**HP 8921A,D Cell Site Test Sets**

# HP 11807B Option 120, *Call Analysis, Logging, and Monitoring Software User's Guide*

Firmware Revision A.14.14

**HP Part No. 11807-90131**
**Printed in U. S. A.**
**May 1995**

**First Edition (Software Revision: B.00.00 and above)**

**RESTRICTED RIGHTS LEGEND**

# In This Book

This book will teach you how to install and use the Call Analysis, Logging and Monitoring software (C.A.L.M.). It will also introduce you to some common tasks performed by users of this software

## How to Use This Manual

This manual has three chapters directly relevant to the use of the C.A.L.M. software: "Getting Started", "Making Tests", and "Reference". Other chapters ("Problem Solving", "Glossary", and "Index" provide supplemental information to help you better understand the software.)

**1** Read the "Getting Started" chapter thoroughly

Use the "Getting Started" chapter to learn

- which equipment you need to use the software
- how to install the software
- how to run a quick check of the installed software to make sure it functions
- where to get help if something goes wrong in the installation or quick check

**2** Scan the "Making Tests" chapter to find out what the software is designed to do.

Use the "Making Tests" chapter to

- learn what tests can be made with the software
- learn how the tests are performed using the software
- see some examples of test procedures

**Continued on Next Page**

**3** Look up specific menu items and topics in the "Reference" chapter.

Use the "Reference" chapter to

- get step-by-step information on using the individual menu functions
- learn the importance of signal strength and how to check it with the software
- learn how to find an active control channel
- learn how to use the test set to run the software
- find out more about which antennas can be best used for a task
- learn how to load and retrieve configuration data from a RAM card
- learn how to use Terminal mode to control the instrument remotely
- learn how to log data to a printer on a database/spreadsheet
- learn how to upgrade the firmware
- learn how to set up the test set to automatically start the software when the unit is switched on

***4*** *Use the "Product Description" to get a concise product overview.*

***5*** *Use the "Problem Solving" chapter to help you track down problems.*

**6** Use the "Glossary" and "Index" for definitions and cross-referencing.

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# Restrictions on the Use of This Software

# Notice

This product is intended for the support and troubleshooting of AMPS cellular systems by providers of cellular services.

Hewlett-Packard sells this product only to service providers, manufacturers of cellular equipment, and law enforcement organizations.

**Notice**

# 2



# Getting Started

**READ THE "GETTING STARTED" CHAPTER THOROUGHLY.**

Use the "Getting Started" chapter to learn

- which equipment you need to use the software (see What You Need to Get Started)
- how to install the software (see Installing the Software)
- how to run a quick check of the installed software to make sure it functions (see Running a Quick Check of Functional Operation)
- where to get help (see Troubleshooting the Software Installation)

# What You Need to Get Started

You will need the following to get started:

- This software package and its contents
- An HP 8921A or HP 8921D Cell Site Test Set with firmware revision A.14.14 or later
- An antenna

Requirements for these items are detailed below. A list of optional equipment is also included.

## Items Supplied in this Software Package

r ROM card with HP 11807B Option 120 AMPS Call Analysis, Logging, and Monitoring software installed
r This manual (part number 11807-90131)
r Serial cable for logging or remote operation (part number 08921-61038, RJ-11 to DB-9)
r 32 kB RAM card for storing configuration setup information
r Firmware upgrade for the HP 8921A,D (supplied in this package during early production only)

***MAKE SURE YOU HAVE THE CORRECT FIRMWARE REVISION***

The HP 8921A,D must have firmware revision A.14.14 or later. The latest firmware upgrade is included during early production versions of this software. After this initial phase, the upgrade must be ordered separately. If you need the firmware upgrade, and it is not included in this package, contact your local Hewlett-Packard sales representative for details on ordering your upgrade. The upgrade is **HP 8921A Option R58**.

***IF YOU ARE MISSING A PIECE OF THE PACKAGE***

Contact your local Hewlett-Packard sales office for assistance.

## Test Set Requirements

This software is designed to work only with the HP 8921A or the HP 8921D test sets. It will not work with any HP 8920 series test set.

The software will only work with an HP 8921 firmware revision of A.14.14 or later. To check the firmware revision on your test set, follow the procedure outlined below. If you need more help on using the HP 8921 test set, look in the "Reference" chapter, or refer to your *HP 8921 Cell Site Test Set User's Guide*.

**Procedure to check the firmware revision of the HP 8921 test set:**

1. With power on, press the blue key labeled [SHIFT].
2. Press the key labeled [DUPLEX] in the topmost row of keys.
3. The CONFIGURE menu should appear.
4. Read the revision number from the top right hand corner of the CRT.

## Antenna and Location Requirements

If you are physically located within a mobile radio cell, and you can make and receive mobile phone calls, you should be able to receive a signal strong enough to make basic measurements. Under these conditions you will probably be able to complete this "Getting Started" chapter with a simple antenna. If you have sub-optimum conditions (for example if you are inside a building), or if your signal is very weak, you may need to change antennas or your location to improve reception.

A simple antenna, such as the telescoping BNC antenna available for the test set (antenna part number 08920-61060), may be acceptable for this "Getting Started" section. When you are ready for more complex testing, or if you have reception difficulties, you should obtain antennas that are suited to your particular tests. Read more about this in the "Antennas" and "Signal Strength" topics of the "Reference" chapter.

## Optional Equipment

### Cellular Equipment

You may want to have an AMPS cellular phone to help in your testing. The phone needs to be active in your system.

### Printer

A printer can be used to collect data directly from the test set. The printer used must have an RS-232 or parallel connection with cable. Test sets with serial number prefixes lower than 3501 do not have a parallel connection. Some printers that are in common use:

HP LaserJet Series 4L printer

HP LaserJet Series 4P printer

HP DeskJet 520 printer

HP DeskJet 320 printer

HP DeskJet 500C printer

HP DeskJet 560C printer

### Personal Computer (PC) hardware, Communications and Spreadsheet software

A personal computer (PC) which has at least one available serial port can be used for either controlling the test set or collecting data in a spreadsheet or database program. Instructions for controlling a test set with a PC have been provided in the Product Note 8920-1, *Using the IBASIC Programming Environment in the HP 8920 Test Set Family*.

Known terminal/communications programs that have worked to control the test set are:

**Microsoft® Windows Terminal** program

**ProComm®** telecommunications software

**HP AdvanceLink for Windows®** terminal software

Known spreadsheet or database programs that have worked with data collection on the HP 8921 test set are:

**Lotus®1-2-3®**
**Microsoft® Access 2.0**
**Excel®**

***NOTE:*** If you want to simultaneously control the test set and log data to a PC, you must have two available serial ports on the PC.

# Installing the Software

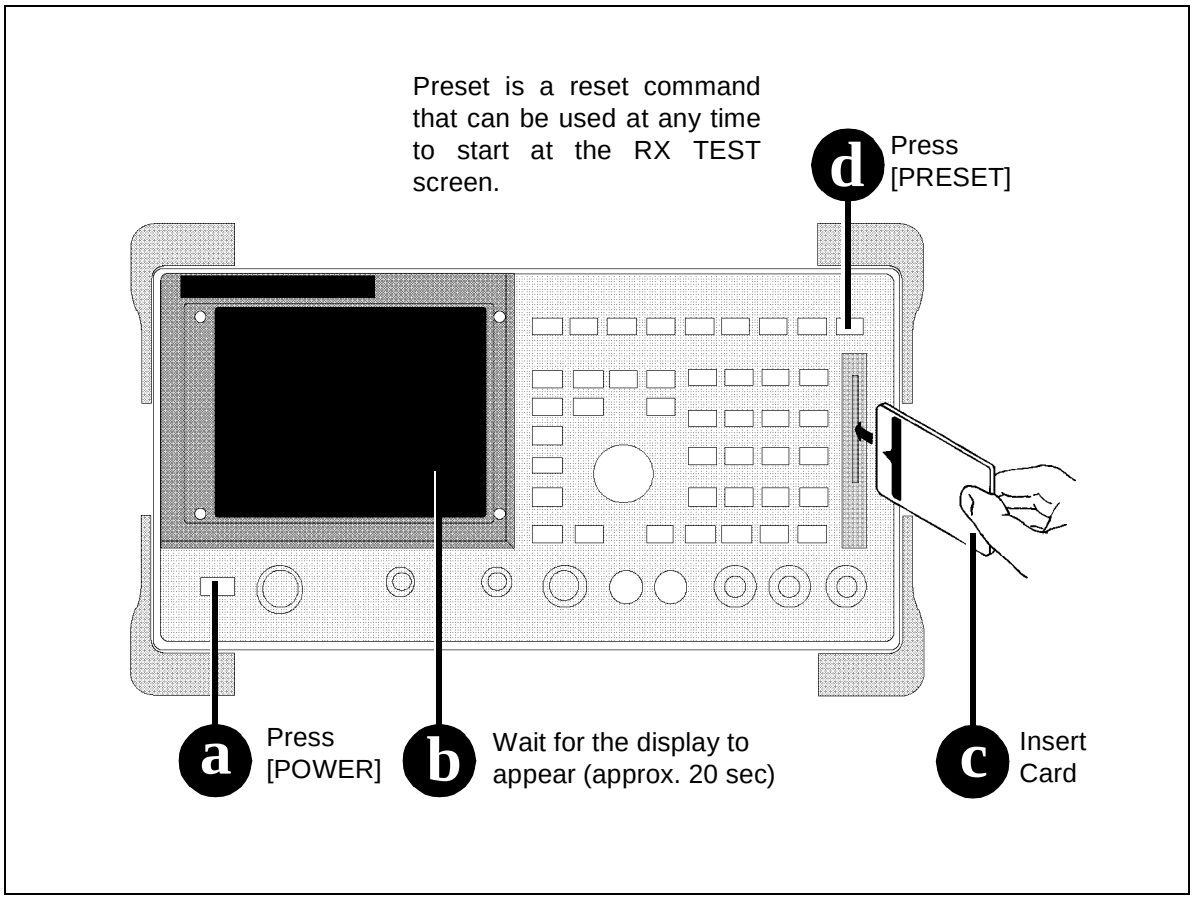
***HOW TO TROUBLESHOOT THE INSTALLATION***

At the end of this section are some hints to help debug any problems you may have during the installation of the C.A.L.M. software. You may want to refer to the problem solving section if you have problems.

**1** Read the SOFTWARE LICENSE AGREEMENT**.**

**2** Read the RESTRICTIONS ON USE OF THIS SOFTWARE in chapter 1

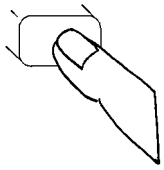
**3** Follow the instructions below to set up the software for use:



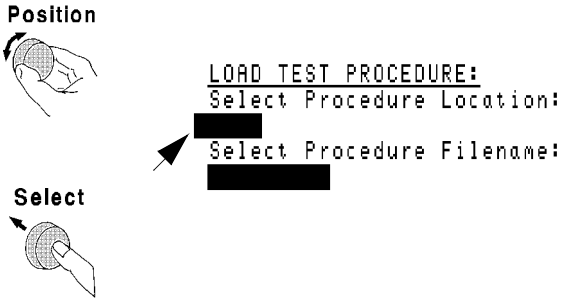
**4** Follow these instructions to set up your desired procedure:

**1** Press [**TESTS**] to display the **TESTS (main menu)** screen.

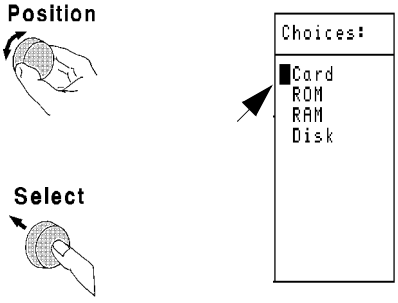
If you are in the IBASIC TESTs screen press**, [PRESET**] before pressing **[TESTS**].



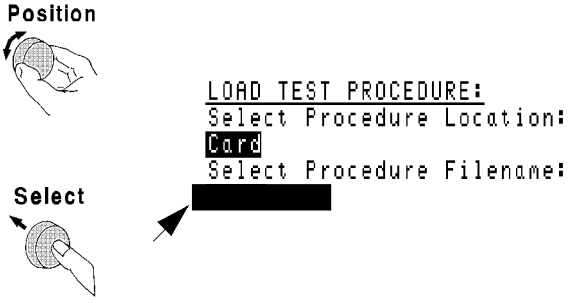
**2** Position cursor at **Select Procedure Location:** and select it.



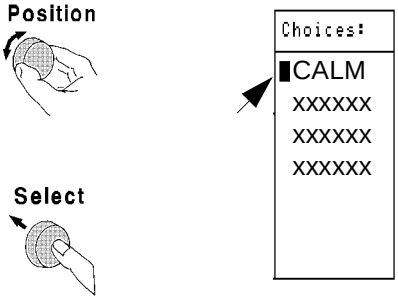

**3** Position cursor at **Card** and select it.



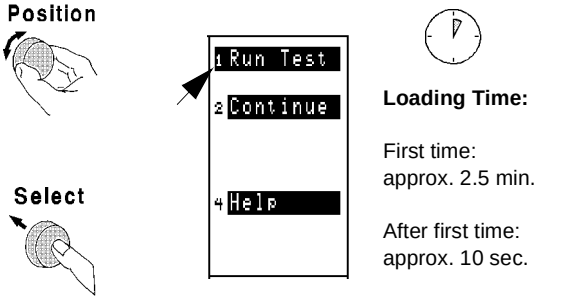

**4** Position cursor at **Select Procedure Filename:** and select it.




**5** Position cursor at **Choices:** and select CALM.




**6** Position cursor at **Run Test** and select it. Software is loading.




**Loading Time:**

First time:
approx. 2.5 min.

After first time:
approx. 10 sec.

5 Attach antenna. Connect the antenna of your choice to the ANT IN input. You will probably want to use an antenna that you regularly use with the cell site test set.

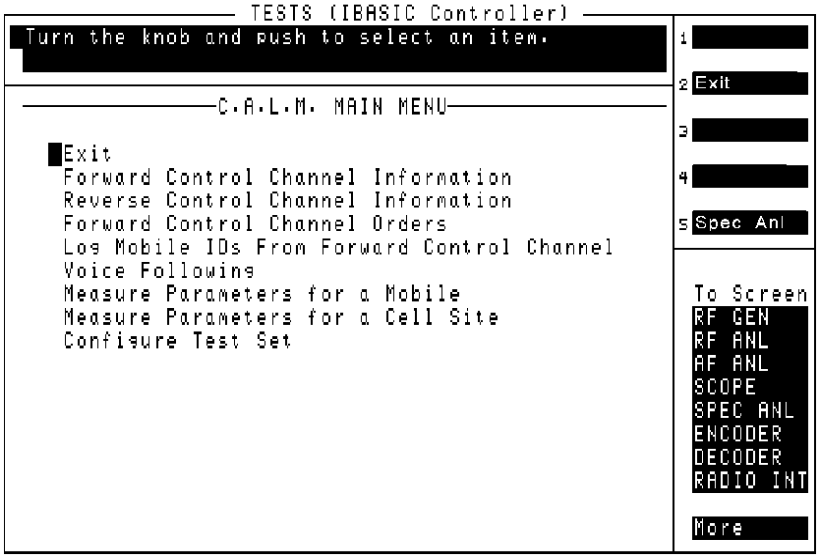
If you do not have a favorite antenna, you may be able to use a telescoping BNC antenna such as the cell site test set accessory antenna (antenna part number 08920-61060). If you are physically located within a mobile radio cell, and can make and receive mobile phone calls, you should be able to receive a signal strong enough to make these initial tests.

***TO LEARN MORE*** Read more about antennas in the "Antennas" section of the "Reference**"** chapter.

6 Verify that the CALM MAIN MENU is shown as pictured below.

**a** If the main menu is shown, your software has installed properly. Proceed to the Running a Quick Check of Functional Operation section.

**b** If the software did not install properly, proceed to the section "Troubleshooting the Software Installation."



## Troubleshooting the Software Installation

If your software did not install properly, check the following:

- Is power on? Do you see text on the display?
- Check the AC or DC power connection and the setting of the AC/DC switch on the rear panel. See the test set's *User's Guide.*
- Is the card inserted into the test set clearly labeled with HP 11807B Option 120 AMPS Call Analysis, Logging, and Monitoring Software? If not, you may be trying to install from the RAM card included with the package.
- Is the card inserted in the right direction? The arrow on the card must line up with the arrow on the test set.
- Is the card firmly seated in the slot? It should slide in loosely, then must be firmly pushed in to make proper contact.
- Did you get to the TESTS screen? Pressing [PRESET] should take you to the RX TEST screen, and [TESTS] should take you to the TESTS screen.
- Did CALM show up on the list of test procedures? Is the right card inserted? Is it firmly seated?

***NOTE:*** *If the test set displays an error that states "One or more self-tests failed", you have a hardware problem. In this case, refer to the test set's Assembly Level Repair manual.*

***IF A PROBLEM PERSISTS*** Call the HP Factory Hotline from anywhere in the USA or Canada (1-800-922-8920, 8:30 am - 5:00 pm Pacific time).

# Running a Quick Check of Functional Operation

## Finding a Control Channel

Before you can make any measurements, or log any data, you must first find the available control channels in your desired system. The control channel is an important building block of the mobile telephone system. The C.A.L.M. software uses the control channel as the major dividing unit for data collection or measurements. Use the following procedure for finding a control channel during the Quick Check of Functional Operation:

1. From the MAIN MENU of the C.A.L.M. software, select the **`Forward Control Channel Information`** menu item.
2. Select **`Find Control Channels.`**
3. Select **`System A or System B`** depending on which system you wish to test.
4. *Wait* while the test set finds the strongest control channel for your chosen system. This should take less than a minute.
5. One or more control channel numbers should be displayed, along with the signal levels.
6. Select **`Done`** (or press the user key [k1]). You should be back at the MAIN MENU again.

## Selecting a Control Channel

After finding available control channels, you must select one before making any measurements:

1. From the MAIN MENU of the C.A.L.M. software, **`Log Mobile IDs From Forward Control Channel.`**
2. Select **`Present Control Channel.`**
3. Choose a channel from the list of those provided.
4. Select **`Done`** to return to the MAIN MENU.

## Signal Strength

One of the most important considerations in using this software is to maintain proper signal strength. If your signal is too weak, you will not be able to make measurements or log data. If your signal is too strong, the measurements may be inaccurate.

If you are physically located within a mobile radio cell, and you can make and receive mobile phone calls, you should be able to receive a signal strong enough to make basic measurements.

**Procedure for checking signal strength**

1. From the MAIN MENU, select **`Forward Control Channel Information.`**
2. After you have selected a control channel, read the signal strength directly from the display. It is located in the upper right hand side of the FORWARD CONTROL CHANNEL SELECTIONS screen.

**Alternate Procedure for checking signal strength (returns a measurement that is frequently updated)**

1. From the MAIN MENU, after you have selected a control channel, press user key [k5], SPEC ANL.
2. Read the signal strength from the field marked LVL dBm. This number changes with the display on the spectrum analyzer screen.
3. To return to the MAIN MENU, press the [SHIFT] key. Press the user key [k1]. Select **`[Continue]`** (at the top of the screen). These instructions are repeated on the first two lines of the screen. Press [ENTER] or the knob.

***TO FIND OUT MORE***

To learn more about using the spectrum analyzer, check the “Reference” chapter, *HP 8921 Basics*, and read about it in the *HP 8921 Cell Site Test Set User’s Guide*.

For this Quick Check, your signal level needs to be between 0 and -80 dBm. You may need to adjust the attenuation and/or sensitivity, or both settings to get best results. To change the Attenuation or Sensitivity, use the following procedure:

**Procedure to change Attenuation**

1. Determine the signal strength using the procedure above, Procedure for checking signal strength.
2. Find the appropriate Attenuation setting for your measured signal strength from the table below. Your signal level needs to be between 0 and -80 dBm for this Quick Check. Some of the ranges in the table overlap. Choose a setting which is in the middle of a signal strength range.

