SAT deviation (kHz)

TX SAT frequency error (Hz)

TX test point JK output (dBm)

TX voice deviation (kHz)

TX voice deviation narrow mode (kHz)

TX voice limiting deviation (kHz)

TX voice limiting deviation narrow mode (kHz)

Parameters

TEST_03 uses the following parameters:

GN auto exit adj [0=no xx=times in spec]

GN perform extended tests [0=no 1=yes]

GN site Average Voice Level (AVL) (dBm)

GN site has LNAs [0=no 1=yes]

GN test state of [0=INS_OPT 1=MANUAL]

GN type of site [0=omni 1=sec .skip ant]

GN verify all selections [0=no 1=yes]

RX level for DSAT/DST detector (dBm)

RX level for voice SAT/ST detector (dBm)

RX path loss to antenna 1 (dB)

RX path loss to antenna 2 (dB)

RX path loss to antenna 3 (dB)

RX path loss to antenna 4 (dB)

RX path loss to antenna 5 (dB)

RX path loss to antenna 6 (dB)

RX/TX audio freq response step [.01-2.7] (kHz)

TX output power for level 0 (Watts)

TX output power for level 1 (Watts)

TX output power for level 2 (Watts)

TX output power for level 3 (Watts)

TX output power for level 4 (Watts)

TX output power for level 5 (Watts)

TX output power for level 6 (Watts)

TX output power for level 7 (Watts)

TX path loss to harmonic filter 1 (dB)

TX path loss to harmonic filter 2 (dB)

TX path loss to harmonic filter 3 (dB)

TX path loss to harmonic filter 4 (dB)

TX path loss to harmonic filter 5 (dB)

TX path loss to harmonic filter 6 (dB)

TX path loss to harmonic filter 7 (dB)

TX path loss to harmonic filter 8 (dB)

TX perform loopback test [0=no 1=yes]

TX stepping PA pwr lvls tested [0-127]

TX peak voice limit step [1-299] (Hz)

TX voice/signal pwr use [0=anz 1=pwrmtr]

TEST_04 - Signaling Transceiver MANUAL Mode

This TEST determines the performance of the Signaling Transceiver and allows for receiver calibration. This TEST may be performed in the MANUAL mode only; the cell site must be taken out of service.

CAUTION: While testing the SIG unit, a high-power load must be placed on the RF coupler output leading to the antenna. It must be capable of handling at least 30 watts. The load is necessary to prevent the SIG transmitter signal from being radiated to mobile stations. Place the high-power load on the RF coupler output leading to the antenna after taking the cell site out of service.

MANUAL Mode

There are several ways to take the cell site out of service:

- See the procedure “To take the cell site out of service:” in the description of TEST_01 in this chapter.
- Ask the switch personnel to perform the task.
- Take the cell site out of service through the switch, using a laptop computer.

After you take the cell site out of service, send SIG OFF 0 and SIG OFF 1 commands if the Signaling Transceivers are still connected to an antenna. You should terminate the outputs to antennas to prevent the SIG signal from being radiated. When you run TEST_04, a SIG ON will be sent shortly after the TEST starts.

You must verify that the *GN test state of* parameter is set to MANUAL. Access the TESTS (Test Parameters) screen to do this. You must do this only the first time that you are running this TEST because the parameter will be stored. If the parameter is not in MANUAL mode and you run TEST_04, a message will be displayed, prompting you to change the parameter.

To set `GN test state of` to MANUAL:

1. Press CANCEL to pause the program, or, press SHIFT CANCEL to stop the program.
2. Press TESTS. The TESTS (Main Menu) screen will appear.
3. From the **`CUSTOMIZE TEST PROCEDURE:`** menu, select **`Parm Test Parameters`**. The TESTS (Test Parameters) screen will appear.
4. In the **`Parm#`** column, select the *GN test state of* parameter.
5. Move the cursor to the **`Value`** field.
6. Using the numeric keypad, enter 1, then press ENTER.
7. Press TESTS. The TESTS (Main Menu) screen will appear.
8. Press USER (**`Run Test`**) to run the program.

HDII or LD Equipment

The Test Software will display a menu item for a selection of whether the cell site has HDII or LD equipment. Calibration factors for handoff levels must be uploaded to the Signaling Channel Controller if it is an HDII SCC. Make certain of the type of SCC in the system, because there might be a mixture of LD and HDII equipment at the site.

LD equipment may be calibrated at – 60, – 90, or –100 dBm. The Test Software will assign USER keys to allow you to select the level. On HDII equipment, calibration is performed at – 90 dBm.

Calibration Parameters

Parameters must be entered into the Test Software for the path loss to each of the harmonic filters. *See "Transmitter Path Loss Calibration," in chapter 3, on page 81*.

Questions Displayed

When the test is first run you will see the TEST_04 menu, in which you can fill in values that define which elements of the site are to be tested. Other entries determine how the results will be presented.

You can enter the number for the TX harmonic filter that is passing the signal that you are measuring. Refer to a site diagram or the Motorola Cell Site manual to see which harmonic filters are used by the signaling transceivers. Make connection to the couplers that are installed at the outputs of the harmonic filters.

Scroll and select the type of signaling unit to be tested and select SSI units of **`HEX`** or **`DBM`**.

When your entries are correct, press USER (**`Continue`**) to start the test.

The Test Software then sends commands to the base station to select the CSC and set up the SCC and SIG unit.

The Test Software will display a diagram to show the connection of the equipment. Refer to *figure 4, "Cell Site to Test Equipment Interconnections," on page 72* for a description of these connections.

The TEST_04 menu has an additional USER key defined, with the label **`LNA Offs`**. If you press the **`LNA Offs`** USER key to check the LNA offsets (and you have set the parameters to indicate that there are LNAs installed), the Test Software checks the state of the LNA offset values with a base station hardware query. If the information does not match, the Test Software will display a screen that tells you there is a mismatch and allows you to choose to modify the values or continue on without changing them.

If you wish to modify the offsets, press the **`Modify`** USER key. To continue on with the current LNA offset values (not recommended), press the **`Continue`** USER key.

Also, the Test Software will display question prompts to determine whether you intend to calibrate the Signaling Transceiver. The *GN always cal sig/scan* parameter may be used to cause the Test Software to calibrate the Signaling Transceiver automatically. If you have not enabled this mode, the Test Software will display the following question prompt when a failure in the RX SSI calibration is encountered:

```
Do you want to calibrate this frequency?
```

If you are confident that the test has been performed properly, answer USER (**`Yes`**). The testing will proceed. Or you may press USER (**`All cal`**) and any further errors will result in automatic calibration.

If you are testing at a non-LD site, the Test Software will display the following question prompt at the end of testing:

```
Do you want to upload the sig cal data to the SCC?
```

If you answer USER (**`Yes`**), and the firmware revision of the base station is equal to or later than 4.5.0.0, the Test Software will display question prompts to determine if you wish to display the cal data on the Test Set display. If a printer is configured in the TESTS (External Devices) screen, the information will be printed also.

When the TEST on this unit is complete, the Test Software will display the following question prompt:

```
Do you want to test another signaling unit?
```

If your answer is USER (**No**), you will be returned to the Test Menu and you can select a new test to run. If you select USER (**Yes**), you will return to the TEST_04 menu and can update the harmonic filter number (and other entries) and re-run the test.

If you see a frequency error when you are measuring the TX frequency, the source of this error will usually be the URDM or RDM. This is because the frequency reference for the transceivers is in the URDM or RDM. Run TEST_02 at this time if you suspect that the URDM or RDM is the source of frequency error (see *"TEST_02 - URDM or RDM Frequency/Level" on page 153*).

Tests

TEST_04 performs the following tests. See “Appendix B” for filter, detector and some other Test Set settings used.

- TX frequency error (The RDM/URDM adjustment is in TEST_02.)
- TX power (with adjustment)
- TX data deviation (with adjustment)
- RX SINAD
- RX SSI calibration and linearity

Pass/Fail Limits

TEST_04 uses the following pass/fail limits:

- RX scan and sig calibration reading (dBm)
- RX scan sig linearity error (dB)
- RX sensitivity with LNA (dBm)
- RX sensitivity without LNA (dBm)
- RX SINAD at sensitivity spec (dB)
- TX data deviation (kHz)
- TX frequency error (ppm)
- TX output power error for signaling unit (percent)

Parameters

TEST_04 uses the following parameters:

GN perform adj [0=no 1=yes]

GN auto exit adj [0=no xx=times in spec]

GN always cal sig/scan [0=no 1=yes]

GN site has LNAs [0=no 1=yes]

GN test state of [0=INS_OPT 1=MANUAL]

GN type of site [0=omni 1=sec .skip ant]

GN verify all selections [0=no 1=yes]

RX path loss to antenna 1 (dB)

RX path loss to antenna 2 (dB)

RX path loss to antenna 3 (dB)

RX path loss to antenna 4 (dB)

RX path loss to antenna 5 (dB)

RX path loss to antenna 6 (dB)

TX path loss to harmonic filter 1 (dB)

TX path loss to harmonic filter 2 (dB)

TX path loss to harmonic filter 3 (dB)

TX path loss to harmonic filter 4 (dB)

TX path loss to harmonic filter 5 (dB)

TX path loss to harmonic filter 6 (dB)

TX path loss to harmonic filter 7 (dB)

TX path loss to harmonic filter 8 (dB)

TX output power for signaling unit (Watts)

TX voice/signal pwr use [0=anz 1=pwrmtr]

TEST_05 - Scanning Receiver MANUAL Mode

This TEST determines the performance of the scanning receivers, and allows for receiver calibration. This TEST may be performed in the MANUAL mode only; the cell site must be taken out of service.

