Motorola TACS Cell Site Test Software

HP 11807B Option 050 Software User's Guide

Software Version: B.00.01 and above

HP Part No. 11807-90159
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Rev A

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1

Product Description

About the Software

The HP 11807B Option 050 software is one element of a cellular base station test system. The following items make up the cellular base station test system:

- HP 11807B Option 050 Motorola AMPS/NAMPS Cell Site Test Software,
- HP 8921A Cell Site Test Set
- and accessories:
  - HP 83202A OPT 040 Base Station Accessory Kit
  - or, other switch and interconnect arrangements

This system performs tests that determine 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.

Items Supplied in the Software Package

- HP 11807B Option 050 Cell Site Test Software card, part number HP 11807-10303
- HP 11807B Option 050 Software User's Guide, part number HP 11807-90105
- Software licensing agreement, part number 5180-1566
- 128 Kbyte SRAM memory card for storing customized test programs and results. This card must be initialized, see **"Initializing a Memory Card" on page 133**, part number HP 85702A.
- Cable and adaptor for serial connection to base station
  - 6-Conductor RJ11 (m) — RJ11 (m) cable, part number 08921-61015
  - RJ11 (f) — DB25 (m) adaptor, part number 08921-61016

Cell Site Equipment You Can Test

Using this cellular base station test system, you can test Motorola TACS, ETACS, and UTACS Base Stations. The firmware revision of the base station must be 4.3.2.1 or higher.

Tests of Voice Transceivers, Scan Receivers, Signaling Transceivers, Combiners, Power Amplifiers and Universal Reference Distribution Modules can be performed. Major adjustment procedures are included in the software.

Product Features

The following features simplify testing:

- Base station control commands are automatically sent from the Test Set via the RS-232 interface. Responses from the base station are also displayed.
- When an adjustment is required, the HP 11807B Option 050 software can display the location of the adjustment.
- While adjustments are being made, a large meter display and variable auditory feedback are provided.
- When cable connections need to change, system interconnects are graphically shown on the Test Set CRT display.
- Results of tests and pass/fail indications are displayed on the Test Set CRT, and can be printed, or collected in an HP Palmtop, PC, disk drive or memory card.
- Switches that change the external RF or audio signal paths can be controlled by the software.
- The software allows the operator to change the order of TESTs, pass/fail limits, parameters and external device configurations.
- Base station control commands can be selectively sent as the tests proceed.
- RF path losses can be determined and corrected for.

When Can This Software Be Used?

This 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 cases when it may be advantageous to choose one of the modes. **See "Entering the Order of TESTs," in chapter 4, on page 151**.

Learning to Use the Software

CAUTION: **Before You Make Connections**

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

The following two sections will get you started learning to use the software. The first section, **"Getting Started with FW Above Rev. A.14.00" on page 22**, contains steps to follow if you haven't run software on a Test Set. The next section,**"Learning To Use the Software" on page 46**, describes steps you can follow to continue to learn to use the software.

Getting Started with FW Above Rev. A.14.00

NOTE: The firmware revision A.14.00 in the HP 8921A,D had several enhancements. This section is written to reflect those changes. If the graphics in this section do not match what appears on your test set's screen (8921A,D firmware above revision A.14.00), refer to the next section, **"Getting Started with FW Above Rev. A.14.00" on page 22**. Contact Hewlett-Packard at 1-800-922-8920 for details on upgrading your instrument if desired.

If you haven't run software on a Test Set, the next pages have steps to get you started.

To perform these steps, you will need an HP 8921A Cell Site Test Set and the HP 11807B Option 050 software memory card. If you want to perform the steps with a base station connected, you will need the RS-232 / RJ-11 cable to connect the base station to the Test Set.

The steps will guide you to running **TEST_01 - Laptop Emulator**. Then, steps will show you how to stop TEST_01, and select and run another TEST. The steps on the next pages will show you how to:

- Turn-on and set up the Test Set
- Insert a memory card
- Load and run TEST_01 - RS-232 Laptop Emulator
- Stop TEST_01
- Select and run another TEST

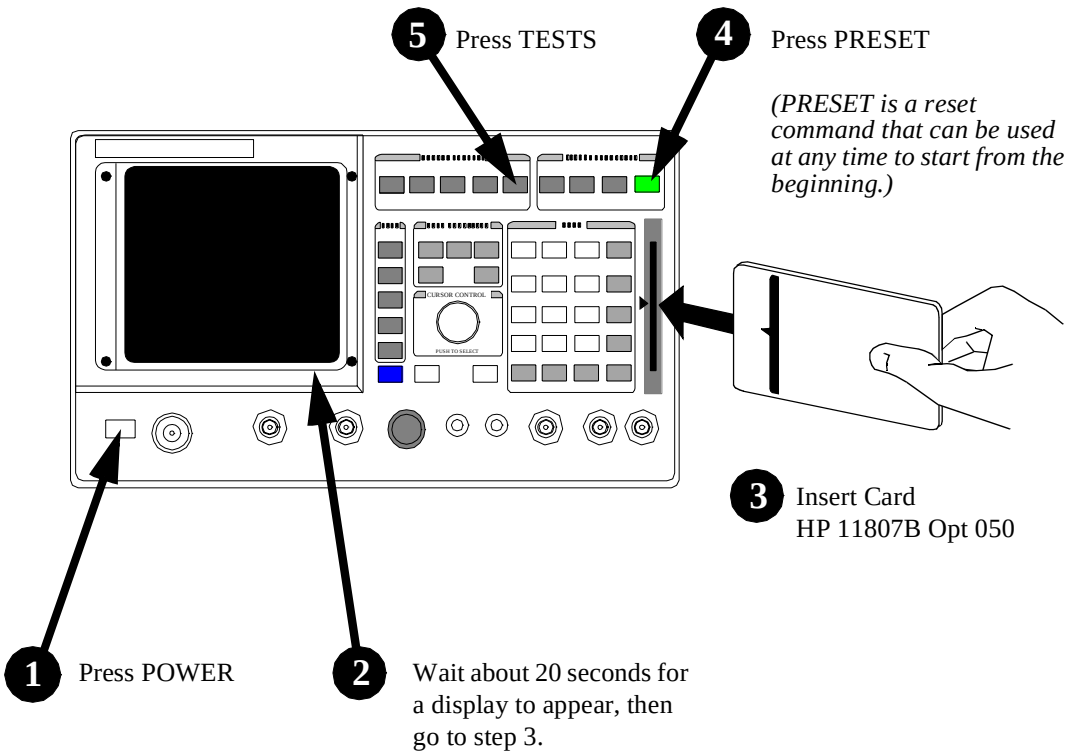
If you want to perform these steps with a base station connected, you must connect the Test Set RJ-11 Serial B port to the TTYMP #8 CSC Network Address Connection. Do this before starting the steps. **See "Connection for RS-232 Base Station Control," in chapter 3, on page 78**.

For a description of TEST_01, see **see "TEST_01 - Laptop Emulator," in chapter 5, on page 165**.

When you are done with these steps, continue with the next section, **"Learning To Use the Software" on page 46**.

To Turn On and Set Up the Test Set:

Do steps 1-5 in numbered order.

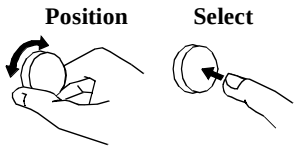


Turn page to list procedures on the memory card

To Select 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**.

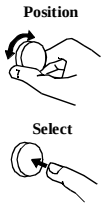
Select Procedure Location:

If previous entries appear disregard them.

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

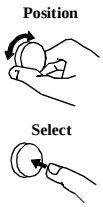
Select Procedure Location:

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:
- TACS_CS

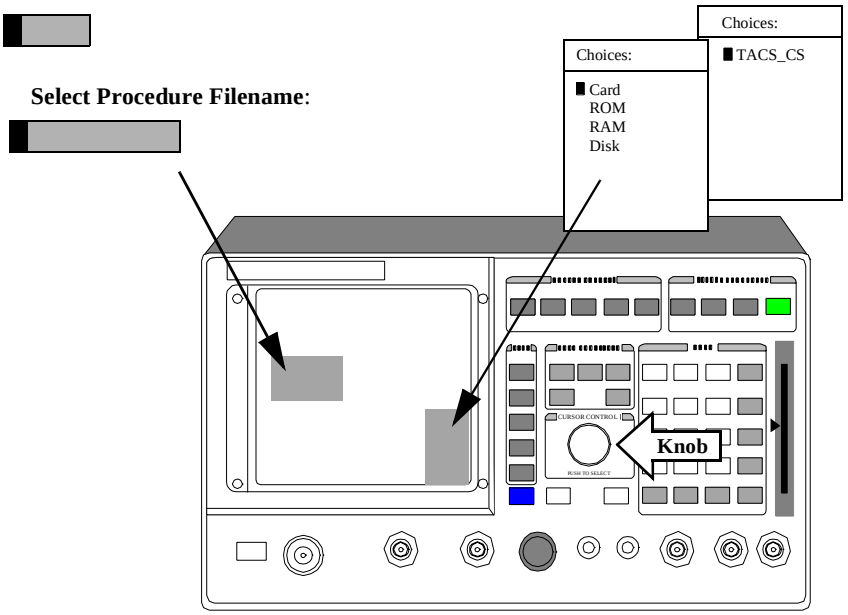
Turn page to load software

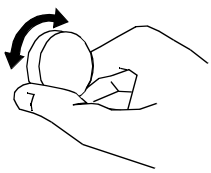
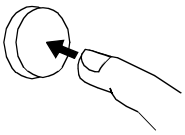
To Select Software Procedure Location: (Continued)

Reference Page

Select Procedure Location:

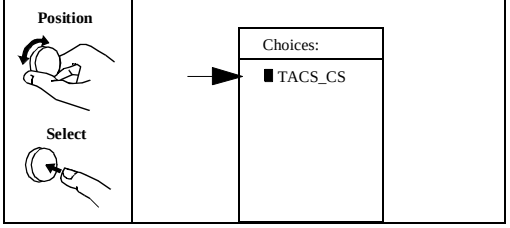
Select Procedure Filename:



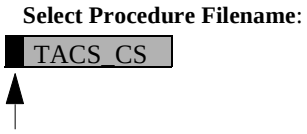
Rotate knob to position cursor.	***Press knob to select a field.***
	

To Load and Run Software:

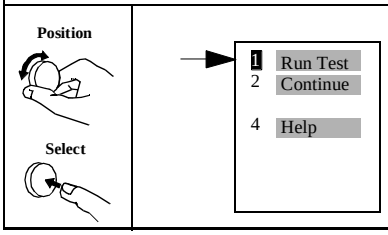
1 Position cursor at **TACS_CS** and select it.



2 Note; TACS_CS is now the selected procedure filename.



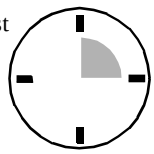
3 Position cursor at **Run Test** and select it.



4 The TACS_CS program is loading.

Loading program first time: 2 min. 30 sec.

After first time: 20 sec.

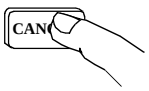


After TACS_CS is loaded, TEST_1 - Laptop Emulator begins running.

If the base station is connected, you should see characters on your display in the box labeled “Base Station Response”. See **"Connection for RS-232 Base Station Control" on page 78**, and **"TEST_01 - Laptop Emulator" on page 165**.

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 Software: (Continued)

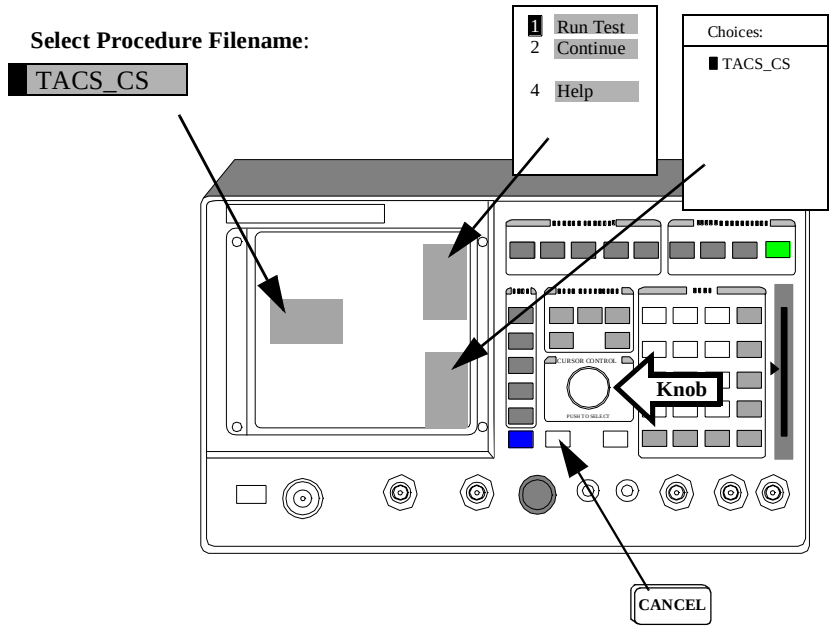
Reference Page

Select Procedure Location:

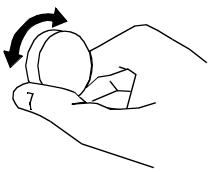
Card

Select Procedure Filename:

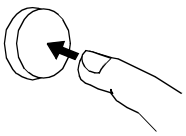
TACS_CS



Rotate knob to position cursor.



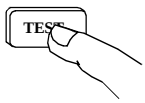
Press knob to select a field.



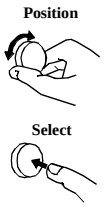
To Change the Order of Tests

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

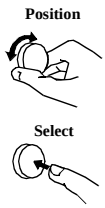
The Order of Tests screen is now present on your CRT.

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.

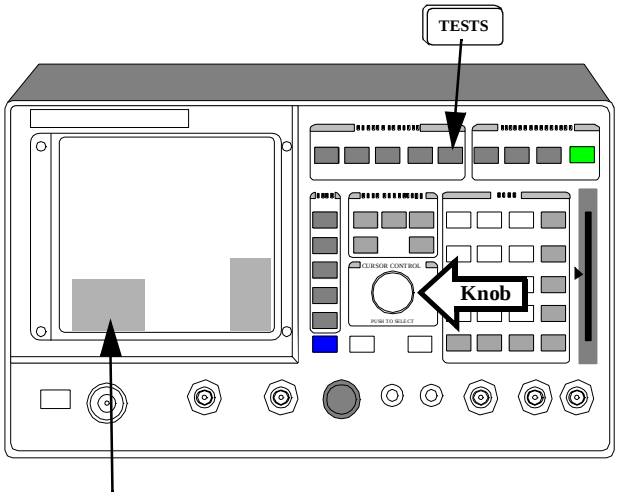
1 TEST_02
URDM or RDM frequency/level

Yes/No

Turn page to select a TEST

To Change the Order of Tests (Continued)

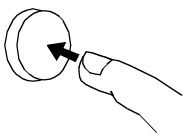
Reference Page



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

Rotate knob to position cursor.

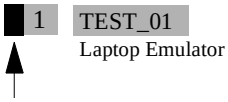
Press knob to select a field.



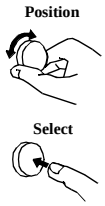
To Select URDM or RDM frequency/level test

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

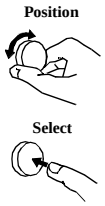
TEST shown is an example only, actual test may be different.

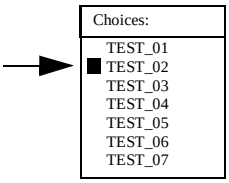


2 Position cursor at **TEST_01** and select it.

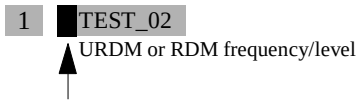


3 Position cursor at **TEST_02** and select it.





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

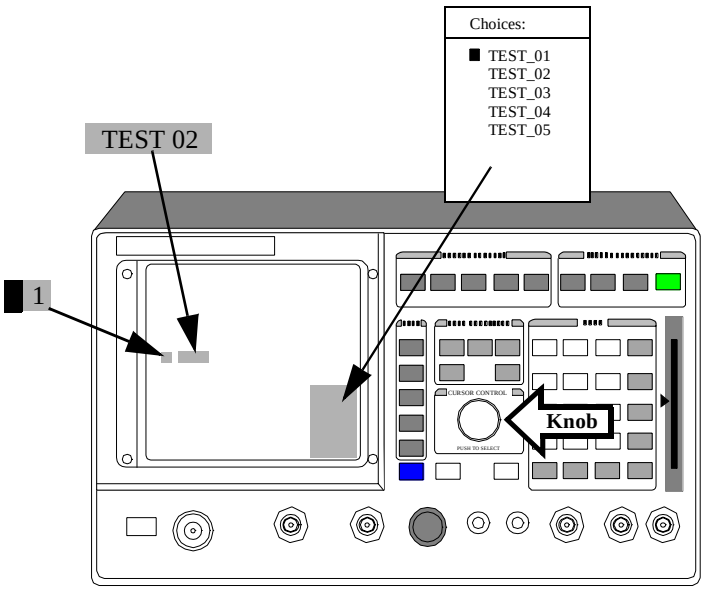


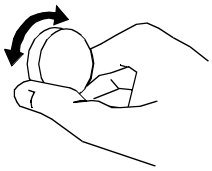
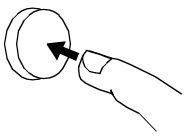
TEST_02 URDM or RDM frequency/ level is now selected and ready to run.

To run TEST_02, turn page

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

Reference Page



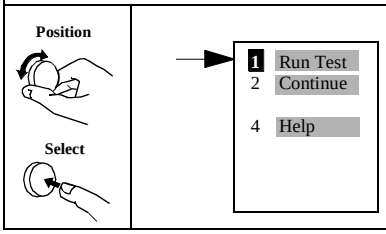
Rotate knob to position cursor.	*Press knob to select a field.*
	

To run TEST_02 URDM or RDM frequency/level:

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

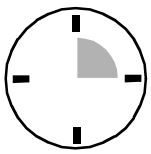
If you are in IBASIC, press SHIFT, CANCEL before pressing TESTS.

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



3 The TEST is loading.

Wait 20 seconds.



TEST_02 begins running.

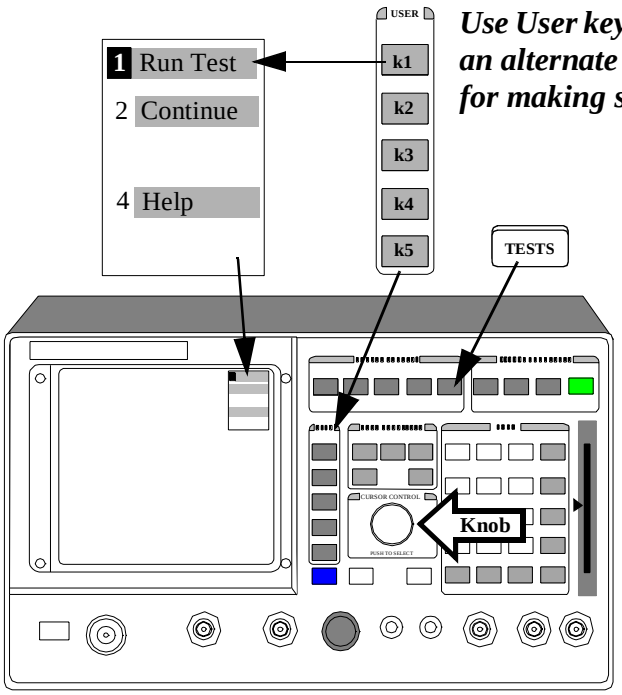
If the Test Set is connected to the base station, see **"TEST_02 - URDM or RDM Frequency/Level" on page 169**.

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.

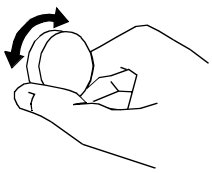
To run TEST_02 URDM or RDM frequency./level: (Continued)

Reference Page

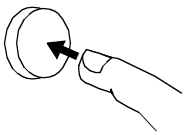


Use User keys k1-k5 as an alternate method for making selections.

Rotate knob to position cursor.



Press knob to select a field.



Getting Started with FW Below Rev. A.14.00

NOTE: The firmware revision A.14.00 in the HP 8921A,D had several enhancements. This section is written to reflect the test environment prior to those changes. If the graphics in this section do not match what appears on your test set's screen (8921A,D firmware below revision A.14.00), refer to the previous section, **"Getting Started with FW Above Rev. A.14.00" on page 22**. Contact Hewlett-Packard at 1-800-922-8920 for details on upgrading your instrument if desired.

If you haven't run software on a Test Set, the next pages have steps to get you started.

To perform these steps, you will need an HP 8921A Cell Site Test Set and the HP 11807B Option 050 software memory card. If you want to perform the steps with a base station connected, you will need the RS-232 / RJ-11 cable to connect the base station to the Test Set.

The steps will guide you to running **TEST_01 - Laptop Emulator**. Then, steps will show you how to stop TEST_01, and select and run another TEST. The steps on the next pages will show you how to:

- Turn-on and set up the Test Set
- Insert a memory card
- Load and run TEST_01 - RS-232 Laptop Emulator
- Stop TEST_01
- Select and run another TEST

If you want 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 78**.

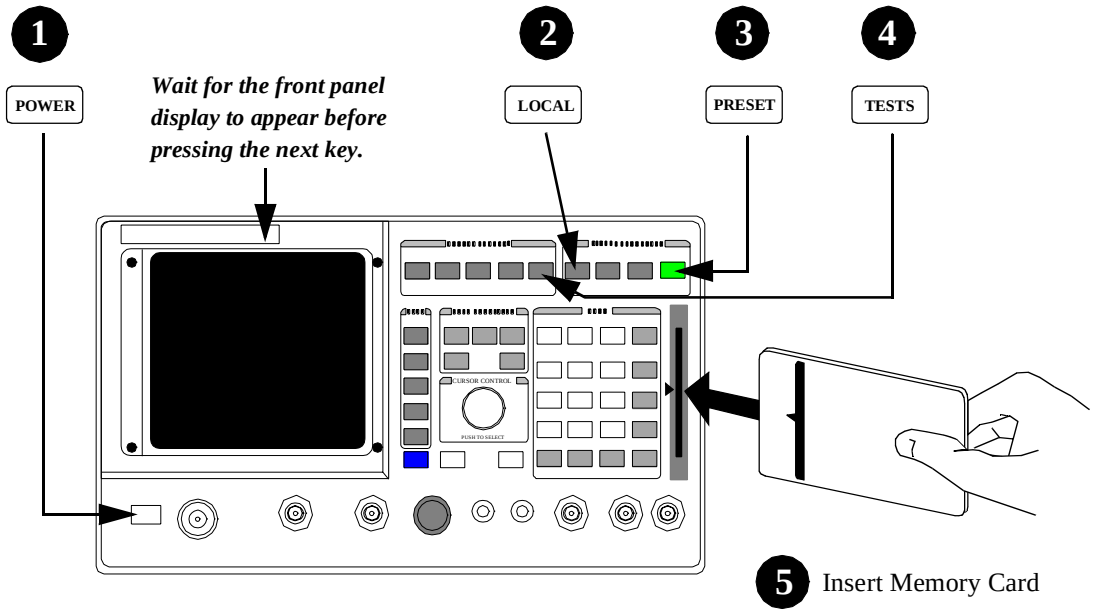
For a description of TEST_01, **See "TEST_01 - Laptop Emulator," in chapter 5, on page 165**.

When you are done with these steps, continue with the next section, **"Learning To Use the Software" on page 46**.

To turn-on and setup the Test Set

To turn-on and setup the Test Set

Perform steps 1 through 5 in numbered order.



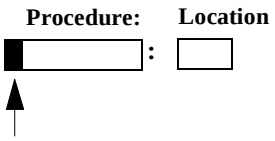
Turn page to load the memory card software

To select the Software Procedure Location:

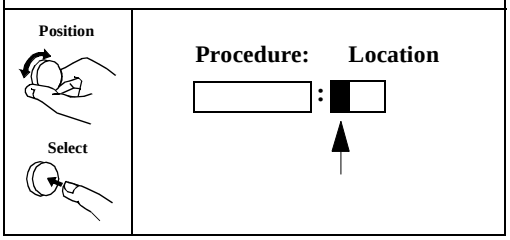
Use figure on opposite page for reference.

To select the Software Procedure Location:

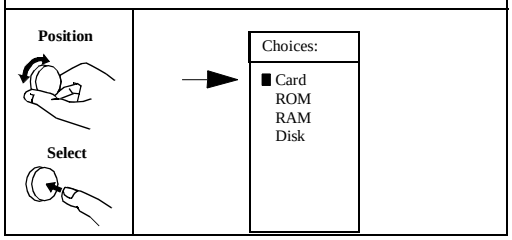
1 Note; location of the highlighted cursor.



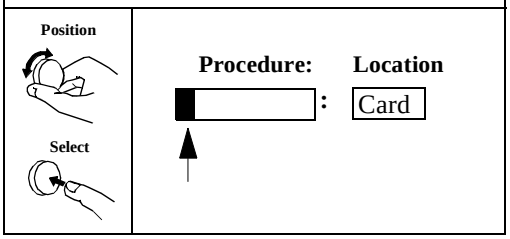
2 Position cursor at **Location** and select it.



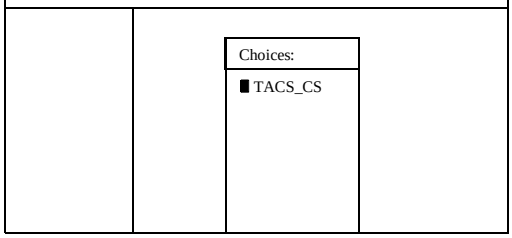
3 Position cursor at **Card** and select it.



4 Position cursor at **Procedure** and select it.



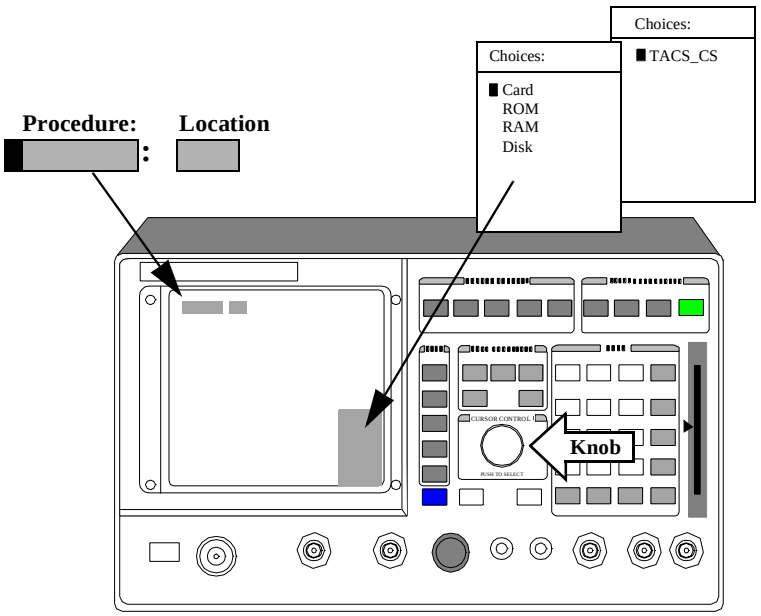
5 The **Choices:** menu is now available to select from.