**Table 1**

| Attenuation and Sensitivity Settings | | |
|---|---|---|
| **Signal Range (dBm)** | **Attenuation (40, 20, 0 dB)** | **Sensitivity (High, Normal)** |
| 0 to -60 | 40 dB | Normal |
| -20 to -80 | 20 dB | Normal |
| -40 to -100 | 0 dB | High |

3 From the MAIN MENU, select **`Configure Test Set.`** Both the attenuation and sensitivity settings can be adjusted in this menu.
4 Page down either using the cursor, or by pressing user key [k4].
5 Select **`Attenuation For Forward Channel.`**
6 A menu appears in the upper right hand corner of the Configuration screen. Choose either 0, 20, or 40 dB, based on your signal strength measurement.
7 Press the user key [k1] to finish. You will return to the C.A.L.M. MAIN MENU.

## Make Sure the Software Functions

This procedure will log some Mobile Identification Numbers (MINs) just to confirm that the software is functioning in a basic manner. Now that you have selected a control channel, and have checked the signal strength of that channel, do the following:

**Procedure to check the basic functions of C.A.L.M. software**

1. After you have selected a control channel and checked the signal strength, set the SQUELCH knob to the fully counterclockwise position.
2. From the MAIN MENU of the C.A.L.M. software, select **`Log Mobile IDs From Forward Control Channel.`**
3. Confirm that the **`Present Control Channel`** field lists your desired control channel
4. Confirm that the **`Mobile Area Code`** field reads “Any”.
5. Confirm that the **`Mobile Phone Number`**.field reads “Any-Any.” You must also choose ODD or EVEN numbers. For this test choose ODD NUMBERS.
6. Select the field **`LOGGING.`** A blank menu should appear on the screen, and a list of MINs should begin to scroll up the screen. Each MIN should have an order type on the same line. Some common orders are: “Page”, “Registration”, and “Initial Voice Channel.”
7. When you are satisfied that MINs are actually being logged to the screen, end the task by pressing the cursor control knob . The display will be returned to the **`Log Mobile IDs From Forward Control Channel`** menu.
8. To return to the MAIN MENU, press the user key [k1]**`,Done`**.

If you received MINs, then the software has been installed properly. Congratulations! This completes the Quick Check. You are now ready to start making actual tests. Proceed to the “Making Tests” chapter.

## Troubleshooting the Quick Check

If your Quick Check did not work, check the following:

- Was the software installed properly? Check the previous section, “Installing the Software.”
- Was a control channel properly selected? Is it still active? Check the signal strength again.
- Is either the **`Mobile Area Code`** or the **`Mobile Phone Number`** not set to “Any?” If they are something other than “Any,” the test set may be waiting for a specific area code or number, and not recording the numbers actually on the control channel. Remember, you must choose either ODD or EVEN numbers.
- Did you verify the signal level? You may also want to read the topic “Multipath” in the “Reference” chapter.
- Did the software freeze the display? Does the menu on the upper right hand side of the display have 5 items: RUN, CONTINUE, SNGL STP, CLR SCR, MAIN MENU? If so, you have accidentally paused or stopped the program. Select the user key [k2],**`Continue`** to continue. If that does not work, you will have to re-start the software

***NOTE:*** If the test set displays an error that states “One or more self-tests failed”, you have a hardware problem. In this case, refer to the test set’s *Assembly Level Repair* manual.

***IF A PROBLEM PERSISTS*** Call the HP Factory Hotline from anywhere in the USA or Canada (1-800-922-8920, 8:30 a.m. - 5:00 p.m. Pacific time).

# 3



# Product Description

**THE *PRODUCT DESCRIPTION* GIVES A CONCISE OVERVIEW OF C.A.L.M.**

Use the "Product Description" chapter to learn

- what the product is
- primary functions of the software
- specific uses and benefits of this software

# What the HP 11807B Option 120 is

The HP 11807B Option 120 software is an HP Instrument Basic (IBASIC) application for AMPS that runs on the HP 8921A,D cell site test set. It uses the sensitive receiver of the test set to monitor, decode and display forward and reverse AMPS control channel data. Message content is continuously updated and used in following calls through setup and handoff sequences on voice channels.

***SOFTWARE/ HARDWARE COMPATIBILITY***

This software requires the HP 8921A or the HP 8921D cell site test set. *It will not work with any HP 8920 series test set.* In addition, the HP 8921A,D must also have a minimum firmware revision level of A.14.14. The latest firmware upgrade is included during early production versions of this software. After this initial phase, the upgrade must be ordered separately. If you need the firmware upgrade, and it is not included in this package, contact Hewlett-Packard at 1-800-922-8920 or 1-509-994-9385 for details on ordering your upgrade. The upgrade is **HP 8921A Option R58.**

# Primary Functions of the Software

- Search for and list local AMPS control channels and their signal levels.
- Read and display system information from AMPS forward control channel (FOCC) wideband data streams.
- Keep a running count of orders on the FOCC.
- Decode MIN information and associated orders from FOCC.
- Follow call setups to a voice channel and through subsequent handoffs.
- Monitor mobile data transmissions on the reverse control channel (RECC).
- Measure cell site transmitter performance off-air.
- Measure phone transmitter characteristics off-air.

# Software Features

- Multiple Test Modes

  The software provides seven different test modes for monitoring and problem solving various AMPS system problems. Use one or more of these modes to verify system performance or identify problems. The menu-driven interface allows you to change modes quickly.

- Decoded Data

  Five test modes decode the data from either the Forward Control Channel (FOCC) or the Reverse Control Channel (RECC). The data is then displayed in a manner consistent with the test mode.

- Parametric Measurements

  In addition to the decoded data displays, two of the test modes return parametric measurements of important transmitter performance parameters for mobiles and base stations. These measurements help you identify performance problems on both base stations and mobile phones remotely.

- Logging of Retrieved Data

  Several test modes support logging of retrieved data. They are:

  - LOG MOBILE IDS FROM FORWARD CONTROL CHANNEL
  - MEASURE CELL SITE PARAMETERS
  - REVERSE CONTROL CHANNEL INFORMATION

  You may send results to a printer or log to a PC for archival and analysis. Results can be imported into many popular spreadsheet and database programs for post-processing.

- Remote Control of the Test Set

  For drive-around environments, the test set can be accessed remotely via its serial port. It then presents the system menus on a terminal or PC with terminal software.

- Benefits
  - Gather valuable data to assist in system planning
  - Increase confidence in system performance
  - Use measurement modes to reduce site maintenance time
  - Use mobile measurements to improve customer satisfaction

# Test Modes

## Forward Control Channel Information

This mode allows you to quickly identify control channels in your area. The test set will scan either A or B spectrum, finding any control channels that meet a signal strength limit that you provide. The channels are listed by number and signal level and are then selectable from any other screen.

Once control channels are identified, you can select from any on the list and monitor its wide-band data stream. The software allows you to select specific data messages to monitor and then displays only the message content. Important fields are translated into decimal notation for easy reading. You can view stream A or stream B data and individual word content while a timer display shows the rate at which various message types are sent. You can select from the following message types:

**System Parameters**

- System Identification (SID)
- Digital Color Code (DCC)
- Combined Paging/Access (CPA)

**Control Filler**

- Control Mobile Attenuation Code (CMAC)
- Overhead Message type (OHD)
- reserved bits

**Registration ID**

- Registration ID (REGID) in decimal and binary
- DCC
- END

**Global Action Message Types**

- rescan
- registration increment
- new access channels
- overload control
- access type
- access attempt

## Forward Control Channel Order Count

It is often useful to monitor the rate at which various types of orders are being sent across the forward control channel. This order rate information helps you identify loading on system elements and can be used as a check for other analysis tools that study usage. The order count mode presents a single screen that tabulates the messages by type. A running total of pages, registrations, channel assignments, and other message types is maintained while a counter shows elapsed time. You can quickly change from one control channel to another or re-enable the count on the same channel. Select from Stream A or Stream B data (not both).

## Forward Control Channel Log MINs

This mode functions very much like the order count mode, except that rather than displaying a count of the orders it shows the actual order data in a running list. You can view the MIN along with the associated order information in a running stream of numbers. As this mode can generate much data, it has a logging function that allows you to print or store the results for archival or later analysis.

**User Options in this mode include**

- view of Stream A or Stream B orders (not both) and MINs
- view all activity, specific area codes, phone prefixes, or even a specific MIN
- instant access to the spectrum analyzer, which then displays the control channel centered on-screen
- change quickly to other control channels
- log output including time and date stamp

## Reverse Control Channel Data

This mode monitors the Reverse Control Channel (RECC) looking for responses from local mobiles. These responses are then decoded and the data is displayed on-screen. The information returned allows you to analyze local usage patterns and the mobile types in a given area (for example, power class and whether they support extended AMPS channels). This mode, too, can deliver a large amount of data so printouts and logging are available. Note: The test set does not track call setup and handoffs during this mode.

**User Options in this Mode are**

- display of all recovered data or selection by area code, prefix, or even a specific MIN.
- change quickly to other control channels.
- logging mode setup for printer or file format.
- quick selection of spectrum analyzer screen.

## Voice Following

For situations where voice quality is a concern, the software has a voice following mode to track call setup and to monitor voice once it is established on a voice channel. It will follow calls through channel re-assignments and handoffs and display the system data while the user monitors voice.

**User Options in this mode include**

- monitor stream A or stream B orders (not both).
- follow all activity, a specific area code, phone prefix, or even a specific MIN. This can be particularly useful when used with your own phone to monitor your call setups and handoff activity.
- switch quickly between forward and reverse channels once a call is established.
- instant access to the spectrum analyzer, which then displays the transmitter signal centered on-screen.
- change quickly to other control channels.

## Cell Site Measurements

This unique parametric mode uses the call setup process to find active forward voice channels. Once on a channel, the test set makes important measurements of the cell site transmitter's performance and displays the results. After measurements are taken, the test set returns to the control channel for the next frequency assignment. Using this mode you can perform checks on all voice channels at a given site - even multiple sites. Transmitters with problems or that are out of adjustment can be identified before visiting the site for maintenance.

**Measurements returned are**

- Voice channel number
- Transmitter RF frequency error
- Transmitter RF level
- SAT frequency
- SAT deviation

**User Options in this mode include**

- Channel selection by next assignment or manual entry (user enters channel number).
- Automatic or manual measurement mode (the test set can stay on a channel of interest and continually monitor transmitter performance).
- Quick selection of other control channels.
- Logging of data to a printer or PC.

## Mobile Phone Measurements

This parametric mode looks at mobile, rather than cell site, performance. It allows you to follow a mobile call setup and then make important measurements off-air of the phone's transmitter performance (reverse voice channel). This can be useful when problem solving a phone and when a phone is newly-programmed for a system. The system will track the call setup and then allow you to select from several available measurements.

**Measurements available are**

- Transmitter RF frequency error
- Transmitter RF level
- SAT frequency and deviation
- Voice deviation and distortion
- Signaling tone frequency and duration (on END of call)

**User Options in this mode include**

- Call tracking by specific MIN or by area code or MIN prefix.
- Quick access to spectrum analyzer to see the phone's transmitted signal.

# 4

# Making Tests

**SCAN THE "MAKING TESTS" CHAPTER TO FIND OUT WHAT THE SOFTWARE IS DESIGNED TO DO.**

Use the "Making Tests" chapter to learn:

- Learn what tests can be made with the software
- Learn how the tests are performed using the software
- See some examples of test procedures

# About the “Making Tests” Chapter

The C.A.L.M. software is immensely versatile. Coupled with this versatility is a certain level of complexity. This chapter is designed to give you exposure to the types of tests you can make with this software, and to provide some examples of how these tests are made. The examples will provide you with basic instructions on using the software.

The following chapter, “Reference”, contains detailed instructions on how to perform the steps described in these procedures. Use the “Reference” chapter if you feel that you want more information on a particular step or steps.

Structure of the “Making Tests” chapter

- About the “Making Tests” chapter
- Lookup table of tests versus menu items
- Graphic of menu tree
- Test types
  - Searching for and listing AMPS control channels and signal levels
  - Forward Control Channel Data
  - Reverse Control Channel Data
  - Determining usage patterns
  - Voice Following
  - Measuring Cell Site parameters
  - Measuring Mobile parameters

# Test Lookup Table and Menu Tree

This table gives you a cross-reference between tests you may wish to perform and their associated test modes. Shaded areas (dark or light) indicate that the task can be performed within that mode. An empty cell indicates that the task cannot be performed in that mode. The darkest cells indicate the primary mode for performing the task.

**Table 2**

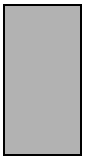
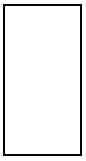
LEGEND:  Primary test mode for performing the task  Secondary test mode for performing the task  Cannot perform the task in this mode

**Table 3 Test Lookup Table**

| | Test Mode | | | | | | |
|---|---|---|---|---|---|---|---|
| **Task** | **Forward Control Channel Informa-tion** | **Reverse Control Channel Informa-tion** | **Forward Control Channel Orders** | **Log Mobile IDs from Forward Control Channel** | **Voice Follow-ing** | **Measure Parame-ters for a Mobile** | **Measure parame-ters for a Cell Site** |
| Searching for and listing control channels and signal levels | | | | | | | |
| Forward Control Channel (FOCC) Data | | | | | | | |
| Reverse Control Channel (RECC) data | | | | | | | |
| Keep a running count of orders on the FOCC | | | | | | | |
| Compare a mobile's transmitted digits to keys pressed | | | | | | | |

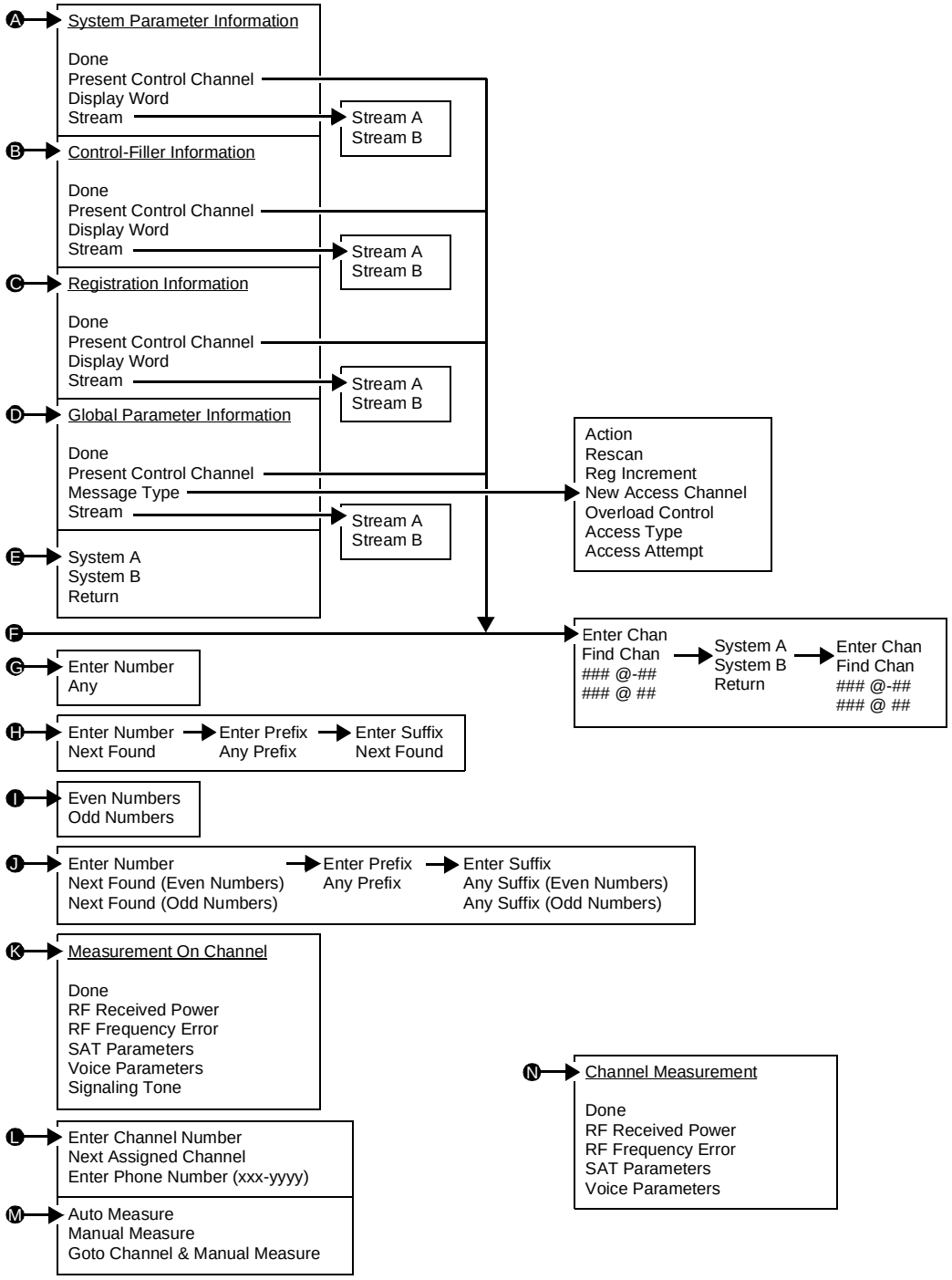
**Table 3 Test Lookup Table**

| | Test Mode | | | | | | |
|---|---|---|---|---|---|---|---|
| **Task** | **Forward Control Channel Informa-tion** | **Reverse Control Channel Informa-tion** | **Forward Control Channel Orders** | **Log Mobile IDs from Forward Control Channel** | **Voice Follow-ing** | **Measure Parame-ters for a Mobile** | **Measure parame-ters for a Cell Site** |
| Compare SIDs or DCCs | ■ | | | | | | |
| Check voice channel assignments | | | | ■ | ▒ | | |
| Compare actual versus expected registration timing | ■ | | | | | | |
| Look for mobiles which register at wrong rate | | ■ | | | | | |
| Compare ESN to MIN | | ■ | | | | | |
| Determine types of mobiles using the system | | ■ | | | | | |
| Build a list of users | | | | ■ | | | |
| Monitor activity for a specific MIN or a group of MINs | | | | ■ | ▒ | | |
| Determine usage patterns | | ▒ | ▒ | ■ | | | |
| Find a mobile's geographic location within a cell | | ■ | | | | | |
| Find a mobile's geographic location using a directional antenna | | | | | ■ | | |

**Table 3 Test Lookup Table**

| | Test Mode | | | | | | |
|---|---|---|---|---|---|---|---|
| **Task** | **Forward Control Channel Information** | **Reverse Control Channel Information** | **Forward Control Channel Orders** | **Log Mobile IDs from Forward Control Channel** | **Voice Following** | **Measure Parameters for a Mobile** | **Measure parameters for a Cell Site** |
| Check cell site loading | | | ■ | | | | |
| Monitor a voice for quality | | | | | ■ | | |
| Monitor for dropped calls | | | | | ■ | | |
| Find out the number being called | | ■ | | | | | |
| Monitor voice for law enforcement | | | | | ■ | | |
| Track handoffs | | | | | ■ | | |
| Measure a mobile's performance in an actual call environment | | | | | | ■ | |
| Measure many voice channel transmitters at a site | | | | | | | ■ |
| Measure one voice channel's performance | | | | | | | ■ |
| Measure variation of cell performance/ parameters over time | | | | | | | ■ |

## Test Lookup Table and Menu Tree



# Tests

All of the tasks listed in the above Test Lookup Table have direct parallels in this section. The names are the same, but the individual tests are grouped under the test types as listed in the first section of this chapter.