MANUAL Mode

See “MANUAL Mode” in the description of *"TEST_04 - Signaling Transceiver MANUAL Mode" on page 163*.

After you take the cell site out of service, send SIG OFF 0 and SIG OFF 1 commands if Signaling Transceivers are connected to an antenna. You must do this to prevent mobile stations from attempting to access the cell site.

AMPS or NAMPS

The Test Software will query the base station to determine whether it is an AMPS or an NAMPS site. If it is an NAMPS site, DSAT is measured. The DSAT code used is sent by the base station to the Test Set.

Connections

The Test Software will display a diagram to show the connection of the equipment. The Test Set DUPLEX OUT connector is used to supply an RF signal to the scan receivers. Transmitter output line connection to the RF IN/OUT connector is shown on the Test Set display drawing. This connection is optional. It may be left connected if you use it for other TESTs.

See *figure 4, "Cell Site to Test Equipment Interconnections," on page 72* for a description of connections.

Calibration Parameters

Parameters must be entered into the Test Software for the path loss to each of the RX antennas. *See "Receiver Path Loss Calibration," in chapter 3, on page 85.*

Questions Displayed

You will be prompted if the LNA offsets do not match. At the start of testing, the Test Software compares the setting of the **`GN site has LNAs`** parameter and the answers to its base station hardware query. If the information does not match, the Test Software will display the following question prompt:

```
Do you want to modify LNA offsets or continue?
```

If you wish to modify the offsets, press the **`Modify`** USER key. To continue on with the current LNA offset values (not recommended), press the **`Continue`** USER key.

The TEST_05 menu will allow you to enter values for the VCC number of the receiver that you are testing. Refer to a site diagram or the Motorola Cell Site manual for this information.

The TEST_05 menu also has an entry to indicate whether you are testing in the AMPS or the extended AMPS frequency range (selections are **`AMPS`** or **`E-AMPS`**).

The Test Software will display question prompts to determine if you intend to calibrate the Scan Receiver.

The *GN always cal sig/scan* parameter may be used to cause the program to calibrate the Scan Receiver automatically. If you have not enabled this mode, the Test Software will display the following question prompt:

```
Do you want to calibrate this frequency?
```

If you are confident that the test has been performed properly, answer USER (**`Yes`**).

The Test Software performs linearity tests at -60 dBm and -100 dBm. If you wish to reduce the number of channels at which linearity is tested, set the *SC fewer linearity channels* parameter to 1 (yes). The Test Software will perform tests at the same four frequencies at which the SINAD test is performed.

If you are at a non-LD site, the Test Software will display the following question prompt:

```
Do you want to upload the scan cal data to the VCC?
```

If you answer USER (**`Yes`**), and the firmware revision of the base station is 4.5.0.0 or later, the Test Software will display question prompts to determine if you wish to display the cal data on the Test Set display. If a printer is configured in the TESTS (External Devices) screen, the information will be printed also.

When the TEST on this channel is complete, the Test Software will display the following question prompt:

```
Do you want to test another scan receiver?
```

If your answer is USER (**Yes**), the TEST will be repeated for another VCC that you select.

NOTE: Signals picked up by antennas can affect measurements and result in inaccurate calibration data. Install 50-ohm terminations on the RF coupler ports leading to the antennas if necessary.

Tests

TEST_05 performs the following tests. See *"Appendix: Test Set Measurement Settings" on page 223* for filter, detector and some other Test Set settings used.

- RX scan sensitivity for each antenna
- RX SAT/DSAT detect
- RX SSI calibration and linearity

Pass/Fail Limits

TEST_05 uses the following pass/fail limits:

- RX scan and sig calibration reading (dBm)
- RX scan sig linearity error (dB)
- RX sensitivity with LNA (dBm)
- RX sensitivity without LNA (dBm)
- RX sensitivity without LNA narrow mode (dBm)
- RX SINAD at sensitivity spec (dB)

Parameters

TEST_05 uses the following parameters:

GN always cal sig/scan [0=no 1=yes]

GN site has LNAs [0=no 1=yes]

GN site [0=non-wireline 1=wireline]

GN test state of [0=INS_OPT 1=MANUAL]

GN type of site [0=omni 1=sec .skip ant]

GN verify all selections [0=no 1=yes]

RX level for scanner DSAT detector (dBm)

RX level for scanner SAT detector (dBm)

RX path loss to antenna 1 (dB)

RX path loss to antenna 2 (dB)

RX path loss to antenna 3 (dB)

RX path loss to antenna 4 (dB)

RX path loss to antenna 5 (dB)

RX path loss to antenna 6 (dB)

SC fewer linearity channels [0=no 1=yes]

SC skip items in scan test [0=no 1=yes]

TEST_06 - Combiner Adjustment

This TEST uses the voice transceiver or the signaling unit as a signal source to optimize the adjustment of the power combiner. Refer to *figure 4, "Cell Site to Test Equipment Interconnections," on page 72* for connections to the base station, Test Set, and accessories.

This test runs in the MANUAL mode. See “MANUAL Mode” in the description of *"TEST_04 - Signaling Transceiver MANUAL Mode" on page 163*.

You may run this TEST in the same way that power is tested in TEST_03 or TEST_04, leaving the RF coupler in the path as the power is measured (see *"TEST_03 - Voice Transceiver" on page 156* or *"TEST_04 - Signaling Transceiver MANUAL Mode" on page 163*). The spectrum analyzer or the power meter may be used, depending on the level of power available at the coupled port. Set the *TX voice/signal pwr use* parameter to your desired choice. See *chapter 6, "Parameters - Reference"*. You must perform calibration using the same measuring device, spectrum analyzer or power meter, that you use in running TEST_06.

Calibration Parameter

A calibration factor must be entered into the *TX path loss to combiner for adjustment* parameter. *See "Combiner to Test Set Path Loss Factor," in chapter 3, on page 90*.

Running TEST_06 - Combiner Adjustment

After you select TEST_06 and press the knob, the combiner adjustment menu will be displayed. Select the **`Controller`** type (**`CSC`** for a signalling transceiver or **`VCC`** for a voice channel) and fill in the corresponding values in the menu.

Once the values have been entered, press USER (**`Continue`**) to run the test. First, system initialization takes place, and the Test Software sends commands to the base station.

A signal from the selected channel will be available at the output of the combiner, and power output adjustment may be performed. Adjust the Combiner by loosening and resetting the combiner bolts for a minimum on the reflected power meter. Check the forward-power reading on the Test Set.

Questions Displayed

After you have adjusted the combiner for the channel being tested and the measured result is displayed, you will see the following prompt:

```
Do you want to test another channel?
```

Test

TEST_06 performs the following test. See “Appendix B” for filter, detector and some other Test Set settings used.

TX power with adjustment

Pass/Fail Limits

TEST_06 uses the following pass/fail limits:

TX output power error at level 0 (percent)

TX output power error for signaling unit (percent)

Parameters

TEST_06 uses the following parameters:

GN auto exit adj [0=no xx=times in spec]

GN test state of [0=INS_OPT 1=MANUAL]

GN type of site [0=omni 1=sec .skip ant]

GN verify all selections [0=no 1=yes]

TX output power for level 0 (Watts)

TX path loss to combiner for adjustment (dB)

TX output power for signaling unit (Watts)

TX voice/signal pwr use [0=anz 1=pwrmtr]

TEST_07 - Wideband Data on an Active Voice Channel

TEST_07 provides a method for measuring the wideband data deviation of a voice transceiver without taking the cell site out of service. The TEST is performed while the voice transceiver is on an active voice channel with a call from your mobile phone. You may perform this TEST on Motorola base stations with a firmware revision later than 4.3.2.1.

In this TEST, you will use a cellular telephone to set up a call. After the base station and telephone have established connection, the deviation of the data transmitted by the base station will be measured.

The Test Software will prompt you for the VCC and voice transceiver that you wish to test. You must press USER (**Send USE**) as you are setting up the call from the mobile station. Press USER (**Send FREE**) if the channel is not available. Verify that connection is made by turning up the volume on the Test Set. When you establish connection, press USER (**Yes**) to answer the question displayed, and to make a measurement.

The first measurement will be made before the wideband data is transmitted by the transmitter. Press USER (**Send TM**) to command the base station to send a wideband data burst. The deviation will then be displayed.

Press USER (**To Chan**) to select another channel to test. The channel list will be displayed.

The Test Software will display the question prompt:

```
Is the new channel free? Press NO to return to channel list.
```

Press USER (**Yes**) when the channel is available.

You should plug a Bantam 309 plug into the EQUIP XMT jack. This will prevent audio from a live microphone or other source from modulating the transmitter and affecting the deviation measurement.

Wideband data deviation measurement is performed using the Peak ± max hold detector. This detector captures the instantaneous peak deviation of the transmitter.

The data deviation measurement is affected by audio filters at the output of the FM demodulator. The Test Software will select the <20 Hz high-pass filter and the >99 kHz low-pass filter to minimize the effect of the filters.

Test The following test is performed in TEST_07:

Wideband data deviation on the selected voice channel

Pass/Fail Limits TEST_07 uses no pass/fail limits.

Parameters TEST_07 uses no parameters.

TEST_08 - Manual Switch and Calibration Aid

This TEST has several routines that help you to calibrate and control (manually) cell site equipment. Typically, this TEST will not be included in a sequence. Routines in this TEST may be run individually when required.

For example, the **`Tune the HP 8921A to a channel number`** routine may be used to set the Test Set RF Analyzer/receiver/spectrum analyzer and RF Generator to a channel number.