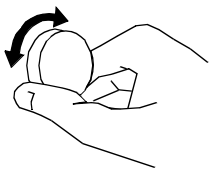
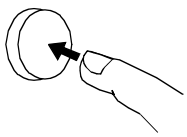


Turn page to select a Procedure from the "Choices" menu

To select the Software Procedure Location: (Continued)

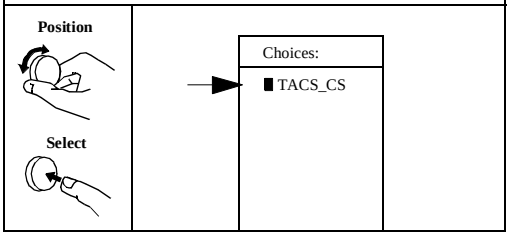
Reference Page



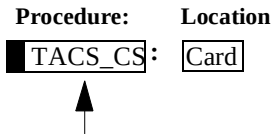
Rotate knob to position cursor.	*Press knob to select a field.*
	

To Load and Run Software:

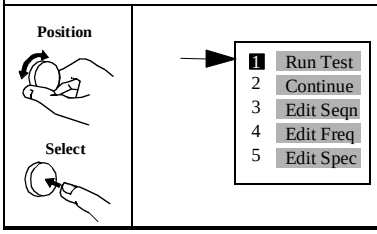
1 Position cursor at **TACS_CS** and select it.



2 NOTE; **TACS_CS** is entered in the **Procedure** field.



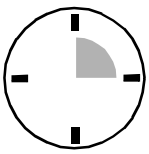
3 Position cursor at **Run Test** and select it.



4 The TACS_CS program is loading.

Loading program first time: 2 min. 30 sec.

After first time: 20 sec.



After TACS_CS is loaded, TEST_01 - 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 **"Connection for RS-232 Base Station Control" on page 78**, and **"TEST_01 - Laptop Emulator" on page 165**.

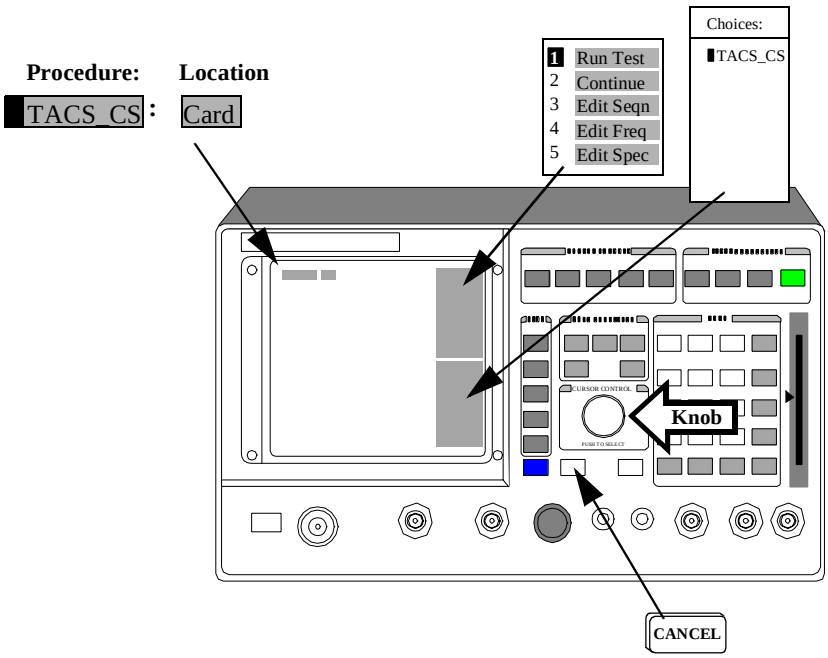
If the base station is not connected, or if you want to exit this TEST and run a new TEST, continue to step 5.

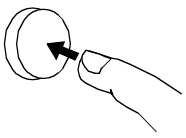
5 Press **<CANCEL>** to stop the program.

Turn page to select a new TEST

To Load and Run Software: (Continued)

Reference Page



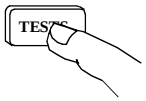
Rotate knob to position cursor.	*Press knob to select a field.*
	

To Edit a TEST Sequence:

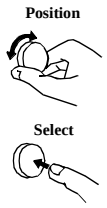
Use figure on opposite page for reference.

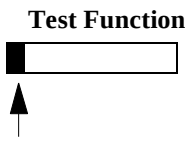
To edit a TEST sequence:

1 Press **TESTS** to display the **TESTS** screen.

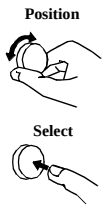


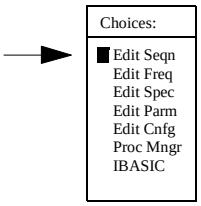
2 Position cursor at **Test Function** and select it.



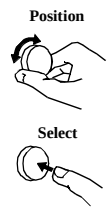


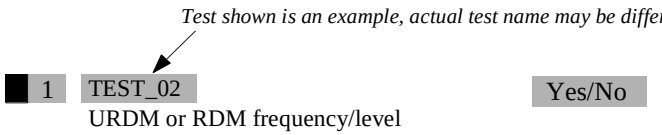
3 Position cursor at **Edit Seqn** and select it.





4 The **TESTS** (Edit Sequence) screen is now displayed. Use it to edit the **TEST** sequence, select a new **TEST**, or delete a **TEST**.

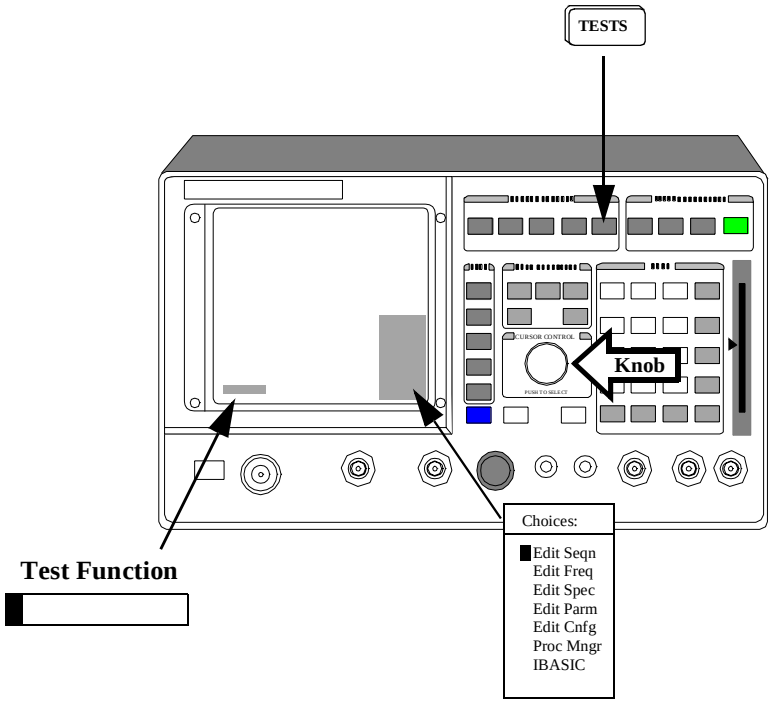


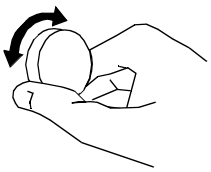
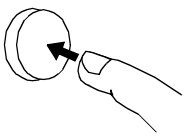


Turn page to select a test

To Edit a TEST Sequence (Continued)

Reference Page



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

To Select URDM or RDM frequency/level TEST:

Use figure on opposite page for reference.

To select URDM or RDM frequency/level TEST:

1 Note; location of the highlighted cursor.

1 TEST_01

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

Position

Select

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

1 TEST_01
Laptop Emulator

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

Position

Select

Choices:
TEST_01
TEST_02
TEST_03
TEST_04
TEST_05
TEST_06
TEST_07
TEST_08
TEST_09
TEST_10

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

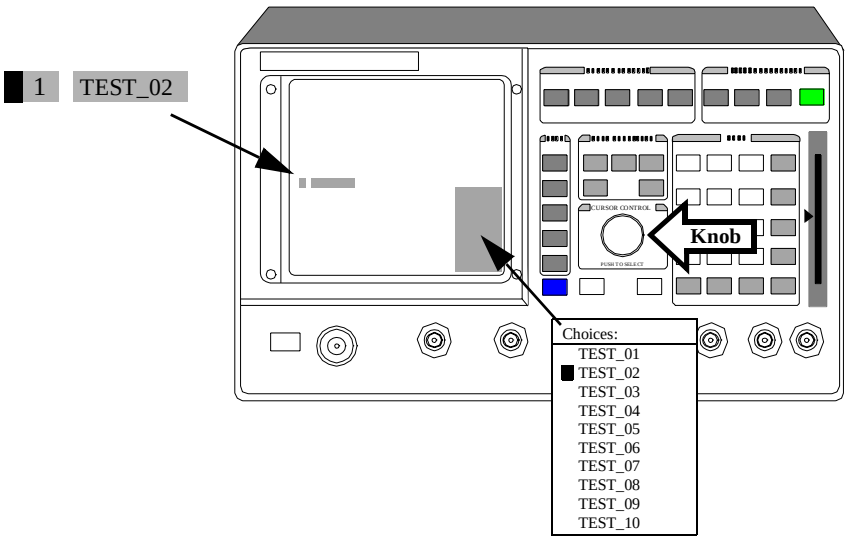
1 TEST_02
URDM or RDM frequency/...

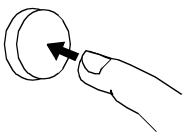
TEST_02 URDM or RDM frequency/ level is now selected and ready to run.

Turn page to run TEST_02

To Select URDM or RDM frequency/level TEST (Continued)

Reference Page



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

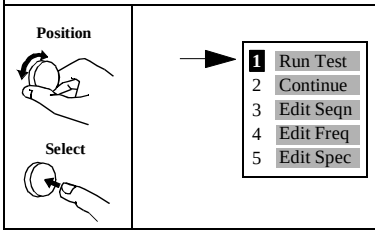
To run TEST_02 URDM or RDM frequency level:

Use figure on opposite page for reference.

To run TEST_02 URDM or RDM frequency/level:

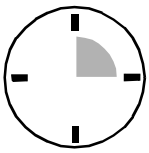
1 Press **TESTS** to display the **TESTS** screen.

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



3 The TEST is loading.

Wait 20 seconds.



TEST_02 begins running.

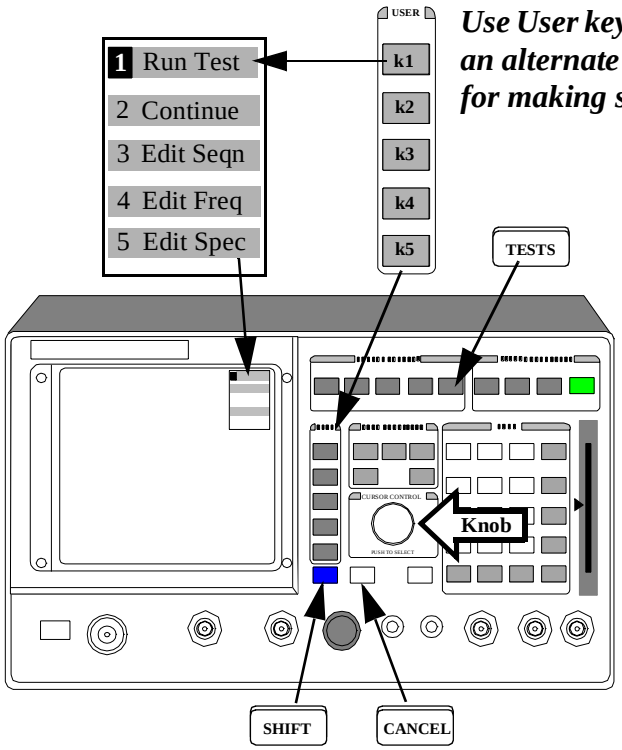
If the Test Set is connected to the base station, see **"TEST_02 - URDM or RDM Frequency/Level" on page 169**.

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

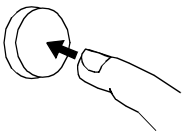
4 Press <Shift> <CANCEL> to stop the program.

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 Software

To learn to use the software:

1. Become familiar with the steps in **"Getting Started with FW Above Rev. A.14.00" on page 22**.
2. Become familiar with the following terms:
   a. Memory Card - **See "Memory Cards," in chapter 2, on page 53**.
   b. Main Menu/TESTS Screen -**See "What is a Test?," in chapter 4, on page 138** and **see "TESTS Main Menu Screen," in chapter 4, on page 142**.
   c. Procedures - **See "Procedures," in chapter 3, on page 100**.
   d. TEST_01 through TEST_09 - **See chapter 5, "TESTs - Reference"**.
   e. Order of Tests - **See "Entering the Order of TESTs," in chapter 4, on page 151**.
   f. Parameters - **See chapter 6, "Parameters - Reference"**.
   g. Pass/Fail Limits (Specifications) - **See chapter 7, "Pass/Fail Limits (Specifications) - Reference"**.
3. If necessary, calibrate system components, and make one or more Procedures with your parameters. **See "Determining Calibration Parameters," in chapter 3, on page 87** and **see "Procedures," in chapter 3, on page 100**.
4. Next you will need to make connection to the base station. **See "Equipment Connections," in chapter 3, on page 72**.
5. Then you can begin performing tests.**See chapter 4, "Running Tests"**.
6. As you are running tests, **see chapter 5, "TESTs - Reference"**, 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 050 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 refer to the specific information you need for the task you are performing.

Manual Contents

Chapter 1 - *Equipment* details items you need, or may need to have before you can begin testing. Some of the items may be permanently installed at the cell site.

You can skip this chapter if you are sure that necessary items are present and installed correctly.

Chapter 2 - *Setting Up* will help you install and connect equipment, determine calibration factors, and enter parameters, pass/fail limits, and external device configuration. Procedures and data collection are described.

If tests have previously been performed at the cell site, you should be able to refer to **figure 2, "Cell Site to Test Equipment Interconnections," on page 74** to verify connections, and then skip the rest of this chapter.

Chapter 3 - *Running Tests* shows you how to select a TEST to put into a procedure, and how to start the program.

Chapter 4 - *TESTs - Reference* details important aspects of each TEST.

Chapter 5 - *Parameters - Reference* contains a description of each parameter.

Chapter 6 - *Pass/Fail Limits (Specifications) - Reference* describes the pass/fail limits you can enter into the software.

Chapter 7 - *Problem Solving* details some of the problems that may occur.

A **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 referred to.

Examples of these special presentations are:

TESTS

A key on the Test Set.

Procedure:

Characters displayed on the CRT display.

USER **Run Test**

A USER key, in the key column next to the CRT. **Run Test** *is displayed on the CRT.*

0.000000

A field on the CRT where entries can 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 use the knob to position the cursor in front of a field (**inverse video** area), and then press the knob.
- **choose** means to position the cursor in front of an item in the **Choices:** or **To Screen** column in the lower right corner of the CRT display, 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 you need, or may need to have before you can begin testing. Some items may become permanent test accessories, installed at the cell site.

Cell Site Equipment

A Motorola TACS 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 higher. A powered-up Base Station Controller and Cell Site Controller are necessary.

Memory Cards

Memory cards are inserted into the slot on the Test Set's front panel. The memory card is powered by the Test Set while it is inserted. Arrows printed on the memory card and Test Set front panel indicate the direction and orientation of card insertion.

Memory cards are used to store or retrieve the following:

- HP 11807B Option 050 software code
- An HP-supplied Procedure, containing:
  - A default testing order
  - Default parameter values
  - Default pass/fail limits
- A Library file
- Procedures you make, optimized for your application
- Data collection files

Two types of memory cards are available:

- Static Random Access Memory (SRAM)
- One Time Programmable (OTP)

SRAM cards have read and write capability. Once programmed, OTP cards have read-only capability.

Software Memory Cards

The HP 11807B Option 050 Motorola TACS Cell Site Software is normally supplied on a One Time Programmable memory card (HP part number 11807-10303). It may be supplied on a SRAM memory card. You can tell 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. Otherwise, it is an OTP.

CAUTION: **Accidentally Erasing Software**

If your software is resident on an SRAM card, it is possible to delete it from the card. To prevent the loss of your program, check the write protect switch on the SRAM memory 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 software memory card can 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 Memory Cards

A Static Random Access Memory Card (SRAM) can be used to store test results and Procedures you make. The following parts can be used.

Table 1 SRAM Memory Card Part Numbers

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

The SRAM memory card must be initialized before its first use. **See "Initializing a Memory Card," in chapter 3, on page 133**.

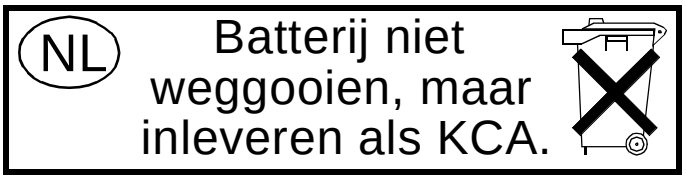
CAUTION: **SRAM Memory Card Battery Life**

The Static Random Access Memory cards use a battery to retain data while the card is not plugged into a powered-up Test Set. The lifetime of the battery depends on the memory card size and the average temperature in its environment. See the next paragraph.

SRAM memory cards use a lithium battery (part number CR 2016 or HP part number 1420-0383). Programs and data will be retained for over one year if the memory card is stored at 25° C. The memory card is powered by the Test Set while it is inserted. Replace the battery while the memory card is inserted into a powered-up Test Set. To retain data and procedures, the battery should be replaced annually. If you are storing memory cards in a warm environment, you should 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 memory card will write protect the card when it is set toward the outside of the card.



Memory Card Storage Space

Procedures use 16 records each. A Library uses 22 records. A single library must be included on the card. A record is 256 bytes. Approximately 11 kilobytes of overhead is required on each card.

Use the following formula to estimate the storage space needed:

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

For example, if you are testing ten cell sites, you will need ten procedures, and 58 kilobytes of memory. The 128 kilobyte card is sufficient.

The storage space you need for data collection depends on the number of test results that are saved. You will need approximately 4 kilobytes per page of test results that you save. A page of test results is about 57 lines of CRT or printer output.

The storage space of smaller SRAM cards can be quickly used. If you are collecting large quantities of data, data collection using a PC or printer may be preferable.

HP 8921A Cell Site Test Set

The HP 11807B Opt 050 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 extensively test cellular base stations. Most of the hardware and all of the firmware you need 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 higher. At the time this manual was revised, firmware revision A.14.02 was being shipped.

You can determine the revision of the firmware by pressing SHIFT CONFIG on the HP 8921A front panel. The revision number will be displayed in the CONFIGURE screen.

An internal switchable 600 Ω load was supported in firmware revisions A.06.11 and greater. If the load is not installed in your instrument you will have to place an external load in line with the connection from the RCV LINE JK to the Test Set AUDIO IN. **See "Audio Connections," in chapter 3, on page 77**.

When software has been loaded into Test Set memory, a pre-run operation takes place after **`Run Test`** is pressed. The pre-run will be done much faster if the Test Set has a firmware revision greater than or equal to A.08.02.

Test Set Option

Depending on your application, the following Test Set option may be needed.

Radio Interface Card (Option 020).

This option can be used to control RF and audio switches that route signals from the base station to HP 8921A connectors. If you are going to be using another switching arrangement this option is not required. **See "RF and Audio Switching Arrangements" on page 62**.

Peripheral Items

This section describes items needed to interconnect the major components of the system. An HP supplied solution is described in this section. Individual switch and interconnect items are also described. See **figure 1, "Overall System Block Diagram," on page 73**, **figure 2, "Cell Site to Test Equipment Interconnections," on page 74** and **chapter 3, "Setting Up," on page 71**.

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/Adaptors

Description	Purpose	Qty	Part Number
Directional couplers	See Fig 2-2 in HP 11807B #050 User's Guide	4	0955-0711
50 Ω SMA(m) termination	Terminates coupler port	4	0960-0053
N(f) to N(f) Adaptor	For VSWR and cable calibration	1	1250-0777
N(m) to N(m) Adaptor	For VSWR and cable calibration	1	1250-0778
N(m) to BNC(f) adaptor	To adapt HP 8921A RFIN/OUT forRDM/ URDM measurements	1	1250-0780
SMA(f) to N(m) Adaptor	Connects to HP 8921A RF IN/ OUT	1	1250-1250
Phone jack to BNC(f) adaptor	For measuring RDM and URDM power	1	1250-1853
BNC(m) to SMA(f) Adaptor	Connects to HP 8921A DUPLEX OUT	2	1250-2015
BNC(m) to Banana(f) Adaptor	Connects to HP 8921A AUDIO IN HI/LO	2	1250-2164
Banana(m) to BNC(f) Adaptor	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 RF IN/OUT	5	08921-61006
BNC(m) to BNC(m) 15 ft. cable	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 DB3710 ft. ribbon cable	From HP 8921A to switch	1	08921-61013

Table 2 Motorola Cables/Adaptors (Continued)

Description	Purpose	Qty	Part Number
RJ11(m) to RJ11(m) 6 wire 25 ft. twisted cable	Connects to dual port splitter and to RJ(11) to DB(25) adaptor	1	08921-61015
RJ11(f) to DB25 (m) adaptor	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 HP 11807B Option 050 Cell Site Test Software supports two ways of 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 using the Radio Interface Card. Appendix A describes the method using the HP 3488A.

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

RF and Audio Switches

A single-pole six-throw (SP6T) RF switch can be used to route one of the receiver-coupled ports to the Test Set DUPLEX OUT connector. The switch preferably has TTL control inputs. The RLC Electronics Model S-1519A 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 63**. The HP 87106A Opt 050 SP6T switch may also be used.

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 Radio Interface Card**

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 may 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 may 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 may be needed between the Radio Interface connector and the switch.

If a buffer is required, a 7407 non-inverting TTL buffer can be used. The buffer outputs must be pulled up to the 5 volt supply with 1000 Ω resistors.

See "Radio Interface Connections" in chapter 3, "Setting Up." for connector pinouts.

RF Couplers

A directional coupler with low through-path loss will normally be 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 Ω Terminations

It may 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 necessary to prevent the SIG transmitter signal from being radiated to mobiles. A 150 watt load is available from Lucas Aerospace (part number M1428).

6 dB Pads

Two 6 dB pads are required to perform the cable loss measurement in the manual switch and calibration aid test. These pads are required to improve the mismatch uncertainties of the Test Set. A 6 dB pad with BNC connectors is available from Hewlett-Packard Company (HP Part Number 0955-0270). **See "Vendor Information" on page 69**.

Cables, Adaptors, and Connectors

You will need some of the following items:

RS-232 Base Station Control Cable

A DB-25 to RJ-11 cable may be assembled. Alternatively, adaptors, described below, can be used with RJ-11 cables.

6-pin Modular-to-DB-25 Adapter

The following parts can be used:

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

RJ-11 Cable

You will need 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, be certain that it has six conductors.

Single-to-Dual RJ-11 Adapter

The 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 simultaneously connect 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 need to buy two Modular-to-DB-25 adaptors and two RJ-11 cables.

RF IN/OUT Cables

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

The connection to the 3 MHz RDM/URDM output can be made using adaptors 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) adaptors 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 can be used.

Cable lengths should be as short as possible so losses are minimized. Low loss cable should be used. To improve accuracy, you may 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 can 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 losses are minimized. Low loss cable should be used. To improve accuracy, you may 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 can be made with cables with SMA connectors on both ends.

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

Audio Cables

Bantam 309-to-BNC cables can 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) adaptors (Pomona part number 3430-0 black, 3430-2 red, HP part number 1250-1263 gray), can be used to convert the AUDIO IN HI and LO connectors to banana. 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 (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 DB-37 connector is available (HP part number 1252-1682).

HP-IB Cables

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

HP Supplied Connector Kit

If you are assembling your own switching and interconnect arrangement, you may 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 VSWR tests, running TEST_09 or TEST_10, or cable fault tests using TEST_11, you will need additional items.

For VSWR measurement, a return loss bridge and a 6 dB pad is required.

A return loss bridge with the necessary characteristics is available from Eagle (P/N RLB150N3B). **See "Vendor Information" on page 69**.

A 6 dB pad with BNC connectors is available from Hewlett-Packard Co. (HP P/N 0955-0270). **See "Vendor Information" on page 69**.

For cable fault tests a resistive power splitter is required. Some power splitters isolate the outputs from each other. These types of splitters cannot be used for VSWR tests using this software. The HP 11805C Power Splitter is a resistive type and can be used. **See "Vendor Information" on page 69**.

Cable Loss Measurement Equipment

Two 6 dB pads are required to perform the cable loss measurement in the manual switch and calibration aid test. These pads are required to improve the mismatch uncertainties of the Test Set. A 6 dB pad with BNC connectors is available from Hewlett-Packard Company (HP Part Number 0955-0270). **See "Vendor Information" on page 69**.

Additionally, a short reference cable is needed to calibrate from DUPLEX OUT to ANT IN on the Test Set.

High Accuracy Frequency Reference

To verify the performance of the URDM, a highly accurate 10 MHz reference source is required. The Electronic Research Co. Model 130 has the necessary characteristics.

Documentation

After you have learned to use the HP 11807B Option 050 Cell Site Test Software, you will be able to run the tests without documentation. However, if you want to change Procedures or if you are expecting to have to troubleshoot, you will want to have this manual handy. You may want to have the HP 8921A User's Guide, Volumes 1 and 2 (HP part number 08921-90002) if you are using the Test Set manually. Motorola base station documentation may be necessary if troubleshooting or module replacement is expected. It may also be helpful to have your own documentation describing the particular procedures you follow when 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
PO Box 4010
Sedona, AZ 86340
(520) 204-2597 (520) 204-2568 FAX

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

Hewlett-Packard Co.
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 shows you how to:

- Make connections to the equipment in the system.
- Measure or determine calibration parameters.
- Make, load, delete, copy and secure Procedures.
- Enter pass/fail limits, parameters, and an external device configuration.
- Set up data collection.