By reading this section, you will learn more details about these tests, and will see some specific examples. You must know the following before running any of these tests:

- You must be familiar enough with the test set to be able to load the C.A.L.M. software.
- You must be able to select menu items with the knob on the front panel.
- You must be able to find the user keys ([k1] through [k5]) on the front panel and use them according to the menus which appear on the display.
- You must know which type of antenna you want to use for a particular test, and have it attached to the test set. A directional antenna must be properly oriented.
- All test examples listed below start from and end at the MAIN MENU.
- Before making any test, you will always have to make sure you have selected your desired forward control channel and confirmed that the signal strength is within the required limits.

***IF YOU NEED MORE DETAILS***

If you need more information than is provided in this section, you should refer to the following areas:

*The "Getting Started" Chapter;*
*The "Reference" Chapter;*
or *The HP 8921 Cell Site Test Set User's Guide*.

## Searching For and Listing AMPS Control Channels and Signal Levels

This task is vital to all other tests. You must first find and select a Forward Control Channel before you can successfully perform any test or measurement with the C.A.L.M. software. Use the Finding and Listing Available Control Channels procedure. If you already know the number of your desired control channel, you can use the second procedure, Entering a Known Control Channel.

### Finding and Listing Available Control Channels

1. From the MAIN MENU of the C.A.L.M. software, select the **`Forward Control Channel Information`** menu item.
2. Select **`Find Control Channels.`**
3. Select **`System A`** *or* **`System B`** depending on which system you wish to test.
4. Wait while the test set finds the strongest control channel for your chosen system. This should take less than a minute.
5. One or more control channel numbers should be displayed, along with the corresponding signal levels.
6. Select **`Done`** (or press the user key [k1]). You should be back at the MAIN MENU.

### Entering a Known Control Channel

1. From the MAIN MENU of the C.A.L.M. software, select the **`Forward Control Channel Orders`** menu item.
2. Select **`Present Control Channel`**.
3. Select **`Enter Chan`**.
4. Enter your channel number in the highlighted area next to the **`Present Control Channel`** menu item using the numeric keypad.You can also use the knob to increase or decrease the control channel number.
5. Select **`Done`** (or press the user key [k1]). You should be back at the MAIN MENU.

## Forward Control Channel Data

The Forward Control Channel (FOCC) transmits data which communicates with mobile radios in the cell. This data is broken into three streams, Stream A, Stream B, and the busy-idle stream. Stream A contains control data for mobiles whose Mobile Identification Number (MIN) ends in a binary “0” (corresponds to all mobiles which have even “phone” numbers). Stream B contains control data for mobiles whose Mobile Identification Number (MIN) ends in a binary “1” (corresponds to all mobiles which have odd “phone” numbers). The busy-idle stream is not decoded.

The FOCC data streams contain many parameters and messages. Some of the most used data is

- System Parameters
  - System Identification (SID)
  - Digital Color Code (DCC)
  - Combined Paging/Access (CPA)
- Control Filler Information
  - Control Mobile Attenuation Code (CMAC)
  - Overhead Message type (OHD)
  - reserved bits
- Registration ID
  - Registration ID (REGID) in decimal and binary
  - DCC
  - End Indication field (END)
- Global Action Message Type
  - rescan
  - registration increment
  - new access channels
  - overload control
  - access type
  - access attempt

#### Some Uses of Forward Control Channel Information

By comparing the transmitted data from the FOCC to the values that are set up in your system, you can confirm that your system is functioning properly. You can also compare data from cell to cell.

Some specific items to compare

- Compare transmitted SID to expected SID for a cell.
- Compare transmitted DCC to expected DCC.
- Compare actual versus expected registration timing.
- Check any of the other data listed above to make sure that the data transmitted is what you expected.

**Example: Compare actual versus expected registration increment timing**

1. From the MAIN MENU of the C.A.L.M. software, select **`Forward Control Channel Information`**.
2. Select **`Registration ID`**.
3. Select the desired control channel, if necessary, by selecting menu item **`Present Control Channel`**.
4. Check signal strength.
5. You must choose either **`Stream A`** *or* **`Stream B`** (corresponds to even or odd numbers). If you wish to change the present setting, use the **`Stream`** menu item.
6. Watch the ΔT above the `OHD` field. It will indicate the approximate time between registration increments. Compare this ΔT value to the value set up for your system. This time is typically the same for all cells within one system. .

***NOTE:*** IMPORTANT: you should ignore the first ΔT value, since the timing probably started during the period, not at the beginning

7. Press user key [k1] twice to return to the MAIN MENU.

## Reverse Control Channel Data

The Reverse Control Channel (RECC) is a single wideband data stream which is sent from the mobile to the base station.

### Parameters Contained in the RECC Data Stream

- Orders
  - page responses
  - call origination
  - order confirmations
- Mobile Identification Number (MIN)
- Station Class Mark (SCM)
- Electronic Serial Number (ESN)

#### Some Uses of Reverse Control Channel Information

You can use your own mobile to transmit data onto the reverse channel, and check its validity with the C.A.L.M. software, or you can gather information on actual mobiles in the field. Note that since handoff data is not provided on the RECC, the test set will not follow a handoff while it is monitoring the RECC.

#### Reverse Control Data to Check

- Compare a mobile's transmitted digits to the keys actually pressed by setting up your own call and reading the number dialed on the test set.
- Compare ESN to MIN (fraud or error detection). Fraud is sometimes committed by using a MIN with one ESN for a short time, then changing ESNs and/or MINs or both. You can log RECC information, and look for MINs which have more than one ESN associated with them, or ESNs with more than one MIN. This would be an indication of an error or possibly fraud.
- Determine the types of mobiles using the system by interpreting the Station Class Mark (SCM), which can identify mobiles based on their power class, transmission type (continuous or discontinuous), and bandwidth (20 or 25 MHz)
- Look for mobiles which are registering at the wrong rates.
- Determine which number the mobile is calling
- Determine the manufacturer of the mobile by interpreting the three most significant decimal digits of the ESN (or the eight most significant binary digits)

***ABOUT THE SPECTRUM ANALYZER WHILE IN RECC MODE***

Within any of the MAIN MENU items, you can press user key [k5] to activate the spectrum analyzer. The signal is then displayed. NOTE: at this point, data decoding is suspended. When you are in the **`Reverse Control Channel Information`** test mode, the signal that you are observing is the REVERSE portion of that control channel. In the other menu items, you are observing the forward control channel signal. To end the spectrum analyzer display, press [SHIFT]-[k1] and then press [ENTER].

**Example: Compare a mobile's transmitted digits to the keys actually pressed**

1. From the MAIN MENU of the C.A.L.M. software, select **`Reverse Control Channel Information`**.
2. Select the desired control channel, if necessary, by selecting **`Present Control Channel`**.
3. Check signal strength.
4. If you wish to view reverse control channel data for a specific mobile ID, change the area code and mobile number using the menu items **`Mobile Area Code`** and **`Mobile Phone Number`**.
5. Select **`Monitoring`**. The bottom half of the display should begin to show data soon. Precisely how long it takes depends directly on the data which is being transmitted, and which mobile area codes and numbers you have selected to monitor.
6. Using a mobile phone set up for the system you have chosen, dial a phone number. You should see the mobile ID and the number dialed appear on the screen. If the number dialed is the same as the buttons you pressed, this test has passed.
7. Press user key [k1] once to return to the MAIN MENU.

***SIGNAL LEVEL OF THE RECC IS IMPORTANT TOO***

You may want to check the signal level of the RECC. The RECC has the same requirements for signal quality as the FOCC. In addition, if you are using your own mobile, and you are located near the test set, you have increased the chance of having too much RECC signal at the antenna input. Refer to the "Signal Strength" section in the "Reference" chapter.

**Example: Look for mobiles which are registering at the wrong rates**

The objective with this procedure is to check the relative rate of registration of mobiles by monitoring all RECC transmissions. If a mobile is registering much more frequently than the service provider requires (for example: once every minute when the algorithm requires only once an hour), the mobile is using valuable control channel resources.

1. From the MAIN MENU, select **`Reverse Control Channel Information`**.
2. Select the desired control channel, if necessary, by selecting menu item **`Present Control Channel`**.
3. Check signal strength.
4. To monitor all mobile area codes and phone numbers, confirm that "Any" is selected for the **`Mobile Area Code`** and **`Mobile Phone Number`**.
5. Select **`Monitoring`**. The bottom half of the display should begin to show data soon.
6. Track this information to see how often mobiles are registering.
7. Press user key [k1] once to return to the MAIN MENU.

***TO IMPROVE EFFICIENCY***

Use **`Log Data To Printer`** or **`Log Data To Spreadsheet`** in order to create a record of registrations. You can then review these at a later time to look for mobiles which may be registering at the wrong rate. See the "Reference" chapter for instruction on setting up logs.

## Determining usage patterns

One of the most powerful aspects of the C.A.L.M. software is the ability to collect and record data. The data can later be used in a spreadsheet or other data analysis tool to analyze the cell's demographics.

**Usage Information Available**

- What types of mobiles are using the system (menu item Reverse Control Channel Information)?
- When are the mobiles using the system (Log Mobile ID from Forward Control Channel)?
- Which are mobiles are the heaviest users of the service (either Log Mobile IDs or Reverse Control Channel Information)?
- A count of various key orders in the system: (Forward Control Channel Orders)
  - registrations
  - pages
  - voice channel assignments
  - maintenance
  - releases
  - and many other orders

**Some Uses of this Information**

By collecting and analyzing the above information, you can build a profile of your users and how they use your system. You can do all of this without ever being physically connected to the cell site.

**What to Do with Usage Information**

- Determine which types of mobiles are using the system (how many pagers, how many analog phone, how many digital phones)
- Build a list of users by logging MINs
- Check cell site loading by monitoring the number of various orders over time
- Monitor activity for a specific MIN or a group of MINs
- Determine cell loading geographically by using a directional antenna and monitoring orders over time in various locations within a cell (very useful if you are planning to sectorize a cell)

**Example: Check cell site loading by monitoring the number of various orders over time**

The objective of this procedure is find out how many orders of various types are transmitted on a control channel.

1. From the MAIN MENU of the C.A.L.M. software, select **`Forward Control Channel Orders`**.
2. Select the desired control channel if necessary, by using the menu item **`Present Control Channel.`**
3. Check signal strength.
4. Choose **`Odd`** or **`EVEN`** phone numbers.
5. Select **`ORDER COUNT`**. A menu should appear in the lower half of the display, with various orders listed. In a reasonably active cell, an order count should begin within a few seconds.
6. Press [ENTER] (select ORDER COUNT again) to reset the counter.
7. Press user key [k1] *once* to return to the MAIN MENU.

**Example: Monitor activity for a group of MINs**

The objective of this procedure is find out what the cell activity is for a group of MINs, in this case all MINs which have a common prefix.

1. From the MAIN MENU, select **`Log Mobile IDs From Forward Control Channel`**.
2. Select the desired control channel if necessary, by using the menu item **`Present Control Channel`**.
3. Check signal strength.
4. Select the **`Mobile Phone Number`** menu item. A list of choices should appear.
5. Select **`Enter Number`**. Another list of choices should appear.
6. Select **`Enter Prefix`**.. Three zeroes next to the **`Mobile Phone Number`** item should be highlighted.
7. Enter your desired prefix. In this case, enter a prefix which frequently is used within your cell.
8. Press the [ENTER] key. A list of choices should appear.
9. Select **`Any Suffix (Odd Numbers)`**. The choice between odd and even numbers exists because the data stream in the forward channel is divided between these two sets of numbers.
10. Select **`Logging`**. In a reasonably active cell, data should begin scrolling up the screen.
11. Push the knob or press the [ENTER] key to disable **`Logging`**. You will return to the LOG MOBILE IDS FROM FORWARD CONTROL CHANNEL screen.
12. Press user key [k1] once to return to the screen.

***TO IMPROVE EFFICIENCY***

Use **`Log Data To Printer`** or **`Log Data To Spreadsheet`** in order to create a record of mobile IDs. You can then review these at a later time to analyze the data. See the “Reference” chapter for instruction on setting up logs.

## Voice Following

Voice quality is vital to customer satisfaction. To enable you to monitor voice quality, a voice following mode has been included. It has the capability to track call setup and to monitor a voice once it has been established on a voice channel. It can follow calls even while channels are re-assigned and during handoffs. In addition, some system data is displayed during voice following.

**System Data Displayed During Voice Following**

- MIN.
- Voice channel assignment.
- SAT Color Code (SCC).
- Voice Mobile Attenuation Code (VMAC).
- When a handoff occurs, the SAT and VMAC for the new voice channel is also provided.
- When an order to change power level occurs, the new MAC is displayed.

***IMPORTANT INFORMATION ABOUT SIGNAL LEVEL DURING VOICE FOLLOWING***

Location of the antenna and test set have a direct impact on the quality of your voice following activity. For optimal performance, you need to have a good omnidirectional antenna and be in the line-of-sight of the cell sites. In addition, if you have a directional antenna, you can get an indication of the general direction of travel of a mobile from the Reverse Voice Channel. When you want to track handoffs, you should have a good omnidirectional antenna and be in the line-of-sight of as many cell sites as possible.

**Basic uses for voice following**

Voice following can be useful when you are getting customer complaints about problems in the field. If, for example, the customer is complaining about poor voice quality or voice dropouts in the field, you can take the test set with the C.A.L.M. software, go to the location, and confirm the problem. In addition, you can use other C.A.L.M. features to help diagnose the problem by measuring voice distortion or deviation (see “Measure Parameters for a Mobile”), or even search out possible interference sources with a directional antenna and the spectrum analyzer.

**Uses for Voice Following**

- Monitor a voice for quality.
- Monitor the voice for dropped calls.
- Monitor voice for law enforcement.
- Track handoffs.
- Determine a mobile’s geographical location by following the mobile’s calls on the Reverse Voice Channel with a directional antenna. Triangulation techniques can assist in this activity.

**Example: Track handoffs**

The objective of this procedure is to track a call as the mobile moves from cell-to-cell. It can be particularly useful when trying to discover problems in the handoff process, such as dropped calls or poor voice quality in the cell near the handoff point.

1 From the MAIN MENU, select **`Voice Following`**.
2 Select the desired control channel, if necessary, by selecting menu item **`Present Control Channel`**.
3 Check signal strength.
4 If you want to follow a specific phone number or group of numbers, adjust **`Mobile Area Code`** or **`Mobile Phone Number`**.
5 Select **`Following`** to enable voice following. The bottom half of the display will begin to show the active MIN, and its associated information:
   - Voice channel, SCC and VMAC if it is a call.
   - Order and Local data if it is not a call.
   - When a handoff occurs, both the new and old voice channel information is displayed.
6 Press user key [k1] once to return to the PAGE VOICE FOLLOWING INFORMATION menu. Press user key [k1] twice to return to the MAIN MENU.

***SPECIAL OPTIONS WITH VOICE FOLLOWING***

When a call has been placed, and the voice channel is being monitored, two extra user keys are utilized:

- By pressing user key [k3]: you can monitor either the Forward Voice Channel (FVC) or the Reverse Voice Channel (RVC). The decoding from the forward channel is disabled during the RVC monitoring period. You may miss a handoff if it occurs while monitoring the RVC.
- By pressing user key [k4]: you can display a measure of the signal level. The reverse control channel level is measured when monitoring the RVC. Otherwise, the forward control channel level is measured. You can repeat this measurement every time you switch between FVC and RVC. It can take 4-5 seconds to make this measurement. During this period, forward channel decoding is disabled.

## Measuring Cell Site Parameters

This mode uses the call setup process to find active forward voice channels. Once on a channel, it makes measurements of the transmitter's performance. The benefit to this is that these measurements are made without being physically connected to the cell site. By using the automatic mode, many channels can be measured in a short amount of time.

**Cell Site Measurements returned**

- Voice channel assignment (VCA)
- SAT frequency
- SAT deviation
- Transmitter RF frequency error
- Transmitter RF level

There are three measurement modes:

- Automatic Mode: after finding a voice channel and making the measurements, the software searches for another voice channel and measures it. The display continues to show the last measured channel number and its results while it searches for another voice channel.
- Manual Mode: you can make individual measurements at the time you choose. The measurement you choose is frequently updated.
- Goto Channel and Manual Measure Mode: works only with a specifically entered channel.

With voice channel assignment, you can:

- Go immediately to a channel and make a manual measurement without a VCA
- Select one particular channel and wait for the next assignment to that channel (automatic or manual measurements)
- Take the next channel assignment to any channel (automatic or manual measurements)
- Enter a phone number (MIN) and follow channel assignments for that MIN (automatic or manual measurements)

A table outlining the measurement modes and the "Follow From" options is on the next page.

**Table 4 Following and Measuring Modes for Cell Site Measurements**

| | | "FOLLOW FROM" MODES | | |
|---|---|---|---|---|
| | | **ENTER CHANNEL NUMBER** | **NEXT ASSIGNED CHANNEL** | **ENTER FROM PHONE NUMBER** |
| MEASUREMENT MODES | AUTOMATIC (Auto Measure) | 4Waits for VCA TO specified channel, measures, then waits for next VCA to that same channel | 4Waits for any VCA, then measures and waits for new VCA | 4Waits for VCA of specified MIN, then waits for new VCA |
| | MANUAL (Manual Measure) | 4Waits for VCA to specified channel, user selects measurements until done | 4Waits for any VCA, waits for manual meas. must select "done" to find another VCA | 4Waits for VCA of specified MIN, then waits for manual meas. until done |
| | GOTO CHANNEL & MANUAL MEASURE | 4 Goes immediately to channel and manual measures | 5<br>Not applicable | 5<br>Not applicable |

**Uses of Measure Parameters for a Cell Site**

There are several ways to use the cell site measurements:

- Measure many voice channel transmitters without being at the site
- Measure one channel's performance
- Measure the variation of cell performance/parameters over time

**Example: Measure a voice channel transmitter**

1. From the MAIN MENU of the C.A.L.M. software, select **`Measure Parameters For A Cell Site`**.
2. Select the desired control channel, if necessary, by selecting menu item **`Present Control Channel`**.
3. Check signal strength.
4. If you want to follow from a specific channel or phone number, adjust the **`Follow From`** menu item. For this example, choose **`Next Assigned Channel`**.
5. Choose **`Auto Measure`** from the field **`Mode`**.
6. Select **`Measuring`**. The bottom half of the display will track Mobile ID, and Order and Local messages, until a voice channel is assigned. Depending on the system activity, you may have to wait a few minutes until a voice channel is assigned.
7. Once a voice channel is assigned, the bottom half of the display changes. Read the measurement values from the bottom of the display. The test set tracks the voice channel just long enough to measure the channel's parameters, then goes automatically back to searching for the next voice channel.
8. The test set continues to display the measurement results for the last channel measured, until a new channel has been measured. If the measurement is not completed by the time the call ends, the results for that channel will not be displayed.
9. Press user key [k1] once to return to the MAIN MENU.

***TO IMPROVE EFFICIENCY***

Use **`Log Data To Printer`** or **`Log Data To Spreadsheet`** in order to create a record of mobile IDs. You can then review these at a later time to analyze the data. See the "Reference" chapter for instruction on setting up logs.

## Measuring Mobile Parameters

This mode is analogous to the cell site measurements. Once on the channel, it makes measurements of the mobile's performance. You will probably find that this mode is quite useful when you are trying to debug a mobile. Best results are obtained with the mobile in your hands while you are making the tests.

### Mobile Parameter Measurements Returned

- Voice channel assignment (VCA)
- SAT frequency
- SAT deviation
- Transmitter RF frequency error
- Transmitter RF received power
- Voice distortion
- Voice deviation
- Signaling Tone frequency
- Signaling Tone deviation
- Signaling Tone duration

The measurement mode for mobile parameters is different than the measurement mode for the cell site measurements. There is only a manual mode, during which the individual measurements are frequently updated. Since this is a manual mode, once a measurement is made, you must specifically end the measurement task and go back to the **`Waiting For Voice Channel Assignment`** mode.