Rotate the CURSOR CONTROL knob and press USER (**`Page Up`**) or USER (**`Page Down`**) to select the desired function. Then press the knob to start the routine.

Routines

The following functions are available:

`Go to the Laptop Emulator`

To send a command to the base station, and view messages from the base station.

`Set the HP 8921A for RX path calibration`

See "Receiver Path Loss Calibration," in chapter 3, on page 85.

`Read the spec. analyzer TX path calibration`

See "Receiver Path Loss Calibration," in chapter 3, on page 85.

`Read the spec. analyzer RDM path calibration`

See "Reference Distribution Module Level Correction Factor," in chapter 3, on page 88.

`Tune the HP 8921A to a channel number`

To set the Test Set RF Generator Frequency and Tune Frequency manually.

`Switch to receiver antenna #1 - #6`

To set the RF switch manually.

`Switch to audio JK / RCV`

To set the audio switch from TEST JK to RCV manually.

Pass/Fail Limits TEST_08 uses no pass/fail limits.

Parameters TEST_08 uses no parameters.

TEST_09 - Calculate Transmitter Power

This TEST calculates the maximum permissible transmitter power, given the ERP limit, the antenna gain, and the losses of various items in the system. You may select from a list of items, and the TEST will calculate the loss introduced by each item. No measurements are performed in this TEST. This TEST is ordinarily run when the system is installed. The maximum permissible transmitter power may be used as a parameter for TESTs that determine if the transmitters are operating acceptably. A single parameter is used, so it is important to verify that the differences between antenna paths is negligible.

After you press USER (**`Run Test`**), the Test Set will display a list of system hardware elements. After you make an entry, the program will recalculate the System Attenuation, Input to Antenna, and Harmonic Filter Output. You must enter this last value as a parameter into the list in the TESTS (Test Parameters) screen. *See chapter 6, "Parameters - Reference" on page 187* and *"Parameters" on page 99*.

Available Entries

The following entries may be made. Default values are given.

Transmit ERP = 100 watts

Antenna Gain = 11.5 dB

Amount of 7/8 in. foam cable = 0 ft

Amount of 1/4 in. foam cable = 0 ft

Amount of 1 5/8 in. foam cable = 0 ft

Amount of 1 5/8 in. air cable = 0 ft

Amount of 1/2 in. foam jumper = 0 ft

Amount of 1/2 in. superflex jumper = 0 ft

Lightning suppressor attenuation =0.1 dB

Other component(s) loss = 0.0 dB

Mismatch loss = 0.2 dB

Number of connectors = 6 QTY

Select **`Done`** or USER (**`Done`**) when entries are complete.

Pass/Fail Limits TEST_09 uses no pass/fail limits.

Parameters TEST_09 uses no parameters.

TEST_10 - Voice Channel Manual Test Mode

This TEST semiautomatically checks many parameters of a voice transceiver. It is generally used when changes are to be made in test conditions or the sequence of tests as the test is running.

This TEST may be run in the MANUAL mode or In-Service Optimization mode. If the *GN test state of* parameter is set to **0** (INS_OPT mode), the TX data deviation test is not displayed in the list of measurements.

In this TEST, select a test from the list in the window labelled **Measure** by moving the cursor to the desired test and pressing the CURSOR CONTROL knob. The Test Software displays measurement results in the window above the **Measure** window.

You may use the Test Set or an external PC to control the base station. If you use an external PC, you will be prompted for the channel number being tested. The last channel tested will be displayed in the upper left-hand area of the TEST screen. Press USER (**Continue**) to use the value displayed, or use the data keys to enter a new channel number.

Pressing USER (**Next Wind**) moves the cursor to one of the other windows on the TEST screen. Parameters may be changed and base station commands may be sent by selecting the desired item after the cursor is in the corresponding window.

In making entries into parameters, the cursor will be in the upper left-hand corner of the screen. Enter data values using the DATA keys. End the entry process by pressing the ENTER key.

The values that you enter into the parameters do not change the values in the TESTS (Test Parameters) screen. The initial values of the parameters used in this manual TEST are coded into the Test Software. After you change the values, those will be retained in the Test Set battery-backed-up RAM. The values will be restored to those coded into the Test Software if you load a different program into the Test Set memory.

The parameters that you enter into the **Parameters** window may be saved to an SRAM card file. The filename of the SRAM card file is always **uMAN_PARM**. When you select **Store Parameters** from the list in the **Measure** window, the Test Software will attempt to store the latest values of parameters in a file with that filename. The Test Software will display the following message if there is an existing parameter file on the card:

….Duplicate file name.….

If you do not wish to over-write the old file, you must save your parameters on a different SRAM card.

This TEST uses parameters from the TESTS (Test Parameters) screen that correct for the losses of cables, couplers and switches.

The item **Tune test set** in the list in the **Measure** window does not relate to a voice channel test. When this item is selected, the Test Set may be tuned to frequencies in the scan receiver channel list. After you select **Wireline Ch** or **Non-wireline Ch** from the list in the **Parameters** window, the Test Software assigns USER keys to allow you to change the channel and select a different antenna. Also, you may change the RF level by selecting that item in the **Parameters** window. As an example of the use of **Tune test set**, a laptop computer may be used to send commands manually and read the RSSI of a scan receiver.

Pass/Fail Limits

TEST_10 uses the following pass/fail limits to determine the position of the lines displayed on the meter when you press USER (**Zoom**):

- RDM frequency error
- RX audio output level
- TX data deviation
- TX loop-back level
- TX output power error at level 0
- TX SAT deviation
- TX test point JK output
- TX voice deviation
- TX voice limiting deviation

Parameters

The parameters displayed in the TEST_10 screen window labelled **`Parameters`** are not associated with the parameters on the TESTS (Test Parameters) screen.

TEST_10 uses the following parameters from the TESTS (Test Parameters) screen:

GN auto exit adj [0=no xx=times in spec]

GN test state of [0=INS_OPT 1=MANUAL]

RX path loss to antenna 1 (dB)

RX path loss to antenna 2 (dB)

RX path loss to antenna 3 (dB)

RX path loss to antenna 4 (dB)

RX path loss to antenna 5 (dB)

RX path loss to antenna 6 (dB)

TX output power for level 0

TX path loss to harmonic filter 1 (dB)

TX path loss to harmonic filter 2 (dB)

TX path loss to harmonic filter 3 (dB)

TX path loss to harmonic filter 4 (dB)

TX path loss to harmonic filter 5 (dB)

TX path loss to harmonic filter 6 (dB)

TX path loss to harmonic filter 7 (dB)

TX path loss to harmonic filter 8 (dB)

TX voice/signal pwr use [0=anz 1=pwrmtr]

TEST_11 - Test Menu

This TEST allows you to bypass the Tests Subsystem and select and run TESTs very quickly and very easily. This TEST is useful in running impromptu sequences for special testing circumstances. Although selecting TESTs in the formal manner, from the TESTS (Order of Tests) screen, is not difficult, this TEST allows you to run TESTs in special circumstances somewhat faster and with easier selection.

When you select this TEST from the TESTS (Order of Tests) screen, or when this TEST is encountered in a test sequence, the Test Software will display the TEST_11 screen. This screen contains the following menu:

Exit

TEST_01 - Laptop emulator

TEST_02 -URDM or RDM frequency/level

TEST_03 - Voice transceiver

TEST_04 - Signaling transceiver MANUAL mode

TEST_05 - Scanning receiver MANUAL mode

TEST_06 - Combiner adjustment

TEST_07 - Wideband data on active voice channel

TEST_08 - Manual switch and calibration aid

TEST_09 - Calibrate transmitter power

TEST_10 - Voice channel manual test mode

This menu allows you to select the next TEST to be run. You need not return to the TESTS (Main Menu) to run the TEST. Selecting the TEST (that is, moving the cursor to the TEST name and pressing the CURSOR CONTROL knob) causes the TEST to run. When the TEST that you selected completes its testing, it terminates, and this screen returns to the display. You may select and run the next TEST, and continue to select and run as many TESTs as required, in any order. You may repeat TESTs as many times as is required.

Thus, you might find this test useful instead of defining a test sequence in the TESTS (Main Menu) and other screens. In impromptu testing situations, this test is typically quicker to use than is the TESTS (Main Menu) and other screens.

When you have completed your special testing, select **`Exit`**. The TESTS (Main Menu) will reappear on the Test Set display.

Pass/Fail Limits TEST_11 uses no pass/fail limits.

Parameters TEST_11 uses no parameters.

6

Parameters - Reference

Parameters are used by the Test Software to optimize the program for your specific application.

Change parameters by selecting **Parm Test Parameters** from the **CUSTOMIZE TEST PROCEDURE:** menu in the TESTS (Main Menu) screen. The Test Software will display the TESTS (Test Parameters) screen. Change parameters by using the cursor control knob to select the parameter number, then **Value**, and then use the DATA keypad to enter the new value.

See "Entering Parameters, Pass/Fail Limits, and External Device Configuration," in chapter 3, on page 99, to enter a parameter value.

The first few capital letters in the title of each parameter indicate the subject to which the parameter refers. These are:

GN=General

RDM=Reference Distribution Module

RX=Receiver

TX=Transmitter

RX/TX=Receiver or Transmitter

SC=Scan

ZZZZ=To place the demo mode parameter at the end of the list

Parameter Descriptions

GN always cal sig/ scan [0=no 1=yes]

This parameter controls whether the program is to provide calibration of the SIG units and scan receivers after measurements are made. Calibration is performed only when the test has failed.

GN auto exit adj [0=no xx=times in spec]

This parameter determines the number of measurements that are required to be within the adjustment pass/fail limits before the adjustment procedure terminates.