Equipment Connections

CAUTION: **Damage to Equipment**

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 **see appendix A, "Appendix: Using the HP 3488A"** if you are using an HP 3488A Switch/Control Unit.

Figure 1 on page 73 is an overall system block diagram

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

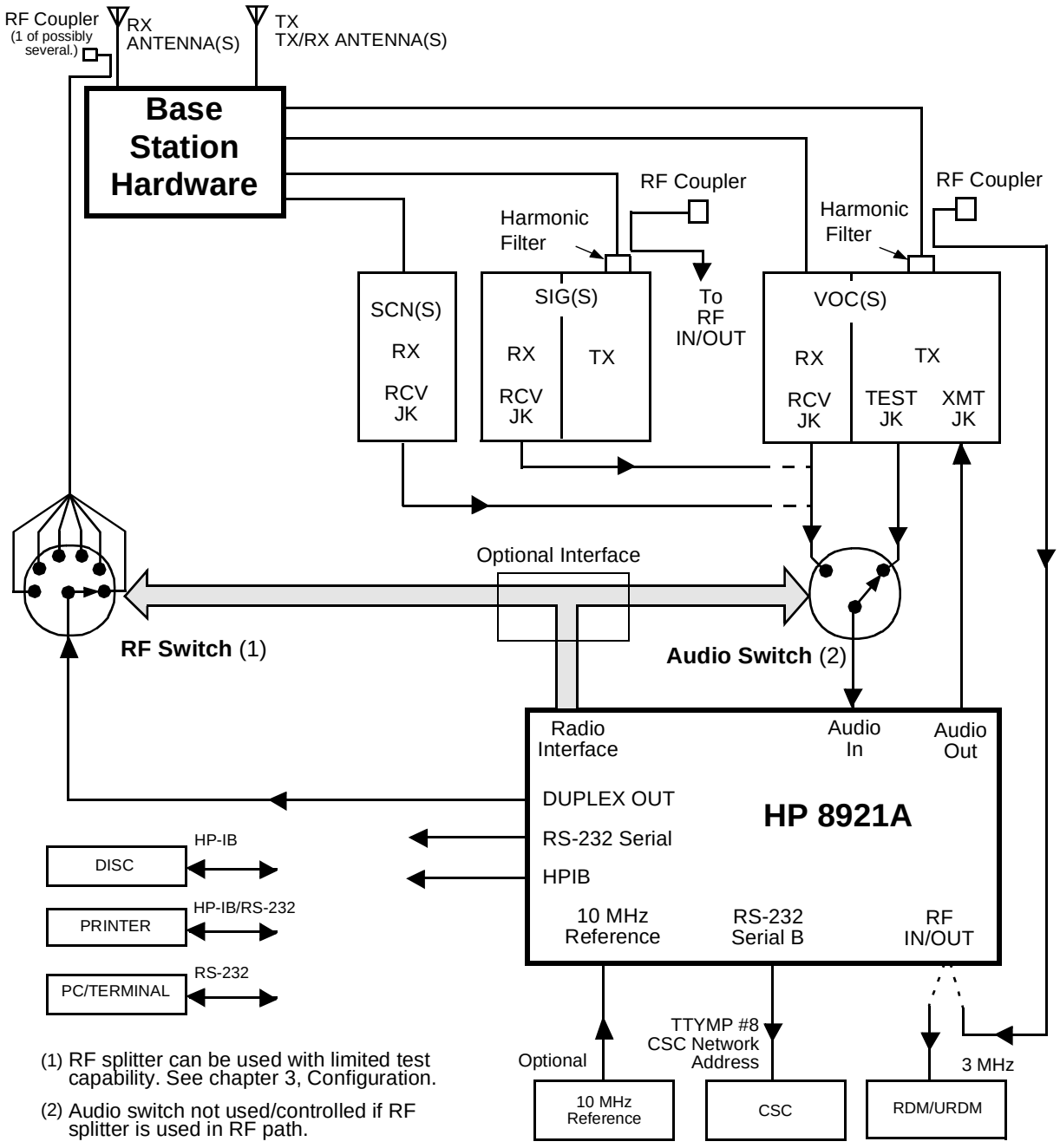


Figure 1 **Overall System Block Diagram**

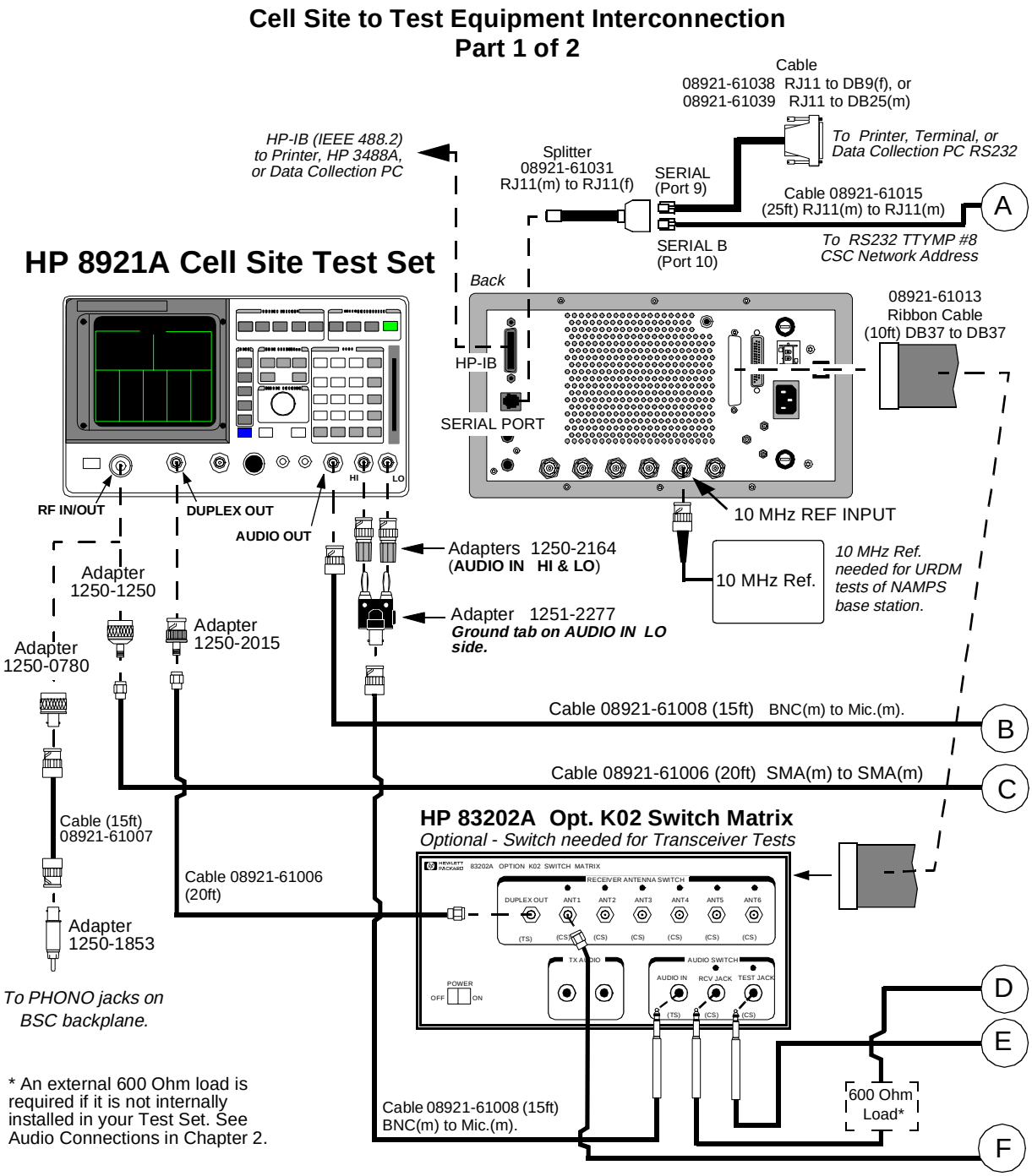
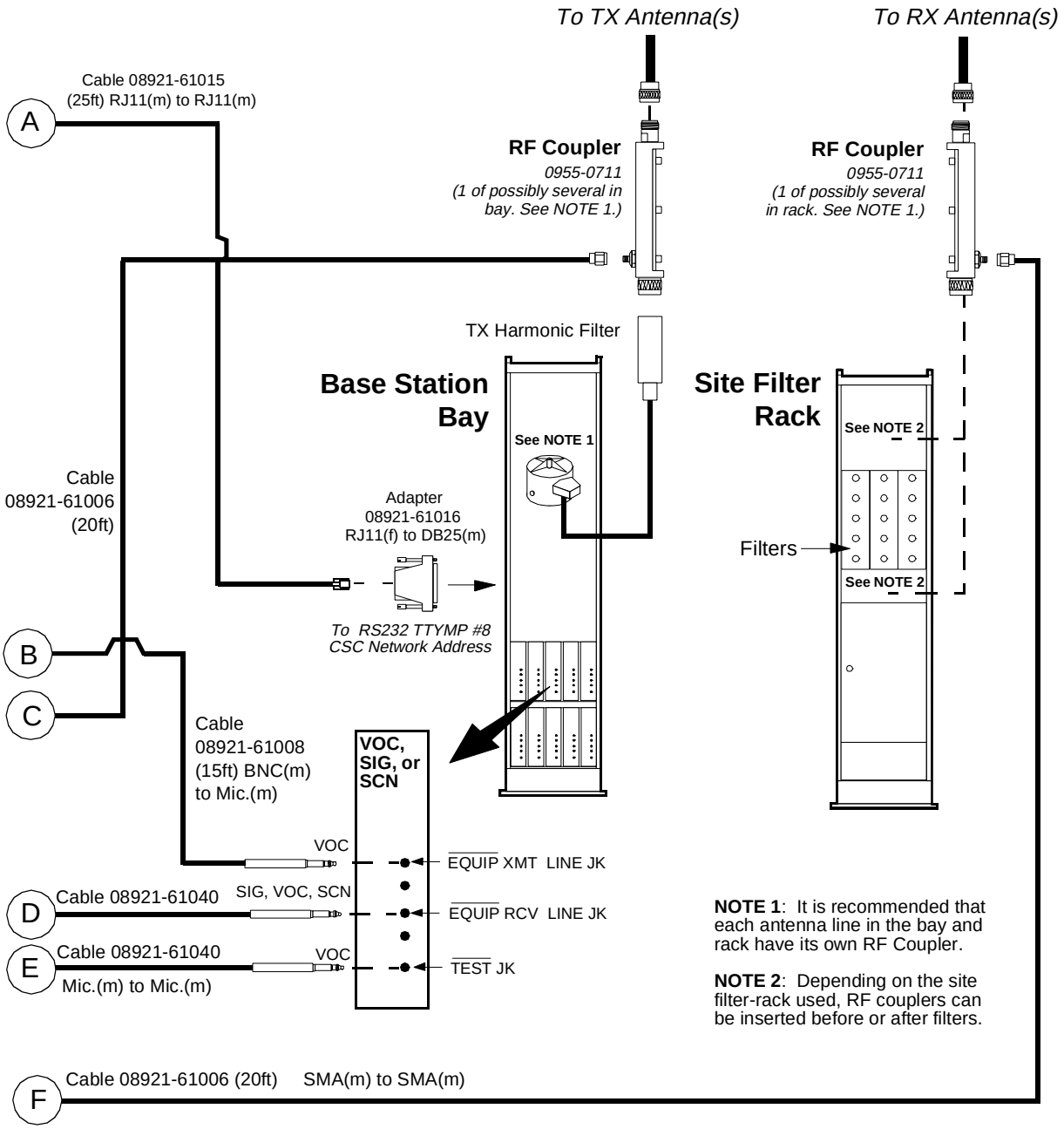


Figure 2 **Cell Site to Test Equipment Interconnections**

Cell Site to Test Equipment Interconnection
Part 2 of 2



Receiver RF Connections

See **figure 2, "Cell Site to Test Equipment Interconnections," on page 74** for a description of these connections. An RF coupler must be installed between each of the receive antennas and base station receiver inputs. 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 84** for details of the connection of the Radio Interface to the RF N-Way switch.

CAUTION: **Damage to the DUPLEX OUT Port**

The application of RF power greater than 200 mW (+23 dBm) can damage the Test Set DUPLEX OUT port. Be certain that signals applied to this port are less than 200 mW. If an RF power higher than about 200 mW is applied, an overpower relay will trip. Press MEAS RESET or turn the Test Set power off and on to reset it.

Signals that affect the equipment being measured can be picked up by the RX antennas. It is necessary to terminate the RF coupler when performing tests of the SIG unit and scan receivers.

When measuring voice channel receivers, antennas can be left connected to the RF couplers. Interference can be detected by turning up the speaker volume of the Test Set. The interfering signal may be the result of a problem in the frequency plan. If it is impossible to proceed with measurements, the RF coupler port leading to the antenna will have to be terminated with a 50 Ω load.

Transmitter RF Connections

See **figure 2, "Cell Site to Test Equipment Interconnections," on page 74** for a description of these 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. 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's transmitter signal from being radiated to mobiles.

Audio Connections

See **figure 2, "Cell Site to Test Equipment Interconnections," on page 74** for a description of these 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. A 600 Ω load must be connected across the EQUIP RCV, if your Test Set does not have a built-in switchable 600 Ω floating load. This internal load will be in Test Sets shipped after October 1992. You can 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 you can display these three choices, then the switchable load is installed.

The HP 11807B Option 050 software selects a floating AUDIO IN LO, if the Test Set does not have an internal 600 Ω load.

See **"Radio Interface Connections" on page 84** for details of the connection of the Radio Interface to the audio path switch. The transmitter's EQUIP LINE JACK is connected to the Test Set's AUDIO OUT connector with a coaxial cable. You may want to route this connection through the switch box.

Connection for RS-232 Base Station Control

The HP 11807B Option 050 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 3, "Connector on Test Set Rear Panel," on page 81**. It has two serial ports on it, Serial port and Serial B port. The Serial B port is used for base station control and messaging.

NOTE: **Check the RJ-11 Wiring**

RJ-11 cable and adapters can be wired several ways. Verify the connections between the Test Set's RJ-11 connector and the DB-25 base station connector.

The connections between the Test Set's RJ-11 connector and the DB-25 TTYMP #8 CSC Network Address connector are described below:

Table 3 **Connection for Base Station Control**

Item	Test Set	DB-25
Test Set Receive B data	RJ-11 pin 1	DB-25 pin 2
Ground	RJ-11 pin 4	DB-25 pin 7
Test Set Transmit B data	RJ-11 pin 6	DB-25 pin 3
DB-25 pins 8 and 20 must be jumpered together.		

The transmit data line (pin 6) for this serial port is the uppermost pin on the RJ-11 connector on the rear panel of the Test Set.

An adapter and cables can be used to connect the RJ-11 connector and the DB-25 connector. Depending on the adapter you select, you may have to insert three supplied pins with attached wires and a jumper into the DB-25 connector. See **figure 4, "Adapters for Base Station Control," on page 82** to determine which pins to insert. If you are wiring an adapter as described in **figure 4**, verify that the cable going from the Test Set to the RJ-11 to DB-25 adapter inverts the pins 1 through 6. In other words, if you lay the 6-wire cable flat on a table, without twists, the RJ-11 connectors should have the same side facing up.

After you insert the pins into the RJ-11 to DB-25 adapter, cover the unused pins with tape so they won't cause shorts.

If you are using a cable or an adapter other than described in this section, verify the wiring from the Test Set to the base station by referring to **table 3, "Connection for Base Station Control" on page 78** and **figure 4, "Adapters for Base Station Control," on page 82**.

Serial Port Connections for Data Collection

The HP 11807B Option 050 software has the capability to upload 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 information sent out the Test Set Serial port.

The following pins are used by the Serial port:

- RJ-11 Pin 2 - Test Set Receive data
- RJ-11 Pin 4 - Ground
- RJ-11 Pin 5 - Test Set Transmit data

See **figure 4, "Adapters for Base Station Control," on page 82**. The transmit data line (pin 5) for the Serial port is just below the uppermost pin on the RJ-11 connector on the rear panel of the Test Set. (**See appendix C, "Appendix: Cable Wiring Diagrams for Data Collection to PC and Printer"**.)

Printer Connection

An HP-IB printer can be connected to the Test Set rear-panel HP-IB connector. A serial printer can be attached to the Serial port. See **figure 4, "Adapters for Base Station Control," on page 82**. Use the following RJ-11 pins for this connection.

- RJ-11 Pin 2 - Test Set Receive data
- RJ-11 Pin 4 - Ground
- RJ-11 Pin 5 - Test Set Transmit data

See **"Serial Port Configuration" on page 117** for information on how to set the Test Set Serial port settings to match the printer settings. (**See appendix C, "Appendix: Cable Wiring Diagrams for Data Collection to PC and Printer"**.)

Test Set Serial Port Location

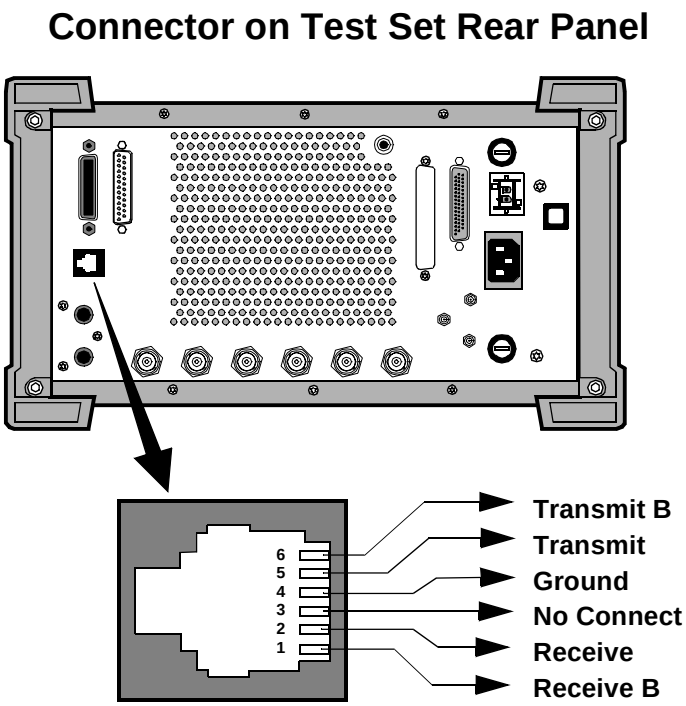


Figure 3 **Connector on Test Set Rear Panel**

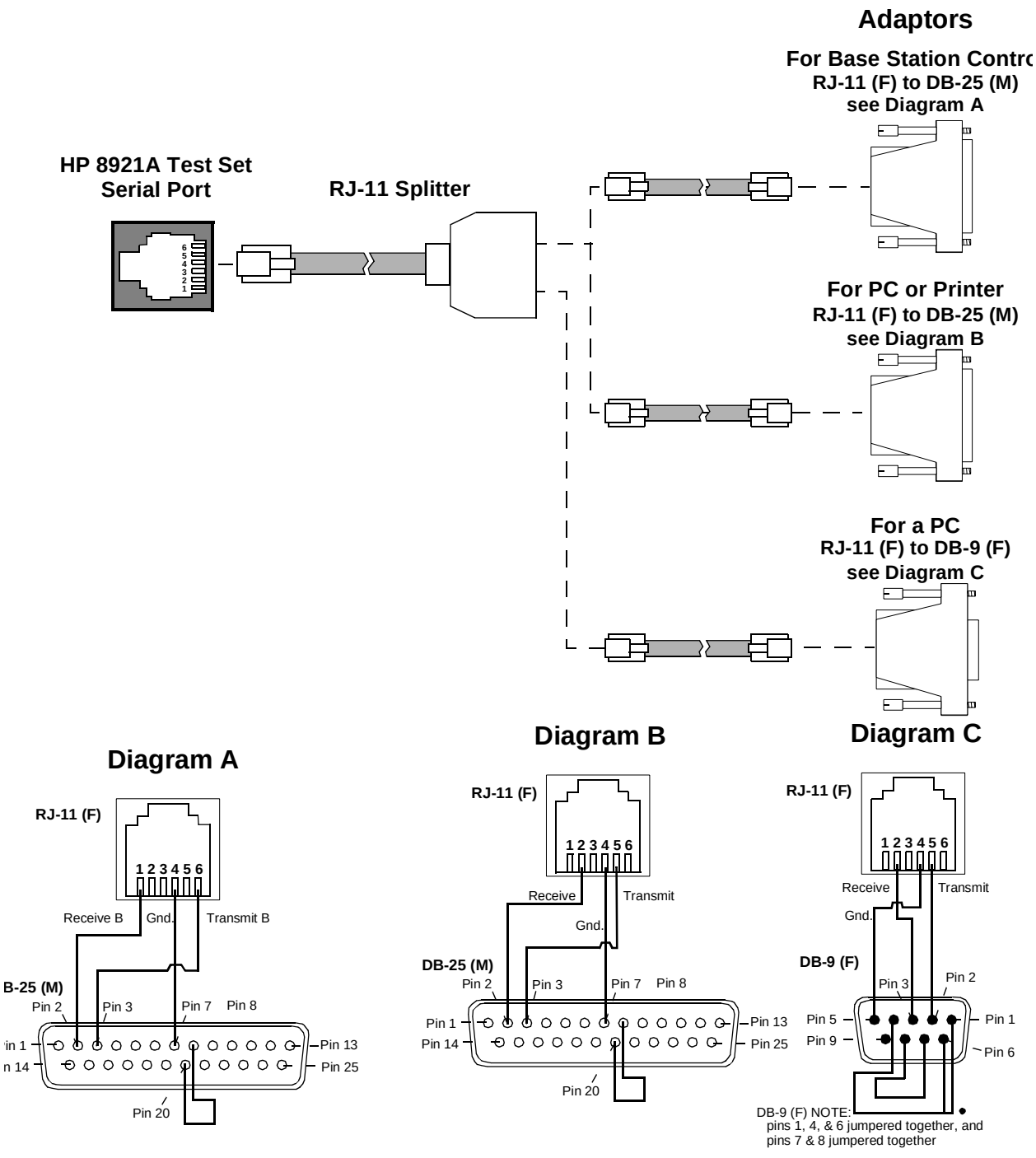


Figure 4 **Adapters for Base Station Control**

Parallel Port Connections

A parallel printer can be attached to the parallel port. Use the following **figure 5** for pin information.

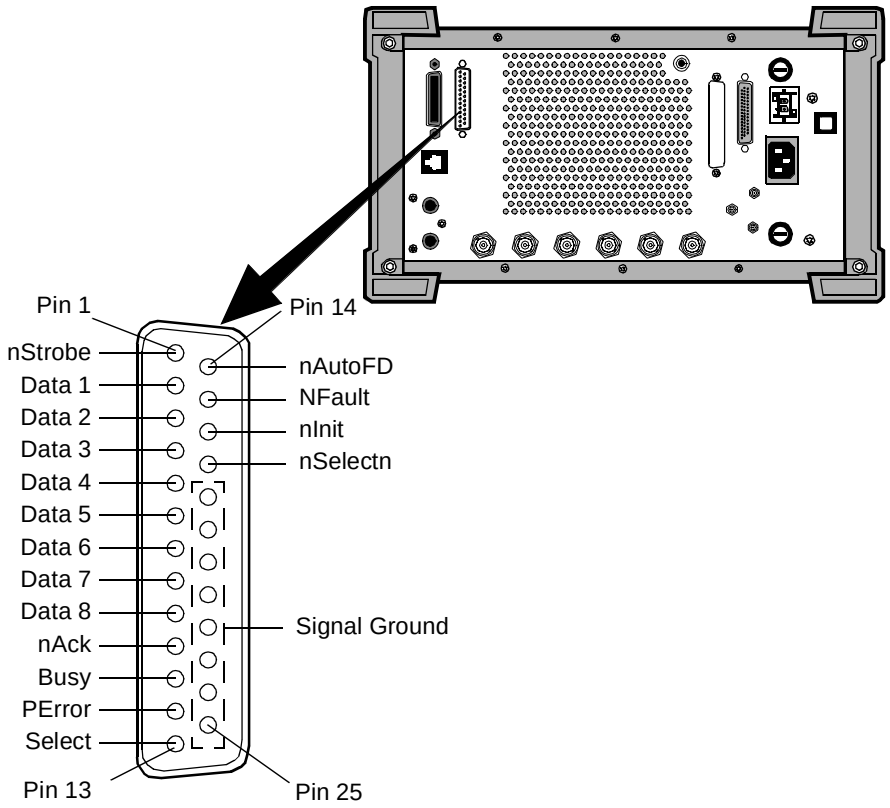


Figure 5 **Test Set Parallel Port Connections**

Disk Drive Connections

A disk drive can be attached to the rear-panel HP-IB connector. See **"Data Collection" on page 130**.

Radio Interface Connections

CAUTION: **Damage to the Radio Interface Card**

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 may 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.

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)

There are Radio Interface connector pins used for other purposes that are 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 may be required between the switch and the Radio Interface connector. **See "Switch Control Input Buffer," in chapter 2, on page 63**.

The Radio Interface Card has the capability to have a 5.1 volt or user changeable high state logic output voltage.

The Parallel Data Out lines are open collector outputs with 3.16 kΩ internal pull up resistors. The resistors are connected between the collectors of the drive transistors and a logic voltage that may be determined by an externally applied voltage. The internal logic voltage is approximately 0.6 volts less than the voltage externally applied to pin 9 of the Radio Interface connector. The applied voltage

can be between 5.1 volts and 20 volts. The maximum loading on the voltage is 145 Ω 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 kΩ 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 µH for RFI control on all lines.

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

DC Power to the RF and Audio Switches

DC power must be supplied to the RF and audio switches. It cannot be supplied from the Radio Interface Card. Refer to the switch documentation for power requirements.

VSWR Measurement Connections

VSWR measurements are performed by measuring the level at the coupled port of a return loss bridge using the Test Set spectrum analyzer.

The coupled or reflected port is applied to the Test Set ANT IN connector through a 6 dB pad. The 6 dB pad must be placed at the ANT IN connector. The tracking generator output from the DUPLEX OUT is applied to the source connector on the bridge. The antenna feedline or other device under test is connected to the output port of the bridge.

A drawing showing these connections is displayed on the Test Set CRT shortly after TEST_09 (or TEST_10) starts running.

Cable Fault Connections

Cable fault tests are performed by combining the power from the DUPLEX OUT connector with the reflected power from the device under test and applying the combination to the ANT IN port of the Test Set.