Measurements can be made based on a voice channel assignment with the following options:

- Mobile area code (specific or "Any")
- Mobile prefix and/or suffix (specific or "Any")

### Use of Measure Parameters for a Mobile

One extremely valuable use of this mode is to be able to determine the parameters of a specific mobile in an actual call environment. You must be receiving a sufficient signal level from the mobile. Your best results will be obtained when you are controlling the mobile of interest.

**Example: Measure signaling tone parameters**

1. From the MAIN MENU of the C.A.L.M. software, select **`Measure Parameters For A Mobile`**.
2. Select the desired control channel, if necessary, by selecting menu item **`Present Control Channel`**.
3. Check signal strength.
4. If you want to follow a specific phone number or group of numbers, adjust **`Mobile Area Code`** or **`Mobile Phone Number`**.
5. You must choose either even or odd numbers (corresponds to Stream A or Stream B). If the setting displayed in the **`Mobile Phone Number`** menu item is not correct, change it now.
6. Select **`Measuring`**. The bottom half of the display will track Mobile ID, and Order and Local messages, until a voice channel is assigned. Depending on the system activity, you may have to wait a few minutes until a voice channel is assigned.
7. If you are using your own phone, dial a number on your phone and press [SEND]. Otherwise, just wait for a voice channel assignment.
8. Wait a few seconds. If you are monitoring the correct control channel, you should see the voice channel assignment for your MIN appear on the screen.
9. Once a voice channel is assigned, the active display changes. The top half of the screen now gives you the measurement options, and the bottom half of the screen is reserved for measurement results. Choose your desired measurement. For this example, choose **`Signaling Tone`**.
10. Press [END] on your phone. This will generate a signaling tone.
11. The measurements for the signaling tone will appear on the display in a few seconds. Note: if you did not use your own phone, the ST may not have been transmitted.
12. Press user key [k1] once to return to the **`Waiting For Voice Channel Assignment`** mode, or press user key [k1] to return to the MAIN MENU.

# 5

# Reference

**LOOK UP SPECIFIC MENU ITEMS AND TOPICS IN THE "REFERENCE" *CHAPTER.***

Use the "Reference" chapter to

- get step-by-step information on using the individual menu functions
- learn the importance of signal strength, antennas and control channel
- learn how to use the test set to run the software
- find out more about which antennas can be best used for a task
- learn how to log data and control the instrument remotely

# In This Chapter

This chapter is arranged alphabetically by section heading. The section headings are listed below:

- AMPS Information
- Antennas
- Autostarting the Software
- C.A.L.M. Configuration Menu
- C.A.L.M. Test Modes
- HP 8921 Basics
- Logging Data
- Multipath
- RAM Card Initialization and Use
- Rear Panel Connector Diagrams and Pinouts
- Signal Strength
- Terminal Operation
- Using Both Terminal Operation and Logging Data at the Same Time
- Using an External Speaker

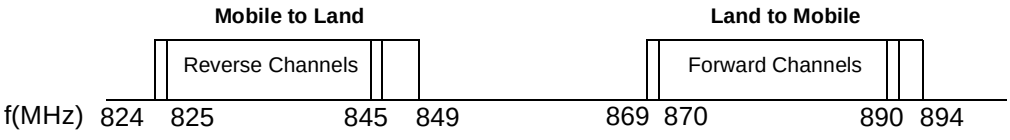
# AMPS Information

***WHERE TO GET SYSTEM SPECIFICATIONS***

The specification used in building AMPS systems and for creating this software is the EIA/TIA-553 - 89. These specifications may be obtained from:

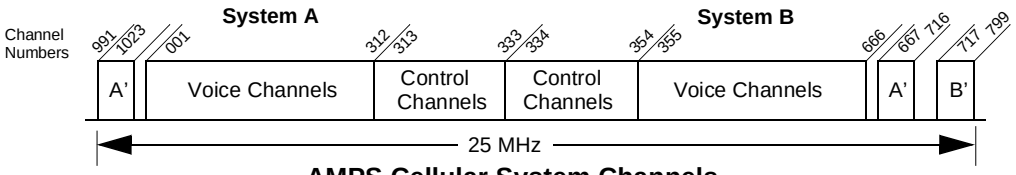
Global Engineering Documents
15 Inverness Way East
Englewood CO 80112
1-800-854-7179
FAX 303 792-2192

Two diagrams which may help you when using the C.A.L.M. software are shown below. They indicate the frequency and channel allocations for the AMPS cellular system.




**AMPS Cellular System Frequency Spectrum**

**832 Channels @ 30 kHz Channel Spacing**




**AMPS Cellular System Channels**

# Antennas

Your choice of antenna can have a large impact on the quality of signal you receive. No specific antenna is always guaranteed to be optimum. Below are guidelines to choosing antennas, as well as a listing of a few antennas that may be useful in your application.

## Types of Antennas and Their Use With the C.A.L.M. Software

Omnidirectional antennas are quite useful for most tests within the C.A.L.M. software. Directional antennas should be used whenever you need to consider where the signal comes from. Alternatively, you could increase the level of a weak signal using a directional (gain) antenna.

**Use an Omnidirectional antenna when**

- you are gathering data from a cell site (forward or reverse data)
- you are logging MINs
- you are measuring mobile parameters
- you are following a voice, trying to track handoffs, monitoring a voice for quality

**Use a Directional Antenna when**

- you are measuring cell site parameters
- you are gathering cell site loading data prior to sectorizing the cell
- you are following a voice, trying to locate the mobile geographically
- you need increased signal level

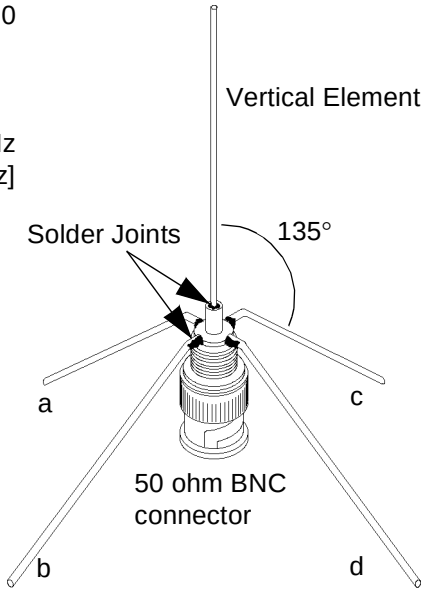
Some common commercial antennas are listed below. In addition, you can also try either a BNC telescoping antenna, or (as a “quick and dirty” temporary solution) make your own Monopole antenna above a ground plane (see figure below).

**Table 5 Typical Antennas for use with AMPS C.A.L.M. software**

| Type | Gain | Frequency Range | Size | Supplier/Model | Phone |
|---|---|---|---|---|---|
| 4 element Yagi | 6 dB | 806 - 896 MHz | 1 ft. | Cushcraft PC804N | 1-800-258-3860 |
| 3 element Yagi | 6 dB | 824 - 896 MHz | 1.5 ft. | Maxrad MYA-8783 | For more information, call: (708) 372-6800 |
| Small omni | 3 dB | 824 - 896 MHz | 2.2 ft. | Maxrad MFB-8823 | |
| Portable omni | 3 dB | 806 - 896 MHz | 1.25 ft. | Larsen FB2 800 | For more information, call: 1-800-426-1656 |
| Portable omni | 5 dB | 806 - 896 MHz | 1.80 ft. | Larsen FB2 5T 800 | |

Wire gauge: approximately 16-20 (1.5 - 2.0mm)

Wire length: approx.
3.5 inches (8.9cm) for 800 MHz
[3.1 inches (7.9cm) for 900 MHz]




Ground Plane Elements
a, b, c, d @ 90° with respect to each other in a plane ≈135° with respect to Vertical Radiator

### Connecting to a receive antenna at the cell site

Some cell sites have extra receive antenna ports that are part of the receiver multicoupler circuitry. These ports can provide very good reception. When you physically connect to one of these antennas, you will not only get a nice strong signal, but the antenna also represents what the cell site "sees."

***CHECK THAT SIGNAL LEVEL!***

Remember to always verify that the antenna input of the test set is receiving less than 200 mW.

# Autostarting the Software

If you are frequently using the C.A.L.M. test software, and moving the test set around, you may want to set up the test set so that it will automatically load the software upon power-up. The procedure for doing this is as follows:

**Procedure for setting up Autostart of the software**

1. From the C.A.L.M. software MAIN MENU, press user key [k2], **`Exit`**.
2. Press user key [k5], to go to the MAIN MENU (of the TESTS menu).
3. Use the knob to select **`Exec`**, under **`Set Up Test Set`**.
4. Select **`Autostart Test Procedure on Power-up`**, at the bottom of the screen. Make sure it is set to **`On`**.
5. Press user key [k1] ,**`Run Test`** to return to the software MAIN MENU. Do not press **`[Continue]`**.

**Procedure for turning off Autostart of the software**

1. From the C.A.L.M. software MAIN MENU, select user key [k2],**`Exit`**.
2. Press user key [k5], to go to the MAIN MENU (of the TESTS menu)
3. Use the knob to select **`Exec`**, under SET UP TEST SET
4. Select **`Autostart Test Procedure on Power-up`**, at the bottom of the screen. Make sure it is set to **`Off`**.
5. Press user key [k1], **`Run Test`** to return to the software MAIN MENU. Do not press **`[Continue]`**.

# C.A.L.M. Configuration Menu

The Configuration Menu provides for the following control of the C.A.L.M. software:

- Control mode: controls the test set from the front panel or via a terminal.
- Remote Inverse: controls inverse video display in terminal operation.
- Terminal Address, Baud, Parity, Data and Stop Length, and Pace: controls terminal communications.
- Logger Format, Address, Baud, Parity, Data and Stop Length, and Pace: controls logging communications.
- Beep: controls the test set's beep volume.
- Control Channel Level Sets: the minimum level which will be acceptable during a FIND CONTROL CHANNEL search.
- Attenuation and Sensitivity for Forward Channel: controls the antenna input sensitivity and attenuation for the forward control channel operation.
- Attenuation and Sensitivity for Reverse Channel:controls the antenna input sensitivity and attenuation for the reverse control channel operation.
- Save/Load Parameters to/from a Card: saves or loads your configuration parameters to a RAM card.

## Using the Configuration Menu

Each field in the Configuration Menu is listed below, along with instructions on its use.

#### Control Mode

**Function.** Allows operation from either the front panel (Local) or remotely via a terminal (Terminal).

**Typical or Default Values.** Local

**Operating Considerations.** A screen will pop up, indicating that Terminal mode is active. Press user key [k5],**`Lcl Mode`** to return to front panel control. You will return to the C.A.L.M. MAIN MENU. The Control Mode still will indicate Terminal, but Terminal Mode must be reselected before you return to that mode.

#### Remote Inverse

**Function.** Enables reverse video during Terminal mode.

**Typical or Default Values.** Enabled

**Operating Considerations.** Even though it may be enabled, this is only active during Terminal Mode. Some terminals may have trouble with inverse video, so this function can be disabled.

#### Terminal Commands

**Function.** These commands control the communications between the test set and the terminal.

**Typical or Default Values:**

- Address: 9
- Baud: 9600
- Parity: None
- Data Length: 8 bits
- Stop Length: 1 bit
- Pace: Xon/Xoff

**Operating Considerations.** Refer to the Product Note HP 8920-1 for detailed instructions on setting up PC terminal emulator programs. Baud rate, Parity, Data Length, Stop Length, and Pace must be the same on both the PC and the test set.

#### Logger Commands

**Function.** These commands control communications between the test set and a PC or a printer.

**Typical or Default Values:**

- Format: Off
- Address: 10
- Baud: 9600
- Parity: None
- Data Length: 8 bits
- Stop Length: 1 bit
- Pace: Xon/Xoff

**Operating Considerations:** None

#### Beep

**Function.** This field controls the volume of the beep, which occurs when a field is selected, or a measurement is completed.

**Typical or Default Values.** Quiet

**Operating Considerations.** Select a setting from list of choices. After choosing, BEEP will remain at this level, even when power is cycled.

**Beep Choices:**

- Off
- Quiet
- Loud

**Control Channel Level**

**Function.** This field controls the minimum acceptable level during FIND CONTROL CHANNEL.

**Typical or Default values:** -90 dBm.

**Operating Considerations:** You may want to change this when you are in a location with many strong signals. To modify, enter your desired level with the numeric keypad

**Attenuation Forward Channel**

**Function:** This field controls the attenuation of the antenna's input during forward channel operation.

**Typical or Default Values:** 0 dB

**Operating Considerations:** Monitor the signal with the spectrum analyzer. If clipping occurs, increase the attenuation.

**Sensitivity Forward Channel**

**Function:** This field controls the sensitivity of the antenna's input stage during forward control channel operation.

**Typical or Default Values: High**

**Operating Considerations:** None

**Attenuation Reverse Channel**

**Function:** This field controls the attenuation of the antenna's input stage during reverse control channel operation

**Typical or Default Values:** 0 dB

**Operating Considerations:** None

**Sensitivity Reverse Channel**

**Function.** This field controls the sensitivity of the antenna's input stage during reverse control channel operation

**Typical or Default Values:** High

**Operating Considerations:** None

**Save Parameters to Card**

**Function.** This field saves the Configuration Menu's parameters to a RAM card.

**Typical or Default Values.** None

**Operating Considerations.** You must have a RAM card with the Write control switch in the "write" position in the slot. A ROM card or no card in the slot will produce error messages.

**Load Parameters from Card**

**Function.** This field loads the Test Set Configuration parameters from a RAM card.

**Typical or Default Values:** None

**Operating Considerations:** You must have a RAM card with a valid file on it in the slot. A ROM card or no card in the slot will produce error messages.

# C.A.L.M. Test Modes

This section lists all of the test modes except for the Configuration Mode, which is in the following section.

***WHERE TO GET SYSTEM SPECIFICATIONS***

The specification used in building AMPS systems and for creating this software is the EIA/TIA-553 - 89. These may be obtained from

Global Engineering Documents
15 Inverness Way East
Englewood CO 80112
1-800-854-7179
FAX 303 792-2192

## EXIT

**EXIT Usage**

1. Select **`[Exit]`** or press user key [k2] to go to the TESTS (IBASIC Controller) screen.
2. Press user key [k5] to go to the TESTS menu.
3. Press user key [k1] to re-enter the C.A.L.M. software

## FORWARD CONTROL CHANNEL INFORMATION

Select **`Forward Control Channel Information`** to gather data on the Forward Control Channel. This data is broken down into four sections, and a fifth section contains the procedure for finding a control channel.

**Forward Control Channel Information Menu Choices**

- **`[Done]`** - select this or press user key [k1] to return to the MAIN MENU.
- **`System Parameters`** - delivers system data
- **`Control Filler`** - data contained in the control filler message
- **`Registration ID`** - delivers registration data
- **`Global Action`** - global action messages
- **`Find Control Channels`** - searches for available control channels

## System Parameters

The overhead message is transmitted in two data streams, Stream A and Stream B. Stream A contains data corresponding to MINs with even numbers, and Stream B contains data corresponding to MINs with odd numbers. Both streams contain two words for the System Parameter portion of the overhead message. They are cleverly named Word 1 and Word 2.

**System Parameter Menu Choices:**

- Present Control Channel - choose between
  - enter a new control channel
  - select a new control channel
  - search for control channels in either System A or System B
- Display word - choose between Word 1 or Word 2
- Stream - choose between Stream A or Stream B

**Table 6 Word 1 Data**

| T1T2 | DCC | SID1 | EP | RSVD | NAWC | OHD | P |
|---|---|---|---|---|---|---|---|
| 11 | | | n.a. | | | 110 | n.a. |

**DCC** The two-bit Digital Color Code transmitted by the cell site.

**SID1** The 14-bit first part of the System Identification field.

**RSVD** reserved word

**NAWC** The four-bit indicator of how many words are still coming.

**Table 7 Word 2 Data**

| T1T2 | DCC | S | E | REGH | REGR | DTX | RSVD | N-1 | RCF | |
|---|---|---|---|---|---|---|---|---|---|---|
| 11 | | | | | | | | | | |

**Table 8 Word 2 Data Continued**

| | CPA | CMAX-1 | END | OHD | P |
|---|---|---|---|---|---|
| | | | | 111 | n.a. |

**DCC** The two-bit Digital Color Code transmitted by the cell site

**S** Serial number field

**E** Extended address field

**REGH** Registration field for home stations

**REGR** Registration field for roaming stations

**DTX** Two-bit discontinuous transmission field

**RSVD** reserved word

**N-1** N is number of paging channels in the system. Five bits.

**RCF** Read control filler field

**CPA** Combined Paging/Access field.

**CMAX-1** CMAX is number of access channels. Seven bits.

**END** End indication field. 1 if this is the last word of the overhead message train; '0' if not last word.

## Control Filler

The control filler message exists to ensure that the forward control channel has a continuous data stream. In addition, it carries data concerning power level for the mobile, and indicates whether the overhead message must first be read before the mobile can attempt to access the system.

### Control Filler Menu Choices

- Present Control Channel - allows the user to
  - enter a new control channel
  - select a new control channel
  - search for control channels in either System A or System B
- Stream - choose between Stream A or Stream B

**Table 9 Control Filler Data**

| T1T2 | DCC | 010111 | CMAC | RSVD | 11 | RSVD | 1 | WFOM | 1111 | OHD | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | | 010111 | | 00 | 11 | 00 | 1 | | 1111 | 001 | n.a. |

**DCC**

The two-bit Digital Color Code transmitted by the cell site

**CMAC**

Three-bit control mobile attenuation code. Indicates mobile power level associated with reverse control channel. See table below.

**Table 10** **Mobile station power levels**

| Mobile Station Power Level | Mobile Attenuation |
|---|---|
| **PL** | **CMAC** |
| 0 | 000 |
| 1 | 001 |
| 2 | 010 |
| 3 | 011 |
| 4 | 100 |
| 5 | 101 |
| 6 | 110 |
| 7 | 111 |

**WFOM**

Wait for overhead message field.

**OHD**

Three-bit message indicating message type. ‘011’ is control filler word.

## Registration ID

This message contains the registration ID. This message is always appended to a system parameter overhead message.

**Software Features**

- Above the message is a ΔT. This tracks the change in time between registration of any mobile.

**Registration ID Menu Choices**

- Present Control Channel - allows the user to
  - enter a new control channel
  - select a new control channel
  - search for control channels in either System A or System B
- Stream - choose between Stream A or Stream B

**Table 11** **Control Filler Data**

| T1T2 | DCC | REGID | END | OHD | P |
|---|---|---|---|---|---|
| 11 | | | | 000 | n.a. |

**DCC**

The two-bit Digital Color Code transmitted by the cell site

**REGID**

The 20-bit registration ID field.

**END**

End indication field. 1, if this is the last word of the overhead message train; 0, if not last word.

**OHD**

Three bit message indicating message type. ‘011’ is the control filler word.

## Global Action

This message consists of one word, but any number of global action messages can be appended to any system parameter overhead message. The C.A.L.M. software identifies and displays six types of global action messages:

**Global Action Messages Displayed in C.A.L.M. software**

- Rescan
- Registration Increment
- New Access Channel
- Overload Control
- Access Type
- Access Attempt

**Software Features**

- In addition to displaying these six messages, the first mode (ACTION) displays all messages as they occur.
- A ΔT is displayed and updated whenever another message is sent.