GN perform adj [0=no 1=fail 2 =always]

This parameter sets the conditions under which the program will provide an adjustment procedure.

GN perform extended tests [0=no 1=yes]

This parameter determines if the following additional voice transmitter and voice receiver tests will be performed. The tests are performed if this parameter is set to **1**:

- RX audio distortion
- RX hum and noise
- RX expandor response
- RX audio response
- TX audio distortion
- TX hum and noise
- TX compandor track error
- TX audio frequency response

GN site Average Voice Level (AVL) (dBm)

This parameter sets the standard level used for transmitter input power, in dBm into a 600-ohm load.

GN site has LNAs [0=no 1=yes]

This parameter indicates whether low noise amplifiers are installed at the receiver inputs. Setting parameter to **1** means that LNAs are installed. When testing starts, the Test Software reads the setting of this parameter, then queries the base station as to whether LNAs are installed. If the two results do not agree, the Test Software will display a prompt stating that the offsets do not match.

GN site [0=non-wireline 1=wireline]

This parameter indicates whether the site is a wireline or non-wireline type and thus determines the RF channels to be used for the test.

GN test state of [0=INS_OPT 1=MANUAL]

This parameter indicates whether the site is in or out of service. If you are testing with the base station in service (that is, in In-Service Optimization mode), set this parameter to 0. If you are testing with the cell site out of service (that is, in MANUAL mode), set this parameter to **1**. At the start of testing, the Test Software reads the setting of this parameter and will prompt you to verify the mode if it is set to **1**, but not if it is set to 0.

GN type of site [0=omni 1=sec .skip ant]

This parameter indicates the type of site: omni or sectored receive. If the cell site is an omni receive site, set this parameter to **0**. The test system will then test two RX antennas. If the cell site is a sectored receive site, set this parameter to **1**. The test system will then test six RX antennas. If the cell site does not use specific antennas, the test system will skip the testing of these antennas if each is entered after the decimal point in one of the above cases. For example, if the site is a sectored site but antennas 2, 4, and 5 are not to be tested, the entry will be 1.245. This entry will direct the test system to test the cell site as a sectored site, but skip testing for antennas 2, 4, and 5. Note that an entry of 0.245 would not be correct, because antennas 4 and 5 are not tested on an omni site.

GN verify all selections [0=no 1=yes]

This parameter indicates to the Test Software that verification of entries is required. When this parameter is set to **1**, the program will prompt you for verification of each entry.

RDM level correction factor (dB)

This parameter sets the correction factor that is used to enhance the accuracy of 3-MHz level measurements using the Test Set spectrum analyzer. *See "Reference Distribution Module Level Correction Factor," in chapter 3, on page 88*.

RX level for scanner DSAT detector (dBm)

This parameter sets the signal generator levels that are applied to the scan receiver during DSAT tests.

RX level for scanner SAT detector (dBm)

This parameter sets the signal generator levels that are applied to the scan receiver during SAT tests.

RX level for voice DSAT/DST detector (dBm)

This parameter sets the signal generator levels that are applied to the voice receiver during Digital SAT and Digital Signaling Tone tests.

RX level for voice SAT/ST detector (dBm)

This parameter sets the signal generator levels that are applied to the voice receiver during SAT and Signaling Tone tests.

RX path loss to antenna 1 (dB)

This parameter sets the calibration factor that the Test Software will use to accommodate cable and RF coupler losses when setting the Test Set signal generator level. Its value can be determined by a method of measurement in *"Receiver Path Loss Calibration" in chapter 3, on page 85*.

RX path loss to antenna 2 (dB)

See “RX path loss to antenna 1”.

RX path loss to antenna 3 (dB)

See “RX path loss to antenna 1”.

RX path loss to antenna 4 (dB)

See “RX path loss to antenna 1”.

RX path loss to antenna 5 (dB)

See “RX path loss to antenna 1”.

RX path loss to antenna 6 (dB)

See “RX path loss to antenna 1”.

RX/TX audio freq response step [.01-2.7]

This parameter sets the value of the audio frequency step that occurs as the frequency response of the audio passband is measured. The two end points, 300 Hz and 3 kHz are always measured.

SC fewer linearity channels [0=no 1=yes]	This parameter allows you to reduce the number of channels at which RSSI linearity tests will be performed. Set this parameter to **1** (=yes) if you want to reduce the number of channels. The fourteen test channels will be reduced to the four channels at which SINAD is performed.
SC skip items in scan test [0=no 1=yes]	This parameter allows you to skip some of the scan receiver tests.If you set this parameter to **1**, the Test Software will provide USER keys that allow you to skip SINAD and SAT tests, and begin testing on the next antenna.
TX output power for level 0 (Watts)	This parameter sets the rated RF power level of the voice transmitter at power level 0.
TX output power for level 1 (Watts)	This parameter sets the rated RF power level of the voice transmitter at power level 1.
TX output power for level 2 (Watts)	This parameter sets the rated RF power level of a voice transmitter at power level 2.
TX output power for level 3 (Watts)	This parameter sets the rated RF power level of a voice transmitter at power level 3.
TX output power for level 4 (Watts)	This parameter sets the rated RF power level of a voice transmitter at power level 4.
TX output power for level 5 (Watts)	This parameter sets the rated RF power level of a voice transmitter at power level 5.
TX output power for level 6 (Watts)	This parameter sets the rated RF power level of a voice transmitter at power level 6.
TX output power for level 7 (Watts)	This parameter sets the rated RF power level of a voice transmitter at power level 7.
TX output power for signaling unit (Watts)	This parameter sets the rated RF power level of a signaling transmitter.

TX path loss to combiner for adjustment (dB)

This parameter sets the calibration factor that is used in “TEST_06 - Combiner Adjustment” to account for cable losses, RF coupler coupling factors, and the Test Set power meter measurement error. This parameter can be determined by the method of measurement *"Combiner to Test Set Path Loss Factor" in chapter 3, on page 90*. Also see *"TEST_06 - Combiner Adjustment" on page 173*.

TX path loss to harmonic filter 1 (dB)

This parameter sets the calibration factor that accounts for cable losses, RF coupler coupling factors, and Test Set measurement error when measuring transmitter power. Its value can be determined by a method of measurement in *"Transmitter Path Loss Calibration" in chapter 3, on page 81*.

TX path loss to harmonic filter 2 (dB)

See “TX path loss to harmonic filter 1”.

TX path loss to harmonic filter 3 (dB)

See “TX path loss to harmonic filter 1”.

TX path loss to harmonic filter 4 (dB)

See “TX path loss to harmonic filter 1”.

TX path loss to harmonic filter 5 (dB)

See “TX path loss to harmonic filter 1”.

TX path loss to harmonic filter 6 (dB)

See “TX path loss to harmonic filter 1”.

TX path loss to harmonic filter 7 (dB)

See “TX path loss to harmonic filter 1”.

TX path loss to harmonic filter 8 (dB)

See “TX path loss to harmonic filter 1”.

TX perform loopback test [0=no 1=yes]

This parameter control whether loopback test will be performed. If this parameter is set to **1**, the average voice level will be applied to the TX line input and the level at the RCV line output will be measured in “TEST_03 - Voice Transceiver”.

TX stepping PA pwr lvls tested [0-127]

This parameter sets the output power levels that are tested. Entry is made with a binary word, expressed in decimal. Select the power levels at which you wish to test from the list below and add the numbers after the equal sign. Power level 0 is always tested.

Power level 1 = 1

Power level 2 = 2

Power level 3 = 4

Power level 4 = 8

Power level 5 = 16

Power level 6 = 32

Power level 7 = 64

For example, if you wish to test power levels 0, 1, 4 and 7, enter **73** (73=1+8+64) into the field. Enter **0** if you want to test only power level 0. If you wish to test low power levels, you must use the spectrum analyzer to measure power. See the parameter *"TX voice/signal pwr use [0=anz 1=pwrmtr]" on page 194*.”

TX peak voice limit step

This parameter sets the audio frequency step size for the transmitter peak deviation/limit verification test. The step size can be in the range 1 to 200 Hz.

TX voice/signal pwr use [0=anz 1=pwrmtr]

This parameter controls whether the Test Set spectrum analyzer or power meter will be used to measure the base station RF power output. Use the following criteria to determine your choice:

- If there are multiple high-level signals present, you must make the measurement with a spectrum analyzer.
- For the most accurate measurement of one high-level signal, you should use the power meter.
- If you are using the In-Service Optimization mode, you should use the spectrum analyzer.
- If you are testing in the MANUAL mode, you should use the power meter.

You must verify that adequate power is applied to the Test Set RF IN/OUT connector if you are using the power meter. The power applied must be greater than 17 dBm.

Calibration and testing must be performed with the same instrument, either power meter or spectrum analyzer.

ZZZZ test mode [0=normal 1=demo]

This parameter controls whether the Test Software will disable base station communications and allow its use in training or demonstration operations. It affects tests that do not require communication with the base station. Make certain that you set it to **0** if you wish to perform tests. If it is set to **1**, training or demonstration can take place and dummy values for test results will be displayed.

If this parameter is set to **1**, and you initiate a TEST, the Test Software will display the following message in large type:

```
RUNNING IN DEMO MODE.
RESULTS WILL BE INVALID.
PRESS CONTINUE TO PROCEED.
```

If the Test Software displays this message, and you wish to operate the system in demo mode, press **Continue**. If the Test Software displays this message, but you wish to make actual measurements, press **Stop** to stop the TEST, re-set the parameter to **0**, and start the TEST again.

7

Pass/Fail Limits (Specifications) - Reference

Pass/Fail Limits, or specifications, are values that the Test Software uses to determine the pass/fail status of a test. The default values included in the Test Software for pass/fail limits have been derived from EIA and Motorola specifications.