Connect the ANT IN and DUPLEX OUT ports to the split ports of the resistive splitter. The combined port of the splitter is connected to the device under test or to a short or open during a calibration step. Leave the device under test port unconnected if you want to use the open option during calibration.

A connection diagram is displayed on the TEST SET CRT shortly after TEST_11 starts running.

Determining Calibration Parameters

Methods of measurement in this section determine RF losses and inaccuracies in your test system. The resulting calibration factors will be entered as parameters into the TESTS (Edit Parameters) screen. The test program will use these calibration factors when the tests are run.

If you are using a switch to automatically change RF paths, you will have to make entries into the **`External Devices`** (or **`Edit Configuration`**) screen before you begin these methods. Entries are needed so the software can control the switch when you run **TEST_07 - Manual Switch and Calibration Aid**. **See "Making Entries to a Test Set CONFIGURE Screen" on page 116**.

Table 4 Recommended Equipment for Measuring Calibration Parameters

Equipment	Recommended Accuracy	Frequency Range	Connector Type	Model/Part No.
Power Meter	1% in Watt or 0.5 dB in dBm mode	800 - 1000 MHz		HP 436A
Power Sensor	SWR < 1.1:1	800 - 1000 MHz	Type-N(m)	HP 8481B
High power attenuator (10 dB)	SWR < 1.1:1, 50 Ω	800 - 1000 MHz	Type-N(m) input Type-N(f) output	Part no. 45-10-43

Transmitter Path Loss Calibration

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

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

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 will use an external, highly accurate, power meter to determine a calibration factor that will correct for the errors a through c, listed above. A single factor for each TX path loss is obtained. Changes in loss versus frequency are not corrected for. 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’s error will be covered.

To determine this calibration factor:

1. See **figure 6**. 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 may not be required if the power meter and sensor range is correct for the power being measured. Be sure that there are no extra cables in the setup. The attenuator should have a 50 Ω input and output impedance, with a VSWR less than 1.1:1. Record the value of the attenuation as ATTVALUE in dB.

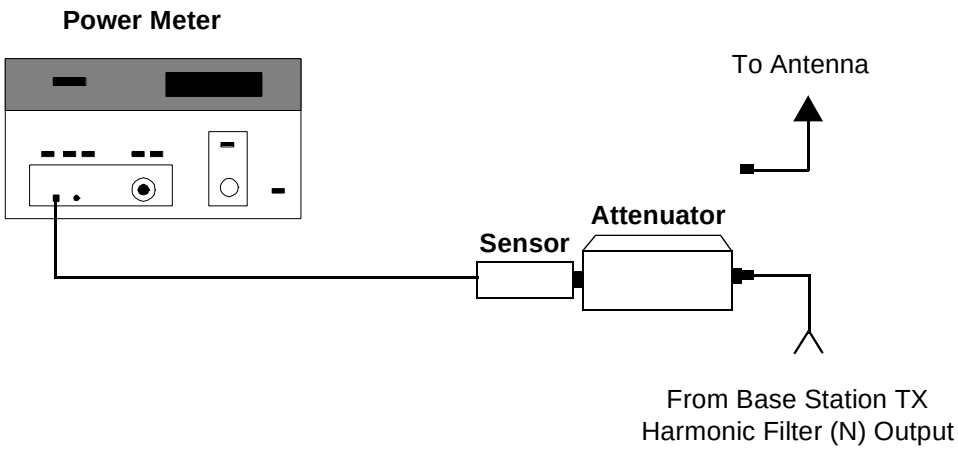


Figure 6 **Transmitter Path Loss - POWERREF Measurement**

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

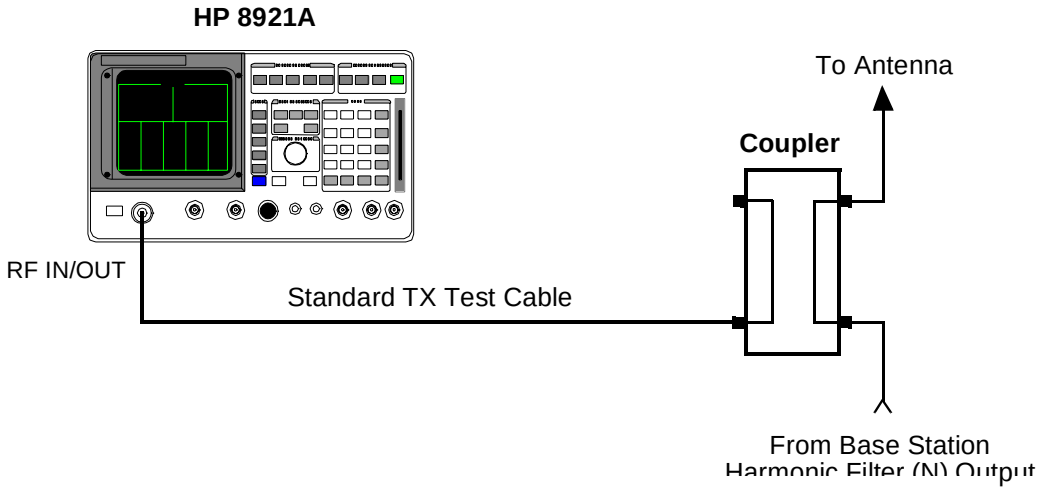


Figure 7 **Transmitter Path Loss - POWER8921 Measurement**

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: **Automatically Performing the Next Steps**

The steps a through p listed below, can be automatically performed by running **TEST_07 - Manual Switch and Calibration Aid** and selecting *Read the spec. analyzer TX path calibration*.

a. Press PRESET on the Test Set.

b. Choose the SPEC ANAL screen.

c. Select the **Center Freq** field. Enter a value equal to the transmitter frequency.

d. Select the **Span** field. Enter **50** kHz.

e. Select the **Main** field. Choose **Marker**.

f. Select **Marker To Peak**.

g. Select **Marker To Ref Level**.

h. Select the **Marker** field. Choose **Auxiliary**.

i. Select the **Sensitivity dB/div** field. Choose **2 dB/div**.

j. Select **Marker To Peak**.

k. Select **Marker To Ref Level**.

l. Select **Ref Level**.

m. Enter a value to increase the **Ref Level** on the spectrum analyzer by 8 dB. Use the numeric keypad or the knob. You can change the resolution of the reference level adjustment by pressing the INCR ÷ 10 or INCRx10 keys.

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

o. Select **Marker To Peak**.

p. Record the **Marker Lvl** (in the upper right corner of the CRT display) 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 parameters *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. Changes in loss versus frequency are not corrected for.

To determine this calibration factor:

1. See **figure 8**. Zero the power meter and set the power meter calibration factor if necessary. Connect the power meter sensor to the Test Set DUPLEX OUT.

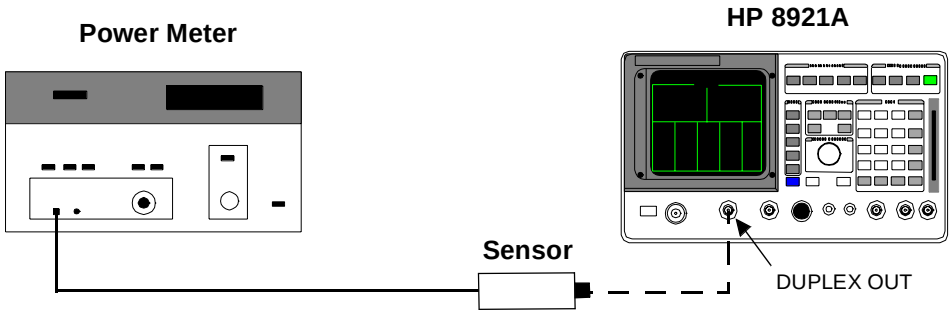


Figure 8 **Receiver Path Loss - POWERREF Measurement**

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: **Automatically Performing the Next Steps**

Steps a through f below can be automatically performed by running **TEST_07 - Manual Switch and Calibration Aid** and selecting *Set the HP 8921A for RX path calibration*.

a. Press PRESET on the Test Set.

b. Choose the RF GEN screen.

c. Select **`RF Gen Freq`**. Enter **`834.5`** MHz.

d. Select the **`AFGen1 To`** (lower field). Press ON/OFF to turn it off. Press the knob.

e. Select the **`Output Port`** field. Press the knob to make **`Dupl`** underlined. The DUPLEX OUT port is selected.

f. Enter the RF Gen **`Amplitude`** 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 9**. 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.

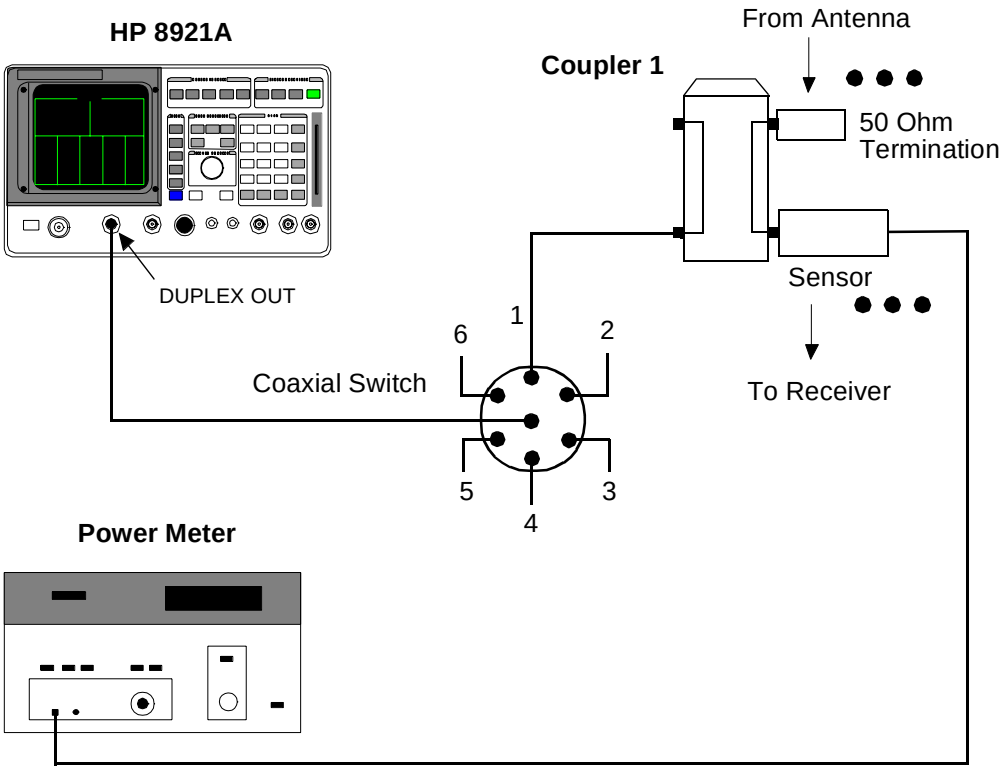


Figure 9 **Receiver Path Loss - POWERRECEIVERS Measurement**

5. Switch the coaxial switch to the desired position. You can manually switch it, or use **TEST_07 - Manual Switch and Calibration Aid**. If you are using TEST_07, verify that the switch is properly configured, with the right entries made to the **`External Devices`** (or **`Edit Configuration`**) 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 parameters *RX path loss to antenna 1*(to)*6*.

Reference Distribution Module Level Correction Factor

The method of measurement described here can be used to obtain a value for the parameter *RDM level correction factor*. The 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, the difference between the power meter reading and the spectrum analyzer reading will be determined.

To determine this calibration factor:

1. Zero the power meter if necessary.
2. Set the power meter calibration factor if necessary.
3. Remove the 50 Ω load that is on the URDM/RDM Phono #2 jack.
4. See **figure 10**. Connect the power meter sensor to a connector adapter, if necessary, attached to the URDM/RDM Phono #2 jack.

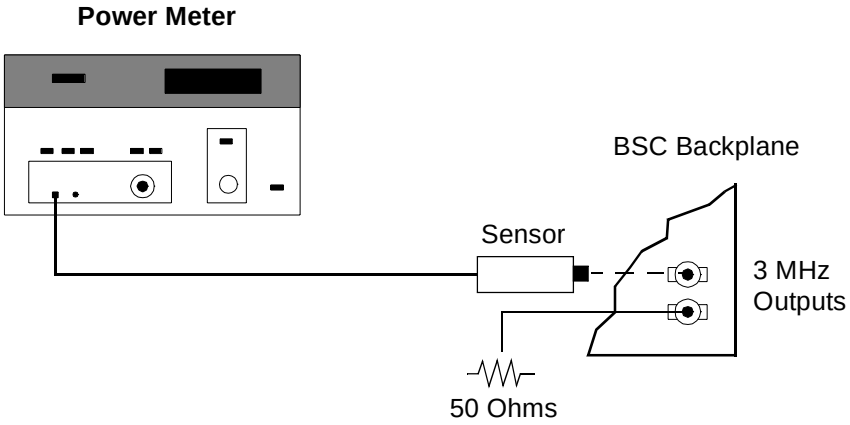


Figure 10 **RDM Level Correction - POWERREF Measurement**

5. Record the power meter reading in dBm as POWERREF.
6. Disconnect the power meter sensor.
7. See **figure 11**. Connect a standard test cable between the 3 MHz Phono #2 jack, and the RF IN/OUT connector on the Test Set.

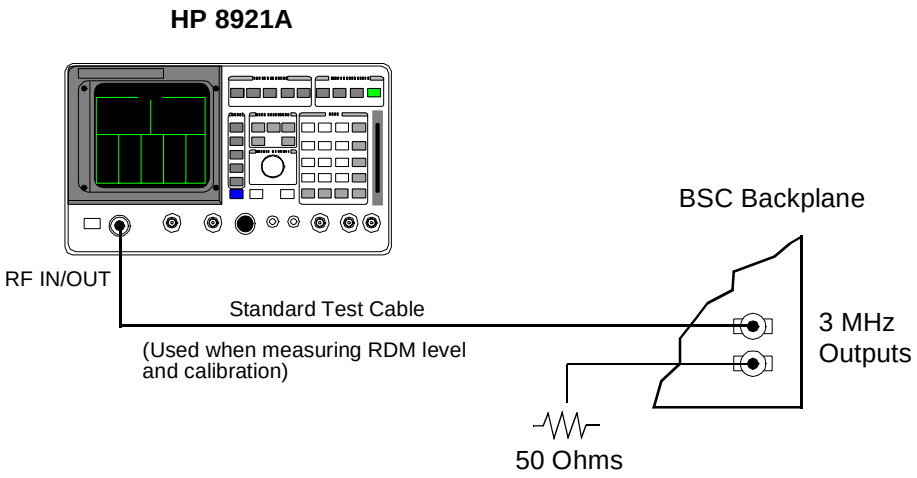


Figure 11 **RDM Level Correction - POWER8921 Measurement**

8. Perform the following steps, using the Test Set:

NOTE: **Automatically Performing the Next Steps**

The steps a through p, listed below, can be automatically performed by running **TEST_07 - Manual Switch and Calibration Aid** and selecting *Read the spec. analyzer RDM calibration*.

a. Press PRESET on the Test Set.

b. Choose the SPEC ANAL screen.

c. Select the **`Center Freq`** field. Enter **`3`** MHz.

d. Select the **`Span`** field. Enter **`50`** kHz.

e. Select the **`Main`** field. Choose **`Marker`**.

f. Select **`Marker To Peak`**.

g. Select **`Marker To Ref Level`**.

h. Select the **`Marker`** field. Choose **`Auxiliary`**.

i. Select the **`Sensitivity dB/div`** field. Choose **`2 dB/div`**.

j. Select **`Marker To Peak`**.

k. Select **`Marker To Ref Level`**.

l. Select **`Ref Level`**.

m. Enter a value to increase the **`Ref Level`** on the spectrum analyzer by 8 dB. Use the numeric keypad or the knob. You can change the resolution of the reference level adjustment by pressing the INCR ÷ 10 or INCRx10 keys.

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

o. Select **`Marker To Peak`**.

p. Record the **`Marker Lvl`** (in the upper right corner of the CRT display) 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*. Be sure to also enter the sign of the value. The value obtained in step 9 is added to spectrum analyzer readings made by the 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 can 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 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 needs to cover the loss of the cable used between the harmonic filter's output and the Test Set RF IN/OUT connector. You need to measure the loss of this cable. One way to do this is to use the method in **"Receiver Path Loss Calibration" on page 92** replacing the RX antenna switch, RF coupler, and cables with the cable you are measuring. Enter the loss value into the parameter *TX path loss to combiner for adjustment.*

Cable Loss

Loss for any RF cable can be measured using the *Measure cable loss* feature of TEST_07. This feature uses the Test Set signal generator to apply an RF level through a reference cable from the DUPLEX OUT to the ANT IN ports on the Test Set. The frequency is swept over the user-requested range and a reference level for each frequency is stored. The cable to be tested and the same reference cable are then connected from the DUPLEX OUT to ANT IN on the Test Set. The same user-requested frequency range is swept and the average loss, maximum, and minimum loss for the cable is displayed. Two 6 dB pads should be used on the Test Set's ports to improve the mismatch of the ports. Since this test uses the Test Set spectrum analyzer in the 2 dB/div mode, this test is valid for cable loss of less than 12 dB.

Procedures

This section describes how you can use Procedures to save and retrieve calibration parameters and other information using an SRAM memory card, or disk.

A Procedure is a collection of parameters, pass/fail limits and a TEST sequence, saved in a file, that customizes the test software to a specific application. You will save the file on a memory card or disk.

Calibration parameters for a particular cell site can be saved in a Procedure. You should name the Procedure with a name that refers to a particular cell site. After you connect the Test Set, you choose the Procedure for the cell site. You should have a Procedure for each of the cell sites you maintain.

You do not have to save a TEST sequence in a Procedure. Each of the TESTs, TEST_01 through TEST_11, is a stand-alone TEST. After you choose a Procedure, you can choose which of the TESTs you want to run.

When you save a Procedure you will only be saving parameters, pass/fail limits and a sequence. The memory 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 Base Station Test Software. The Library you use will be the Library that is supplied with your software. It is named **TACS_CS**. When you save your Procedure, the Library will be automatically saved on the same card or disk.

The Procedure supplied with your software will be the first Procedure in the list that appears in the **Choices:** column when you select the **Procedure:** field. It is named **TACS_CS** and will be displayed if your software memory card is plugged in.

Procedures do not contain actual program steps or code. These software steps are contained in a code file. The code file **TACS_CS** is on the software memory card.

Making a Procedure

After you have set up the test software you can save the setup to a SRAM memory card, disk, or internal RAM memory by doing the following.

The memory card or disk you use must be initialized before its first use. **See "Initializing a Memory Card" on page 133** or **"Initializing a Disk" on page 132**. If you are using a disk drive, you may have to enter the External Disk Specification into the CONFIGURE screen. It will be used when the **Location** field on the TESTS screen is **Disk**.

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

To Save a Procedure:

1. Press TESTS.
2. On the TESTS screen verify that the **Library** is the one that was shipped with your software. It should read **TACS_CS**. If it isn't, load the **TACS_CS** Procedure. **See "Getting Started with FW Above Rev. A.14.00," in chapter 1, on page 22** or **see "Starting the Program," in chapter 4, on page 146**.
3. Select **Save/Delete Procedure** from the **CUSTOMIZE TEST PROCEDURE** list (or **Proc Mngr** from the **Test Function** field).
4. Position the cursor to the **Select Procedure Location** (or **Location**) field and select it.
5. From the **Choices** menu, select the desired location. The media must be initialized before a file can be saved. See also **"Initializing a Memory Card" on page 133**. To initialize a RAM disk, see "Memory Cards/Mass Storage" in the Test Set *User's Guide* .
6. Position the cursor to the **Enter Procedure Filename** (or **Procedure**) field and select it.
7. From the list of characters in the **Choices** menu, enter a filename. Filename must be nine characters or less. When filename is complete, position cursor to **Done** and select it.
8. If you selected **Card** , insert an initialized memory card into the slot on the Test Set front-panel.
9. Verify that the card or other media is not write-protected. **See "Memory Cards," in chapter 2, on page 53**.
10. Position the cursor to the **Enter Description for New Procedure** (or **Comment for new procedure**) field and select it. From the list of characters in the **Choices** menu, enter comments. When the comments are complete, position the cursor to **Done** and select it.

11. Position the cursor to the **Procedure Library** (or **Library for new procedure**) field and select **Current** (Current underlined). The name of the Library is displayed on the TESTS screen.
12. Position the cursor to the **Code Location** (or **Program location for new Procedure**) field and select it. Choose memory **Card**, **RAM** disk, or external **Disk**. When a procedure is run, the TESTS system will look in this location for a code file, if it is not resident in the Test Set's battery-backed-up memory. This location will usually be the software memory card.
13. Press k1 (**Save Proc**) (or position the cursor to the **Action** field and select **Make Procedure**). A Procedure will be saved at the location you chose.

Loading a Procedure

A Procedure can be loaded from storage media into the Test Set's battery-backed-up memory by doing the following.

To load a Procedure:

1. Press the front-panel TESTS key.
2. Select the **Select Procedure Location:** (or **Location**) field.
3. Choose the location where the Procedure is stored: memory **Card**, **RAM** disk, or external **Disk**.
4. Select the **Select Procedure Filename** (or **Procedure**) field.
5. Choose the **Procedure** file that you want to load.
6. Read the **Description** (or **Comment**) field to ensure that the loaded Procedure file is the one you want.

Deleting a Procedure

Procedures can be removed from an SRAM memory card, disk or RAM by doing the following.

To delete a Procedure:

1. Press TESTS.
2. Select **`Save/Delete Procedure`** from the **`CUSTOMIZE TEST PROCEDURE`** list (or **`Proc Mngr`** from the **`Test Function`** field).
3. Position the cursor to the **`Select Procedure Location`** (or **`Location`**) field and select it.
4. From the **`Choices`** menu, select the desired location.
5. Position the cursor to the **`Enter Procedure Filename`** (or **`Procedure`**) field and select it.
6. From the **`Choices`** menu, select the name of the procedure you wish to delete.
7. Press k2 (**`Del Proc`**) (or position the cursor to the **`Action`** field and select **`Delete Procedure`**).
8. Answer the question with SHIFT YES, 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, you may wish to secure it. This operation will prevent the viewing and changing of those functions. You can select the items you wish to secure or un-secure. An IBASIC ROM program is stored in the Test Set's firmware to do this.

You can secure the procedure that is supplied with the test software. It is shipped un-secured.

After you make a procedure, you can secure it.

To secure a Procedure:

1. Press TESTS.
2. Position the cursor to the **`Select Procedure Location`** (or **`Location`**) field and select it.
3. From the **`Choices`** menu, select **`ROM`**.
4. Position the cursor to the **`Select Procedure Filename`** (or **`Procedure`**) field and select it.
5. From the **`Choices`** menu, select **`IB_UTIL`** (or **`SECURE_IT`**).
6. Press k1 (**`Run Test`**).
7. Select the location of the procedure you want 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 a Disk" on page 132**.

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.

To un-secure a procedure:

To un-secure a procedure, you must know the **pass number**.

1. Press TESTS.
2. Position the cursor to the **Select Procedure Location** (or **Location**) field and select it.
3. From the **Choices** menu, select **ROM**.
4. Position the cursor to the **Select Procedure Filename** (or **Procedure**) field and select it.
5. From the **Choices** menu, select **IB_UTIL** (or **SECURE_IT**).
6. Press k1 (**Run Test**).
7. Select the location of the procedure you want to un-secure: k1 memory (**Card**) or k2 (**RAM**).
8. Enter the name of the procedure you wish to un-secure.
9. If the procedure has any item secured, you will be asked for the **pass number**.
10. Proceed with the on-line instructions. Select the items you wish to un-secure.
11. When you are prompted, enter the **pass number** using the DATA keypad.

Copying a Procedure

You may wish to have more than one copy of the Procedures you use.

Using the COPY_PL ROM Program

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

To run `COPY_PL`:

1. Press TESTS.
2. Select the **`Select Procedure Location`** (or **`Location`**) field.
3. From the **`Choices`** menu, select **`ROM`**.
4. Select the **`Select Procedure Filename`** (or **`Filename`**) field.
5. Choose **`IB_UTIL`** (or **`COPY_PL`**).
6. Select the **`Run Test`** field to start the program.
7. Follow the displayed instructions.