**Global Action Message Menu Choices**

- Present Control Channel - allows the user to
  - enter a new control channel
  - select a new control channel
  - search for control channels in either System A or System B
- Message Type - chooses from
  - Action (displays the next message regardless of type)
  - Rescan
  - Registration Increment
  - New Access Channel
  - Overload Control
  - Access Type
  - Access Attempt
- Stream - chooses between Stream A or Stream B

**Table 12** **Rescan Data**

| T1T2 | DCC | ACT | RSVD | END | OHD | P |
|---|---|---|---|---|---|---|
| 11 | | 0001 | | | 100 | n.a. |

**Table 13** **Registration Increment Data**

| T1T2 | DCC | ACT | REGIN CR | RSVD | END | OHD | P |
|---|---|---|---|---|---|---|---|
| 11 | | 0010 | | | | 100 | n.a. |

**Table 14** **New Access Channel Data**

| T1T2 | DCC | ACT | NEW ACC | RSVD | END | OHD | P |
|---|---|---|---|---|---|---|---|
| 11 | | 0110 | | | | 100 | n.a. |

**Table 15** **Overload Control Data**

| T1T2 | DCC | ACT | OLC 0 | OLC 1 | OLC 2 | OLC 3 | OLC 4 | OLC 5 | OLC 6 | OLC 7 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | | 1000 | | | | | | | | | |

**Table 16** **Overload Control Data Continued**

| | OLC 8 | OLC 9 | OLC 10 | OLC 11 | OLC 12 | OLC 13 | OLC 14 | OLC 15 | END | OHD | P |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 100 | n.a. |

**Table 17** **Access Type Data**

| T1T2 | DCC | ACT | BIS | RSVD | END | OHD | P |
|---|---|---|---|---|---|---|---|
| 11 | | 1001 | | | | 100 | n.a. |

**Table 18** **Access Attempt Data**

| T1T2 | DCC | ACT | MAXBUSY -PGR | MAXSZTR -PGR | MAXBUSY -OTHER | MAXSZTR -OTHER | END | OHD | P |
|---|---|---|---|---|---|---|---|---|---|
| 11 | | 1010 | | | | | | 100 | n.a. |

**ACT**

Global action field. Four bits. Defines the type of action in a message.

**BIS**

Busy-idle status field. One bit.

**DCC**

The two-bit Digital Color Code transmitted by the cell site

**REGINCR**

The 12-bit registration increment field.

**NEWACC**

11-bit new access channel starting point field.

**MAXBUSY-PGR**

Four-bit field identifying the number of maximum busy occurrences for page responses.

**MAXBUSY-OTHER**

Four-bit field identifying the number of maximum busy occurrences for other accesses.

**MAXSZTR-PGR**

Four-bit field identifying the number of maximum seizure tries for page responses.

**MAXSZTR-OTHER**

Four-bit field identifying the number of maximum seizure tries for other accesses.

**OLC n**

Overload class (0 to 15).

## Find Control Channels

This procedure scans the frequency band, searching for active control channels, and lists the strongest ones (greater than the minimum search level specified in the CONFIGURE TEST SET menu). If only one channel is found, it is automatically selected. Otherwise, you must select one of the available channels.

**Find Control Channels Menu Choices**

- System A
- System B
- Return - returns to FORWARD CONTROL CHANNEL INFORMATION screen

## Finding and Selecting a Control Channel

### Finding a Control Channel

Before you can make any measurements, or log any data, you must first find the available control channels in your desired system. The control channel is an important building block of the mobile telephone system. The C.A.L.M. software uses the control channel as the major dividing unit for data collection or measurements. Use the following procedure for finding a control channel during the Quick Check of Functional Operation:

1. From the MAIN MENU of the C.A.L.M. software, select the **`Forward Control Channel Information`** menu item.
2. Select **`Find Control Channels`**.
3. Select **`System A`** or **`System B`** depending on which system you wish to test.
4. Wait while the test set finds the strongest control channel for your chosen system. This should take less than a minute.
5. One or more control channel numbers should be displayed, along with the signal levels.
6. Select **`[Done]`** (or press the user key [k1]). You should be back at the MAIN MENU again.

### Selecting a control channel

After finding available control channels, you must select one before making any measurements:

1. From the MAIN MENU of the C.A.L.M. software, select **`Log Mobile IDs From Forward Control Channel`**.
2. Select **`Present Control Channel`**.
3. Choose a channel from the list of those provided.
4. Select **`[Done]`** to return to the MAIN MENU.

## REVERSE CONTROL CHANNEL INFORMATION

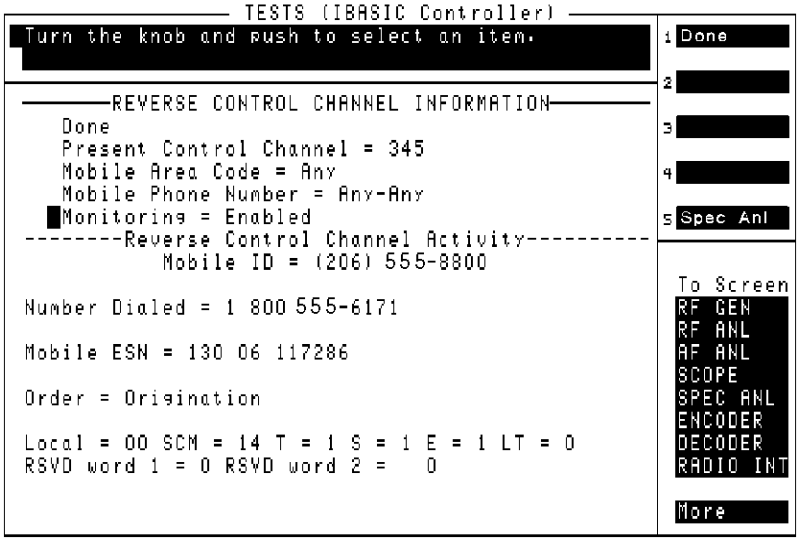
Select **`Reverse Control Channel Information`** to collect data which is being transmitted over the Reverse Control Channel.The reverse control channel is a data stream sent from the mobile to the base station. It can consist of one to seven words. Messages sent are page responses, call originations, orders, and order confirmations. In contrast to the FORWARD CONTROL CHANNEL INFORMATION mode, which displays many of the actual messages being transmitted, the REVERSE CONTROL CHANNEL INFORMATION test mode interprets the message data and displays the results.

### Software Features in Reverse Control Channel Information Mode

- Displays Electronic Serial Number in decimal
- Displays the dialed number when a call is originated
- Displays the order contained in the message
- Shows other relevant data such as SCM, local status, and reserved words

### Reverse Control Channel Test Mode Menu Choices

- **`[Done]`** - select this item or press user key [k1] to return to the MAIN MENU
- **`Present Control Channel`** - allows the user to
  - enter a new control channel
  - select a new control channel
  - search for control channels in either System A or System B
- **`Mobile Area Code`**
- **`Mobile Phone Number`**
- **`Monitoring`**



**Explanation of Reverse Control Information Fields**

- Mobile ID: The phone number of the mobile (first and second words).
- Number Dialed: the number the mobile is trying to reach (fourth through seventh words).
- Mobile ESN: The serial number of the mobile (third word).
- Order: the type of order being transmitted (second word).
- Local: indicates local control. The order must be set to local before this field can be interpreted.
- SCM: Station class mark. Identifies power class, transmission type, and control channel bandwidth.

**Table 19 Station Class Mark (4 bits)**

| Power Class | | Transmission Type | | Bandwidth | |
|---|---|---|---|---|---|
| Class I | xx00 | Continuous | x0xx | 20 MHz | 0xxx |
| Class II | xx01 | Discontinuous | x1xx | 25 MHz | 1xxx |
| Class III | xx10 | | | | |
| Reserved | xx11 | | | | |

- **T:T field** A ‘1’ identifies the message as a call origination. A ‘0’ identifies the message as an order.
- **S: S field** A ‘1’ indicates that the serial number word is sent. A ‘0’ indicates that the serial number word is not sent.
- **E: Extended address field** A ‘1’ indicates that the extended address word is sent. A ‘0’ indicates that the extended address word is not sent. (The extended address word is the second word of the reverse control channel message.)
- **LT: Last try code field** If the mobile is set up for directed retry, then LT = ‘0’ indicates that this is not the last try; LT = ‘1’ indicates that this is the last try.
- **RSVD word 1** Reserved bits in the first word.
- **RSVD word 2** Reserved bits in the second word. These bits determine the type of mobile. The bits are utilized as follows:

**Table 20 Reserved Bits in Word 2**

| ... | LT | RSVD | RSVD | RSVD | | RSVD | RSVD | MIN2 | ... |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 BIT | 1 BIT | 2 BITS | | 2 BITS | 2BITS | | |
| | | EP | SCM(4) | MPCI | TYPE | SDCC1 | SDCC2 | | |
| | | | | 00 | IS-54A | | | | |
| | | | | 01 | IS-54B (DUAL MODE) | | | | |
| | | | | 10 | RSVD | | | | |
| | | | | 11 | RSVD | | | | |

## FORWARD CONTROL CHANNEL ORDERS

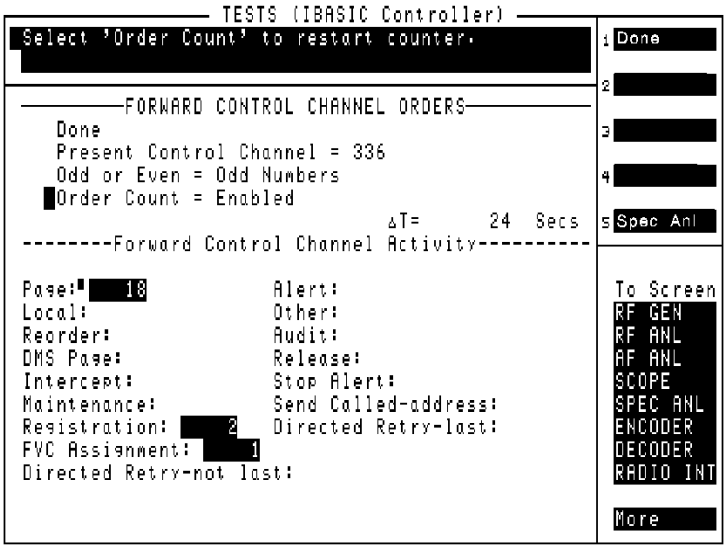
This menu item counts orders which are transmitted on the forward control channel:

**Orders Displayed During Forward Control Channel Order Count**

- Page
- Local
- Reorder
- DMS Page
- Intercept
- Maintenance
- Registration
- FVC Assignment
- Directed Retry-not last
- Alert
- Other
- Audit
- Release
- Stop Alert
- Send Called-Address
- Directed Retry-last

**Software Features in Forward Channel Order Count Test Mode**

- A timer counts the total elapsed time since the count was enabled. Read the elapsed time in seconds in the upper right half of the display.
- You must choose between even and odd phone numbers (even or odd MINs).
- You can reset the counter by reselecting ORDER COUNT.




**Menu Choices for Forward Channel Order Count Test Mode**

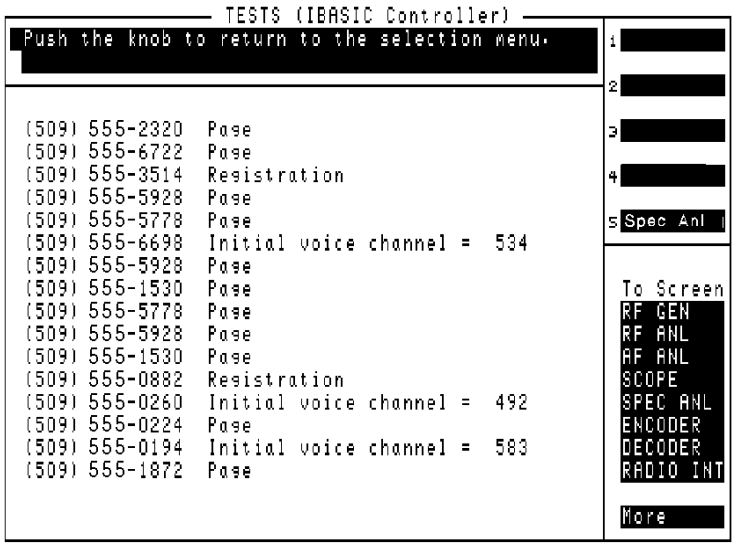
- [**Done**] - select this to exit to the MAIN MENU.
- **Present Control Channel** - choose from:
  - ENTER CHANNEL
  - FIND CHANNEL
  - xxx @-yy (The list of channels previously found.)
- **Odd or Even** - choose odd or even phone numbers
- **Order Count** - select this to enable count, select again to reset counter. Select **[Done]** to end counting.

## LOG MOBILE IDS FROM FORWARD CONTROL CHANNEL

This menu item returns a listing of orders to mobile IDs on a specific control channel (odd or even numbers), along with the type of order. In the case of a voice channel assignment (VCA), the VCA is also displayed. This is a running list, particularly suited to logging data.

**Software Features in Log Mobile IDs from Forward Control Channel Test Mode**

- You can select to log information on all phone numbers (even or odd), or select by the following:
  - a specific area code or “ANY”
  - a specific 3-digit number prefix or “ANY”
  - a specific 4-digit number suffix or “ANY”



**Menu Choices for Log Mobile IDs from Forward Control Channel Test Mode**

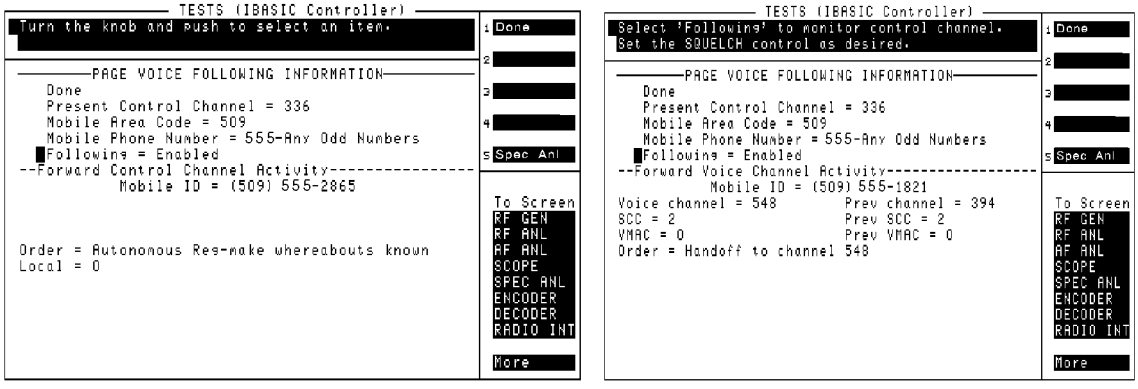
- **`[Done]`** - select this to exit to the MAIN MENU.
- **`Present Control Channel`**
  - ENTER CHANNEL
  - FIND CHANNEL
  - xxx @-yy (The list of channels previously found.)
- **`Mobile Area Code`** - choose “ANY” or enter a number
- **`Mobile Phone Number`** - select “ANY” for either the prefix and/or the suffix, or enter a specific number for either.
- **`Logging`** - select to enable data collection, press the knob again to end data collection.

## VOICE FOLLOWING

This menu item tracks MINs and displays certain forward control channel information. When a voice channel assignment is made, the test set tracks that call until the call is ended or the mobile goes out of range. During this tracking period, the monitoring of the control channel stops.

### Software Features in Voice Following Test Mode

- Displays the following forward control information when no call is being followed
  - MIN
  - order
  - local
- Displays the following information when a call is being followed
  - MIN
  - Voice channel assignment
  - SCC
  - VMAC
  - When an order that applies to the call being followed occurs, it is also displayed. (for example, Order = Change to power level 3)
  - Previous voice channel assignment when a handoff has been followed
  - Previous SCC when a handoff has been followed
  - Previous VMAC when a handoff has been followed
- select MINs to follow based on area code, prefix or suffix
- during following, you can monitor either the forward or reverse voice channel. If you are monitoring the RVC, be aware that if a handoff occurs (in the FVC), the monitored signal will be gone.
- display the signal level of the voice channel. When displaying the signal level, the voice following may end if the call hands off during the approximately 3 seconds it takes to measure the signal level.



**Menu Items for Voice Following Test Mode**

- **[Done]** - select this to return to the MAIN MENU.
- **Present Control Channel**
  - ENTER CHANNEL
  - FIND CHANNEL
  - xxx @-yy (The list of channels previously found.)
- **Mobile Area Code** - choose “ANY” or enter a number
- **Mobile Phone Number** - select “ANY” for either the prefix and/or the suffix, or enter a specific number for either.
- **Following** - select to enable voice following
- User key [k3] - switches monitoring between forward and reverse voice channels.
- User key [k4] - interrupts monitoring to measure the voice channel signal level

## MEASURE PARAMETERS FOR A MOBILE

This mode enables the manual measurements of many mobile parameters. This measurement mode is particularly effective in trying to characterize a mobile that you have in your hand, as opposed to measuring mobiles off the air. When a voice channel is assigned, the user can select from the following measurements:

**Measurements Returned in Measure Parameters for a Mobile Test Mode**

- RF received power
- RF frequency error
- SAT parameters: frequency and deviation
- Voice parameters: distortion and deviation
- Signaling tone: frequency, deviation and duration

**Software Features in Measure Parameters for a Mobile Test Mode**

- When a voice channel is assigned, the measurement menu appears. The user must choose from the above listed measurements. If the call ends before any measurement is selected, it cannot be measured. This measurement is most useful when you have the mobile in your hand and can control the call.
- To disable the measurement, you must select **[Done]** from the **Mobile Measurement Information** menu. This will return you to the MAIN MENU.
- You can choose which measurements to make from the voice channel measurements menu, which appears after a voice channel has been assigned.

**Menu Choices in Measure Parameters for a Mobile Test Mode**

- **`[Done]`** - select this to return to the MAIN MENU
- **`Present Control Channel`**
  - ENTER CHANNEL
  - FIND CHANNEL
  - xxx @-yy (The list of channels previously found.)
- **`Mobile Area Code`** - choose “ANY” or enter a number
- **`Mobile Phone Number`** - select “ANY” for either the prefix and/or the suffix, or enter a specific number for either.
- **`Measuring`** - select this to enable a measurement after a voice channel is assigned. Select **`[Done]`** when you want to disable measuring. You will return to the MAIN MENU.

## MEASURE PARAMETERS FOR A CELL SITE

This mode enables automatic or manual measurements of many cell site parameters. It uses the call setup process to find active forward voice channels. Once on the channel it makes measurements of the transmitter’s performance, all without being physically connected to the cell site.

**Measurements Returned in Measure Parameters for a Cell Site Test Mode**

- Voice channel number
- SAT frequency
- SAT deviation
- Transmitter RF frequency error
- Transmitter RF level

**Software Features in Measure Parameters for a Cell Site Test Mode**

- There are three measurement modes:
  - Automatic mode: after finding a voice channel and making the measurements, the software searches for another voice channel and measures it. The display continues to show the last measured channel number and its results while it searches for another voice channel.
  - Manual mode: you can make individual measurements at the time you choose. The measurement you choose is frequently updated.
  - Goto Channel and Manual Measure: works only with a specifically entered channel.
- With voice channel assignment, you can
  - Go immediately to a channel and make a manual measurement
  - Select one particular channel and wait for the next assignment to that channel (automatic or manual measurements)
  - Take the next channel assignment to any channel (automatic or manual measurements)
  - Enter a phone number (MIN) and follow channel assignments for that MIN (automatic or manual measurements)

**Menu Choices in Measure Parameters for a Cell Site Test Mode**

- [**Done**] - select this to return to the MAIN MENU
- **Present Control Channel**
  - ENTER CHANNEL
  - FIND CHANNEL
  - xxx @-yy (The list of channels previously found.)
- **Follow From** - choose from:
  - ENTER CHANNEL NUMBER
  - NEXT ASSIGNED CHANNEL
  - ENTER PHONE NUMBER (xxx-yyyy)
- **Mode**
  - AUTO MEASURE
  - MANUAL MEASURE
  - GOTO CHANNEL & MANUAL MEASURE
- **Measuring** - select this to enable a measurement after a voice channel is assigned. Select **[Done]** when you want to disable measuring. You will return to the MAIN MENU.