Change pass/fail limits by selecting **Spec Pass/Fail Limits** from the **CUSTOMIZE TEST PROCEDURE:** menu in the TESTS (Main Menu) screen. The Test Software will display the TESTS (Pass/Fail Limits) screen. Under **Spec#**, select the pass/fail limit that you wish to change. Under **Lower Limit** or **Upper Limit**, select the field for the value that you wish to change and enter the new value using the DATA keypad. Press ENTER to complete the entry.

Pass/Fail Limits may be secured. *See "Securing a Procedure," in chapter 3, on page 95*.

See "Entering Parameters, Pass/Fail Limits, and External Device Configuration," in chapter 3, on page 99.

The first few capital letters in the title of each parameter indicate the general subjects to which the pass/fail limit pertains. These are:

RDM=Reference Distribution Module

RX=Receiver

TX=Transmitter

Pass/Fail Limit (Specification) Descriptions

RDM frequency error (Hz)

This pass/fail limit sets the acceptable frequency error caused by the RDM or URDM 3-MHz reference signal. The frequency error displayed is the frequency error of the voice transmitter and voice receiver, not the frequency error referenced to 3 MHz.

RDM output level (volts peak to peak)

This pass/fail limit sets the maximum and minimum levels of the 3-MHz reference signal voltage.

RX audio distortion (percent)

This pass/fail limit sets the maximum acceptable distortion of a 1-kHz rate sine wave after it is output from the receiver.

RX audio output level (dBm)

This pass/fail limit sets the window of acceptable receiver output power that results from an input signal modulated with a standard deviation at a 1-kHz rate. The standard deviation is 2.9 kHz (AMPS) and 1.5 kHz (NAMPS). The receiver output power is based on the voltage applied to a 600-ohm load.

RX audio response dev from -6 dB/oct R1 (dB)

This pass/fail limit sets the acceptable level variation of the audio output compared to the expected response. The frequency response should result in an output level reducing by 6 dB when the audio frequency is doubled. This pass/fail limit sets the deviation, in dB, from this ideal response for audio frequencies in the range of 0.4 to 2.4 kHz. The frequency response is checked from 0.3 to 3 kHz.

RX audio response dev from -6 dB/oct R2 (dB)

This pass/fail limit sets the acceptable level variation of the audio output compared to the expected response. The frequency response should result in an output level reducing by 6 dB when the audio frequency is doubled. This pass/fail limit sets the deviation, in dB, from this ideal response below 0.4 kHz and above 2.4 kHz. The frequency response is checked from 0.3 to 3 kHz.

RX expandor track error <0 dB (dB)

This pass/fail limit increases the output level by 2 dB for every 1-dB increase in input level. This pass/fail limit sets the acceptable deviation from the desired characteristic for levels less than a 2.9 kHz (AMPS) or 1.5 kHz (NAMPS) reference deviation.

RX expandor track error >0 dB (dB) This pass/fail limit increases the output level by 2 dB for every 1-dB increase in input level. This pass/fail limit sets the acceptable deviation from the desired characteristic for levels greater than a 2.9 kHz (AMPS) or 1.5 kHz (NAMPS) reference deviation.

RX hum and noise (dB) This pass/fail limit sets the minimum acceptable ratio of the level of a 1-kHz sine wave output to the level of the noise that is present when the signal generator is not modulated.

RX scan and sig calibration reading (dBm) This pass/fail limit sets the level that the reported RSSI level is compared to during the calibration of a scan or SIG receiver. If the upper and lower limits are set to -90 dBm, the test will fail if there is any offset from -90 dBm. Calibration can then be performed.

RX scan sig linearity error (dB) This pass/fail limit sets the maximum acceptable deviation between the level that the scan or SIG receiver reports and the level applied to the scan receiver by the Test Set, while the linearity test is running.

RX sensitivity with LNA (dBm) This pass/fail limit sets the signal generator level that is applied to an AMPS receiver with a Low Noise Amplifier during SINAD tests.

RX sensitivity without LNA (dBm) This pass/fail limit sets the signal generator level that is applied to an AMPS receiver without a Low Noise Amplifier during SINAD tests.

RX sensitivity without LNA narrow mode (dBm) This pass/fail limit sets the signal generator level that is applied to an NAMPS receiver during SINAD tests.

RX SINAD at sensitivity spec (dB) This pass/fail limit sets the SINAD level used during sensitivity tests. If the measured SINAD is greater than this pass/fail limit, the RX sensitivity test will pass.

TX audio distortion (percent) This pass/fail limit sets the acceptable distortion of the transmitter modulation at a 1-kHz rate.

TX audio response dev from 6 dB/oct (dB)
This pass/fail limit sets the maximum acceptable level variation of the modulation on the transmitter signal compared to the expected response. The frequency response should result in a deviation increasing by 6 dB when the frequency is doubled. This pass/fail limit sets the deviation in dB from this ideal response. The frequency response is checked from 0.3 to 3 kHz.

TX compressor track error <0 dB (dB)
This pass/fail limit increases the output level by 1 dB for every 2-dB increase in input level. This pass/fail limit sets the acceptable deviation from the desired characteristic for levels less than a 2.9 kHz (AMPS) or 1.5 kHz (NAMPS) reference deviation.

TX compressor track error >0 dB (dB)
This pass/fail limit increases the output level by 1 dB for every 2-dB increase in input level. This pass/fail limit sets the acceptable deviation from the desired characteristic for levels greater than a 2.9 kHz (AMPS) or 1.5 kHz (NAMPS) reference deviation.

TX data deviation (kHz)
This pass/fail limit sets the maximum and minimum acceptable peak frequency deviation of the wideband data signal.

TX DSAT deviation (Hz)
This pass/fail limit sets the maximum and minimum acceptable peak frequency deviation of the DSAT signal in an NAMPS transmitter.

TX FM hum and noise (dB)
This pass/fail limit sets the minimum acceptable ratio of the level of a 1-kHz tone, modulated on the transmitter, to the level of the noise that is present when the transmitter is not modulated.

TX frequency error (ppm)
This pass/fail limit sets the acceptable ratio, in parts per million (ppm), of the difference between the measured and assigned transmitter frequencies, to the assigned transmitter frequency. The error will usually be contributed by the RDM or URDM.

TX loopback level (dBm)
This pass/fail limit sets the acceptable level at the RCV line output when the Average Voice Level is applied to the TX line input during the loopback test.

TX output power error at level 0 (percent)
This pass/fail limit sets the acceptable difference in the measured power level of a voice transmitter and the nominal output power at level 0. The nominal output power is entered into the Test Software as a parameter.

TX output power error at level 1 (percent)	Same as above, at power level 1.
TX output power error at level 2 (percent)	Same as above, at power level 2.
TX output power error at level 3 (percent)	Same as above, at power level 3.
TX output power error at level 4 (percent)	Same as above, at power level 4.
TX output power error at level 5 (percent)	Same as above, at power level 5.
TX output power error at level 6 (percent)	Same as above, at power level 6.
TX output power error at level 7 (percent)	Same as above, at power level 7.
TX output power error for signaling unit (percent)	This pass/fail limit sets the maximum acceptable difference in the measured power level of a signaling transmitter and the nominal output power. The nominal output power is entered into the Test Software as a parameter.
TX SAT deviation (kHz)	This pass/fail limit sets the maximum and minimum acceptable frequency deviation of the SAT.
TX SAT frequency error (Hz)	This pass/fail limit sets the maximum acceptable error of the 5970-Hz, 6000-Hz, or 6030-Hz Supervisory Audio Tones.

TX test point JK output (dBm)
This pass/fail limit sets the maximum and minimum acceptable TX TEST JK audio power calculated into a 600-ohm load.

TX voice deviation (kHz)
This pass/fail limit sets the maximum and minimum acceptable peak frequency deviation that results when the AVL voltage is applied to an AMPS transmitter. The modulation signal is a 1-kHz tone.

TX voice deviation narrow mode (kHz)
This pass/fail limit sets the maximum and minimum acceptable peak frequency deviation that results when the AVL voltage is applied to an NAMPS transmitter. The modulation signal is a 1-kHz tone.

TX voice limiting deviation (kHz)
This pass/fail limit sets the maximum acceptable frequency deviation of an AMPS transmitter caused by a high-level modulating signal.

TX voice limiting deviation narrow mode (kHz)
This pass/fail limit sets the maximum acceptable frequency deviation of an NAMPS transmitter caused by a high level modulating signal.

8

Problem Solving

This chapter contains problem modules that list alphabetically the location of potential problems, each with a brief symptom (for example, Test Set Doesn't Power Up). Each problem module describes possible causes and corrections.

If a problem persists, call the HP Factory Hotline from anywhere in the USA or Canada (1-800-922-8920, 8:30 a.m. - 5:00 p.m. Pacific time).

NOTE: If the Test Set displays an error that states "One or more self-tests failed", the cause is a hardware problem. In this case, refer to the Test Set *Assembly Level Repair* manual.

Base Station Control Difficulties

You might see the following message displayed:

```
No RS-232 response from base station. Program stopped.
```

This message is displayed when the Test Software is unable to receive a response after the VER command is sent to the base station. This command is sent in many of the TESTs. It is not sent automatically in “TEST_01 - Laptop Emulator”.

Base station and Test Set baud rates might not match. You can check this by sending an Autobaud command. This command will match the baud rate of the base station to that of the Test Set. If the base station has been recently connected to a PC or other RS-232 source, the baud rate might have changed. *See "TEST_01 - Laptop Emulator," in chapter 5, on page 149*.