Copying Files Using IBASIC Commands

Files can be copied from one mass 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 “MY_TEST:INTERNAL” TO “MYFILE:,700,0”
```

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

```
SAVE “MY_TEST:INTERNAL”
```

You can 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 mass storage is already defined to be the memory card, then **":INTERNAL"** is optional. If you are entering many characters into the IBASIC command line, you will want to connect a terminal to the Test Set. **See "Serial Port Configuration" on page 117**. You will also want to use a terminal if you have many files to list. File names displayed with the **CAT** IBASIC command scroll past the top of the Test Set CRT display and cannot be scrolled down.

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

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

Parameters, pass/fail limits, and external device configuration entries give you flexibility in the way you use the HP 11807B Option 050 software. Default values for parameters and pass/fail limits are entered into the software. This section shows you how you can change them.

NOTE: **Channel Information/Edit Frequencies is not Used**

The Channel Information/Edit Frequencies Test Function is not used by the HP 11807B Option 050 software. Base station frequencies are coded into the software, or are determined by messages sent by the base station to the Test Set. Entries into the fields in the **`Channel Information`** (or **`Edit Frequencies`**) screen will not affect the operation of the base station test software.

Parameters

Parameters are values you enter that optimize your use of the test software. Many of the parameters are determined by examining your test needs. An example of one of these is *GN site has LNAs*. Other parameters are determined by performing measurements to calibrate items in your system. An example of one of these is *RX path loss to antenna 1*.

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

To edit a parameter value:

1. Press TESTS.
2. Select **`Test Parameters`** from the **`CUSTOMIZE TEST PROCEDURE`** list (or **`Edit Parm`** from the **`Test Function`** field).
3. Position the cursor to the **`Parm#`** field and select it.
4. Rotate the knob to the desired parameter number and select it.
5. Position the cursor to the **`Value`** field and select it.
6. Enter the desired value using the DATA keypad and press ENTER.
   a. Use the ⇐ key to backspace.
   b. Press CANCEL to cancel entries and retain the old value.
7. Press k5 (**`Main Menu`**) (or TESTS) to return to the TESTS screen.

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

You should verify that parameters are properly set after you select the TESTs to be placed in your sequence. Lists of the parameters used by each of the TESTs are contained in **chapter 5, "TESTs - Reference"**. Some of the parameters are designed to provide flexibility in the way tests are run. For example, *GN auto exit adj* lets you enter the number of measurements that must be within specification before the program automatically exits an adjustment procedure. There are a number of general parameters that affect the operation of many of the tests in this software. They 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=fail 2 =always]

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]

Refer to the section **"Determining Calibration Parameters" on page 87** for details on how to obtain values for parameters that require a measurement.

Refer to **chapter 6, "Parameters - Reference"** for descriptions of each parameter.

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

Parameters remain in battery-backed-up memory until you select a Procedure to run. If you wish to prevent them from being lost when a new Procedure is selected, you will have to save them in a Procedure. See **"Securing a Procedure" on page 104**.

Pass/Fail Limits (Specifications)

Pass/Fail Limits (Specifications) are values you enter that set passing limits for tests. Default values are available in the test software. They have been derived from standard methods of measurement or from Motorola requirements.

To edit a pass/fail limit value:

1. Press TESTS.
2. Select **`Pass/Fail Limits`** from the **`CUSTOMIZE TEST SET`** list (or **`Edit Spec`** from the **`Test Function`** field).
3. Position the cursor to the **`Spec#`** field and select it.
4. Rotate the knob to the desired pass/fail limit number and select it.
5. Position the cursor to the **`Lower Limit`** or the **`Upper Limit`** field and select it.
6. Enter desired value using the DATA keypad and press ENTER.
   a. Use the ⇐ key to backspace.
   b. Press CANCEL to cancel entries and retain the old value.
7. Position the cursor to the **`Check`** field and select it.
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 104**.

Pass/Fail Limits (specifications) do not have to be changed when you select a TEST or change the TESTs in your sequence. Each TEST has pass/fail limits that apply to it.

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

See **chapter 7, "Pass/Fail Limits (Specifications) - Reference"** for descriptions of each pass/fail limit.

Pass/Fail Limits remain in the Test Set's battery-backed-up memory until you select a Procedure to run. If you wish to prevent them from being lost when a new Procedure is selected, you will have to save them in a Procedure. See **"Making a Procedure" on page 101**.

External Device Configuration

Configuration defines the equipment arrangement you use for data collection, RF and audio switching (or use of a splitter), printing (for test set firmware below revision A.14.00), and logging of base station messages.

See **figure 12** for a typical **`External Devices (or Edit Configuration)`** screen.

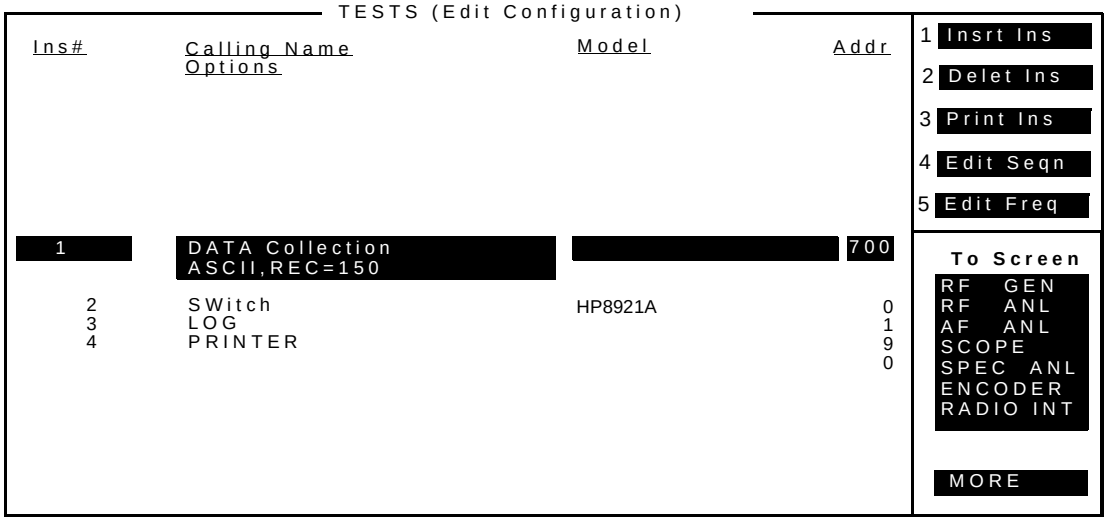


Figure 12 **A Typical TESTS (Edit Configuration) Screen**

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 CRT.

See **"Conventions Used" on page 49** for descriptions of the terms **select** and **choose**.

To enter an item into `External Devices` (or `Edit Configuration`):

1. Press TESTS.
2. Select **`External Devices`** from the **`SET UP TEST SET`** list (or **`Edit Cnfg`** from the **`Test Function`** field).
3. Position the cursor to the field in the column labeled **`Inst#`** and select it.
4. Rotate the knob and select the desired **`Inst`** number (the next available field).
5. Press USER (**`Insrt Ins`**) or USER (**`Delet Ins`**) to insert or delete instruments.
6. Position the cursor to the **`Calling Name`** field and select it.
7. Using the characters available in the **`Choices Menu`**, enter the desired **`Calling Name`**. (See **table 5, "Configuration Table Entries" on page 114**)
   - Use the ⇐ key to backspace.
   - Press CANCEL to cancel entries and retain the old entry.
8. Choose **`Done`** from the list after the entry is made.
9. Repeat for **`Options`**, **`Model`**, or **`Addr`** fields as appropriate.

Default configuration entries have not been entered into the software. You will have to enter the RF and audio switch or splitter arrangement you are using. Messages will be displayed if you do not make necessary entries into the **`External Devices`** (or **`Edit Cnfg`**) screen. If a switch is specified, the software will initially display the necessary connections and then automatically control RF and audio switching during test.

If a splitter is specified, the software will display the necessary connections and prompt the user to manually change the audio connections. A calling name of SPLitter configures the Test Set to not display connectivity information each time an antenna connection has to be changed. Each time an audio connection needs to be made (Test Jack or RCV out) to the Test Set's audio in, the program will prompt the operator to make the connection. This allows users to use the Test Set without a mechanical switch box. The splitter, cable losses and coupler (if used) to the antenna ports need to be calibrated and the RX path loss factors entered into the Test Set's Edit Parm 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 software will display connections and prompt you for manual changes.

The external device configuration remains in the Test Set's 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, or disk.

The key words in **table 5, "Configuration Table Entries" on page 114**, are used by the software to provide information about the particular disk drive, signal path switches, and printers that you have in your system.

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

See "Data Collection" on page 130 for examples of entries you can make into the External Devices (or Edit Cnfg) screen.

Table 5 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 5 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 130.
5. See Data Collection on page 130.
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 130.
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 to a Test Set CONFIGURE Screen

You can change the CRT intensity, beeper volume, and set the time and date of the Test Set real-time clock using the CONFIGURE screen. See the Test Set *User's Guide*.

NOTE: **Two CONFIGURE Screens**

In versions of firmware shipped after October 1992, fields have been placed on a new Test Set CONFIGURE screen. To accommodate the fields, a second CONFIGURE screen has been added. You can access the second CONFIGURE screen by selecting **`More`** from the **`To Screen`** list in the lower right corner of the CRT display. Some of the fields on the original CONFIGURE screen were moved to the second CONFIGURE screen.

Depending on your use of the HP-IB and Serial port, you may have to use CONFIGURE to set up communication and protocol characteristics.

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. You can print screens or connect a terminal to remotely operate the Test Set. The Serial port can also be used to print test results or for data collection when tests are being run. You will have to make entries to a CONFIGURE screen if you use the Serial port.

The other serial port, the Serial B port, can only be controlled 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 cannot be entered manually. They are set automatically by the software.

Serial Port Configuration

Configuration for Printing Test Results

The characteristics of the Serial port are determined by settings on a Test Set CONFIGURE screen. The HP 11807B Option 050 software sets some of the fields on this screen. It does not set the following serial configuration items:

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

You will have to manually make entries into these fields. Determine the characteristics of your printer and enter them into a Test Set CONFIGURE screen. The entries will be retained after a power-down/ power-up cycle.

If you have test set firmware above revision A.14.00, you may setup a printer using the **`Printer Setup`** screen from the **`SET UP TEST SET`** list. **See "To Setup Printer Using the HP 8921A Firmware Above Rev. A.14.00" on page 121**. If you have test set firmware below revision A.14.00, you will have to make entries into the **`External Devices (or Edit Cnfg)`** screen to use this serial port for printing test results. **See "To print test results" on page 126** and **"Data Collection" on page 130** for the key words you must enter.

Configuration for Data Collection

The characteristics of the Serial port, when used for data collection, are determined by settings on a Test Set CONFIGURE screen. The HP 11807B Option 050 software sets some of the fields on this screen. It does not set the following serial configuration items:

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

You will have to manually make entries into these fields. Determine the characteristics of your computer and enter them into a Test Set CONFIGURE screen. The entries will be retained after a power-down/ power-up cycle.

You will have to make entries into the **`External Devices (or Edit Cnfg)`** screen to use this serial port for data collection. **See "Data Collection" on page 130** for the key words you must enter.

Configuration for Terminal or PC Operation

It is preferable 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 a Test Set 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 can use a compatible serial printer to print what is currently displayed on the CRT. You will need to select **`Serial`** for the **`Print To`** selection.

You can enter a **`Print Title`** into a CONFIGURE screen. It will appear at the top of the printout after you press PRINT.

HP-IB Port Configuration

If you use an HP-IB printer, you do not have to make entries into a Test Set CONFIGURE screen. If the **Mode** on the CONFIGURE screen is not set to **Control**, the software will ask you if you want it to be set. Answer USER (**Yes**). The setting will be retained after power-down.

If you have test set firmware above revision A.14.00, you may setup a printer using the **Printer Setup** screen from the **SET UP TEST SET** list. See **"To Setup Printer Using the HP 8921A Firmware Above Rev. A.14.00" on page 121**. If you have test set firmware below revision A.14.00, and you want to use an HP-IB printer to print test results, you will have to enter a keyword and address into the **External Devices (or Edit Cnfg)** screen. **See "Making Entries to a Test Set CONFIGURE Screen" on page 116**. You will also have to select **Printer** as the **Output Destination** in the TESTS **Test Execution Conditions**. **See "Test Execution Conditions," in chapter 4, on page 153**.

If you want to use an HP-IB printer to print what is currently displayed on the CRT, you will need to enter the following into the CONFIGURE screen:

- **Mode** - **Control**
- **Prnt Adrs** - The last two digits of the HP-IB address of your printer.
- **Print To** - **HP-IB**

You can enter a **Print Title** into a CONFIGURE screen. It will appear at the top of the printout after you press SHIFT PRINT.

NOTE: **Printer Setup Differences**

The HP 8921A had several firmware enhancements. The following **Setup Printer** section applies to users with:

- HP 8921A test sets with firmware above revision A.14.00.

The test set's firmware revision is displayed on the top right corner of the configuration screen.

- Press SHIFT CONFIG to display the configuration screen and read the firmware revision.

If you have an HP 8921A with firmware revision below A.14.00, refer to the next section, titled **"To Setup Printer Using the HP 8921A Firmware Below Rev. A.14.00" on page 125**. Contact Hewlett-Packard at 1-800-922-8920 for details on upgrading your firmware if desired. EXCEPTION: If you are using A.xx.xx revision software, you can not use the **Printer Setup** screen regardless of your firmware revision. Refer to the instructions for firmware below A.14.00.

To Setup Printer Using the HP 8921A Firmware Above Rev. A.14.00

1. Press TESTS
2. Select **`Printer Setup`** from the **`SET UP TEST SET`** list.
3. Position the cursor to **`Model`** and select the desired printer.
4. Position the cursor to **`Print Port`** and select the desired port.
5. (If HP-IB only) Position the cursor to **`Printer Adrs`** and enter the HP-IB address for your printer (0-30).
6. Set the following options if desired:
   a. Lines/Page (controls the number of lines, 20-120, printed on a page before a form feed is sent to the printer)
   b. FF at Start (to cause a form feed at the start of a test sequence)
   c. FF at End (to cause a form feed at the end of a test sequence)
7. From the **`To Screen`** menu, select **`More`**.
8. From the **`Choices`** menu, select **`IO CONFIG`**.
   a. For Serial Printing, set the **`Serial Baud`** field and other serial communications fields listed under it to correspond to your printer's configuration.
   b. For HP-IB Printing, set the **`Mode`** field to **`Control`**.
9. Press TESTS to return to the TESTS (**`Main Menu`**) screen.

To print test results:

1. Press TESTS
2. Select **`Printer Setup`** from the **`SET UP TEST SET`** list.
3. Position the cursor to **`Output Results To`** and select **`Printer`**.
4. Position the cursor to **`Output Results For`** and select **`All`** if you want all results printed, or **`Failures`** if you want failures only printed.
5. (Optional) Position the cursor to **`Output Heading`** and enter your desired heading.

To send Escape Sequences to the printer

If you have revision B.xx.xx software, you may use the test set to send escape sequences to control printer options such as pitch, margins, paper size, etc… The software comes with some pre-defined escape sequences compatible with HP printers, listed below, or you have the option to enter others which are compatible with your printer (use your printer's user's manual for the available print features and corresponding escape sequences). This function is not available with revision A.xx.xx software.

The software already has an implied escape character for the first sequence, you need only to enter the escape sequence following the escape character. However, if you are linking two or more sequences together, you must use the **~** to indicate the escape character between each sequence. If the sequence exceeds the space allotted in the options field, you may continue with additional escape sequences in the next available **Options** field. You must however, still enter **Escape Seq** in the **Calling Name** field and the appropriate address in the **Addr** field for all subsequent entries.

How to send an Escape Sequence:

1. Press TESTS.
2. Select **External Devices** from the **SET UP TEST SET** list.
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. Select **Escape Seq** from the **Choices** menu.
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. Select the desired escape sequence from the **Choices** menu if applicable, or enter an appropriate sequence using the list of characters below the choices.

Table 6 Escape Sequence Definitions for HP Printers

Escape Sequence	Print Feature
&l66P	Sets page length to 66 lines
&l72P	Sets page length to 72 lines
&l6D	Sets lines per inch to 6 lines
&l8D	Sets lines to inch to 8 lines
(s12h12v6T	Selects 12 characters per inch 12/72 inch character height gothic typeface
&a9L~&l6E	Sets left margin to 9 characters top margin to 6 lines
(s12h12v6T~&a9L~&l6E	Selects 12 characters per inch 12/72 inch character height gothic typeface left margin to 9 characters top margin to 6 lines
&l8d88P	Selects 8 lines per inch 88 lines per page
&l8d96P	Selects 8 lines per inch 96 lines per page
(s16.67h12V~&a17L~&l6E	Selects 16.67 characters per inch 12/72 inch character height left margin to 17 characters top margin to 6 lines

To print TESTS screens:

TESTS screens include:

- ”External Devices”
- ”Order of Tests”
- ”Channel Information”
- ”Pass/Fail Limits”
- ”Test Parameters”

The same general process is used to print the information for all of the above TESTS screens.

1. Make sure that your printer is properly connected and configured as explained earlier in this section.
2. Press TESTS.
3. Select the **CUSTOMIZE TEST PROCEDURE** screen of your choice.
4. Press k3 (**Print All**) and select it.
5. Press TESTS to return to the TESTS (Main Menu) screen.

To Setup Printer Using the HP 8921A Firmware Below Rev. A.14.00

1. Press TESTS
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 **Model** field and select it (optional).
8. Using the DATA keypad, enter the Model # and press ENTER.
9. Position the cursor to the **Addr** (address) field and select it.
10. Using the DATA keypad, enter **9** for serial printers, **15** for parallel printers, or **70X** for HP-IB printers, then press ENTER. .
11. Position the cursor to the **Options** field (directly under **Calling Name**) and select it.
12. 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**)
    a. **LN** equals the number of printed lines per page.
    b. **START** causes a form feed at the start of each printout.
    c. **END** causes a form feed at the end of each printout.
13. From the **To Screen** menu, select **More**.
14. From the **Choices** menu, select **IO CONFIG**.
15. For Serial Printers:
    a. Set the **Serial Baud** field and other serial communications fields listed under it to correspond to your printer's configuration.
16. For HP-IB Printers:
    a Position the cursor to the **Mode** field and select it.
    b From the **Choices** menu, select **Control**.
    c Position the cursor to the **Print Adrs** field and select it.
    d Rotate the knob and select the HP-IB address of your printer.
    e Position the cursor to the **Print To** field. Pressing knob will toggle the underlined selection. Select to underline **HP-IB**.
17. Press TESTS 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 TESTS.
3. Position the cursor to the **`Output Results To:`** field (or the **`Output Destination`** field). Pressing 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.

To send Escape Sequences to the printer

If you have revision B.xx.xx software, you may use the test set to send escape sequences to control printer options such as pitch, margins, paper size, etc… You may enter sequences which are compatible with your printer (use your printer's user's manual for the available print features and corresponding escape sequences). This function is not available with revision A.xx.xx software.

The software already has an implied escape character for the first sequence, you need only to enter the escape sequence following the escape character. However, if you are linking two or more sequences together, you must use the **~** to indicate the escape character between each sequence. If the sequence exceeds the space allotted in the options field, you may continue with additional escape sequences in the next available **`Options`** field. You must however, still enter **`Escape Seq`** in the **`Calling Name`** field and the appropriate address in the **`Addr`** field for all subsequent entries.

How to send an Escape Sequence:

1. Press TESTS.
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. Enter **ESCAPE SEQ** using the characters in the **Choices** menu. Select **Done** when you are finished.
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. Select the desired sequence using the list of characters below the choices.

Table 7 Examples of Common Escape Sequences

Escape Sequence	Print Feature
&l66P	Sets page length to 66 lines
&l72P	Sets page length to 72 lines
&l6D	Sets lines per inch to 6 lines
&l8D	Sets lines to inch to 8 lines
(s12h12v6T	Selects 12 characters per inch 12/72 inch character height gothic typeface
&a9L~&l6E	Sets left margin to 9 characters top margin to 6 lines
(s12h12v6T~&a9L~&l6E	Selects 12 characters per inch 12/72 inch character height gothic typeface left margin to 9 characters top margin to 6 lines
&l8d88P	Selects 8 lines per inch 88 lines per page
&l8d96P	Selects 8 lines per inch 96 lines per page
(s16.67h12V~&a17L~&l6E	Selects 16.67 characters per inch 12/72 inch character height left margin to 17 characters top margin to 6 lines

To print TESTS screens

TESTS screens include:

- ”Edit Cnfg”
- ”Edit Seqn”
- ”Edit Freq”
- ”Edit Spec”
- ”Edit Parm”

The same general process is used to print the information for all of the above TESTS screens.

1. Make sure that your printer is properly connected and configured as explained earlier in this section.
2. Press TESTS.
3. Select the TESTS screen you desire.
4. Press k3 (**`Print All`**) and select it.
5. Press TESTS to return to the TESTS screen.

Data Collection

The HP 11807B Option 050 software has the capability to save test results to a SRAM memory card, to a disk drive, or to a PC.

Collection to a Memory Card or Disk

You will have to make entries into the **`External Devices`** (or **`Edit Cnfg`**) screen to describe the type of data collection you are using.

To make `External Devices` (or `Edit Cnfg`) entries:

1. See the procedure To enter an item into **`External Devices`** or (**`Edit Cnfg`**) in **"External Device Configuration" on page 111**.
2. Enter **`DATA C`** into the **`Calling Name`** next to **`Inst# 1`**. The entry will look like:

```
1  DATA C
```

3. Enter a number into **`Addr`**, depending on the type of storage media you will be using:

If you are using a memory card, enter **`1`** into the **`Addr`**:

```
1  DATA C    1
```

If you are using a disk drive, enter the HP-IB disk address. For example, if the drive you are using is set to 700, then the display needs to look like:

```
1  DATA C   700
```

In this example, **DATA C** was entered into **Inst#=1**. The calling names can be ordered in other ways. **DATA C** may be in **Inst#=2**; **PRINTER** may be in **Inst#=1**. The test software supports data storage on Logical Interchange Format (LIF) and Disk Operating System (DOS) disk formats. Storage can 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 be specifying the file type with the entry you make into the **Options** field immediately below **DATA C**. If no file type is entered, and the disk format is LIF, the software will select an HP-UX file type. If no file type is entered, and the disk format is DOS, the 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 on the **External Devices** (or **Edit Cnfg**) screen will look like:

```
1  DATA C   700
```

If you are using an ASCII, BDAT or HP-UX file, you can specify the number of records allocated to the file. The DOS file is automatically updated as data is stored, so record allocation is not required. If you are using HP-UX files, you will have to 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). You can enter the **REC=** after the file type. For example, to use an ASCII file with 200 records of 256 bytes each, you will 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 can be separated by a comma or a space.

Initializing a Disk

If you are starting with a blank disk, you will have to initialize it to the format you have chosen. 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 you are using 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 CONFIGURE screen is set to **Control**.
2. Enter the following into the TESTS 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 **INITIALIZE "DOS:,7xx,y"**.

Initializing a Memory Card

There are two ways to initialize a memory card. If you have a terminal emulator attached to the Test Set, you can 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 memory card for use under the LIF format, type the following into the IBASIC command line: **INITIALIZE ":INTERNAL"**

To run RAM_MNG, select the TESTS screen, **Location: ROM**, and

Procedure: RAM_MNG. Press **Run Test**. Follow the displayed instructions. Loading RAM_MNG will delete any procedure or program in memory.

To initialize an SRAM memory card for use under the DOS format, type the following into the IBASIC command line: **INITIALIZE "DOS:INTERNAL"**

Collection to a PC

Test results can be output the Serial port. A variety of devices can receive the data. An HP 100LX Palmtop, PC, laptop, or terminal can 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 Test Set's *Instrument BASIC Progammer's Guide* (HP part number E2083-90000) for information on setting up the AdvanceLink program.

To set up for data collection to a PC:

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