To help you in using the automatic and manual measurement modes, the following table will show the modes and the Follow From options:

**Table 21 Following and Measuring Modes for Cell Site Measurements**

| | | "FOLLOW FROM" MODES | | |
|---|---|---|---|---|
| | | **ENTER CHANNEL NUMBER** | **NEXT ASSIGNED CHANNEL** | **ENTER FROM PHONE NUMBER** |
| MEASUREMENT MODES | AUTOMATIC (Auto Measure) | 4 Waits for VCA to specified channel, measures, then waits for next VCA to that same channel | 4 Waits for any VCA, then measures and waits for new VCA | 4 Waits for VCA of specified MIN, then measures and waits for new VCA |
| | MANUAL (Manual Measure) | 4 Waits for VCA to specified channel user selects measurements until done | 4 Waits for any VCA, waits for manual meas. must select "done" to find another VCA | 4 Waits for VCA of specified MIN, then waits for manual meas. until done |
| | GOTO CHANNEL & MANUAL MEASURE | 4 Goes immediately to channel and manual measures | 5<br>Not Applicable | 5<br>Not Applicable |

# HP 8921 Basics

### Use Your User's Guide

Your Cell Site Test Set User's Guide is filled with details on using the test set. You will want to use it frequently. Below, however, are some extractions from that guide which may provide a quick reference on some test set features which are applicable to the C.A.L.M. software.

### First Menus

As you power up the test set, you will see several screens which are used to initialize the test set. The test set will display the RX TEST screen the first time. To use the C.A.L.M. software, you need to start from the TESTS screen. Press the [TESTS] key located in the top row of keys on the front panel.

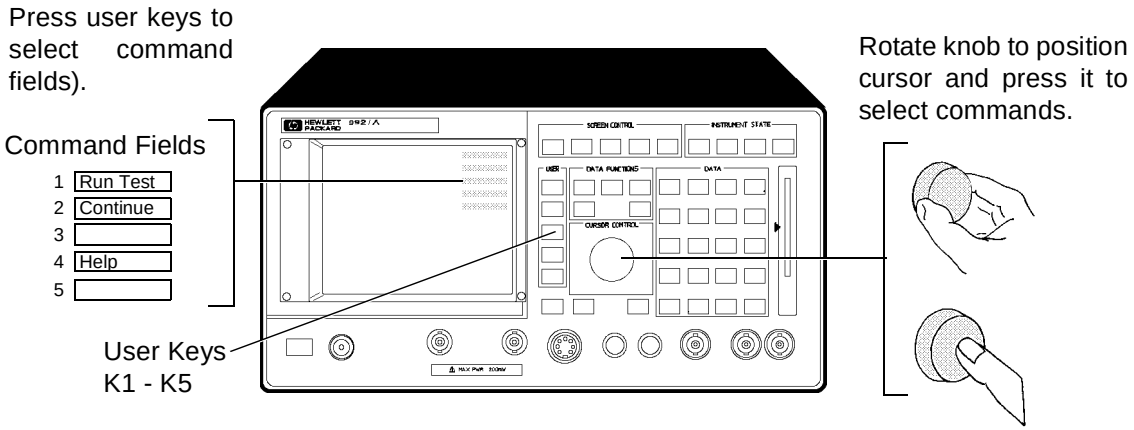
### Controlling the Instrument's Functions

The instrument is typically controlled using the cursor control knob or user keys (described in the next section). The knob moves the cursor to every field on the screen that can be changed. By positioning the cursor in front of a field and pushing the knob to select that field, you can alter that field's setting.

## User keys

User keys instantly access commands and settings without using the knob. You can use user keys to move quickly between fields on the same screen, and to jump between instruments rapidly. With the C.A.L.M. software, user keys are utilized to

- end a measurement and go to the previous menu
- go to the spectrum analyzer display
- make a signal level measurement
- switch between forward and reverse voice channels




## Spectrum Analyzer

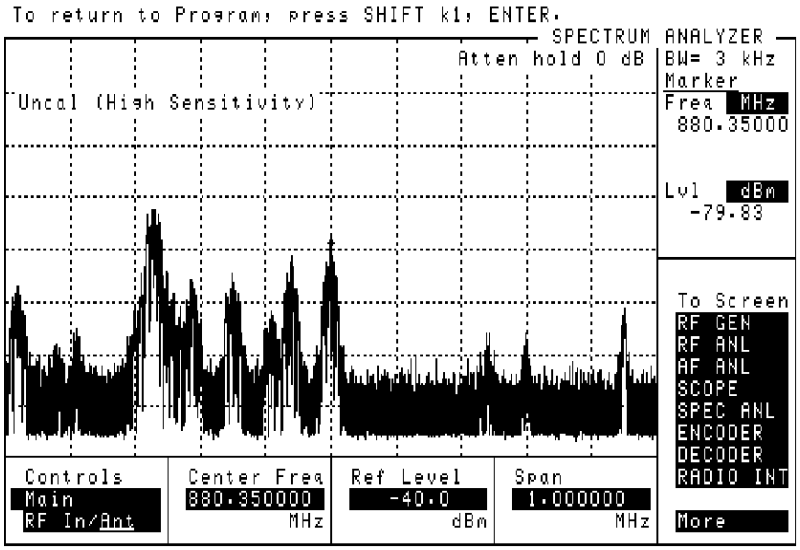
The spectrum analyzer function of the test set is quite versatile, but for the C.A.L.M. software, you will be mostly interested in viewing the transmitted signal quickly, then returning to your measurements. The spectrum analyzer's display has been preset in the C.A.L.M. software to display your desired signal. A user key has been set up in all applicable menus to quickly access the spectrum analyzer. Use the following procedure to access the spectrum analyzer from the C.A.L.M. software.

**Procedure to access and exit the spectrum analyzer**

1. Press the user key [k5] to access the spectrum analyzer.
2. The display will show the signal after a few seconds.
3. You can make adjustments to the reference level, span, and so forth.
4. When you are finished, press [SHIFT],[k1].
5. The top line of the display will tell you to press [ENTER].
6. Press the [ENTER] key or the knob to return to the C.A.L.M. menu from which you exited.

***ABOUT THE DATA WHILE USING THE SPECTRUM ANALYZER***

Within any of the MAIN MENU test modes, you can press user key [k5] to activate the spectrum analyzer. The signal is then displayed. *NOTE: at this point, data decoding is suspended.* When you are in the *REVERSE CONTROL CHANNEL INFORMATION* test mode, *the signal that you are observing is the REVERSE portion of that control channel.* In the other test modes, you are observing the forward control channel signal. To end the spectrum analyzer display, press [SHIFT],[k1] and then press [ENTER].




## Oscilloscope

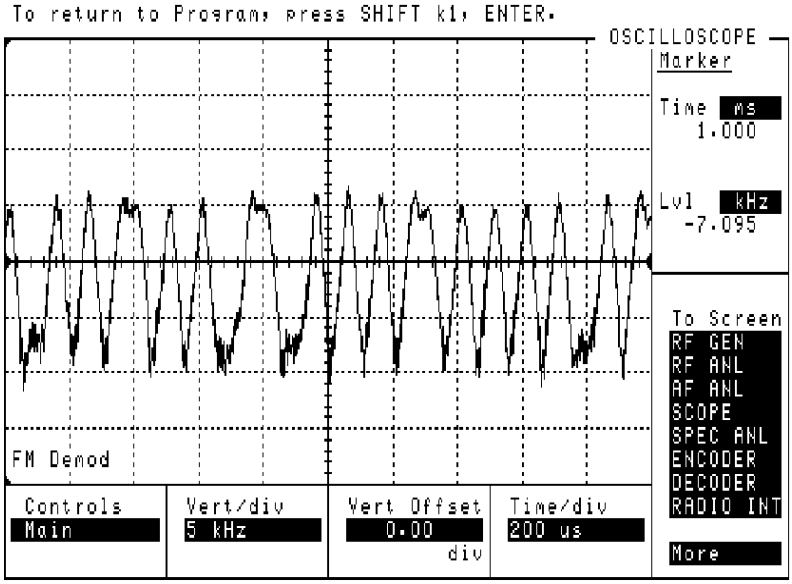
For the C.A.L.M. software, you will rarely use the oscilloscope function. One particular use is when you are searching for multipath propagation.Use the following procedure to access the oscilloscope from the C.A.L.M. software.

**Procedure to access and exit the oscilloscope**

1. From the C.A.L.M. software, press the user key [k5] to access the SPEC ANL screen.
2. Select SCOPE from the TO SCREEN menu in the lower right hand corner of the display.
3. Adjust the oscilloscope display as desired.
4. When you are finished, press [SHIFT],[k1].
5. The top line of the display will tell you to press [ENTER].
6. Press the [ENTER] key or the knob to return to the C.A.L.M. Main Menu.

***ABOUT THE DATA WHILE USING THE OSCILLOSCOPE***

From the spectrum analyzer display you can select the oscilloscope. The scope signal is then displayed. NOTE: from the time you entered the spectrum analyzer, data decoding is suspended. To end the oscilloscope display, press [SHIFT],[k1] and then press [ENTER].




## External CRT

The CRT's VIDEO OUTPUT drives a multisync monitor at 19.2 kHz (analog). Examples of this type of monitor include the Sony CPD-1302, Leading Edge CMC-141M, NEC 3D, and Mitsubishi Diamond scan.

## TESTS Screen

The TESTS screens are also referred to as the "Tests Subsystem"; a group of screens used to create, edit and run automated test programs. There are few of these screens that you will use with the C.A.L.M. software.

Test programs are written in the HP Instrument BASIC (IBASIC) programming language.

For detailed instructions about using the TESTS screens, see your test set's *User's Guide*.

# Logging Data

Data can be logged in two formats: PRINTER (ASCII) and SPREADSHEET (Comma Separated Values CSV). Your test set has up to two connectors available for logging data:

- one Serial connector (contains ports 9 and 10)
- one Parallel connector port 15 (only on test sets with serial numbers that begin with 3501 or greater.)

You can connect either directly to a printer, or (more commonly) to a PC. On a PC, the data is logged into a file, and either printed later, saved, or incorporated into a spreadsheet for data analysis.

### *TEST MODES YOU CAN LOG*

Logging is supported on the following test modes:

- LOG MOBILE IDS IN FORWARD CONTROL CHANNEL
- MEASURE CELL SITE PARAMETERS
- REVERSE CONTROL CHANNEL (RECC) DATA

## Logging the Data to a PC

**Procedure to Log Data to a PC**

**1** Set up the PC for logging data. (described below)
**2** Set up the test set for logging data. (described below)
**3** Connect a cable between the PC and the test set using your chosen cable.
**4** Make tests in any of the test modes that log the data.
**5** Save your logged file before exiting the terminal program.

## Setting up your PC for Logging Data

You can log directly to a PC communications program. Your PC must have the following features available:

**Requirements for Your PC when Logging Data**

- a laptop or desktop PC with one available serial port
- a software communications package.

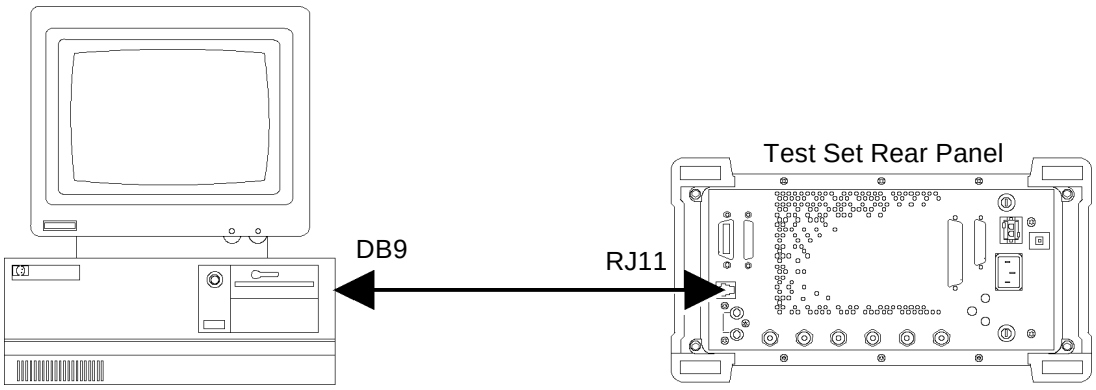
  Packages known to work with the test set are:

  - Microsoft Windows Terminal program
  - ProComm telecommunications software
  - HP AdvanceLink for Windows terminal software
- the capability to save the data to a file

**Equipment needed to log data to a PC**

- PC with terminal software
- the test set with the C.A.L.M. software
- RJ-11 to DB9 cable (08921-61038)

Below is a diagram of the connection between the PC and the test set using the serial cable provided with the software.




The procedure below is an example of how to set up a PC terminal software for logging data. You may need to refer to your software manuals to perform this task with other terminal/communications programs.

**Procedure for setting up the Windows Terminal program for logging data**

1. Start the Terminal program in Windows (run terminal.exe in the Windows directory)
2. From the Terminal menu, select SETTINGS - TERMINAL EMULATION.
3. Choose DEC VT-100 (ANSI).
4. From the Terminal menu, select SETTINGS - COMMUNICATIONS.
5. Choose your serial port connection and edit the parameters to reflect your computer's communication capabilities. The parameters are detailed below.

   **EXAMPLE of a communications setup in Windows Terminal**

   - Terminal emulation: VT-100
   - Connector: COM2 (remember, use your own settings!)
   - Baud Rate: 9600
   - Data Bits: 8
   - Parity: None
   - Flow Control: Xon/Xoff
   - Stop Bits: 1
   - Parity Check and Carrier Detect: both OFF
6. From the Windows Terminal menu, select TRANSFERS - RECEIVE FILE.
7. Enter the path and filename of the file you are saving.

To record data, your printer or PC must be set up to have the same communication parameters as the test set. You do not need all of these values listed below. You must only be able to set up your terminal or printer with at least one from each parameter.

**PC Communications parameters and functions:**

- Terminal emulation
  - VT-100
- Port
  - serial: usually COM or COM2
  - parallel port: usually LPT1
- Communications Baud
  - 150
  - 300
  - 600
  - 1200
  - 2400
  - 4800
  - 9600
  - 19200
- Communications Parity
  - None
  - Odd
  - Even
  - Always 1
  - Always 0
- Communications Data length
  - 7 bits
  - 8 bits
- Communications Stop length
  - 1 bit
  - 2 bits
- Communications Pace (or flow control)
  - None
  - Xon/Xoff
- Filename used for saving the data (refer to your software manual)

## Set up the Test Set for Logging Data

**Procedure to set up the test set for Logging Data**

1 Select **`Configure Test Set`** from the MAIN MENU of the C.A.L.M. software.
2 Select **`Logger Format`**.
3 Choose desired format (**`Printer`** for ASCII or **`Spreadsheet`** for CSV).
4 Select **`Logger Address`**.
5 Choose your desired port (9 when you are using the 08921-61038 RJ-11 to DB9 cable).
6 Set the rest of the Logger options to match your PC's terminal settings:

**EXAMPLE of Test Set Communications Settings**

- Terminal Baud: 9600
- Terminal Parity: None
- Terminal Data length: 8 bits
- Terminal Stop length: 1 bit
- Terminal Pace: Xon/Xoff

7 Press user key [ K1],**`Done`** to return to the MAIN MENU.

**Logger Communications parameter choices**

- Logger Format: Printer or spreadsheet
- Logger Address: choose from ports 9, 10, or 15 based on your connector choice
- Set up the logger communications parameters to the same values you used in the PC setup:
  - Logger Baud
  - Logger Parity
  - Logger Data length
  - Logger Stop length
  - Logger Pace

## Connecting a Printer with the DB25 Serial Cable

A printer which has a serial port (usually a DB25 connector) can be quickly connected and used as a hard-copy data collector. The serial cable with HP part number 08921-61039 is an RJ-11 to DB25 cable.

**Procedure for connecting a printer with a DB25 serial connector**

1 Set up the test set with communication parameters that match your printer (see **Procedure to set up the test set for Logging Data** above).
2 Connect the printer to the test set via the RJ-11 to DB25 cable (HP part number 08921-61039).
3 Run the C.A.L.M. software as usual. The data will be logged to the printer.

## Connecting a Printer with a Parallel Cable

Test sets built after with serial numbers which begin with 3501 or greater have a parallel printer connector. Test sets built with serial numbers lower than 3501 do not have this connector and cannot use the parallel port.

**Procedure for connecting a printer with a parallel connector**

1. Set up the test set with communication parameters that match your printer. (see **Procedure to set up the test set for Logging Data** above)
2. Connect the printer to the test set with the parallel cable.
3. Run the C.A.L.M. software as usual. The data will be logged to the printer.

**Examples of Logged Data**

The following data was extracted from the logging data function. It is presented here to show you the data's format as it appeared in Windows Terminal .

**Table 22**

**Log Mobile IDs from FOCC Log Data as formatted for PRINTER**

Printing started at 15.44 on 41895

| Mobile ID | Order | Voice Ch | Time | Date |
|---|---|---|---|---|
| (509) 555-4426 | Registration | | 15.48 | 0418950 |
| (509) 555-7780 | Page | | 15.49 | 041895 |
| (509) 555-3926 | Initial voice channel = | 103 | 15.49 | 041895 |
| (509) 555-4932 | Registration | | 15.49 | 041895 |
| (509) 555-5794 | Page | | 15.49 | 041895 |

**Table 23**

**Log Mobile IDs from FOCC Log Data as formatted for SPREADSHEET**

"Control Ch","Mobile ID","Order","Voice Ch","Time","Date"

313,"(509) 555-6422","Registration ","",15.37,041895

313,"(509) 555-0996","Page ","",15.38,041895

313,"(509) 555-7778","Initial voice channel", 229,15.38,041895

313,"(509) 555-6416","Registration ","",15.38,041895

313,"(509) 555-1910","Page ","",15.38,041895

**Table 24**

**Measure Cell Site Parameters Log Data as formatted for PRINTER**

Printing started at 15.44 on 41895

| Chan | SAT Freq(Hz) | SAT Dev(kHz) | Freq Error(Hz) | RF lvl(dBm) | Time | Date |
|---|---|---|---|---|---|---|
| 40 | 5970.2 | 1.8 | -719 | -74 | 15.51 | 41895 |
| 187 | 5970.1 | 1.9 | -549 | -63 | 15.52 | 41895 |
| 124 | 5970.1 | 1.9 | -951 | -65 | 15.52 | 41895 |
| 229 | 5970.2 | 1.9 | -643 | -62 | 15.56 | 41895 |
| 61 | 5970.1 | 1.9 | -378 | -86 | 15.58 | 41895 |

**Table 25**

**Measure Cell Site Parameters Log Data as formatted for SPREADSHEET**

"Control Channel","Channel","SAT Freq (Hz)","SAT Dev (kHz)","Freq Error (Hz)","RF level (dBm)","Time","Date"

313, 198,5970.1, 1.9, -159, -62,15.40,041895

313, 187,5970.2, 1.9, -550, -65,15.41,041895

313, 271,5970.2, 2.0, -155, -62,15.42,041895

313, 204,5970.1, 1.9, -614, -61,15.43,041895

**Table 26**

**Reverse Control Channel Information Log Data as formatted for PRINTER**

Printing started at 15.44 on 41895

| Mobile ID | ESN | Dialed/Order | Lcl SCM T S E LT |
|---|---|---|---|
| (509) 555-3078 | 195 26 043627 | Autonomous Reg-make whereabout | 0 14 1 1 1 0 |
| (509) 555-9479 | 195 16 258328 | Autonomous Reg-make whereabout | 0 14 1 1 1 0 |
| (509) 555-5097 | 130 22 078137 | 555-6516 Origination | 0 14 1 1 1 0 |
| (509) 555-0271 | 130 57 076502 | 555-0076 Origination | 2 8 1 1 1 0 |

**Table 27**

**Reverse Control Channel Information Log Data as formatted for SPREADSHEET**

"Control Chan","Mobile ID","ESN","Dialed","Order","Lcl","SCM","T","S","E", "LT","RSVD 1","RSVD 2","Time","Date"

313,"(509) 555-0267","130 57 088968"," ", "Page Response ", 2, 8,0,1,1,0,0, 16,15.25,041895

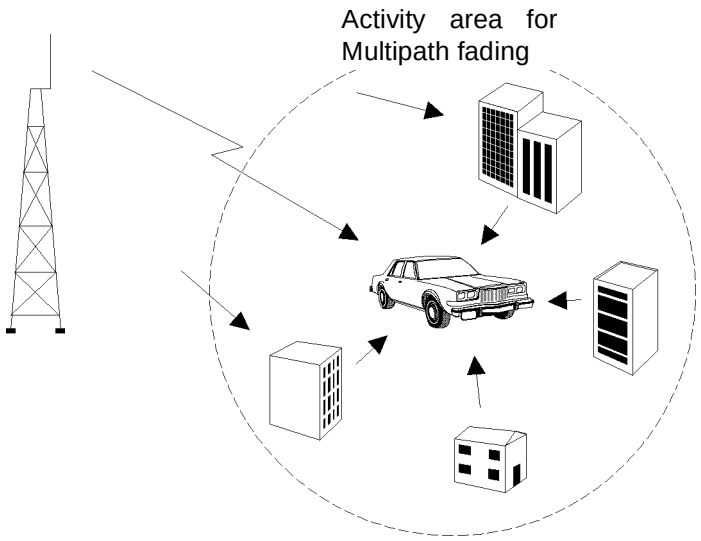
313,"(509) 555-9477","195 16 258366"," ","Autonomous Reg-make whereabouts known ", 0,14,1,1,1,0,0, 0,15.26,041895

313,"(509) 555-0267","130 57 088968","555-0267 ","Origination ", 2, 8,1,1,1,0,0, 16,15.27,041895

# Multipath

Multipath propagation is caused by a number of factors. Radio waves which bounce off objects such as buildings or even trees can impact your received signal. Even the movement of the mobile or the test set itself is a contributor.