Check that the RS-232 and RJ-11 receive and transmit lines are properly wired and that the RS-232 Data Terminal Ready line, if used, is of the proper polarity. Verify that the jumper between pins 8 and 20 is properly installed. *See "Connection for RS-232 Base Station Control," in chapter 3, on page 75*.

Data-Collection Function Does Not Work

❒ Check that you have **DATA C** entered in the TESTS (External Devices) screen.

1. Press TESTS.
2. From the **SET UP TEST SET:** menu, select **Cnfg External Devices**.
3. Move the cursor to the **Calling Name** field, press the cursor control knob and enter:

   DATA C

❒ Check the **Model** field, which should remain empty because it is not used.

❒ Check the **Addr** (address) field to make certain that the correct address is entered for the location in which the data are to be stored.

1. If data are to be stored on an SRAM card, enter 1 into the Addr field.
2. If data are to be stored on an external computer through the Test Set RS-232 serial port (if available), enter 9 into the Addr field.
3. If data are to be stored on an external disk drive over HP-IB, enter an address of 700 or greater into the Addr field.

❒ Check the Options field to make certain that it is correctly set up:

1. **For an external disk drive (LIF format) or an SRAM card:**
   - **a.** Enter ASCII for saving data as an ASCII file.
   - **b.** Enter BDAT for saving data as a Binary-Data file.
   - **c.** As an option, you may enter REC=xxx, where xxx is the number of records for each file. (The Test Software defaults to 80 records. However, if too small a record size is used, there will be an “End of file error” when the test is run.)
2. **For a DOS disk drive, you may leave the Options field empty, or you may enter any of the following key words**:
   - **a.** Enter ASCII for saving data as an ASCII file.
   - **b.** Enter BDAT for saving data as a Binary-Data file.
   - **c.** Enter REC=xxx for the file record size, where xxx is the number of records for each file. (The Test Software defaults to 80 records. However, DOS systems automatically change record size if it is too small.)
   - **d.** Enter a (dot extension) of 3 characters or less for the file name. For example, all model ABCD radios tested may be organized to have a “.ABC” file extension.

❒ Check the Test Set to make certain that it is in the controller mode if you are using an external disk drive.

1. In the **`To Screen`** menu, under **`More`**, select **`IO CONFIG`** to access the I/O CONFIGURE screen.
2. Under **`Mode`**, select **`Control`**.

NOTE:

When you are prompted to enter a file name for the file in which data are to be stored, the protocol for the mass-storage device being used must be followed.

Hierarchical directory paths are not allowed, and all files are created with "**`FORMAT ON`**".

Also, when initializing a disk, use the following format ("**`7xx`**" is the disk address, "**`y`**" is the device selector):

DOS disk: `INITIALIZE "DOS:CS80,7xx,y"`
LIF disk: `INITIALIZE ":,7xx,y"`

Exiting the Program

It is possible to pause the Test Software (by pressing CANCEL), display a screen other than TESTS (IBASIC Controller), return to the TESTS screen, and press the USER **`Continue`** user key to proceed with a TEST. However, there is a very good possibility that these actions will affect subsequent program operation adversely. Error messages might be displayed.

Carefully determine the effect of the changes that you make while a program is paused. You might be required to rerun the program to undo the effect of the changes.

If you exit the program to a screen other than RX TEST or TX TEST, the settings necessary to resume testing will be retained. Selecting the RX TEST or TX TEST screen causes the Test Software to modify signal paths internal to the Test Set. Avoid pressing the RX and TX keys.

After you have made the desired manual settings, press the DUPLEX key as a last step before continuing operation of the Test Software. This will cause the Test Set to be set up properly.

Another way to exit safely is to:

1. Press CANCEL.
2. Press DUPLEX.
3. Press SHIFT SAVE.
4. Enter a register name or number.
5. Select **`Done`**.
6. Operate the Test Set manually.
7. Press RECALL.
8. Select the name of the saved setup.
9. Press TESTS.
10. Press k2 (**`Continue`**).

It might be necessary to use TEST_01 to send commands to the base station controller if it is not responding after you have exited the program.

You should, with few exceptions, exit the program by pressing CANCEL. When you do this, the Test Software will be in a state in which it is ready to run. When you subsequently press USER **`Run Test`**, the Test Software will start running sooner. If the Test Software is in an input/output state, it might not immediately respond to the CANCEL key. A timeout will occur in approximately ten seconds. If the program is paused waiting for a value to be entered, try to enter a value so that the program can be paused with the CANCEL key.

If the Test Software will not pause within a short time after you press CANCEL, you can stop the program by pressing SHIFT then CANCEL.

If you exit the program by pressing CANCEL, and then change specifications, parameters, or configuration, the new values might not be recognized by the Test Software after you press USER **`Continue`**. Start the program over again to ensure that your changes are implemented.

Equipment Control

Verify that you have made the correct entries to the TESTS (External Devices) screen if you are using a switch/splitter or other external equipment. If you are using the radio interface card to control a switch, verify that the option is installed and properly connected to the external switches. Check the connections to the Test Set DB- 37 connector.*See "Serial Port Configuration," in chapter 3, on page 109* and *"Radio Interface Connections" on page 79*.

Memory Space Problems

The program uses a substantial amount of the Test Set RAM space. If the Test Software displays a message that indicates a memory problem, check the memory space that has been used.

To determine the memory space used:

1. Load the program, if it is not already loaded, by pressing k1(**`Run Test`**) and waiting for the program display to appear.
2. Press SHIFT CANCEL to stop the program.
3. Press DUPLEX to exit the TESTS (Main Menu) screen.
4. Press SHIFT SAVE.
5. Read the number to the left of **`free memory`**.

If this number is a few percent or less, the Test Software might display an error message after you have saved additional set-ups to SAVE registers.

If sufficient memory space is not available, you might be required to delete unnecessary save registers.

To delete save_recall registers:

1. Press DUPLEX.
2. Press RECALL.
3. Press ON/OFF to clear register.
4. Press the ON/OFF button again to answer **YES**.

Printing Problems

- ❒ Check that the printer is turned on.
- ❒ Check that the HP-IB, parallel, or serial cable from the Test Set to the printer is connected.

If you have firmware below revision A.14.00:

1. Press TESTS.
2. Check that the printer was selected as the **`Output Results To:`**.
3. Check that the Test Set is correctly configured for HP-IB, parallel, or serial printing:

   For an HP-IB printer:

   a. Check that the printer Calling Name is “PRINTER” and its address is correctly set up in the TESTS (External Devices) screen.

   b. Check that the I/O CONFIGURE screen has been set up correctly:

   i. Mode = Control

   ii. Print To = HP-IB

   iii. Print Adrs = address of your printer

   For a parallel printer:

   a. Check that the printer Calling Name is PRINTER and its address is set to 15 in the TESTS (External Devices) screen.

   For a serial printer:

   a. Check that the printer Calling Name is PRINTER and its address is set to **9** in the TESTS (External Devices) screen.

Refer to the Test Set *User’s Guide* for details about configuring the printer.

Test Results are Unexpected

If one or more tests fail unexpectedly, or you believe there is a problem with the way tests are running, check the settings that are used for the tests.

1. Press TESTS.
2. From the **`SET UP TEST SET:`** menu, select **`Exec Execution Cond`** (firmware above rev A.14.00 only).
3. Under **`Test Procedure Run Mode`**, select **`Single Step`**.
   a. Run the test.
   b. When the message **`Press continue when ready`** is displayed in the top line of the IBASIC controller tests screen, press CANCEL to pause the IBASIC program.
4. From the **`To Screen`** menu, select the desired instrument screen.
5. After viewing the instrument settings, press PREV to return to the TESTS screen.

NOTE: Do not alter the instrument settings. The IBASIC program will not re-configure the settings when continue is executed. You may alter settings to experiment with the measurement, but those must be returned to the initial settings before leaving the instrument screen.

6. Press k2 (**`Continue`**) to return to the IBASIC controller.
7. Press k2 (**`Continue`**) to continue the program.

Test Set Doesn’t Power Up

Check the AC or DC power connection and the setting of the AC/DC switch on the rear panel. See the Test Set *User’s Guide*.

Unstable SINAD Readings

If readings of SINAD are unstable, the measurement might be affected by a signal from an antenna. Co-channel or other interference can be detected by turning up the speaker volume of the Test Set. The signal might be the result of a problem in the frequency plan. If it is impossible to proceed with the measurements, the RF coupler port connected to the antenna cable must be disconnected and terminated with a 50-ohm load.

SINAD readings might appear to be unstable because of normal fluctuations in the readings. If you are making SINAD measurements manually, see “Averaging Measurements” in the *Test Set User’s Guide*.

A

Appendix: Using the HP 3488A Switch/ Control Unit

If you choose to use an HP 3488A Switch/Control Unit, two Option 15/HP 44476A Microwave Switch Units must be installed.

Five SPDT switches are used to select the RX antenna RF coupler port that is to be connected to the Test Set. The remaining SPDT switch selects either the TEST JK or the terminated EQUIP RCV of the base station receiver to be connected to the Test Set AUDIO IN.

Use short jumper cables to connect the switches into an arrangement described in *figure 16, "HP 3488A Cabling," on page 221*. The jumpers are shown as bolder lines in the figure. The first number in the switch identifier refers to the rear-panel row in which the switch is located. The second two numbers refer to the switch column. For example, switch 201 is the middle switch in the second row of switches.