```
1  DATA C
```

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

```
1  DATA C    9
```

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

The Test Set Serial port configuration needs to be set up. See **"Configuration for Data Collection" on page 118**.

Retrieving Data from a Memory Card

To retrieve the test results after they have been saved on a SRAM memory card, you will have to run an IBASIC program. A program to transfer data from a memory card to a terminal emulator is listed below. You can type the program lines into the IBASIC command line from a terminal emulator. See **"Configuration for Terminal or PC Operation" on page 119**.

To enter the data retrieval program:

1. Press TESTS.
2. Select **`IBASIC Cntrl`** from the **`SET UP TEST SET`** list (or **`IBASIC`** from the **`Test Function`** field).
3. Position the cursor next to the large field in the upper part of the display. You can use this field to enter IBASIC program statements and commands.
4. Enter **`SCRATCH`** to delete the IBASIC program. Be sure it's 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 memory 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 USER (**Run**)) to run the entered IBASIC program.

NOTE: **Difference between Run and Run Test**

The USER (**Run**) key, assigned as a default key on the TESTS (IBASIC Controller) screen, will start an IBASIC program that is loaded into program memory. The USER (**Run Test**) key, assigned as a default key on the TESTS screen, will load the program that results from the **Procedure:** and **Location** entries on the TESTS 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 can type it into the IBASIC command line from the terminal emulator.

Be sure your program is saved, because it will be deleted from program memory. 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.
2. Select **IBASIC Cntrl** from the **SET UP TEST SET** list (or **IBASIC** from the **Test Function** field).
3. Position the cursor next to the large field in the upper part of the display. You can use this field to enter IBASIC program statements and commands.
4. Enter **SCRATCH** to delete the IBASIC program. Be sure it’s saved first.
5. See step 6 from **"Retrieving Data from a Memory Card" on page 135**, and 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 the resulting program.
7. Enter RUN (or press USER (**Run**)) to run the entered IBASIC program.

4

Running Tests

What is a Test?

The terms TESTS, TESTs, and tests have different meanings. The following describes these meanings.

TESTS Main Menu Screen

The TESTS Main Menu screen is used in the Test Set to provide a 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 050 TESTs or to the tests described below. See **"TESTS Main Menu Screen" on page 142**, the next section in this chapter.

The TESTS Main Menu screen has sub-screens. They are accessed by selecting the fields under the **CUSTOMIZE TEST PROCEDURE** and **SET UP TEST SET** headings on the Main Menu screen, (or for firmware below revision A.14.00, selecting the **Test Function** field on the TESTS screen). These sub-screens allow you to edit pass/fail limits, parameters and other items that optimize the application of the software.

TEST_01 through TEST_11

In the HP 11807B Option 050 software a combination of measurements, adjustments, commands to the base station, and other program operations are performed in TESTs. These TESTs are numbered. 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 - Signalling Transceiver MANUAL Mode

TEST_05 - Scanning Receiver MANUAL Mode

TEST_06 - Combiner Adjustment

TEST_07 - Manual Switch and Calibration Aid

TEST_08 - Voice Channel Manual Test Mode

TEST_09 - VSWR Swept Return Loss

TEST_10 - VSWR Discrete Channel Return Loss

TEST_11 - VSWR vs Distance (cable fault)

Tests Performed in each TEST

Within each TEST, one or more tests are run. A test is a series of steps taken to determine if some item of base station performance is acceptable. For example, some of the tests performed in **TEST_02 - URDM or RDM Frequency/Level**:

Order of TESTs in a Sequence

You can run TEST_01 through TEST_11 in whatever sequence is best for your application. For example, you may want to put TEST_01 - **`Laptop emulator`** before a TEST requiring the cell site to be taken out of service.

The order of TESTs is entered by displaying the **`Order of Tests (or Edit Sequence`**) screen, and using the knob to select TESTs from a list.

TESTS Main Menu Screen

The TESTS Main Menu Screen is the main screen of the “Tests Subsystem,” a group of screens used to load, customize, and run automated test programs. Your HP 11807B Option 050 software is an example of a test program. When you press TESTS, you access the main TESTS Main Menu screen. See **figure 13** and **figure 14** for an example of this screen.

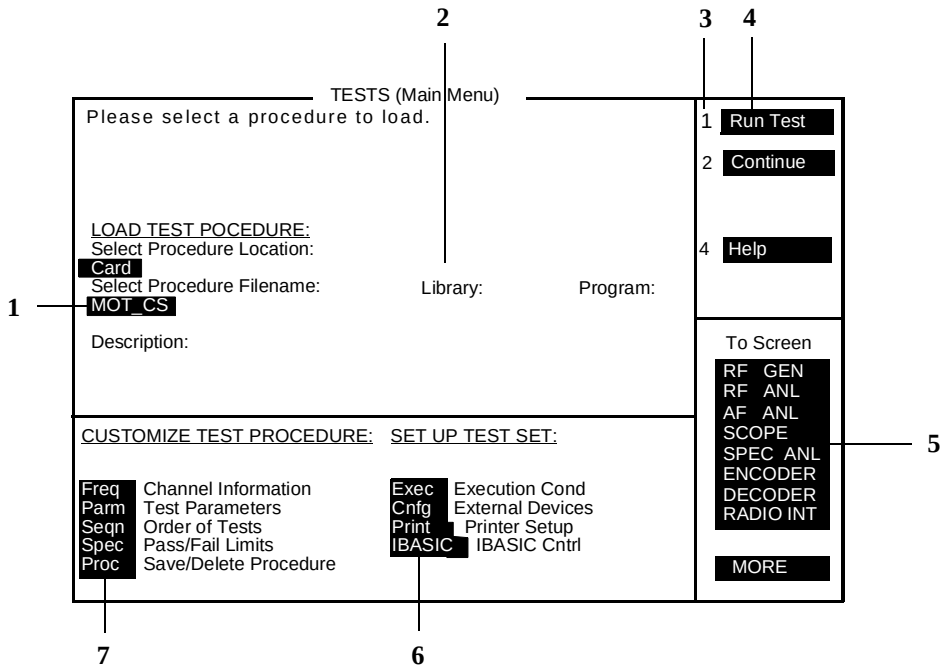


Figure 13 **A Typical TESTS Main Menu Screen (FW Above Rev. A.14.00)**

The following list describes the fields on the TESTS Main Menu screen.

1- **`Procedure Filename`** and the **`Location`** it will be retrieved from - The Procedure contains your testing order, pass/fail limits, and parameters. **See "Procedures," in chapter 3, on page 100**.

2- **`Library name`** - The Library contains the names of all available TESTs, parameters, and pass/fail limits.

3- **`USER key labels`** - The numbers correspond to the USER keys k1 through k5. Default assignments have been made. You can reassign these keys using the front-panel SHIFT ASSIGN and SHIFT RELEASE keys.

4- **`USER keys`** - You can quickly access Help or start or continue a TEST with these keys. **See "USER Keys," in chapter 5, on page 160**.

5- **`To Screens`** - Access to Test Set instrument screens. You can exit the TESTS Main Menu screen by selecting one of these, or by pressing one of the SCREEN CONTROL front-panel keys. **See "Exiting the Program," in chapter 8, on page 224**.

6- **`SET UP TEST SET`** is used to access the screens you need for external device configuration, and accessing **`IBASIC Cntrl`**. Note: the **`Printer Setup`** screen is used by HP 11807B Option 050 only with test set firmware above revision A.14.00. To setup a printer with test set firmware below revision A.14.00, you must access **`External Devices`** and **`Execution Conditions`**. **See "Configuration for Printing Test Results," in chapter 3, on page 117**.

7- **`CUSTOMIZE TEST PROCEDURE`** is used to access the screens you need for editing parameters, pass/fail limits, and the order of tests. **See "Entering Parameters, Pass/Fail Limits, and External Device Configuration," in chapter 3, on page 108**. A screen to save or delete a test procedure is also available. **See "Procedures," in chapter 3, on page 100**.

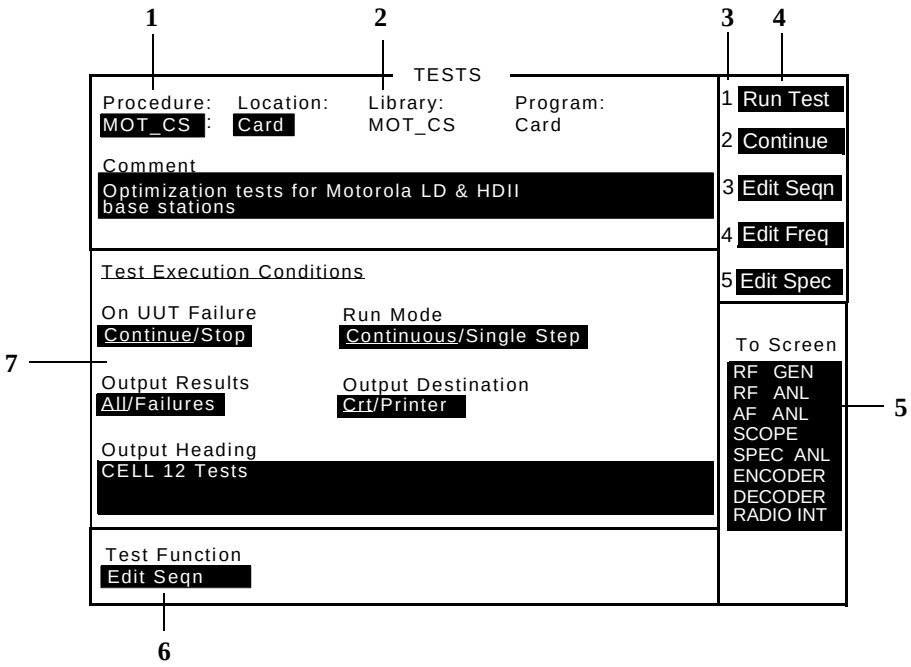


Figure 14 **A Typical TESTS Screen (FW Below Rev. A.14.00)**

The following list describes the fields on the TESTS screen.

1- **`Procedure name`** and the **`location`** it will be retrieved from - The Procedure contains your TEST sequence, specifications, and parameters. **See "Procedures," in chapter 3, on page 100**.

2- **`Library name`** - The Library contains the names of all available TESTs, parameters, and specifications.

3- **`USER key labels`** - The numbers correspond to the USER keys k1 through k5. Default assignments have been made. You can reassign these keys using the front-panel SHIFT ASSIGN and SHIFT RELEASE keys.

4- **`USER keys`** - You can quickly access sub- screens or start or continue a TEST with these keys. **See "USER Keys," in chapter 5, on page 160**.

5- **`To Screens`** - Access to Test Set instrument screens. You can exit the TESTS screen by selecting one of these, or by pressing one of the SCREEN CONTROL front-panel keys. **See "Exiting the Program," in chapter 8, on page 224**.

6- The *Test Function* is used to access the screens you need for entering a TEST sequence, parameters, specifications, and configuration. **See "Entering Parameters, Pass/Fail Limits, and External Device Configuration," in chapter 3, on page 108**. A Procedure Manager is also available. **See "Procedures," in chapter 3, on page 100**.

7- **`Test Execution Conditions`** are used to change the way that the software works when a test result is obtained. **See "Test Execution Conditions," in chapter 4, on page 153**.

Starting the Program

If you are using this software for the first time, **See "Getting Started with FW Above Rev. A.14.00," in chapter 1, on page 22** or **see "Getting Started with FW Below Rev. A.14.00," in chapter 1, on page 34**. It will show you how to load and run the default Procedure, named **TACS_CS**, that is on the your software memory card.

This default Procedure shipped with your software does not have the calibration parameters for each of your cell sites, so you will have to load and run Procedures that you have made for each of your cell sites. **See "Securing a Procedure" in chapter 3, "Setting Up."**.

This section shows you how to start running the software, when you have Procedures that contain your cell site calibration parameters and other conditions you have set up.

The steps you will follow depend on:

- Whether or not the Procedure you want is loaded into the Test Set's battery-backed-up memory.
- Whether or not the HP 11807B Option 050 software code file is loaded into the Test Set's battery-backed-up memory.
- Where the Procedure and other files are stored.
- Whether or not the base station is locked.

Examples will be used to describe the steps you may take. If the base station is locked, you will be selecting **TEST_01 - Laptop Emulator** and running it. Send the base station the password to unlock it. Then select the desired TEST by following the steps in that follow.

As a first example, let's say you are at a cell site and you want to test a voice transceiver. **TEST_01 - Laptop Emulator** was previously run, and then the Test Set was powered off. Now you want to select **TEST_03 - Voice Transceiver**. In this case:

To run a different TEST:

As a second example, let's say you have left Cell Site #1 to test at Cell Site #2, and the Procedure **CELL_1** is in the Test Set's battery-backed-up memory. You will have to replace it with the Procedure **CELL_2** . If no other programs have been loaded, the **TACS_CS** program will remain in the Test Set's battery-backed-up memory. In this case:

To load and run a new Procedure:

1. Push in the Test Set power switch.
2. Wait for self-tests to finish.
3. Connect the Test Set to the base station. See **figure 2, in chapter 3, on page 74**.
4. Insert the SRAM memory card with your Procedures into the front-panel slot.
5. Press the front-panel TESTS key.
6. Select the **`Select Procedure Location`** (or **`Location`**) field, and choose **`Card`**.
7. Select the **`Select Procedure Filename`** (or **`Procedure`**) field, and choose the desired Procedure from the list.
8. Select **`Order of Tests`** from the **`CUSTOMIZE TEST PROCEDURE`** list (or press USER (**`Edit Seqn`**)).
9. Select the top (or only) field in the column labelled **`Test Name`**.
10. If the base station is locked: choose TEST_01; skip the next step in this procedure.
11. Choose the TEST you want to run.
12. Press TESTS.
13. Press USER (**`Run Test`**).

As another example, let's say that you ran a program other than the HP 11807B Option 050. The Procedure and the program are no longer loaded in the Test Set's battery-backed-up memory. You want to run **TEST_02 - URDM or RDM Frequency/Level**. In this case:

To load the software and run a TEST:

1. Push in the Test Set power switch.
2. Wait for self-tests to finish.
3. Connect the Test Set to the base station. See **figure 2, in chapter 3, on page 74**.
4. Insert the SRAM memory card with your Procedures into the front-panel slot.
5. Press the front-panel TESTS key.
6. Select the **`Select Procedure Location`** (or **`Location`**) field, and choose **`Card`**.
7. Select the **`Select Procedure Filename`** (or **`Procedure`**) field, and choose the desired Procedure from the list.
8. Select **`Order of Tests`** from the **`CUSTOMIZE TEST PROCEDURE`** list (or press USER (**`Edit Seqn`**)).
9. Select the top (or only) field in the **`Test Name`** column.
10. If the base station is locked: choose TEST_01; skip the next step in this procedure.
11. Choose the TEST you want to run: TEST_02.
12. Remove the SRAM memory card and plug in the software memory card.
13. Press TESTS.
14. Press USER (**`Run Test`**).

When the Program Starts Running

The test software will start when you press USER (**`Run Test`**).

The program uses the last sets of parameters, pass/fail limits, and testing order that were entered. When you select a Procedure, you are entering into the Test Set memory the parameters, pass/fail limits, and testing order that were stored with that Procedure.

Subsequent changes to parameters, pass/fail limits, and testing order will be stored in the Test Set's battery-backed-up memory.

NOTE: **Display After the Program Starts**

After starting the program, you may 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 may have been placed in the display before you started running the program. Also, the main display area of the CRT may contain information placed by a previously run program. The CRT display and message line will usually be cleared soon after the program starts.

NOTE: **Make TX Connections When They are Displayed**

The Test Set will graphically display connections as they need to be made. You should not make a connection to the Test Set RF IN/OUT connector until a request to do so is displayed. The HP 11807B Option 050 automatically zeroes the Test Set power meter as the software is initializing; an error will be introduced if RF power is applied while zeroing is occurring. A message is displayed to tell you to disconnect the RF IN/OUT connection before zeroing begins.

System initialization begins after USER (**Run Test**) is pressed.

You may have to wait about 3 minutes after pressing **Run Test** for the initialization to be completed. If the program is stored in the Test Set's battery-backed-up memory when you press **Run Test**, initialization will be performed in considerably less time.

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

As TESTs are being run, a USER key is sometimes assigned so that you can access the base station control program. It is available for this purpose when the USER key label displays **Laptop**. Messages to and from the base station can be logged as the tests proceed. Refer to **table 5 on page 114** for details on the calling name **LOG** that can be entered into the **External Devices** (or **Edit Cnfg**) screen.

Refer to **chapter 5, "TESTs - Reference"** for details about each of the TESTs in the sequence you have put together.

Entering the Order of TESTs

You can link one or more TESTs into a procedure. When the first TEST is finished, the next will run. For example, you may want to put **TEST_01 - Laptop Emulator** before a TEST requiring the cell site to be taken out of service.

You may find it preferable to have only one TEST in a procedure. You will be able to select the individual TEST that you want to run. After you load a Procedure, you can edit the order of TESTs, and change the single TEST to the one you want to run. For example, if you are primarily testing voice transceivers, you can create a procedure with only **TEST_03 - Voice Transceiver** in it. **See "Starting the Program" on page 146** 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 may run faster because of a lack 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 due to off-air signals. Some of the TESTs are designed such that they must be run in the MANUAL mode. **See chapter 5, "TESTs - Reference"**.

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

The order of tests can be secured. **See "Securing a Procedure," in chapter 3, on page 104**.

To edit the Order of Tests:

1. Press the front-panel TESTS key.
2. Select **`Order of Tests`** from the **`Customize Test Procedure`** list (or press USER (**`Edit Seqn`**).
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 choose a TEST.
4. Press USER (**`Insrt Stp`**) until the sequence has as many steps as you want. When you press this key, the TEST in the displayed sequence that has its **`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 USER (**`Delet Stp`**) to delete the highlighted step in the sequence. When you press this key, the TEST in the displayed sequence that has its **`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 knob to display all or part of the sequence.
7. To change the TEST that is in a particular step in the sequence:
   a. Select the highlighted (inverse video) field in the column labelled **`Step #`**.
   b. Rotate the knob to the step number you want to change.
   c. Press the knob.
   d. Select the highlighted (inverse video) field in the column labelled **`Test Name`**.
   e. Choose the TEST you want at this step number.
8. The **`Yes/No`** selection in the column labelled **`All Chans?`** on the TESTS (Edit Sequence) screen is not used by the HP 11807B Option 050 software. The channels to be tested are determined by the software.

See "Getting Started with FW Above Rev. A.14.00," in chapter 1, on page 22 or **"Getting Started with FW Below Rev. A.14.00" on page 34** and **"Starting the Program" on page 146** for examples of the use of the **`Order of Tests`** (or Edit Seqn) screen.

Test Execution Conditions

In some situations, you may wish to change the way the software works when a test result is obtained. **Test Execution Conditions** allow you to do this.

Test Execution Conditions are displayed on the TESTS screen in firmware below revision A.14.00. Press TESTS to display them. In firmware above revision A.14.00, **Test Execution Conditions** are located on a screen accessed through the **SET UP TEST SET** list.

Test Execution Conditions are not retained after a power-down/ power-up cycle.

The following **Test Execution Conditions** can be set as needed:

If Unit-Under-Test Fails (On UUT Failure)

You can select either: **Continue/** or **/Stop** Default:**Continue**

If you set this to **Stop**, and a pass/fail result is **F**, the program will stop.

Test Procedure Run Mode (Run Mode)

You can select either: **Continuous/** or **/Single Step** Default:**Continuous/**

You can make tests pause at certain times. If you set this to **Single Step**, the program will pause after a comparison is made between a test determination and the expected result. For example, tests will pause after the program compares the results to a pass/fail limit. You can continue from the paused state by pressing USER (**Continue**).

Output Results For (Output Results)

You can select either: **All/** or **/Failures** Default:**All**

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

Output Results To (Output Destination)

You can select either: **Crt/** or **/Printer** Default:**Crt**

You can specify where test results are to be placed. If you select **Crt**, results will be displayed on the Test Set CRT. If you select **Printer**, test results will be sent to the CRT and to a printer. You must make entries to the **External Devices (or Edit Cnfg)** screen to specify the address of your printer. If you are using a serial printer, you will also have to make entries to the I/O CONFIGURE screen to match the Serial port characteristics to those of the printer.

Output Heading

You can use this field to enter a heading that will be printed or displayed.

Select the **Output Heading** field. Use the knob to choose and enter the characters that you want to appear in the heading.

Choose **Done** when you are finished.

HP-IB Control Annunciators

The words, letters, and symbols at the top right corner of the CRT 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 HP 11807B Option 050 software is running.
- **L** indicates the Test Set is listening, and is ready to receive a manual or remote command.
- **T** indicates the Test Set is talking to another HP-IB device.
- **S** indicates a service request has been generated.
- **C** indicates the Test Set is currently an active controller. Control mode is set on a CONFIGURE screen. The Test Set must be a controller if HP-IB peripherals are to be controlled.
- ***** indicates an IBASIC program is running, or the IBASIC controller is executing a command.
- **?** indicates 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 the program, press CANCEL. With few exceptions you should always stop the program by pressing CANCEL. This operation leaves the software in a state that is ready to run. When you subsequently press USER (**`Run Test`**), the code will immediately run. The Test Set firmware will not perform an unnecessary pre-run; TESTs will start quickly.

If the program is performing an input/output operation, the CANCEL key may not immediately pause the program. If the input/output operation is not successful, a timeout placed in the software will cause the program to pause in approximately ten seconds. Wait for this timeout to occur.

If the software does not pause after some time you may have 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.

CHANGING SETTINGS WHILE PAUSED

If you make changes to instrument setting while the program is paused, subsequent operation may be unpredictable. Error messages may or may not be displayed. See **"Exiting the Program" on page 224**.

After you are done testing, you can use **TEST_01 - Laptop Emulator** to send a command to the base station to lock access to it.

After pausing the program, you can continue it:

To continue a paused program:

1. Select the TESTS Main Menu screen if it not displayed: Press TESTS.
2. Press USER (**`Continue`**).

The test time is displayed when the test is completed. This time includes the time that the program is paused and the time that it is waiting for connection and inputs to be made. If you are testing through midnight, the test time will not display properly.

Saving Test Results

To save test results, you will have to make entries to the External Devices (or Edit Cnfg) screen. Depending on your storage device, you may have to make entries into the I/O CONFIGURE screen. See **"Serial Port Configuration" on page 117**, **"Data Collection" on page 130**, and **"Making Entries to a Test Set CONFIGURE Screen" on page 116**.

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 keys assigned, at times, to k1 through k5. They are assigned to the USER keys by the software when their use is appropriate. USER keys are sometimes referred to as “softkeys”.

`All Cal` Pressing this key causes the program to download scan receiver calibration data.

`Clr Scr` This USER key clears the Test Set’s CRT display.

`Continue` This USER key continues the program after it has been paused.

`Delet Stp` This USER key is used during the editing of items in a TEST sequence. When you press this key, the TEST in the displayed sequence that has its **`Step #`** highlighted (inverse video) will be deleted. The TESTs that follow in the sequence will be scrolled up by one step.

`Disp Data` Cable fault data can be displayed in graphical or tabular form. Pressing this key causes the software to change the display from the graphical form to a tabular form.

`Done` Press this key when you want to exit a TEST or have completed a task. 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.

`Edit Seqn`
`Edit Freq`
`Edit Spec` These keys can be used to quickly access a TESTS sub-screen. For example, when you press **`Edit Seqn`**, the TESTS **`(Edit Sequence)`** screen will be displayed. This sub-screen is used to enter one or more TESTs into a sequence.

`HDII Loc`
`LD Loc` When one of these keys is pressed, the location of an adjustment will be graphically displayed on the Test Set’s CRT display.

Insrt Stp This USER key is used during the entry of items into a TEST sequence. When you press this key, the TEST in the displayed sequence that has its **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. Choose a TEST before using this key to insert another.

Key/Dekey This USER key is used to turn on and off the RF power of the transmitter. When a TX power test starts, you will have to press this key. If an output power adjustment cannot be made with the PA installed, de-key the transmitter before you remove it. Key the transmitter after you have re-installed it.

Laptop When this USER key is displayed, you can exit the TEST to control the base station. Selecting **Done** on the Laptop Emulator screen causes the program to continue execution from the exit point.

Next Wind In TEST_08 - **Voice Channel Manual Test Mode**, several windows are displayed on the CRT. The cursor can be used to change test conditions and send commands in different windows. Pressing this key causes the cursor to move from its present window to a next window. The cursor will not move to a window unless a change is permitted in that window.

Next Chan This key is displayed at times in TEST_08 - **Voice Channel Manual Test Mode**. After you have selected **Tune test set** from the list in the **Measure** window, you can use this key to change the channel displayed above the parameters window. Pressing this key will select the next channel in the scan receiver channel list. **Tune test set** is provided in this TEST so you can use your laptop to manually check messages such as the RSSI of a scan receiver.

Next Ant This key is displayed at times in TEST_08 - **Voice Channel Manual Test Mode**. After you have selected **Tune test set** from the list in the **Measure** window, you can use this key to change the antenna displayed above the parameters window. Pressing this key will select the next antenna. **Tune test set** is provided in this TEST so you can use your laptop to manually check messages such as the RSSI of a scan receiver.

Page Up
Page Down

These USER keys move a selection list up and down in the Test Set's CRT display. They are used to quickly display items in the list when some of the items won't fit on the screen.

Prev Ant

This key is displayed at times in TEST_08 - **Voice Channel Manual Test Mode**. After you have selected **Tune test set** from the list in the **Measure** window, you can use this key to change the antenna displayed above the parameters window. Pressing this key will select the previous antenna. **Tune test set** is provided in this TEST so you can use your laptop to manually check messages such as the RSSI of a scan receiver.

Prev Chan

This key is displayed at times in TEST_08 - **Voice Channel Manual Test Mode**. After you have selected **Tune test set** from the list in the **Measure** window, you can use this key to change the antenna displayed above the parameters window. Pressing this key will select the previous channel. **Tune test set** is provided in this TEST so you can use your laptop to manually check messages such as the RSSI of a scan receiver.

Print All

This USER key can be used to print the parameters, pass/fail limits, external device configuration, and testing order you have entered into the TESTS sub-screens. The Serial Port or the HP-IB port can be used. **See "Making Entries to a Test Set CONFIGURE Screen," in chapter 3, on page 116**.

Prt Full

Pressing this key will expand the display of the base station messages. See **TEST_01 - Laptop Emulator**.

Re-test

This key is displayed after a cable fault test has been performed. Pressing this key causes the software to re-display the connection diagram so that another test can be started.

Run

This USER key starts an IBASIC program that has been loaded into the Test Set memory.

Run Test

This USER key loads and runs the program that results from the Procedure that has been entered into the TESTS screen **Procedure:** entry. If the program is already loaded into Test Set memory, it will be started.

Send ESC

After this key is pressed, the Test Set will send an escape command to the base station. This will terminate the display of information and messages from the base station. This key is displayed while TEST_01 -**Laptop Emulator** is running.

Show Log

This key is displayed at times while TEST_08 - **Voice Channel Manual Test Mode** is running. Pressing this key causes the program to display a log of recent base station commands and messages that have been sent or received. This key will only be displayed when the cursor is in the **BS commands sent** window.

Skip Sens
Skip SAT
Next Ant
Skp N SSI

These USER keys can be used to cause the program to skip over some tests in a Scan Receiver test. They are displayed when the parameter **SC skip items in scan test** is set to **1**. The **N** in **Skp N SSI** refers to the antenna being tested.

Skip TX

This user key can be used to skip the remaining transceiver tests in TEST_03 **Voice transceiver**. It would be used if the transceiver is failing and you want to skip this transceiver.

Sngl Step

This USER key steps 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 153**.

Stop Test

This USER key pauses the base station test software.

Take It

Pressing this key causes the program to accept the setting of an adjustment, and proceed with the program. Testing to determine if the adjustment is within limits is ceased.

Tns off
Tns quiet
Tns loud

These keys set the volume of tones that provide feedback to you during testing.

To Chan

A channel list will be displayed so a new channel can be selected.

Yes
No

These USER keys are pressed when answering questions displayed on the Test Set's CRT display.

Zoom	This key can be used to expand the display of a measurement while TEST_08 - **Voice Channel Manual Test Mode** is running.
-50 dBm **-90 dBm** **-110 dBm**	These keys are displayed during the calibration of LD SIG units and LD scan receivers. They are used to set the RF Generator to the level at which the calibration is performed.

TEST_01 - Laptop Emulator

This TEST allows you to send commands to the base station, and view messages sent from the base station.

CAUTION: **Before Sending a Command**

Commands you send may 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 may want to place TEST_01 immediately before one or more TESTs that require the system to be taken down. You can use this TEST to send the MANUAL command to the base station. **See "Entering the Order of TESTs," in chapter 4, on page 151**.

Sending Commands

The column on the left side of the TEST_01 screen contains commands that can be chosen and sent to the base station. Response messages are displayed in a window on the right side of the display. Rotate the knob to the command you wish to send to the base station, then push the knob to send it.

The base station generally echoes commands sent to it.

Select a command by rotating the knob to the command and pressing the knob.

USER (**`Page Up`**) allows you to quickly display commands that may have scrolled off the top of the display. USER (**`Page Down`**) can be used to view commands that have scrolled down.

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

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

Verify that the cursor is against the upper left corner of the large field in the upper part of the display. Then press the knob or use the numeric keypad to enter a value. Rotate the knob to **`Done`** and press the knob to complete the entry.

If you need to send a command that is not in the list provided in the HP 11807B Option 050 software, the **Enter Command** selection may be used. In some versions of base station firmware, the command syntax includes parameters that are not programmed into the commands in TEST_01. Determine the syntax of these commands and send them 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, suppose you want 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 adequately handed off.
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. Position the cursor in front of the Manual command using a combination of USER (**Page Down**) and rotations of the knob.
7. Push the knob.
8. If you are performing a SIG TEST, terminate the RF power from the SIG units, so mobiles do not attempt access. See **"TEST_04 - Signalling Transceiver MANUAL Mode" on page 178**.
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 signalling transceivers' RF power.

Messages

Messages from the base station are displayed in the box labeled **Base Station Response**.

The first 27 characters sent by the base station can be displayed in the Base Station Response section of the display. If a message has more than 27 characters in it, you can improve its readability by pressing USER (**Prt Full**). This will expand the responses to full screen. Pressing USER (**Continue**) returns 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 HP 11807B Option 050 software. Some messages may not be displayed in this case. After you press USER (**Prt Full),** the possibility of overflow is greatly reduced, and the display will update faster.

After messages have scrolled past the top of the message display, they cannot be retrieved by the Test Set for subsequent viewing.

Baud Rate

The Serial B port baud rate used by the HP 11807B Option 050 software is fixed at 1200 baud. Entries to the CONFIGURE screen of the Test Set do not affect this value.

After starting TEST_01, an **Autobaud** command is sent by the software to the base station. You can verify that a link exists by observing if a response appears on the Test Set display, soon after the TEST starts. If characters are not being 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 software, and connected to another RS-232 source, the baud rate may change. Send an **Autobaud** using TEST_01 to re- establish it.

Base Station Password

If the base station is locked and unable to be controlled, it will send a “#” to the Test Set display each time a command is sent to it. A password must be sent to the base station to allow access. The characters of the password can be entered by turning the knob and picking characters from a list. Always select **Done** after entering the characters. After a password is entered, the HP 11807B Option 050 software uses it as a default entry.

Base Station Report

The HP 11807B Option 050 test software can send a REP VCC# GROUP# command to the base station, and the status of the channels under this Voice Channel Controller will be displayed on the Test Set. You can verify the availability of the channel you are testing by looking for INSOPT after the channel number. The status report can also be used to determine that the system is generally set up and operating. A report can be displayed as you run voice transceiver tests. See **table 5, "Configuration Table Entries" on page 114** 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 your base station. The frequency of the 3 MHz reference is checked by measuring a voice channel's transmitter frequency. The level of the 3 MHz reference signal is measured with the Test Set spectrum analyzer. Frequency and level adjustments can be performed, if needed.

You may want to perform this TEST before testing transceivers, so you can be sure that the 3 MHz reference is working properly.

If you are going to be making adjustments to change the frequency of the RDM or URDM 3 MHz frequency reference, know the frequency error of the reference in the Test Set first. Depending on when the Test Set was calibrated, its frequency error may be greater than that of the frequency reference in the cell site. Calibrate it if necessary.

Selecting the Test State

This TEST can be run in the In-Service Optimization state or the MANUAL states.

If the **GN test state of [0=INS_OPT 1=MANUAL]** parameter is set to **0**, the In-Service Optimization mode will be selected. If the parameter has been set to **1**, you will be asked to verify that the site is in MANUAL mode. If you need to change the mode, pause the program by pressing CANCEL, display the TESTS (Edit Parameters) screen, and change the **GN test state of [0=INS_OPT 1=MANUAL]** parameter.

Calibration Parameter

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 parameter **RDM level correction factor (dB)**, you need to follow the procedure in **"Reference Distribution Module Level Correction Factor" in chapter , "Setting Up"**.

Questions Displayed

If you are running a TEST for the second time , the following question will be displayed:

`Do you want to use the last base station information entered?`

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

The following question will be displayed 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 a FREe command will be sent to the base station. Wait until the channel is taken out of service by the switch, then press USER (**`Continue`**). A DELete command will then be sent to the base station by the software, 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

The following tests are run in TEST_02:

URDM (or RDM) #1 frequency error

URDM (or RDM) #2 frequency error

URDM (or RDM) #1 level

URDM (or RDM) #2 level

Appendix B, "Appendix: Test Set Measurement Settings" contains some of the Test Set settings used for these tests.

Pass/fail limits

The following pass/fail limits are used in TEST_02:

RDM frequency error (Hz)

RDM output level (dBm)

Parameters

The following parameters are used in TEST_02:

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 can be verified and optimized.

Selecting the Test State

TEST_03 is normally performed in the In-Service Optimization mode. If the **`GN test state of`** parameter is set to **`0`**, reflecting the base station set to the In-Service Optimization mode, you will be asked if the channel is free. Otherwise, you will be asked to verify that the site is in manual mode. If you need to change the mode, pause the program by pressing CANCEL, display the TESTS **`(Edit 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 108**.

If you test in the MANUAL mode, **`TX peak data deviation`** will be measured. It cannot be measured in the In-Service Optimization mode using TEST_03.

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

You may find it preferable to take the cell site out of service when you are performing voice transceiver tests. 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.

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 88**.

Questions Displayed

If you are re-running a TEST, the following question will be displayed:

`Do you want to use the last base station information entered?`

The software will use the frequency and channel information displayed on the screen if you press USER (**`Yes`**). The “information” in the question does not refer to parameters, pass/fail limits, or other items you enter into the software. The software always uses the items you have recently entered or loaded with a procedure. If you press USER (**`No`**), you will be asked to select the VCC, VOC and TX harmonic filter.

The following question will be displayed 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 a FREe command will be sent to the base station. Wait until the channel is taken out of service by the switch, then press USER (**`Continue`**). A DELete command will then be sent to the base station by the software, and the channel will be available for testing.

You will be asked for the number of the TX harmonic filter you will use for the TEST. Refer to a site diagram or the Motorola cell site manual to see which harmonic filters are used by the voice transceivers. You will make connection to the couplers that are installed at the outputs of the harmonic filters. The software looks up the calibration parameter for the path loss to the TX harmonic filter you have chosen.

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. You can run the RDM or URDM TEST at this time if you suspect it is the source of unacceptable frequency error.

Keying the Transmitter

If you are making a power adjustment, you will have to press USER (**`Key/ Dekey`**) to key the transmitter. You will need to 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

TEST_03 performs the following tests. This list includes the extended tests. **See "GN perform extended tests [0=no 1=yes]," in chapter 6, on page 205**. **See appendix B, "Appendix: Test Set Measurement Settings"** 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

RX no signal SAT

RX signal ST detect

RX no signal ST detect

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

TX power @level 0 or at sector N (with adjustment)

TX SAT frequency error

TX SAT peak deviation (with adjustment)

TX test point JK output (with adjustment)

TX loop back level (optional) (with adjustment)

TX peak voice limiting (with adjustment)

TX voice deviation (with adjustment)

TX peak composite deviation @AVL

TX peak composite deviation @AVL =32 dB

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

The following pass/fail limits are used in TEST_03:

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 without LNA (dBm)

RX sensitivity without LNA (dBm)

RX SINAD at sensitivity spec (dB)

TX audio distortion (percent)

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

TX composite deviation at AVL (kHz)

TX composite deviation at AVL+32 dB (kHz)

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/sector 0 (percent)

TX output power error at level/sector 1 (percent)

TX output power error at level/sector 2 (percent)

TX output power error at level/sector 3 (percent)

TX output power error at level/sector 4 (percent)

TX output power error at level/sector 5 (percent)

TX output power error at level/sector 6 (percent)