Below is an illustration of the direct signal and sources of a signal with multipath interference.




When you are trying to make cell site measurements, multipath propagation can create errors. The biggest effect on the test set will be corrupted decoded data. Your received power measurement can be impacted. Even distortion measurements may be in error due to the multipath effects.

The best way to view multipath effects with the test set is to use the oscilloscope feature. Below is a representation of a signal with multipath effects and without multipath effects. To look for multipath on your test set, use the procedure which follows the figures below.

**A1 and A2:** Peak deviation is high (≈15 kHz) on the bad signal A1, while it is normal on a good signal A2 (≈8 kHz).

**B1 and B2:** The bad signal has some points which may actually cause mistakes in decoding (B1). These are not present in the good signal (B2).

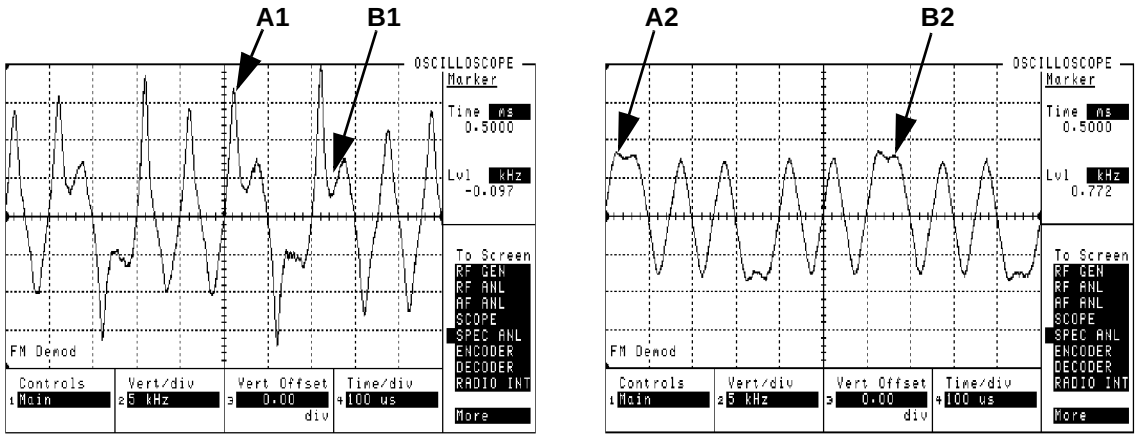



**Figure 1** **Signal with Multipath Interference and Signal without Multipath Interference**

**Using the oscilloscope to view multipath effects**

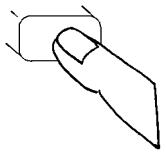
1. From the C.A.L.M. software, press the user key [k5] to access the SPECTRUM ANALYZER screen.
2. Select SCOPE from the TO SCREEN menu in the lower right hand corner of the display.
3. Use the knob to select **`Vert/Div`** at the bottom of the display.
4. Adjust to a level which shows all of the signal from top to bottom, typically 5 kHz per division).
5. Compare this with the diagrams above to determine if multipath is affecting your signal.
6. Adjust either antenna orientation or location or both to minimize effect of multipath.
7. When you are finished, press [SHIFT],[k1].
8. The top line of the display will tell you to press [ENTER].
9. Press the [ENTER] key or the knob to return to the C.A.L.M. Main Menu.

When making measurements with the test set, you should check for multipath occasionally. There are no guaranteed methods of fixing it. If you encounter multipath propagation, you may have to move or redirect your antenna, or even your test set to get out of multipath's way.

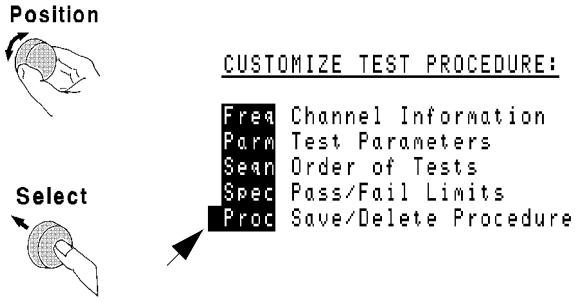
# RAM Card Initialization and Use

**1** Press [**TESTS**] to display the **TESTS (main menu)** screen.

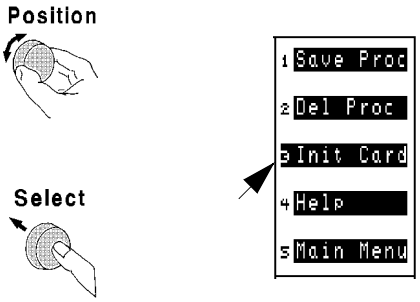
If you are using the IBASIC TESTS screen, press [**PRESET**] before pressing [**TESTS**].



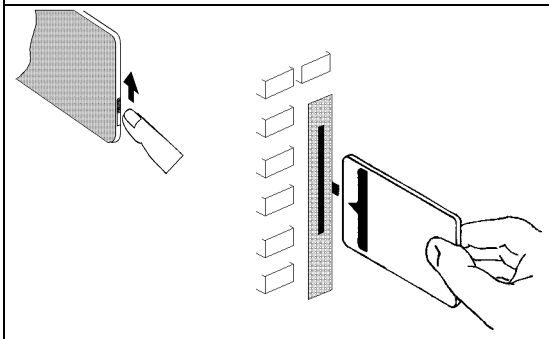
**2** Position cursor at **Proc Save/Delete Procedure** and select it.




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

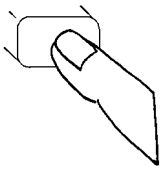



**4** Slide write protect tab to the up position, then insert card into the test set memory slot.

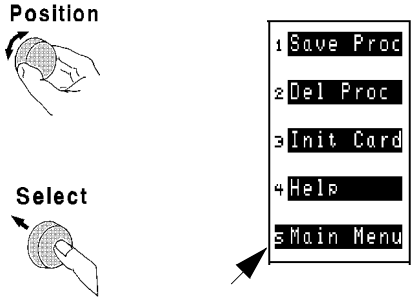


**5** Press **YES** key on test set front panel to begin card initialization.

Initialization takes approx. 5 sec.



**6** Position cursor at **Main Menu** and select it to return to the main menu.



# RAM Card Initialization and Use

## Using the RAM card

The RAM card can be used to store the Configuration Menu parameters. By saving these parameters, you can speed up your testing process.

### Procedure to Save Configuration Menu Parameters to a RAM Card

1. Insert an initialized RAM card.
2. From the Main Menu of the C.A.L.M. software, select **`Configure Test Set`**.
3. Page down (user key [k4]) or scroll to the bottom of the CONFIGURE Test Set screen.
4. Select **`Save Parameters To Card`**.
5. If the save was correctly executed, you will return to the CONFIGURE Test Set screen. Otherwise, see Troubleshooting below.

### Procedure to Load Configuration Menu Parameters from a RAM Card

1. Insert an initialized RAM card with a saved Configuration Menu file.
2. From the Main Menu of the C.A.L.M. software, select **`Configure Test Set`**.
3. Page down (user key [k4]) or scroll to the bottom of the Configure Test Set screen.
4. Select **`Load Parameters From Card`**.
5. If the load was correctly executed, you will return to the Configure Test Set screen. Otherwise, see Troubleshooting below.

### Troubleshooting RAM Card usage

Each of the messages listed below is followed by an explanation of the probable cause.

**`Medium unitialized. Do you want to initialize?`**

- This is a card which has either not been initialized or has other information stored on it. Initializing will overwrite any data which may already be on the card. Press the YES key to initialize.

**`Write protected.`**

- This card has been write protected. Slide the write protect switch into the up position before writing.

**`Medium changed or not in drive. No information was loaded.`**

- This card has possibly not been inserted properly. Re-insert and try again.

**`File name is undefined. No information was loaded.`**

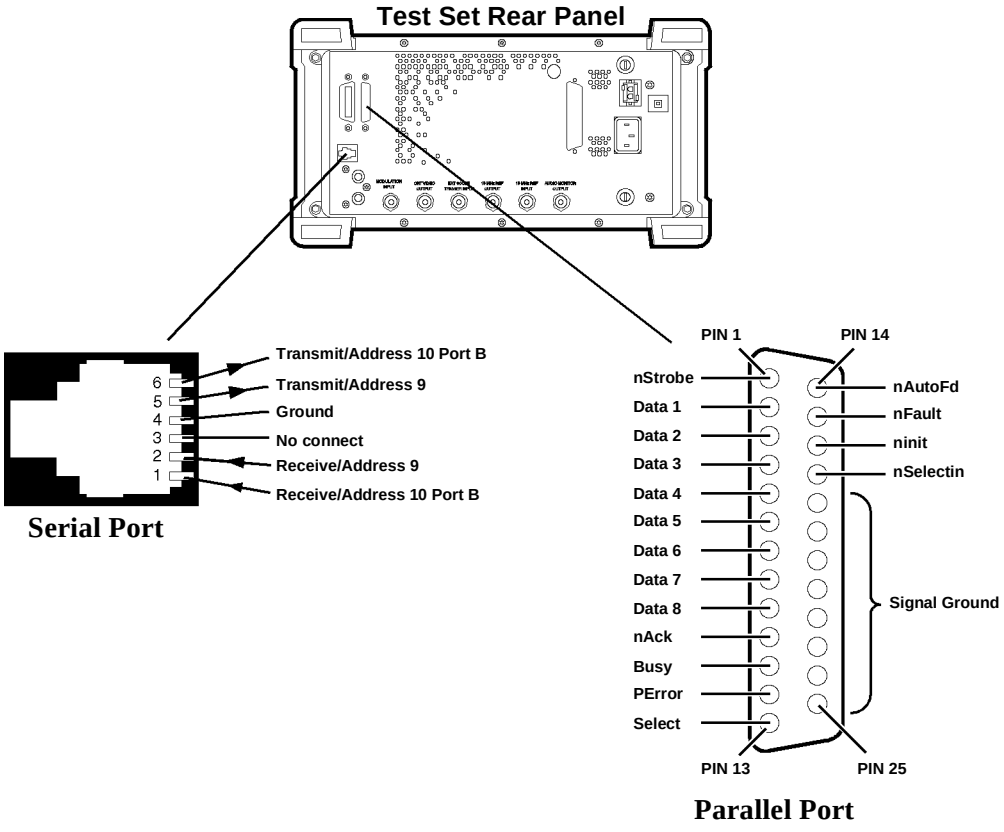
- Probably no information was loaded on the card.

**`Directory Overflow.`**

- The card is probably non-functional. Try again with a different card.

# Rear Panel Connector Diagrams and Pinouts

The serial port and the parallel port are used in terminal operation and for data logging. The pinouts of these ports are shown below.



# Signal Strength

One of the most important considerations in using this software is to maintain proper signal strength. If your signal is too weak, you will not be able to make measurements or log data. If your signal is too strong, your measurements may be inaccurate.

If you are physically located within a mobile radio cell, and you can make and receive mobile phone calls, you should be able to receive a signal strong enough to make basic measurements.

If you cannot receive or make mobile telephone calls, you may have sub-optimum conditions. In that case, you may need to change the antenna and/or your location to improve reception. Some sub-optimum conditions are:

- If the test set is located inside a building
- If the test set is located in the fringe area of a mobile radio cell
- If the test set is not located within a cell
- If the test set is located in an area with strong multipath signals

Moving the test set closer to the base station is one way to improve signal strength. Other ways are to use antennas that have more gain or are more directional. Read more about this in the “Antennas” section of the “Reference” chapter.

***YOU CAN CONNECT DIRECTLY TO A CELL SITE RECEIVE ANTENNA***

If you are at a cell site, and can physically connect to a spare receive antenna, you can get a representation of what the site 'sees'. Remember to always verify that the antenna input of the test set is receiving less than 200 mW. You can also refer to the Antennas section of this chapter.

**Procedure for checking signal strength**

1. From the MAIN MENU, select **`Forward Control Channel Information`**.
2. After you have selected a control channel, read the signal strength directly from the display. It is located in the upper right hand side of the Forward Control Channel selections screen.

**Alternate Procedure for checking signal strength (returns a measure that is more frequently updated)**

1. From the MAIN MENU, after you have selected a control channel, press user key [k5],[SPEC ANL].
2. Read the signal strength from the field marked LCL dBm. The number changes with the display on the spectrum analyzer screen.
3. To return to the MAIN MENU, press the [SHIFT] key. Press the user key [k1]. Select **`[Continue]`** (at the top of the screen). These instructions are repeated on the first two lines or the display.

***TO FIND OUT MORE*** To learn more about using the spectrum analyzer, read about it in *HP 8921 Cell Site Test Set User's Guide.*

In most cases, your signal level needs to be between 0 and -80 dBm. You may need to adjust the Attenuation and/or Sensitivity settings to get best results. To change the Attenuation or Sensitivity, use the following procedure:

**Procedure to change Attenuation**

1. Determine the signal strength using the procedure above, Procedure for checking signal strength.
2. Find the appropriate Attenuation setting for your measured signal strength from the table below. Your signal level needs to be between 0 and -80 dBm for this Quick Check. Some of the ranges in the table overlap. Choose a setting which is in the middle of a signal strength range.

**Table 28**

| Attenuation and Sensitivity Settings | | |
|---|---|---|
| **Signal Range (dBm)** | **Attenuation (40, 20, 0 dB)** | **Sensitivity (High, Normal)** |
| 0 to -60 | 40 dB | Normal |
| -20 to -80 | 20 dB | Normal |
| -40 to -100 | 0 dB | High |

3. From the MAIN MENU, select **`Configure Test Set`**. Both the attenuation and sensitivity settings can be adjusted in this menu.
4. Page down either using the cursor, or by pressing user key [k4]**.**
5. Select **`Attenuation For Forward Channel`**.
6. A menu appears in the upper right hand corner of the CONFIGURATION screen. Choose either 0, 20, or 40 dB, based on your signal strength measurement.
7. Press the user key [k1] to finish. You will return to the C.A.L.M. MAIN MENU.

# Terminal Operation

Controlling the test set from a terminal is a useful tool, especially whenever you need to have your test set a short distance away from you, for example, the test set is in the back of a truck, but you're in the cab. In principle, the test set can communicate with any terminal, real or emulated (such as in a PC's terminal program). Your terminal must be set up to have the same communication parameters as the test set. Your terminal does not need all of these values listed below. You must only be able to set up your terminal with at least one from each parameter.

**Test Set Communications parameters**

- Terminal Mode
  - VT-100
- Terminal Baud
  - 150
  - 300
  - 600
  - 1200
  - 2400
  - 4800
  - 9600
  - 19200
- Terminal Parity
  - None
  - Odd
  - Even
  - Always 1
  - Always 0
- Terminal Data length
  - 7 bits
  - 8 bits
- Terminal Stop length
  - 1 bit
  - 2 bits
- Terminal Pace (or flow control)
  - None
  - Xon/Xoff

## Setting up your PC for Terminal Operation

Probably the most frequent terminal operation is via a laptop or desktop PC. Your PC should have the following features available:

**Requirements for Your PC in Terminal Operation**

- a laptop or desktop PC with one available serial port
- a software communications package.

  Packages known to work with the test set are:

  - Microsoft Windows Terminal program
  - ProComm telecommunications software
  - HP AdvanceLink for Windows terminal software

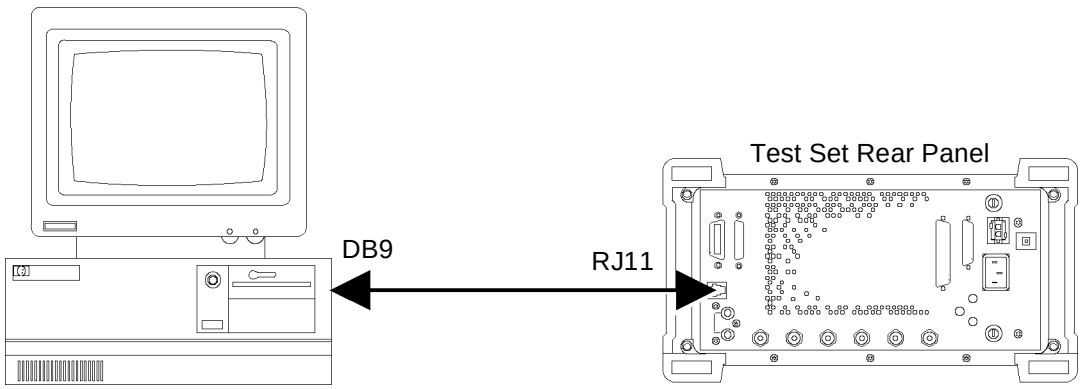
***READ THIS PRODUCT NOTE***

You may also want to refer to Product note 8920-1 for more information on using the ProComm or HP AdvanceLink communications packages.

**What you need to operate from a PC terminal emulator**

- PC with terminal software
- the test set with the C.A.L.M. software
- RJ-11 to DB9 cable (HP part number 08921- 61038)

Below is a diagram of the connection between the PC and the test set using the serial cable provided with the software.



**Procedure for setting up Terminal Operation using Windows Terminal program**

1. Start the Terminal program in Windows (run terminal.exe in the Windows directory).
2. From the Terminal menu, select SETTINGS - TERMINAL EMULATION.
3. Choose DEC VT-100 (ANSI).
4. From the Terminal menu, select SETTINGS - COMMUNICATIONS.
5. Choose your serial port connection and edit the parameters to reflect your computer's communication capabilities.

   **EXAMPLE of a communications setup in Windows Terminal**

   - Connector: COM2 (remember, use your own settings!)
   - Baud Rate: 9600
   - Data Bits: 8
   - Parity: None
   - Flow Control: Xon/Xoff
   - Stop Bits: 1
   - Parity Check and Carrier Detect: both OFF
6. Set up the test set with the same settings, except you must use a Terminal Address setting instead of the Connector setting.