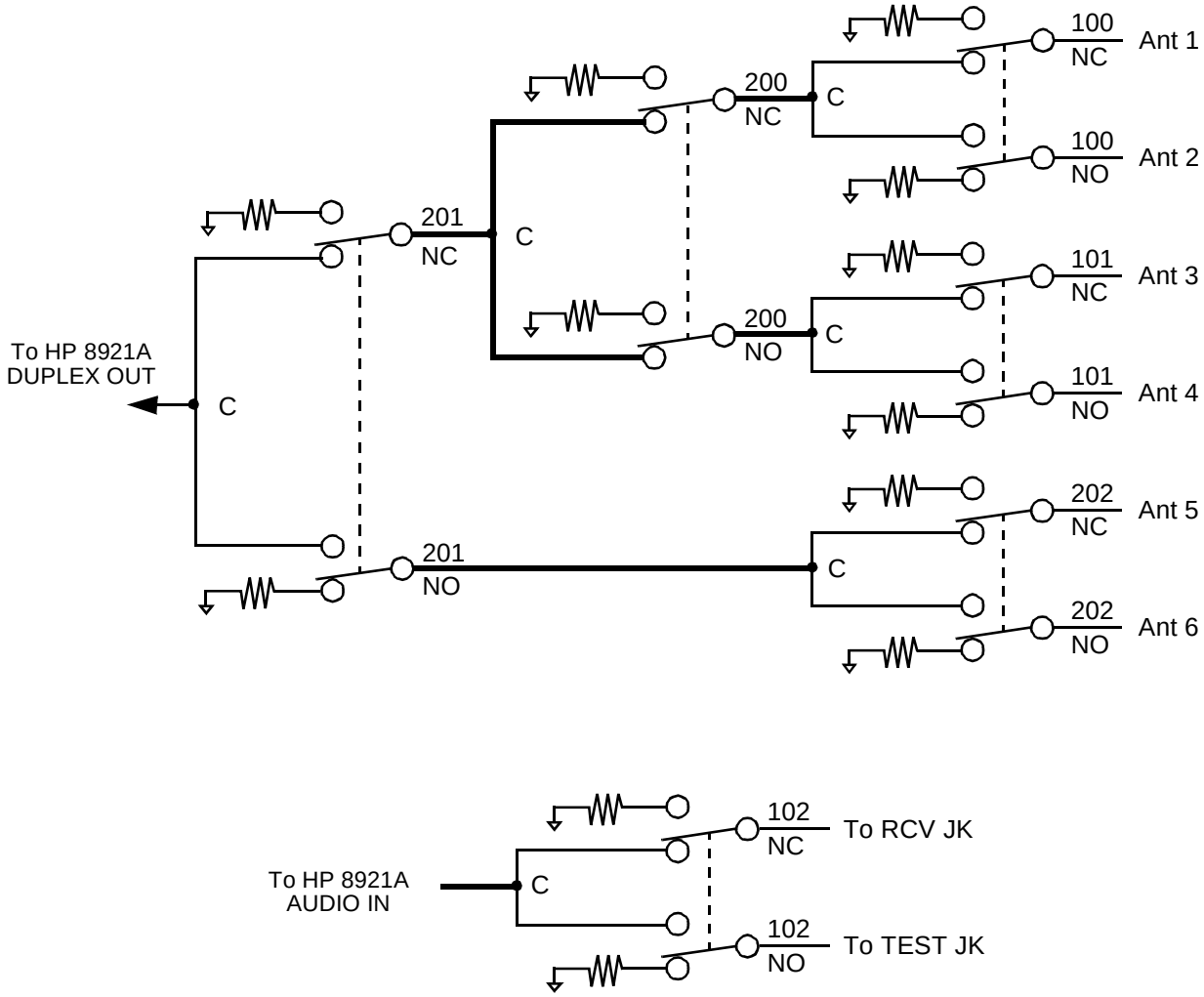


Figure 16 **HP 3488A Cabling**

B

Appendix: Test Set Measurement Settings

This appendix contains some of the Test Set settings made by the Test Software. Many settings are determined by EIA standards and Motorola recommended procedures. This appendix does not cover all of the Test Set settings required by these standards or procedures. It includes Test Set settings that are useful to know when manually performing methods of measurement described in the standards or procedures. This appendix is intended to be used with EIA and Motorola methods of measurement.

The types of settings are listed below:

- Filter choices
- Audio level detectors used
- Frequency counter gate times
- Spectrum analyzer sweep conditions and display resolution

Test Set settings are not made in “TEST_01 - Laptop Emulator” and “TEST_11 - Test Menu”. “TEST_08 -Manual Switch and Calibration Aid” and “TEST_09 - Calculate Transmitter Power” do not use Test Set measurement hardware.

TEST_02 - URDM or RDM Frequency/Level

The following settings are used for the tests:

URDM (or RDM) #1/#2 frequency error

Frequency measurement gate time = 1 s

URDM (or RDM) #1/#2 level

Spectrum analyzer center frequency = 3 MHz

Spectrum analyzer span = 50 kHz

Spectrum analyzer display resolution = 2 dB/div

TEST_03 - Voice Transceiver

The following settings are used for the tests:

RX audio output (with adjustment)

Filter 1: C-Message

Filter 2: > 99-kHz low pass filter

Detector: RMS

Audio In Lo: 600 ohms to Hi

RX SINAD for each antenna

Filter 1: C-Message

Filter 2: > 99-kHz low pass filter

Detector: RMS

Audio In Lo: 600 ohms to Hi

RX audio distortion (extended test)

Filter 1: C-Message

Filter 2: > 99-kHz low pass filter

Detector: RMS

Audio In Lo: 600 ohms to Hi

RX hum and noise (extended test)

Filter 1: C-Message

Filter 2: > 99-kHz low pass filter

Detector: RMS

Audio In Lo: 600 ohms to Hi

RX expandor response (extended test)

Filter 1: C-Message

Filter 2: > 99-kHz low pass filter

Detector: RMS

Audio In Lo: 600 ohms to Hi

RX audio response (extended test)

Filter 1: 50-Hz high pass filter

Filter 2: 15-kHz low pass filter

Detector: RMS

Audio In Lo: 600 ohms to Hi

RX signal SAT/DSAT

Filter and detector settings are not required for this test.

RX no signal SAT/DSAT

Filter and detector settings are not required for this test.

RX signal ST/DST detect

Filter and detector settings are not required for this test.

RX no signal ST/DST detect

Filter and detector settings are not required for this test.

TX frequency error

Frequency measurement gate time = 0.5 s

TX power @ level 0 (with adjustment)

The power meter or the spectrum analyzer may be used. See the parameter *"TX voice/ signal pwr use [0=anz 1=pwrmtr]" on page 194*.

If using the spectrum analyzer: Span = 50 kHz; Resolution = 2 dB/div.

TX SAT frequency error

Filter 1: 300-Hz high pass filter

Filter 2: 15-kHz low pass filter

Audio frequency gate time = 1 s

IF filter: 30 kHz

TX SAT/DSAT peak deviation (with adjustment)

Filter 1: 300-Hz high pass filter (SAT)

Filter 2: 15-kHz low pass filter (SAT)

Filter 1: < 20-Hz high pass filter (DSAT)

Filter 2: 300-Hz low pass filter (DSAT)

Detector: RMS corrected to peak (SAT)

Detector (adjustment): RMS corrected to peak (SAT)

Detector (adjustment): Peak+/- max (DSAT)

Decoder: DSAT

TX TEST JACK output (with adjustment)

Filter 1: 300-Hz high pass filter

Filter 2: 3-kHz low pass filter

Detector: RMS

Audio In LO: Float

TX/RX loopback

Filter 1: C-Message

Filter 2: >99-kHz low pass filter

Detector: RMS

Audio In LO: Float

TX peak voice limiting (with adjustment)

Filter 1: <20-Hz high pass filter

Filter 2: >99-kHz low pass filter

Detectors: Peak+, Peak–

Detector (adjustment): Peak+/– max

IF filter: 30 kHz

TX voice deviation (with adjustment)

Filter 1: 300-Hz high pass filter

Filter 2: 3-kHz low pass filter

Detectors: Peak+, Peak–

Detector (adjustment): Peak+/– max

IF filter: 30 kHz

TX audio distortion (extended test)

Filter 1: C-Message filter

Filter 2: >99-kHz low pass filter

De-emphasis: 750 µs

Detectors: RMS

IF filter: 30 kHz

TX hum and noise (extended test)

Filter 1: C-Message filter

Filter 2: >99-kHz low pass filter

De-emphasis: 750 µs

Detector: RMS

IF filter: 30 kHz

TX compandor track error (extended test)

Filter 1: C-Message filter

Filter 2: >99 kHz low pass filter

Detector: RMS

IF filter: 30 kHz

TX audio frequency response (extended test)

Filter 1: 50-Hz high pass filter

Filter 2: 15-kHz low pass filter

Detector: RMS

IF filter: 30 kHz

TX peak data deviation (in MANUAL mode)(with adjustment)

Filter 1: <20-Hz high pass filter

Filter 2: >99-kHz low pass filter

Detectors: Peak+, Peak–

IF filter: 230 kHz

TEST_04 - Signaling Transceiver MANUAL Mode

The following settings are used for the tests.

TX frequency error

Frequency measurement gate time 1 =s

TX power (with adjustment)

The power meter or the spectrum analyzer may be used. See the parameter *"TX voice/ signal pwr use [0=anz 1=pwrmtr]" on page 194*.

If using the spectrum analyzer: Span = 2 MHz; Resolution = 2 dB/div.

TX data deviation (with adjustment)

Filter 1: <20-Hz high pass filter

Filter 2: >99-kHz low pass filter

Detectors: Peak+, Peak–

Detector (adjustment): Peak+/– max

IF filter: 230 kHz

RX SINAD

Filter 1: C-Message

Filter 2: >99-kHz low pass filter

Detector: RMS

Audio In Lo: 600 ohm to Hi

RX SSI calibration and linearity

Filter and detector settings are not required for this test.