TX output power error at level/sector 7 (percent)

TX SAT deviation (kHz)

TX SAT frequency error (Hz)

TX test point JK output (dbm)

TX voice deviation (kHz)

TX voice limiting deviation (kHz)

Parameters

The following parameters are used in TEST_03:

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 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]

TX output power for level/sector 0 (Watts)

TX output power for level/sector 1 (Watts)

TX output power for level/sector 2 (Watts)

TX output power for level/sector 3 (Watts)

TX output power for level/sector 4 (Watts)

TX output power for level/sector 5 (Watts)

TX output power for level/sector 6 (Watts)

TX output power for level/sector 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 pwr lvls [0 – 127=step PA – 1= sector PA]

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

TEST_04 - Signalling Transceiver MANUAL Mode

This TEST determines the performance of the Signalling Transceiver. Calibration of the receivers can be performed. This TEST can only be performed in the MANUAL mode; the cell site must be taken out of service.

NOTE: **High Power Load Needed when Testing SIG Units**

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 mobiles. 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 - Laptop Emulator** in this chapter.
- Ask the switch personnel to perform the task.
- Take the cell site down through the switch, using a laptop.

After you take the cell site out of service, send SIG OFF 0 and SIG OFF 1 commands if the Signalling 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 - **`Signalling transceiver MANUAL mode`**, a SIG ON will be sent shortly after the TEST starts.

You need to verify that the **`GN test state of`** parameter , in the TESTS **`(Edit Parameters)`** screen, is set to MANUAL. You will only need to do this the first time 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, asking 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 to display the TESTS screen.
3. Select **`Test Parameters`** from the **`CUSTOMIZE TEST SET`** list (or select **`Edit Parm`** from the **`Test Function`** field).
4. Select the field in the column **`Parm#`**.
5. Rotate the knob until the parameter number next to **`GN test state of`** is displayed. Press the knob.
6. Position the cursor in front of the **`Value`**.
7. Type 1 using the numeric keypad and press ENTER.
8. Press TESTS and USER (**`Run Test`**) to run the program.

HDII or LD Equipment

The software asks you whether the cell site has HDII or LD equipment. Calibration factors for handoff levels have to be uploaded to the Signalling Channel Controller if it is an HDII SCC. Be certain of the type of SCC you have, because there may be a mixture of LD and HDII equipment at the site.

LD equipment can be calibrated at –50, –90, or –110 dBm. USER keys are displayed so you can select the level. On HDII equipment, calibration is performed at – 90 dBm.

Calibration Parameters

Parameters must be entered into the software for the loss to each of the harmonic filters. **See "Transmitter Path Loss Calibration," in chapter 3, on page 88**.

Questions Displayed

You will be asked for the TX harmonic filter that is passing the signal you are measuring. Refer to a site diagram or the Motorola Cell Site manual to see which harmonic filters are used by the signalling transceivers. You will make connection to the couplers that are installed at the outputs of the harmonic filters.

If you are running a TEST for the second time , the following question will be displayed:

`Do you want to use the last base station information entered?`

The software will use the frequency and channel information displayed on the screen if you answer USER (**`Yes`**). The “information” in the question does not refer to parameters, pass/fail limits, or other items you enter into the software. The software always uses the items you have recently entered or loaded with a Procedure. If you answer USER (**`No`**), you will be asked for the TX harmonic filter that is passing the signal you are measuring.

You will then be asked for the number of the SIG unit you wish to test.

Questions are asked to determine your intent to have the calibration of the Signalling Transceiver performed.

The parameter **`GN always cal sig/scan`** can be used to make the program automatically calibrate the Signalling Transceiver. If you have not enabled this mode, the following question will be asked.

`Do you want to calibrate this antenna?`

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

If you are testing at a non-LD site, the software will ask:

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, you will be asked if you wish to display the cal data on the Test Set CRT. If a printer is configured in the **External Devices** (or **Edit Configuration**) screen, the information will also be printed.

When the TEST on this unit is complete, you will be asked:

Do you want to test another signalling unit?

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

Commands are then sent to the base station to select the CSC and set up the SCC and SIG unit.

A diagram is displayed to show the connection of the equipment. Refer to **figure 2, "Cell Site to Test Equipment Interconnections," on page 74** for a description of these connections. If you see a frequency error when you are measuring the TX frequency, the source 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. You can run the RDM or URDM TEST at this time if you suspect it is the source of frequency error.

Tests

TEST_04 - **`Signalling transceiver MANUAL mode`** performs the following tests. **See appendix B, "Appendix: Test Set Measurement Settings"** 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

The following pass/fail limits are used in TEST_04:

RX scan and sig calibration reading (dBm)

RX scan sig linearity error (dB)

RX sensitivity without 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 signalling unit (percent)

Parameters

The following parameters are used in TEST_04:

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=fail 2 =always]

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)

RX scan/sig RSSI output [0=dBm 1=hex]

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 signalling 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. Calibration of the receivers can be performed. This TEST can only be performed in the MANUAL mode; the cell site must be taken out of service.

MANUAL Mode

See **"MANUAL Mode" on page 178** in the description of **TEST_04 - Signalling Transceiver MANUAL Mode** in this chapter.

After you take the cell site out of service, send SIG OFF 0 and SIG OFF 1 commands if Signalling Transceivers are connected to an antenna. You need to do this to keep mobiles from attempting to access the cell site.

Connections

A diagram is displayed 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 connections to the RF IN/OUT connector are shown on the Test Set CRT drawing. This connection is optional. It can be left connected if you use it for other TESTs.

See **figure 2, "Cell Site to Test Equipment Interconnections," on page 74** for a description of connections.

Calibration Parameters

Parameters must be entered into the software for the path loss to each of the RX antennas. **See "Receiver Path Loss Calibration," in chapter 3, on page 92**.

Questions Displayed

You will be asked for the VCC number of the receiver you are testing. Refer to a site diagram or the Motorola Cell Site manual for this information.

You will be asked if you are testing TACS, E-TACS or U-TACS, and the pre-selector frequency range.

If you are running a TEST for the second time, the following question will be displayed:

`Do you want to use the last base station information entered?`

The software will use the VCC and frequency band information displayed on the screen if you answer USER (**`Yes`**). The “information” in the question does not refer to parameters, pass/fail limits, or other items you enter into the software. The software always uses the items you have recently entered or loaded with a procedure. If you answer USER (**`No`**), you will be asked for the VCC and frequency band.

Questions are asked to determine your intent to have the calibration of the Scan Receiver performed.

The parameter **`GN always cal sig/scan`** can be used to make the program automatically calibrate the Scan Receiver. If you have not enabled this mode, the following question will be asked.

Do you want to calibrate this frequency?

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

Linearity tests are performed at –50 dBm and –110 dBm. Tests will be performed at the frequencies that the SINAD test is performed at. If you are at a non-LD site, the software will ask:

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 equal to or later than 4.5.0.0, you will be asked if you wish to display the cal data on the Test Set CRT. If a printer is configured in the **External Devices** (or **Edit Configuration**) screen, the information will also be printed.

When the TEST on this channel is complete, you will be asked:

Do you want to test another scan receiver?

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

NOTE: **Signals Picked Up Can Affect Measurements**

Signals picked up by antennas can affect measurements and result in inaccurate calibration data. Terminate the RF coupler ports leading to the antennas in 50 Ω if necessary.

Tests

TEST_05 - Scanning Receiver MANUAL Mode performs the following tests. **See appendix B, "Appendix: Test Set Measurement Settings"** for filter, detector and some other Test Set settings used.

RX scan sensitivity for each antenna

RX SAT detect

RX SSI calibration and linearity

Pass/fail limits

The following pass/fail limits are used in TEST_05:

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))

Parameters

The following parameters are used in TEST_05:

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 scan lin tested [0=ant1 1=all ants]

RX scan/sig RSSI output [0=dBm 1=hex]

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

TEST_06 - Combiner Adjustment

This TEST uses the voice transceiver or the signalling unit as a signal source to optimize the adjustment of the power combiner. Refer to **figure 2, "Cell Site to Test Equipment Interconnections," on page 74** for connections to the base station, Test Set, and accessories.

You can run this TEST in the In-Service Optimization mode or the MANUAL mode. If you use a signalling transceiver to perform the TEST, it must be run in the MANUAL mode. You can use the In-Service Optimization mode if you are using a voice transceiver.

See **"MANUAL Mode" on page 178** in the description of **TEST_04 - Signalling Transceiver MANUAL Mode** in this chapter.

You can run this TEST the same way that power is tested in TEST_03 -**`Voice transceiver`** or TEST_04 -**`Signalling transceiver MANUAL mode`**, leaving the RF coupler in the path as the power is measured. The spectrum analyzer or the power meter may be used, depending on the level of power available at the coupled port. Set the parameter **`TX voice/signal pwr use`** to reflect your choice. See **chapter 6, "Parameters - Reference," on page 203**. Calibration must be performed with the same measuring device, spectrum analyzer, or power meter, you use while you are running TEST_06.

Calibration Parameter

A calibration factor must be entered into the parameter **`TX path loss to combiner for adjustment`**. **See "Combiner to Test Set Path Loss Factor," in chapter 3, on page 99**.

Running TEST_06 -Combiner Adjustment

After the RUN TEST user key is pressed, system initialization takes place, and commands are sent to the base station.

You will be asked for the voice transceiver or signalling unit to use for the TEST. If you want to use a signalling transceiver as the source, press USER (**`Page Down`**) twice to display the CSC unit you want to use.

If you are using a voice transceiver, the following question will be displayed before a power measurement is made:

Is channel free? If NO wait for a free channel for intracell handoff before continuing.

If the channel is not free, answer USER (**No**) and a FREe command will be sent to the base station. Wait until the channel is taken out of service by the switch, then press USER (**Continue**). A DELete command will then be sent to the base station by the software, and the channel will be available for testing. A signal from the selected channel will be available at the output of the combiner, and power output adjustment can be done. The Combiner is adjusted by loosening the combiner bolts and setting them for a minimum on the reflected power meter. Check the forward- power reading on the Test Set.

Test

TEST_06 - Combiner Adjustment performs the following test. **See appendix B, "Appendix: Test Set Measurement Settings"** for filter, detector and some other Test Set settings used.

TX power with adjustment

Pass/fail limits

The following pass/fail limits are used in TEST_06:

TX output power error at level/sector 0 (percent)

TX output power error for signalling unit (percent)

Parameters

The following parameters are used in TEST_06:

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/sector 0 (Watts)

TX path loss to combiner for adjustment (dB)

TX output power for signalling unit (Watts)

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

TX pwr lvls [0 – 127=step PA – 1= sector PA]

TEST_07 - Manual Switch and Calibration Aid

This TEST has several routines that help you calibrate and manually control cell site equipment. This TEST will normally not be in a sequence. Routines in this TEST can be run individually, when necessary.

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

Use a combination of rotations of the knob and USER (**`Page Up`**) or USER (**`Page Down`**) to select the function you want. Then push 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 92 .

`Read the spec. analyzer TX path calibration`

See "Transmitter Path Loss Calibration," in chapter 3, on page 88.

`Read the spec. analyzer RDM path calibration`

See "Reference Distribution Module Level Correction Factor," in chapter 3, on page 96.

`Tune the HP 8921A to a channel number`

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

`Measure cable loss`

To automatically measure the loss of an RF cable (<12 dB of loss)

`Switch to receiver antenna #1 - #6`

To manually set the RF switch.

`Switch to audio JK / RCV`

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

Pass/fail limits

There are no pass/fail limits associated with this TEST.

Parameters

There are no parameters associated with this TEST.

TEST_08 - 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 can be run in the MANUAL or In-Service Optimization modes. If the parameter **GN test state of** is set to **0** (INS_OPT mode) the TX data deviation test is not displayed in the list of measurements.

A test is chosen from the list in the window labelled **Measure** by positioning the cursor in front of the desired test and pressing the knob. Measurement results are displayed in the window above the **Measure** window.

(**Continue**) USER key to use the value displayed, or use the data keys to enter a new channel number.

Pressing the (**Next Wind**) USER key causes the cursor to be displayed in one of the other windows on the CRT. Parameters can be changed and base station commands can be sent by selecting the desired item after the cursor is in the corresponding window.

When making entries into parameters, the cursor will be positioned in the upper left corner of the display. Enter data values using the Test Set front panel data keys. Terminate the entry by pressing the ENTER key.

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

The parameters you enter into the **Parameters** window can be saved to a memory card file. The filename of the memory card file is always **uMAN_PARM**. When you select **Store Parameters** from the list in the **Measure** window, the program will attempt to store the latest values of parameters in a file with that filename. You will get a message saying **….Duplicate file name.…** if the memory card has a pre-existing parameter file. If you do not want to over-write the old file you will have to save your parameters on a different memory card.

This TEST uses parameters from the TESTS**(Edit Parameters)** screen that correct for the losses of cables, couplers and switches. See the section "Parameters" in the description of this TEST.

The item named **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 can be tuned to frequencies in the scan receiver channel list. After you select **TACS, E-TACS or U-TACS** from the list in the **Parameters** window, USER keys are displayed so you can change the channel and select a different antenna. RF level can be changed by selecting that item in the **Parameters** window. As an example of the use of **Tune test set**, a laptop can be used to manually send commands and read the RSSI of a scan receiver.

Pass/fail limits

The following pass/fail limits in the **(Pass/Fail Limits)** screen are used to determine the position of the lines displayed on the meter when USER (**Zoom**) is pressed:

- **RDM frequency error (Hz)**
- **RX audio output level (dBm)**
- **TX data deviation (kHz)**
- **TX loopback level (dBm)**
- **TX output power error at level/sector 0 (percent)**
- **TX SAT deviation (kHz)**
- **TX test point JK output (dbm)**
- **TX voice deviation (kHz)**
- **TX voice limiting deviation (kHz)**

Parameters

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

The following parameters from the TESTS**(Edit Parameters)** screen are used in this TEST.

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/sector 0 (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 pwr lvls [0 – 127=step PA – 1= sector PA]

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

TEST_09 - VSWR Swept Return Loss

NOTE: **Test Signal Can Cause Interference**

This TEST radiates a test signal when it is used to test antennas or cables with antennas attached to them. Verify that the level and frequency span used for the TEST cannot result in interference to another antenna nearby. Set the parameter **`VSWR tests RF level`** for the minimum level that provides good resolution for the measurement you are making. Set the frequency range carefully.

After a single sweep is taken, the tracking generator RF level is not changed. A CW signal is therefore being applied to the antenna.

If you are in an area with other receive antennas nearby, you may want to use TEST_10 - **`VSWR discrete channel return loss`**. This TEST measures the return loss at a frequency offset from a selectable range of TACS channels. The offset (in kHz) from the TACS channels can be set.

This TEST measures the return loss of a cable or device in the swept mode. A SWR bridge and a 6 dB pad are connected to the Test Set. The pad is used to improve the mismatch between the SWR bridge and the ANT IN port on the Test Set. A reference level is measured with a short or open and the return loss is measured with the cable or antenna-under-test. The measurement value returned will be the worst case return loss in the sweep.

A single sweep is taken shortly after the TEST starts. The RF level of the signal generator is subsequently kept at the test level.

The trace can be viewed at the end of the test by pressing CANCEL, TESTS, and selecting **`Spec Anl`** from the **`To Screen`** menu.

VSWR can be calculated from the return loss. The following **table 8** and **table 9** contain some of the values from a calculation.

Table 8 Return Loss (0 to 20 dB) to VSWR

Return Loss (dB)	0	2	4	6	8	10	12	14	16	18	20
VSWR	infinity	8.7	4.4	3.0	2.3	1.92	1.67	1.50	1.38	1.29	1.22

Table 9 Return Loss (20 to 40 dB) to VSWR

Return Loss (dB)	20	22	24	26	28	30	32	34	36	38	40
VSWR	1.22	1.17	1.13	1.11	1.08	1.07	1.05	1.04	1.03	1.03	1.02

The following formula can be used to determine the VSWR from the return loss (=RL in dB):

$$VSWR = \frac{1 + 10^{\frac{-RL}{20}}}{1 - 10^{\frac{-RL}{20}}}$$

VSWR is sometimes stated as a ratio. For example: 1.2:1 or “one point two to one” VSWR. The first number is given in the tables and formula. The second number is always one.

Estimating Antenna Return Loss

If you are measuring the return loss of an antenna connected to the end of a known good feed line, you can approximately determine the return loss of the antenna by subtracting twice the line loss. For example, if you measure a return loss of 24 dB and the line is known to have 2 dB loss, the estimated return loss of the antenna is 20 dB. This estimate is in error if the coaxial line and connectors do not have a return loss somewhat greater than 24 dB.

Pass/fail limits

- **VSWR swept return loss**

Parameters

- **VSWR tests RF level (dBm)**

TEST_10 - VSWR Discrete Channel Return Loss

This TEST measures the return loss for discrete channels. This test is performed at channels entered by the user and offset by a frequency to make the measurement between actual channels. A reference level is measured with the spectrum analyzer at a short or open, then the return loss is measured with the cable or antenna-under-test.

This TEST should be used when there is a chance that a full frequency sweep of the band to be tested may cause interference. In this TEST, the chance of interference is greatly reduced by selecting an offset that sets a CW test frequency in between the assigned TACS channels. For example, selecting an offset of 15 kHz places the test signal between adjacent TACS channels.

See **TEST_09 - VSWR Swept Return Loss** for a return loss to VSWR conversion table and formula and a way to estimate the return loss of an antenna connected to the end of a feed line.

Pass/fail limits

- **VSWR discrete return loss**

Parameters

- **VSWR tests RF level (dBm)**

TEST_11 - VSWR vs Distance (cable fault)

NOTE: **Test Signal Can Cause Interference**

This TEST radiates a test signal when it is used to test cables with antennas attached to them. Verify that the signal used for the TEST cannot result in interference to another antenna. The software reduces the signal generator level except when it is needed to actually perform the measurement.

Frequencies outside the cellular band will be swept. The frequency range used for this TEST depends on the cable length value you enter. For example, the frequency range of 10 MHz to approximately 1000 MHz is used for a 21 meter cable, 10 MHz to approximately 500 MHz for a 42 meter cable and so on.

This TEST displays the relative mismatch of a transmission line as a function of the distance down the line. A frequency-swept signal from the DUPLEX OUT port is applied through a resistive power divider to the cable under test. Signals reflected from faults in the cable are combined with the DUPLEX OUT signal in the power divider and applied to the ANT IN port. The changing interference of the forward and reflected signals, over the swept frequency band, contains information about the distance to one or more faults. The software uses a Fast Fourier Transform (FFT) to convert the frequency domain into the distance domain. The distance displayed on the Test Set CRT is the physical distance to the fault with correction for the velocity factor of the cable.

Cable Fault Performance

Measurements of the cable fault location can typically be made up to 1,000 feet on low loss cables and 300 feet on higher loss cables. Resolution of the fault location is approximately 0.4 feet for cable lengths up to 100 feet and then linearly increases to 4 feet for a 1000 foot cable.

Typical accuracy is approximately ± 1 foot for a fault located up to 100 feet away. The typical accuracy increases linearly to ± 10 feet for faults located 1,000 feet away.

Selecting Cable Type

The velocity factors of many (RG) types of cable are stored in a table in the software. If you are using cable without an RG number, do the following:

1. Determine the velocity factor of the cable.
2. Enter “0” for the RG type when the question is displayed.
3. Begin test.
4. Enter the velocity factor when the question is displayed.

NOTE: **Velocity Factors**

Cables that use polyethylene dielectric typically have a propagation velocity of 0.66, cables that use a teflon dielectric typically have a propagation velocity of 0.70.

Entering Cable Length

The greatest accuracy is obtained when you enter a cable length slightly greater than the actual cable length, considering length uncertainty. If you are not sure of the cable length, enter a value 1.5 times the estimated length. Depending on the return loss of the antenna or device at the end of the cable, you may see a high relative mismatch displayed at the actual length of the cable.

Interpreting Cable Fault Location Results

Distance to the cable fault is accurately quantified when you select the USER (**`Disp data`**) field. The relative mismatch levels and distance at which the mismatch occurs is displayed.

Numeric data for the six largest values of data from the graph is listed. Each data point is shown on a scale from 0 to 1. The scaling does not have an absolute significance, rather, the value only indicates the relative likelihood of a fault. Values less than 0.1 are typically due to noise.

The largest relative mismatch is most likely the location of a cable fault. Other numeric data points, particularly if they are further down the line from a point of high relative mismatch, can be ignored. Data points on the fringe of a point of high relative mismatch are usually attributable to the single fault.

Pass/fail limits

There are no pass/fail limits associated with this TEST.

Parameters

There are no parameters associated with this TEST.

6

Parameters - Reference

Parameters are used by the test software to optimize the program for your specific application.

You can change parameters by selecting **Test Parameters** from the **CUSTOMIZE TEST PROCEDURE** list (or the **Edit Parm** choice from the list of **Test Functions**). The **Edit Parameters** screen will be displayed. Change parameters by using the knob to select the parameter number, then position the knob in front of the value, and enter the new value on the keypad.

See **"Entering Parameters, Pass/Fail Limits, and External Device Configuration" on page 108**, to enter a parameter value.

The first few capital letters in the title of each parameter indicate what the parameter refers to:

GN=General

RDM=Reference Distribution Module

RX=Receiver

TX=Transmitter

RX/TX=Receiver or Transmitter

SC=Scan

VSWR=Voltage Standing Wave Ratio tests

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 determines 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 specification limits before the adjustment procedure exits.

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]

The following additional voice transceiver tests will be performed when 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 Ω load.

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

If this parameter is set to **1**, tests will be made assuming that Low Noise Amplifiers are installed at the receiver inputs.

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

If you are testing with the cell site out of service, this parameter must be set to **1**.

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

If the cell site is an omni receive site, this parameter should be set to **0**. The test system will test two RX antennas in this case. If the cell site is a sectored receive site, this parameter should be set to a **1**. The test system will test six RX antennas in this case. If the cell site does not use specific antennas, the test system will skip the testing of these antennas if they are 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 would be 1.245. This entry would tell the test system to test the cell site as a sectored site, but skip testing for antennas 2, 4, and 5. An entry of 0.245 would not be correct, since antennas 4 and 5 are not tested on an omni site.

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

When set to **1**, the program will ask you if entries are correct.

RDM level correction factor (dB)

The software uses this correction factor to enhance the accuracy of3 MHz level measurements using the Test Set's spectrum analyzer. See **"Reference Distribution Module Level Correction Factor" on page 96**.

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 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 calibration factor accounts for cable losses and RF coupler coupling factors, when setting the Test Set's signal generator level. Its value can be determined by a method of measurement in **"Receiver Path Loss Calibration" on page 92**.

RX path loss to antenna 2 (dB)

See **RX path loss to antenna 1 (dB)**.

RX path loss to antenna 3 (dB)

See **RX path loss to antenna 1 (dB)**.

RX path loss to antenna 4 (dB)

See **RX path loss to antenna 1 (dB)**.

RX path loss to antenna 5 (dB)

See **RX path loss to antenna 1 (dB)**.

RX path loss to antenna 6 (dB)

See **RX path loss to antenna 1 (dB)**.

RX scan lin tested [0=ant1 1=all ants]

When this parameter is set to **`0=ant1`**, the linearity of the scanner will be tested for antenna 1 only. If this parameter is set to **`1=all ants`**, the linearity of the scanner will be tested for all antennas.

RX scan/sig RSSI output [0=dBm 1=hex]

Set this parameter to 1 if you want the report from the base station and the measured value report from the test set to be in hex notation instead of dBm notation.

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

This value is the audio frequency step that occurs as the frequency response of the audio passband is measured. The two endpoints, 300 Hz and 3 kHz are always measured.

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

If this parameter is set to **1**, the software will provide USER keys that allow you to skip some of the tests on the scan receiver. You can skip SINAD and SAT tests, and begin testing on the next antenna if you wish.

TX output power for level/sector 0 (Watts)

There are two ways to specify a power measurement: by sector or by PA level. This choice is control by the parameter **TX pwr lvls [0 – 127=step PA – 1= sector PA]**.

If the power measurement is by sector, you are asked which sectors you would like to test, from 1 to 6 sectors. The parameter *TX output power for level/sector 0* is not used when making power measurements by sector.

If the power measurement selected is for PA level, this parameter defines the rated RF power level of a voice transmitter at power level 0.

TX output power for level/sector 1 (Watts)

This parameter defines the rated RF power level of a voice transmitter at power level 1 or sector 1.

TX output power for level/sector 2 (Watts)

This parameter defines the rated RF power level of a voice transmitter at power level 2 or sector 2.

TX output power for level/sector 3 (Watts)

This parameter defines the rated RF power level of a voice t

TX output power for level/sector 4 (Watts)

This parameter defines the rated RF power of a voice transmitter at power level 4 or sector 4.

TX output power for level/sector 5 (Watts)

This parameter defines the rated RF power level of a voice transmitter at power level 5 or sector 5.

TX output power for level/sector 6 (Watts)

This parameter defines the rated RF power level of a voice transmitter at power level 6 or sector 6.

TX output power for level/sector 7 (Watts)

There are two ways to specify a power measurement: by sector or by PA level. This choice is controlled by the parameter **TX pwr lvls [0 – 127=step PA – 1= sector PA]**.

If the power measurement is by sector, you are asked which sectors you would like to test, from 1 to 6 sectors. The parameter, TX output power for level/sector 7 is not used when making power measurements by sector.

If the power measurement selected is for PA level, this parameter defines the rated RF power level of a voice transmitter at power level 0.

TX output power for signalling unit (Watts)

This parameter defines the rated RF power level of a signalling transmitter.

TX path loss to combiner for adjustment (dB)

This calibration factor, used in **TEST_06 - Combiner Adjustment**, can account for cable losses, RF coupler coupling factors, and the Test Set's power meter measurement error. This parameter can be determined by the method of measurement **"Combiner to Test Set Path Loss Factor" in chapter 3**. Also see **"TEST_06 - Combiner Adjustment" in chapter 5**.

TX path loss to harmonic filter 1 (dB)

This calibration factor 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**.

TX path loss to harmonic filter 2 (dB)

See **TX path loss to harmonic filter 1 (dB)**.

TX path loss to harmonic filter 3 (dB)

See **TX path loss to harmonic filter 1 (dB)**.

TX path loss to harmonic filter 4 (dB)

See **TX path loss to harmonic filter 1 (dB)**.

TX path loss to harmonic filter 5 (dB)

See **TX path loss to harmonic filter 1 (dB)**.

TX path loss to harmonic filter 6 (dB)

See **TX path loss to harmonic filter 1 (dB)**.

TX path loss to harmonic filter 7 (dB)

See **TX path loss to harmonic filter 1 (dB)**.

TX path loss to harmonic filter 8 (dB)

See **TX path loss to harmonic filter 1 (dB)**.

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

If this parameter is set to **1**, the Average Voice Level will be applied to the TX line input and the level of the RCV line output will be measured in **TEST_03 - Voice Transceiver**.

TX pwr lvls [0 – 127=step PA – 1= sector PA]

This parameter sets the output levels that are tested. Entry is made with a binary word, expressed in decimal for stepping PAs. Select the power levels 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,you will enter **73** (73=1+9+64) into the field. Enter **0** if you want to test only power level 0. If you test low power levels, you will have to use the spectrum analyzer to measure power. See the parameter **TX voice/signal pwr use [0=anz 1=pwrmtr]**.

If you set the parameter to –1, you can test power for different sectors. To do this set the parameter TX output for level/sector N and the pass/fail limit, TX output power level error at level/sector N as desired.

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

The RF power output of the base station can be measured using either the Test Set's spectrum analyzer or power meter. Use the following criteria to determine your choice:

- If there are multiple high-level signals present, the measurement must be made with a spectrum analyzer.
- For the most accurate measurement of one high-level signal, the power meter can be used.
- If you are using the In-Service Optimization mode, you should select the spectrum analyzer.
- If you are testing in the MANUAL mode, the power meter should be used.

You will need to 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.

VSWR tests RF level (dBm)

This parameter determines the RF level applied to the external bridge used for VSWR measurements. If antennas are being checked the RF generator signal will be radiated. This parameter can be reduced from the default value if a possibility of interference exists. Using **TEST_10 - VSWR Discrete Channel Return Loss** further reduces the possibility of interference.

You may also want to set this level low if you are measuring the VSWR of a device such as a low noise amplifier.

ZZZZ test mode [0=normal 1=demo]

If this parameter is set to **1**, communication with the base station will be bypassed and the software can be used in a training or demonstration situation. Dummy values for test results will be displayed.

This parameter affects tests that do not require communication with the base station so be sure to set it to **0** if you want to perform tests.

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Pass/Fail Limits (Specifications) - Reference

Pass/Fail Limits, or specifications, are values that the software uses to determine the pass/fail status of a test. The default entries for pass/fail limits have been derived from EIA and Motorola specifications.

You can change pass/fail limits by selecting **`Pass/Fail Limits`** from the **`CUSTOMIZE TEST PROCEDURE`** list (or the **`Edit Spec`** choice from the list of **`Test Functions`**). The **`Pass/Fail Limits`** (or **`Edit Specifications`**) screen will be displayed. Change pass/fail limit values by using the knob to select the number, then position the knob in front of the value, and enter the new value on the keypad. Press ENTER to finish the entry.

Pass/Fail Limits can be secured. **See "Securing a Procedure," in chapter 3, on page 104**.

See "Entering Parameters, Pass/Fail Limits, and External Device Configuration," in chapter 3, on page 108.

The first few capital letters in the title of each parameter indicate what the pass/fail limit pertains to:

RDM=Reference Distribution Module

RX=Receiver

TX=Transmitter

VSWR=Voltage Standing Wave Ratio

Pass/fail limit 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 transceiver, not the frequency error referenced to 3 MHz.

RDM output level (dBm)

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 2.3 kHz. The receiver output power is based on the voltage applied to a 600 Ω 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)

The expandor 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 2.3 kHz reference deviation.

RX expandor track error >0 dB (dB)

The expandor 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 2.3 kHz 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.

These values are converted to hex if the parameter selecting a hex measurement is selected.

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 a 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 a receiver without a Low Noise Amplifier 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 is the pass/fail limit of the distortion of the transmitter's 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 composite deviation at AVL (kHz)

This pass/fail limit sets the maximum and minimum acceptable peak frequency deviation that results when AVL voltage is applied to a voice transmitter with the SAT tone turned on.

TX composite deviation at AVL+32 dB (kHz)

This pass/fail limit sets the maximum and minimum acceptable peak frequency deviation that results when AVL voltage, increased by 32 dB, is applied to a voice transmitter with the SAT tone turned on.

TX compressor track error <0 dB (dB)

The compressor 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 2.3 kHz reference deviation.

TX compressor track error >0 dB (dB)

The compressor 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 2.3 kHz 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 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 no 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)

The pass/fail limit of 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/sector 0 (percent)

The difference in the measured power level of a voice transmitter and the nominal output power at level 0. The nominal output power level is entered into the software as a parameter.

This pass/fail limit is not used if power measurement by sector is selected in parameter **TX pwr lvls [0 – 127=step PA – 1= sector PA]**.

TX output power error at level/sector 1 (percent)

The difference in the measured power level of a voice transmitter and the nominal output power at level 1 or sector 1. The nominal output power is entered into the software as a parameter.

TX output power error at level/sector 2 (percent)

Same as above, at power level 2 or sector 2.

TX output power error at level/sector 3 (percent)

Same as above, at power level 3 or sector 3.

TX output power error at level/sector 4 (percent)

Same as above, at power level 4 or sector 4.

TX output power error at level/sector 5 (percent)

Same as above, at power level 5 or sector 5.

TX output power error at level/sector 6 (percent)

Same as above, at power level 6 or sector 6.

TX output power error at level/sector 7 (percent)

The difference in the measured power level of a voice transmitter and the nominal output power at level 7. The nominal output power level is entered into the software as a parameter.

The pass/fail limit is not used if power measurement by sector is selected in parameter **TX pwr lvls [0 – 127=step PA – 1= sector PA]**.

TX output power error for signalling unit (percent)

The pass/fail limit sets the maximum acceptable difference in the measured power level of a signalling transmitter and the nominal output power. The nominal output power is entered into the software as a parameter.

TX SAT deviation (kHz)

This pass/fail limit sets the maximum and minimum acceptable frequency deviation of the SAT tone.

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 point JK audio power calculated into a 600 Ω 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 a 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 a transmitter caused by a high level modulating signal

VSWR discrete return loss

This pass/fail limit sets the acceptable level of the return loss for a device tested at discrete frequencies using **TEST_10 - VSWR Discrete Channel Return Loss**'.

VSWR swept return loss

This pass/fail limit sets the acceptable level of the return loss for a device tested over a range of frequencies using **TEST_09 - VSWR Swept Return Loss .**

8

Problem Solving

This chapter describes some of the problems that may come up during testing, and ways to resolve them.

Base Station Control Difficulties

You may see the following message displayed:

```
No RS-232 response from base station. Program stopped.
```

This message is displayed when the 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.

Base station and Test Set baud rates may 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 may have changed. **See "TEST_01 - Laptop Emulator," in chapter 5, on page 165**.

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, has 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 78**.

Data Collection Memory Space Problems

An error message will be displayed if the program is unable to save test results. The storage space allocated to files on a memory card is determined by the entries you make into the **`External Devices`** (or **`Edit Configuration`**) screen. Check the file type and use **`REC=`**, if necessary, to reserve the number of records you need. **See "Memory Card Storage Space," in chapter 2, on page 57** and **See "Making Entries to a Test Set CONFIGURE Screen," in chapter 3, on page 116**.

Exiting the Program

It is possible to pause (by pressing CANCEL) the HP 11807B Option 050 program; display a screen other than TESTS (IBASIC Controller); return to the TESTS Main Menu screen; and press the USER (**`Continue`**) user key to proceed with a TEST. There is a very good possibility that these actions will affect subsequent program operation. Error messages may or may not be displayed.

Carefully determine the effect of the changes you make while a program is paused. You may have 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 signal paths internal to the Test Set to be modified. Avoid pressing the RX and TX keys.

After you have made the manual settings you want, press the DUPLEX key as a last step before continuing the software. This will cause the Test Set to be properly set up.

Another way to safely exit is to:

1. Press CANCEL.
2. Press DUPLEX.
3. Press SHIFT SAVE.
4. Enter a register name or number.
5. Choose **`Done`**.
6. Operate the Test Set manually.
7. Press RECALL.
8. Choose the name of the saved setup.
9. Press TESTS.
10. Press USER (**`Continue`**).

It may 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 software will be in a state that is ready to run. When you subsequently press USER (**`Run Test`**), the software will start running sooner. If the software is in an Input/Output state, it may 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 by you, try to enter a value so the program can be paused with the CANCEL key.

If the software will not pause some 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 may not be used by the software after you press USER (**`Continue`**). Start the program over again to ensure that your changes are used.

Equipment Control

Verify that you have made the correct entries to the **`External Devices`** (or **`Edit Configuration`**) 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**See "Equipment Connections," in chapter 3, on page 72** and **see "Radio Interface Connections," in chapter 3, on page 84**.

Test Set Memory Space Problems

The HP 11807B Option 050 program uses a substantial amount of the Test Set RAM space. If you see 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 USER (**`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 screen.
4. Press SHIFT SAVE.
5. Read the number in front of **`free memory`**.

If this number is a few percent or less, you may get an error message after saving additional set-ups to SAVE registers.

Printer 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 have firmware below revision A.14.00 Or you are using software with Revision A.xx.xx

1. Press TESTS.
2. Check that **`Printer`** was selected as the **`Output Results To:`** (or **`Output Destination`**) in the **`Test Execution Conditions`**.
3. Check that the test set is correctly configured for HP-IB, parallel, or serial printing:

   For a HP-IB printer:

   a. Check that the printer's **`Calling Name`** is "PRINTER" and its address is correctly set up in the **`External Devices`** (or **`Edit Cnfg`**) 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's **`Calling Name`** is **`PRINTER`** and its address is set to **`15`** in the **`External Devices`** (or **`Edit Cnfg`**) screen.

   For a serial printer:

   a. Check that the printer's **`Calling Name`** is **`PRINTER`** and its address is set to **`9`** in the **`External Devices`** (or **`Edit Cnfg`**) screen.
   b. Check that the **`I/O CONFIGURE`** screen has been set up correctly for the printer's baud rate, parity, and so forth.

Refer to the test set's *User's Guide* for details about configuring the printer.

If you have a HP 8921A,D with firmware above revision A.14.00 AND you are using software with Revision B.xx.xx

1. Press TESTS.
2. Select **`Printer Setup`** from the **`SET UP TEST SET`** list.
3. Check that **`Printer`** was selected in the **`Output Results To:`**.
4. Check that the test set is correctly configured for HP-IB or serial printing:
   a. Select **`Model`** and choose the most compatible printer model from the **`Choices`** menu.
   b. Select **`Printer Port`** and choose which printer port you are using.
   c. If the HP-IB port was selected, check that the correct **`Printer Adrs`** was entered.
   d. If the Serial port was selected, check that the **`I/O CONFIGURE`** screen has been set up correctly for the printer's baud rate, parity, and so forth.

Refer to the test set's *User's Guide* for details about configuring the printer.

Unstable SINAD Readings

If readings of SINAD are unstable, the measurement may 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 may 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 will have to be disconnected and terminated with a 50 Ω load.

SINAD readings may appear to be unstable due to normal fluctuations in the readings. If you are manually making SINAD measurements, see “Averaging Measurements” in the *Test Set User’s Guide*.

A

Appendix: Using the HP 3488A

If you choose to use an HP 3488A Switch/Control Unit, two Option 01/HP 44476A Microwave switch units must be installed.

Five SPDT switches are used to select which of RX antenna RF coupler ports is 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 15** . The jumpers are shown as bolder lines in the figure. The first number in the switch identifier refers to the rear-panel switch row that it is located in. The second two numbers refer to the switch column. For example, switch 201 is the middle switch in the second row of switches.

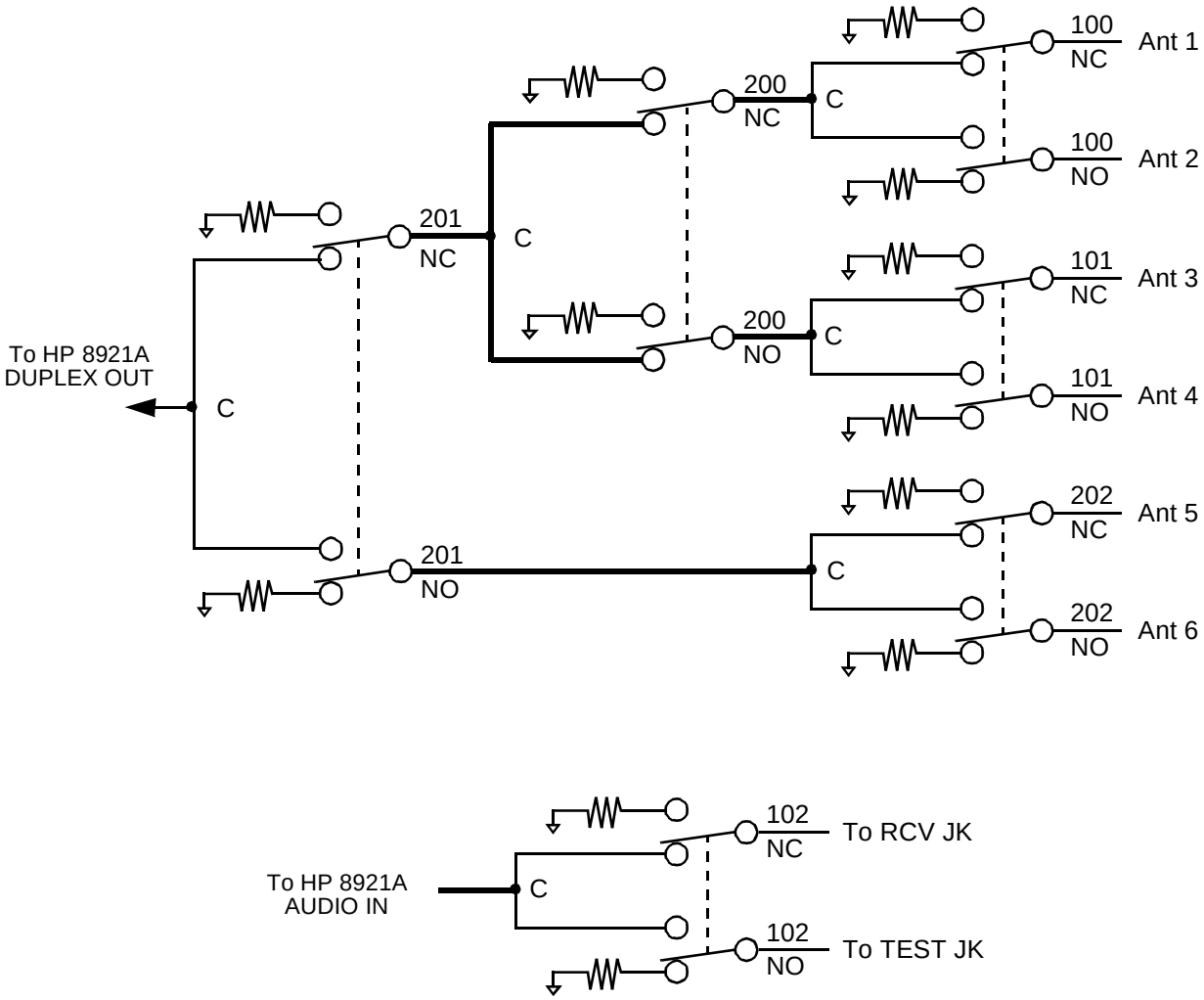


Figure 15 **HP 3488A Cabling**

B

Appendix: Test Set Measurement Settings

Introduction

This appendix contains some of the Test Set settings made by the 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 following 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`**.

TEST_02 - URDM or RDM Frequency/level

The following settings are used for each of 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 each of the tests:

RX audio output (with adjustment)

Filter 1 : CCITT

Filter 2 : > 99 kHz low pass filter

Detector : RMS

Audio In Lo : 600 Ω to Hi

RX SINAD for each antenna

Filter 1 : CCITT

Filter 2 : > 99 kHz low pass filter

Detector : RMS

Audio In Lo : 600Ω to Hi

RX audio distortion (extended test)

Filter 1 : CCITT

Filter 2 : > 99 kHz low pass filter

Detector : RMS

Audio In Lo : 600 Ω to Hi

RX hum and noise (extended test)

Filter 1 : CCITT

Filter 2 : > 99 kHz low pass filter

Detector : RMS

Audio In Lo : 600Ω to Hi

RX expandor response (extended test)

Filter 1 : CCITT

Filter 2 : > 99 kHz low pass filter

Detector : RMS

Audio In Lo : 600Ω 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 : 600Ω to Hi

RX signal SAT

Filter and detector settings are not necessary for this test.

RX no signal SAT

Filter and detector settings are not necessary for this test.

RX signal ST detect

Filter and detector settings are not necessary for this test.

RX no signal ST detect

Filter and detector settings are not necessary for this test.

TX frequency error

Frequency measurement gate time = 0.5 s

TX power @level/sector 0 (with adjustment)

The power meter or the spectrum analyzer can be used. See the parameter **"TX voice/ signal pwr use [0=anz 1=pwrmtr]" on page 212**.

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 : 230 kHz

TX SAT peak deviation (with adjustment)

Filter 1 : 300 Hz high pass filter (SAT)

Filter 2 : 15 kHz low pass filter (SAT)

Detector : RMS corrected to peak (SAT)

Detector (adjustment) : RMS corrected to peak (SAT)

TX test point JK 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 : CCITT

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 composite deviation

Filter 1 : <20 Hz high-pass filter

Filter 2 : >99 kHz low-pass filter

Detector : Peak+, Peak–

If filter : 30 kHz

TX audio distortion (extended test)

Filter 1 : CCITT filter

Filter 2 : > 99 kHz low pass filter

De-emphasis : 750 µ s

Detectors : RMS

IF filter : 30 kHz

TX hum and noise (extended test)

Filter 1 : CCITT filter

Filter 2 : > 99 kHz low pass filter

De-emphasis : 750 µ s

Detector : RMS

IF filter : 30 kHz

TX compandor track error (extended test)

Filter 1 : CCITT 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 : 30 kHz

TEST_04 - Signalling Transceiver MANUAL Mode

The following settings are used for each of the tests.

TX frequency error

Frequency measurement gate time = 1 s

TX power (with adjustment)

The power meter or the spectrum analyzer can be used. See the parameter **"TX voice/ signal pwr use [0=anz 1=pwrmtr]" on page 212**.

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 : CCITT

Filter 2 : > 99 kHz low pass filter

Detector : RMS

Audio In Lo : 600Ω to Hi

RX SSI calibration and linearity

Filter and detector settings are not necessary for this test.

TEST_05 - Scanning Receiver MANUAL Mode

The following settings are used for each of the tests.

RX scan sensitivity for each antenna

Filter 1 : CCITT

Filter 2 : > 99 kHz low pass filter

Detector : RMS

Audio In Lo : 600 Ω to Hi

RX SAT detect

Filter and detector settings are not necessary for this test.

RX SSI calibration and linearity

Filter and detector settings are not necessary for this test.

TEST_06 - Combiner Adjustment

The following settings are used:

TX power with adjustment

The power meter or the spectrum analyzer can be used. See the parameter **"TX voice/ signal pwr use [0=anz 1=pwrmtr]" on page 212**.

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 - Manual switch & calibration aid

This TEST does not use Test Set measurement hardware except for cable loss.

Spectrum analyzer : scale 2 dB/div

Span : 0.01 MHz

Self cal : off

RF generator Amplitude : 0 dBm

TEST_08 - 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 this TEST.

TEST_09 - VSWR swept return loss

The spectrum analyzer and track gen settings made in this TEST depend on parameters and values entered. See the description in this test in **chapter 5, "TESTs - Reference"**.

TEST_10 - VSWR discrete channel return loss

The spectrum analyzer and track gen settings made in this TEST depend on parameters and values entered. See the description of this TEST in **chapter 5, "TESTs - Reference"**.

TEST_11 - VSWR vs distance (cable fault)

The spectrum analyzer and track gen settings made in this TEST depend on parameters and values entered. See the description of this TEST in **chapter 5, "TESTs - Reference"**.

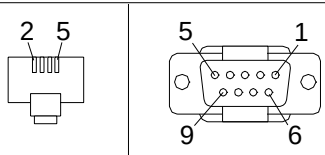
C

Appendix: Cable Wiring Diagrams for Data Collection to PC and Printer

The HP 11807B Option 050 software utilizes various cables when tests are run. So that new cables may be constructed the following diagrams show pin connections for PC and printer interface cables that the software uses. Refer to **"Equipment Connections" in chapter , "Setting Up"** for the purpose of the cables.

PC

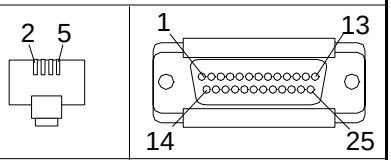
RJ11 (M) to DB9 (F) 08921-61038



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

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, Signalling 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.

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.

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 050 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 a TACS cell site voice channel transmitter. The signal is transponded by the mobile station and is used to help determine RF path integrity.

SCC Signalling Channel Controller - The module that controls signalling 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 Signalling unit - A signalling 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 Signalling Tone - A 10 kHz tone that the mobile sends to the base station when certain signalling operations must occur.

TACS Total Access Communication System.

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_11, 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.

Glossary

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V