TEST_05 - Scanning Receiver MANUAL Mode

The following settings are used for the tests.

RX scan sensitivity for each antenna

Filter 1: C-Message

Filter 2: >99-kHz low pass filter

Detector: RMS

Audio In Lo: 600 ohms to Hi

RX SAT/DSAT detect

Filter and detector settings are not required for this test.

RX SSI calibration and linearity

Filter and detector settings are not required for this test.

TEST_06 - Combiner Adjustment

The following settings are used for the test:

TX power with adjustment

The power meter or the spectrum analyzer may be used. See the parameter *"TX voice/ signal pwr use [0=anz 1=pwrmtr]" on page 194*.

If using the spectrum analyzer and a signaling channel: Span = 2 MHz, Resolution = 2 dB/div.

If using spectrum analyzer and a voice channel: Span = 50 kHz, Resolution = 2 dB/div.

TEST_07 - Wideband Data on Active Voice Channel

The following settings are used in the test:

Wideband data deviation on the selected voice channel

Filter 1: <20-Hz high pass filter

Filter 2: >99-kHz low pass filter

Detectors: Peak+/– max hold

IF filter: 30 kHz

TEST_08 -Manual Switch and Calibration Aid

This TEST does not use Test Set measurement hardware.

TEST_09 - Calculate Transmitter Power

This TEST does not use Test Set measurement hardware.

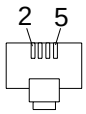
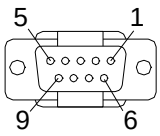
TEST_10 - Voice Channel Manual Test Mode

Filter and detector settings made in this TEST are the same as those made in "TEST_03 - Voice Transceiver." See the measurement settings for that TEST.

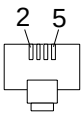
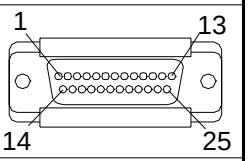
Appendix: Cable Wiring Diagrams for Data Collection to PC and Printer

The HP 11807B Option 040 Test Software uses various cables when tests are run. So that you may construct new cables, the following diagrams show pin connections for appropriate PC and printer interface cables. Refer to *chapter 3, "Setting Up," on page 69* for the purposes of the cables.

PC

RJ11 (M) to DB9 (F) 08921-61038	
	
From	To
5	2
4	5
3	NC
2	3
	*7 to 8
	*1 to 4 to 6

Printer

RJ11 (M) to DB25 (M) 08921-61039	
	
From	To
5	3
4	7
3	NC
2	2
	*4 to 5
	*6 to 8 to 20

* indicates jumpered connection

Glossary

AMPS Advanced Mobile Phone Service - The cellular system in use on the North American continent and on other continents.

AVL Average Voice Level - A standard audio voltage used to set the level of the signal applied to modules in the cell site. It is expressed in dBm into a 600 Ω load.

BSC Base Site Controller - A set of modules including the Voice Channel Controller, Signaling Channel Controller, Cell Site Controller, and Extended Multiple Port Interface. It is the interface between the cell site and the Electronic Mobile Exchange.

choose This word is used in step by step procedures in this manual. It refers to the steps of turning and pressing the knob to pick an item from a list of choices. Choices are displayed in the lower right corner of the CRT display.

CSC Cell Site Controller - The module that controls the cell site and interfaces with the main Electronic Mobile Exchange. A serial interface port communicates with the Test Set.

DSAT Digital Supervisory Audio Tone - A sub-audible data signal that frequency modulates an NAMPS cell site voice channel transmitter. The signal is transponded by the mobile station and is used to help determine RF path integrity.

DST Digital Signaling Tone - A sub-audible data signal that frequency modulates an NAMPS cell site voice channel transmitter. The signal is sent by the mobile to the base station when certain signaling operations must occur.

ESD ElectroStatic Discharge - A transfer of electric charge from one place to another. Devices can be damaged by the energy transferred during the discharge.

field An area on the CRT with an inverse video display where entries can be made.

FOCC FOrward Control Channel - The method by which data is transferred from a base station to a mobile station when the mobile station receiver frequency is set to a control, paging, or access channel. The base station transmitter is frequency modulated by a 10 kbit/s data stream.

FVC Forward Voice Channel - The method by which data is transferred from a base station to a mobile station when the mobile station receiver frequency is set to a voice channel. The base station transmitter is frequency modulated by a 10 kbit/s data stream.

GN Abbreviation for General. GN appears in some parameter titles in the software and indicates that the parameter relates to the general system, as opposed to a transmitter (TX) or receiver (RX).

Help A feature providing specific information about how to use the current screen in the TESTS environment. This feature is accessed by pressing k4 Help from any TEST screen. Note: this feature is only available in the HP 8921A,D firmware above revision A.14.00.

HELP A feature providing additional test set information accessed by pressing SHIFT, then TX (HELP) keys.

IBASIC Instrument BASIC. A computer language, derived from HP BASIC, used in the HP 8920A, HP 8921A and other Hewlett-Packard instruments. Programs written in IBASIC run on the computer in the instrument.

JK Abbreviation for jack.

Library A collection of the names of all of the parameters, specifications, and TESTs in the test software. The test software and the Test Set firmware use the Library, test software program code file, and a Procedure to run a customized application program. A Library is stored as a file on a memory card or other mass storage with its associated procedure files.

Main Menu The screen accessed by pressing the TESTS key, or k5 Main Menu. It is used to customize and execute (run) automated testing.

Also referred to as the “TESTS” screen.

MAN MANUAL - An operation mode of the base station characterized by equipment being taken out of service.

MTTY Maintenance TeleTYpe - The terminal or terminal emulator that is used to transfer data to and from a Cell Site Controller. The Test Set performs the functions of the MTTY in the software described in this manual. MTTY is also used to label the connector on some external terminals.

NAMPS Narrow (band) Advanced Mobile Phone Service - A mobile telephone system that provides greater capacity than the AMPS system by reducing the voice channel spacing to 10 kHz.

OOS Out Of Service - The removal of some or all of a base station from active service.

PA Power Amplifier - The module that amplifies transceiver RF power.

parameters Entries you make for calibration data, cell site characteristics, or test customization. They give you flexibility in the way you use the HP 11807B Option 040 software. Default values for parameters are entered into the software.

pass/fail limits Pass/fail limits are the names of criteria verifying the performance of the unit-under-test. Usually, the associated measurement value must fall within the HI/LO limits of pass/fail values to verify performance of the unit-under-test. Default values in the test software have been derived from standard methods of measurement or from the unit-under-test requirements.

Procedure A Procedure is a collection of parameters, specifications, and a TEST sequence, saved in a file, that customizes the test software to a specific application.

RECC REverse Control Channel - The method by which data is transferred from a mobile station to a base station when the mobile station transmitter frequency is set to a control, paging, or access channel. The mobile station transmitter is frequency modulated by a 10 kbit/s data stream.

RDM Reference Distribution Module - The module that provides frequency reference signals needed by some base station modules.

RSSI Received Signal Strength Indicator - A level in a receiver that corresponds to the signal strength of the incoming signal.

RVC Reverse Voice Channel - The method by which data is transferred from a mobile station to a base station when the mobile station transmitter frequency is set to a voice channel. The mobile station transmitter is frequency modulated by a 10 kbit/s data stream.

SAT Supervisory Audio Tone - A 5970 Hz, 6000 Hz, or 6030 Hz sine-wave signal that frequency modulates an AMPS cell site voice channel transmitter. The signal is transponded by the mobile station and is used to help determine RF path integrity.

SCC Signaling Channel Controller - The module that controls signaling transceivers.

select This word is used in step by step procedures in this manual. It refers to the steps of turning and pressing the knob to locate and highlight, with full inverse video, a field on the CRT display.

sequence The method used in the Test Set to run one or more TESTs in a desired order. A sequence is entered using the TESTS (Edit Sequence) screen.

SIG Signaling unit - A signaling transceiver module.

SINAD Signal plus Noise And Distortion divided by noise and distortion. A measurement result that determines the quality of an audio tone in the presence of noise and distortion. A 12 dB SINAD value is often used when measuring the receiver sensitivity.

softkey The name of the set of keys next to the CRT display that can be assigned to certain special actions or fields. The keys are also called USER keys.

specifications Specifications are values you enter that set passing limits for tests. Default values are in the test software. They have been derived from standard methods of measurement or from Motorola requirements.

SRAM Static Random Access Memory - A data storage device. SRAM memory cards can be used with the Test Set to save programs and test results.

SSI Signal Strength Indicator - SSI is synonymous with Received Signal Strength Indicator (RSSI).

ST Signaling Tone - A 10 kHz tone that the mobile sends to the base station when certain signaling operations must occur.

test Steps within each TEST that make a measurement and compare the results to a specification.

TEST A term to refer to one of the TESTs, TEST_01 through TEST_09, available in the base station test software.

TTY TeleTYpe - Same as MTTY.

TTYMP TeleTYpe Maintenance Port - The RS-232 connector on the base station, through which data is transferred between the Cell Site Controller and the MTTY. In this case, the MTTY is the Test Set.

USER The name of the set of keys next to the CRT display that can be assigned to certain special actions or fields. The keys are also called softkeys.

VOC VOiCe - The module that contains the voice transceiver.

VCC Voice Channel Controller - The module that interfaces with the Base Station Controller to control one or more voice transceivers.

VSWR Voltage Standing Wave Ratio - A ratio that quantifies the level of reflected power that results from the application of forward power to a transmission line. A VSWR of exists on a transmission line terminated in its characteristic impedance.

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