**Procedure to set up the test set for Terminal Operation**

1. From the MAIN MENU of the C.A.L.M. software, select **`Configure Test Set`**.
2. Select **`Terminal Address`**.
3. Choose 9 when you are using the 08921-61038 RJ-11 to DB9 cable.
4. Set the rest of the Terminal options to match your Windows Terminal settings:

   **EXAMPLE of Test Set Communications Settings**

   - Terminal Baud: 9600
   - Terminal Parity: None
   - Terminal Data length: 8 bits
   - Terminal Stop length: 1 bit
   - Terminal Pace: Xon/Xoff
5. Press user key [k1],**`Done`** to end set up of terminal control.

**Procedure to Use the Terminal Operation to Control the Test Set**

1. Set up both the PC and the test set for Terminal operation.
2. Connect the RJ-11 to DB9 cable between the test set and the PC.
3. From the MAIN MENU of the test set software, select **`Configure Test Set`**.
4. Select **`Control Mode`**.
5. Choose **`Terminal`**.
6. Press user key [k1],**`Done`** to exit the **`Configure Test Set`** menu.
7. You will not return to the MAIN MENU. You will see a display which indicates **`Terminal`** mode.
8. The MAIN MENU should now be displayed on the PC. If there is no display, try pressing the PC's [ENTER] key.
9. You now control the test set with the PC. Press the number of the desired menu item to select that item.
10. If you wish to end remote control of the test set, press user key [k5], **`Lcl Mode`**.
11. You will return the MAIN MENU.

***REVERSE VIDEO DISPLAY OPTION IN TERMINAL***

If you select and enable **`REMOTE INVERSE`** from the **`CONFIGURE TEST SET`** menu, some items will appear in reverse video on your Terminal display. This can aid in menu legibility.

# Using Both Terminal Operation and Logging Data at the Same Time

There are two ways to log data and operate the test set through a terminal simultaneously:

- terminal through the serial connector and logging through the parallel connector *(BEST WAY)* Note: only test sets built with serial numbers beginning with 3501 or greater have parallel connector
- terminal and logging both through the serial connector (uses port 9 and 10)

## The best way to use terminal operation and logging simultaneously

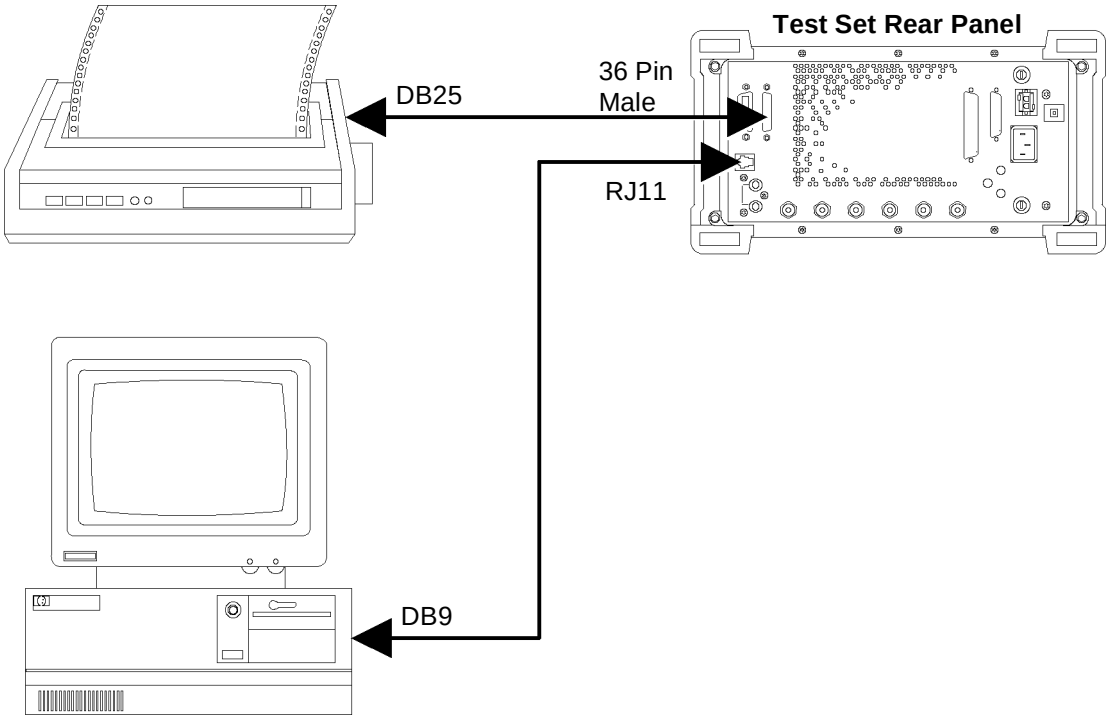
You can log data to a printer and operate the test set through a PC terminal with this method. If you wish to log data to a PC through the parallel port, you must have a communications program which can communicate through the parallel port. The Windows terminal software accesses only COM1,COM2,COM3 or COM4.

**Cables needed for simultaneous operation through the serial and parallel connectors:**

- RJ-11 to DB9 cable wired for test set Port 9 (08921-61038) for the PC
- parallel cable appropriate to your printer (for example, HP part number C2950A is a 36 pin Centronics parallel male to a DB25 male connector)

**Procedure to set up simultaneous operation of terminal and logging**

1. Set up for terminal operation as described in the Terminal Operation section of this chapter, using Port 9 on the test set.
2. Set up for logging as described in the Logging Data section of this chapter, using Port 15 on the test set.
3. Connect the two cables as shown below, and operate the test set through the terminal.




### How to use just the serial connector for terminal operation and logging simultaneously

There are two ports available on the serial connector: port 9 and port 10. Port 10 is normally used with proprietary cables to connect to a base station. If you want to operate through a terminal and log data simultaneously through serial ports, you must:

- make a cable which connects to port 10
- have a PC with two serial ports (when you log data to the PC)

There are at least two reasons for wanting to use both serial ports:

- you do not have a test set with a parallel port
- you want to log data to a PC using Windows terminal

In order to use both terminal operation and logging data at the same time, three cables are needed:

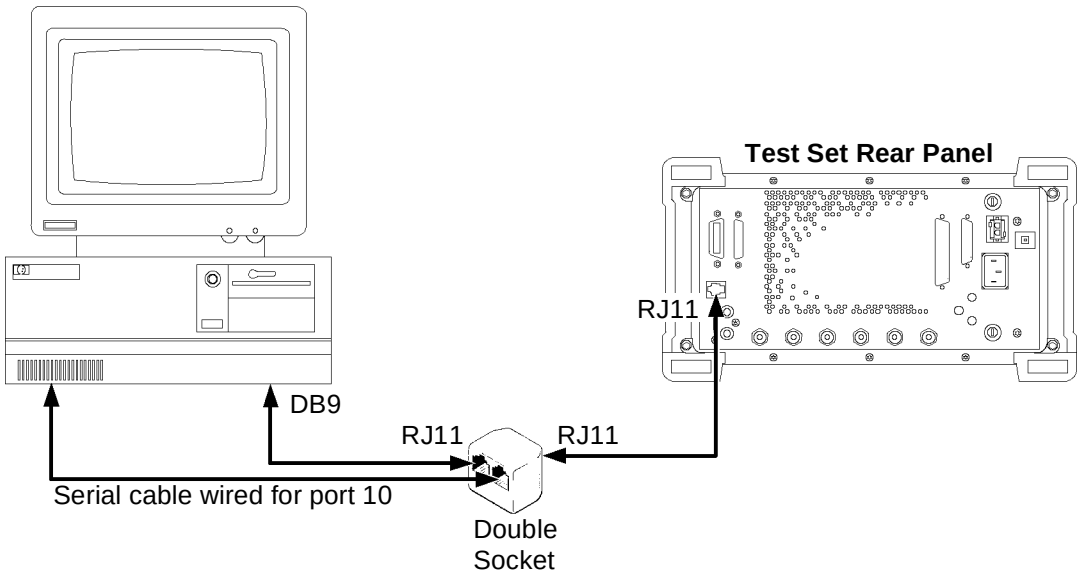
**Cables needed for simultaneous operation via the serial and parallel connectors:**

- RJ-11 to DB9 cable wired for test set Port 9 (08921-61038) for the PC
- a serial cable wired for port 10 (see diagram below)
- RJ-11 to double socket for RJ-11 which has six connections (08921-61031)

**Procedure to set up simultaneous operation of terminal and logging**

1. Set up for terminal operation as described in the Terminal Operation section of this chapter, using Port 9 on the test set.
2. Set up for logging as described as described in the Logging Data section of this chapter, using Port 10 on the test set.
3. Connect the three cables as shown below, and operate the test set with the terminal.

The connection diagram for these three cables is as follows:



The pinout for a serial cable used to connect to port 10 is as follows:

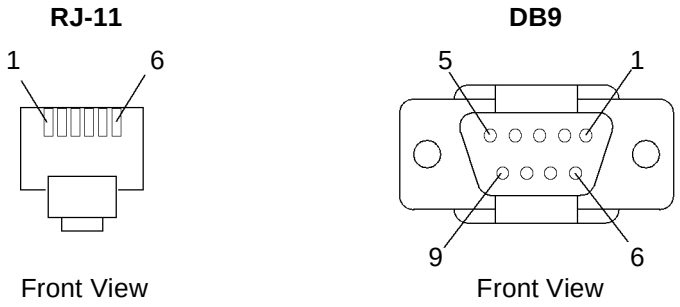



**Table 29** **Serial connector to Port 10 connections**

| RJ-11 pins | Signal | DB9 pins |
|---|---|---|
| 6 | Transmit/Address 10 port B | 2 |
| 4 | Ground | 5 |
| 3 | n.c. | n.c. |
| 1 | Receive/Address 10 port B | 3 |
| not applicable | | connect pins 7 to 8 |
| not applicable | | connect pins 1 to 4 to 6 |
| 2 | | n.c. |
| 5 | | n.c. |

# Using an External Speaker

One frequent use of the test set is to have the test set located in the back of a truck, and to control it with a laptop from the cab of the truck. A problem with this is that the audio from the speaker cannot be heard. The speaker is necessary when performing voice quality measurements. Below is the schematic of one solution to create a remote speaker. This circuit has the following features:

- filters out the audible SAT tone
- provides de-emphasis
- provides local volume control
- provides “multi” input
- operates off 12 VDC supply

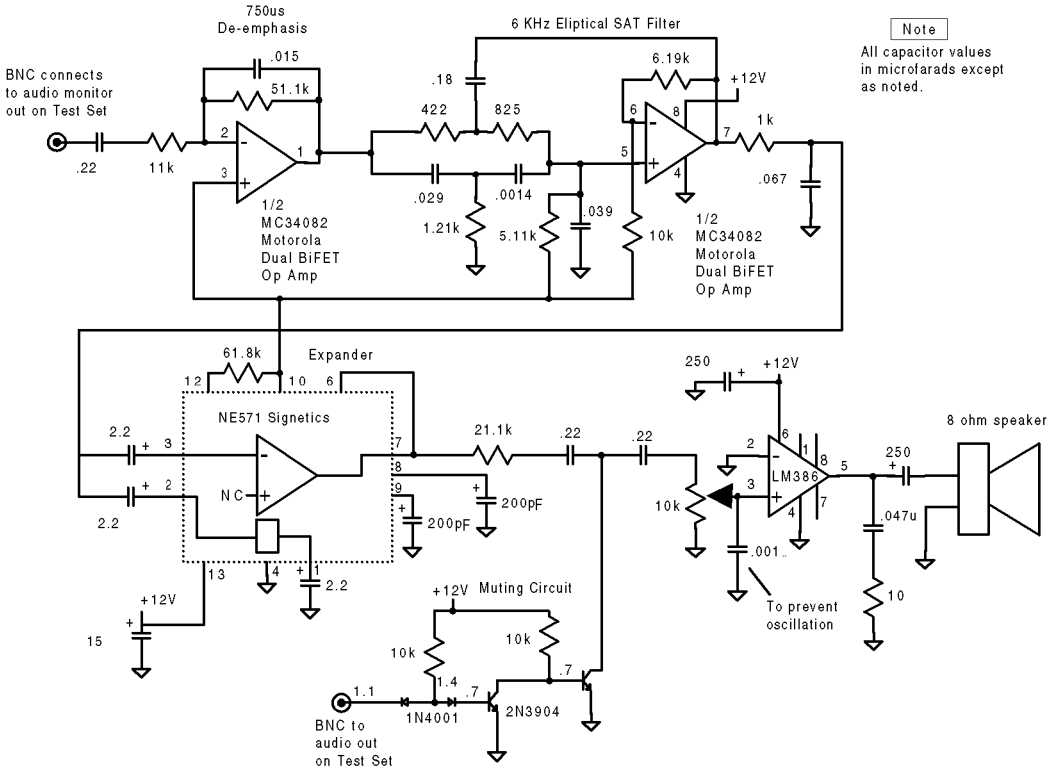



**Figure 2** **Example Circuit to Use an External Speaker**

# 6



# Problem Solving

**USE THE "PROBLEM SOLVING" CHAPTER TO HELP YOU TRACK DOWN PROBLEMS.**

Use the "Problem Solving" chapter

- When the troubleshooting aids at the ends of some sections aren't enough
- To find out some of the more general problems

# Diagnosing the Trouble

Use the following statements to help you diagnose possible problems with the software and its use.

**Checklist to start diagnosing problems**

❒ Is power on? All cables snugly attached?
❒ Was the software loaded? Is it still available to run in the TESTS menu? (Press the [TESTS] key)
- Have you selected "CARD" as the program source?
- If the software isn't available on the TESTS menu, you may have to reload it.
- Did you get a message **`Program not continuable?`** Try pressing **`[Run Test]`** instead of **`[Continue]`** in the TESTS menu.
- Does the TESTS Main Menu display the name of the software?

❒ Can't find any control channels?
- Is the attenuation set too high in the CONFIGURE TEST SET menu?
- Are you in an active cell site? Could the cell be down?
- Is the antenna attached? Is it the proper antenna for your location and test?
- Is the antenna connected to the ANT IN connector?

❒ Did you miss a handoff?
- Did you use the spectrum analyzer or make a level measurement? (this stops decoding temporarily)
- Are you using the proper antenna?
- Do you have enough signal?

❒ Your measurements aren't what you expected?
- Could you have multipath problems?
- Are you using the proper antenna?
- Is your signal strength within the proper limits?

❒ You are not logging as much data as you expected:
- Do you have the area code and/or phone number specified too strictly?
- Are you using the proper antenna?
- Is your signal strength within the proper limits?
- Do you understand Stream A/B limitations?

❒ Can't load the software?
- Is your firmware revision level correct for the test set?

❒ The software cannot be found on the card?
- Are you trying to load from the RAM card instead of the ROM card?

❒ Do you dial a number on your mobile phone, but it doesn't register on your test set?
- Check to make sure you are monitoring the proper control channel.

❒ Does the terminal setup work?
- Are all the communications settings correct?
- Are the proper cables installed?
- Is the port on your PC active?

❒ Can you log data to a printer?
- Is the correct printer cable used?
- Is the port on the printer active?

# Things to Think About...

## Loading Software from the Card

To initially load the software from the card, follow the procedure outlined in the "Getting Started" chapter. Some problems that may occur later:

- It is possible to overwrite the software that you loaded with another program. If you try to run the software, but the test set cannot find it, you will have to reload the software.
- If you try to load the software, but it is not found on the card, make sure you are not trying to load from the RAM card.

## Cabling

The cabling for the C.A.L.M. software is relatively easy: an antenna cable, and optionally cables for the logger and/or terminal operations.

**A Listing of cables used with the software and test set:**

- 50 ohm BNC cables to connect to the antenna
- 08921-61038 RJ-11 to DB9 cable (wired for test set's port 9)
- 08921-61039 RJ-11 to DB25 cable (wired for test set's port 9)
- Dual RJ-11 adapter (08921-61031) for using terminal operation and logging at the same time
- power cable

## Antenna

The antenna can have a big impact of accuracy of the data you collect and the measurements you make. Read the "Reference"chapter about antennas carefully.

## Signal Strength and Multipath

The proper signal strength is vital to getting correct measurements and collecting data. This is closely intertwined with using the proper antenna and avoiding multipath propagation problems. Read these sections in the "Reference" chapter if you suspect you are having problems.

**Issues to consider:**

- Are you using the proper antenna? Is it oriented correctly?
- Have you measured the signal strength?
- Have you checked for multipath problems?
- Are you actually in an active cell?
- Can you make and receive mobile calls?

## Firmware

Don't forget to check the firmware's revision level. It must be A.14.14 or later. In addition, the C.A.L.M. software will *only* operate on the HP8921A or D cell site test sets.

**Power On**

If you have problems at power up, you should refer to the *HP 8921 Assembly Level Repair Guide*. There are numerous diagnostics within the test set to find these problems.

**RLT* bar at top of screen**

At the top-right-hand corner of the screen are three letters, RLT and an asterisk (*). These are indicators of actions being taken while a software program such a as the C.A.L.M. software is running. These letters indicate:

- R: 'remote' mode. On when software is communicating to test set.
- L: 'listen' mode. The software is exchanging messages with the test set.
- T: 'talk' mode. The software is exchanging messages with the test set.
- *: IBASIC is running. Changes to a - (dash) when program is paused.

When the software is actively communicating with the test set, L and T will be blinking. If they are both still, or not present, no action is taking place.

**Autoranging**

Is turned off while C.A.L.M. software is running.

**Missed handoffs**

Possible reasons for missed handoffs

- If the signal strength from nearby channels is too weak (example: the change maybe from a very strong signal to a channel with a weak signal)
- If the test set was temporarily not decoding overhead message information (due to a level measurement, reverse-forward voice channel change or spectrum analyzer) display)
- receiver dynamic range (Example: changing from a normal signal level to a very strong signal level)

**Proper control channel**

When the test set searches for control channels, it selects all which have the requisite signal strength. If more than one channel has been found, you should be careful to select the one you need. If, for example, you are testing a mobile in your hand, and are monitoring the cell you are in, you will be able to observe the phone's origination message on the test set. However if you are coincidentally monitoring an adjacent cell's control channel, you will not see your phone registering on the test set. This could lead to an erroneous result.

### Phone number and area code

For several fields, it is possible to specify the area code and phone number in several ways. However, you should keep these things in mind:

- You will always receive or monitor just one stream (A or B). This means that you will get only even or odd phone numbers, not both.
- If you are collecting data, make sure that you are specifying the numbers as you wish. You do not want to collect data for one area code, when you are expecting to collect it for all area codes. Keep your eye on the area code and phone number fields to make sure you get what you want.
- Once you have specified a number or area code, it will remain that way until you change it.

### Error messages

Error messages that can occur when using the C.A.L.M. software are the same ones that can occur with any IBASIC program. Therefore, you should refer to the *Programmer's Guide* for a detailed explanation of these messages.

# *Glossary*

# Glossary

# Glossary

**AMPS** Advanced Mobile Phone System. The analog cellular system in use on the North American continent and on other continents.

**Autostart** The setup field in the HP 8921's TESTS menu that enables the HP 8921 to automatically run the designated Test Procedure.

**Base Station** A station in the Domestic Public Cellular Radio Telecommunications Service, other than a mobile station, used for communicating with the mobile.

**Blank-and-Burst** The process by which the voice (in a voice channel) is temporarily blanked and a burst of data is transmitted.

**C.A.L.M.** Call Analysis, Logging and Monitoring. The software (HP 11807B Option 120) used with the HP 8921 test set to analyze AMPS systems.

**Coded Digital Color Code (CDCC)** A seven bit code, transmitted by the mobile station on a reverse control channel, that is used to detect the correct link between a base station and a mobile.

**Control Channel** A pair of channels, forward and reverse, used for the transmission of digital control information. Typically used for call setup and system administration.

**Control Filler message** A message sent in the forward control channel whenever no other overhead message is available. It may indicate to the mobile station to change its power level, or tell the mobile station to wait for another overhead message before it may access the system.

**Cursor** Refers to the brightened region of the test set's screen used to indicate the field/function currently being accessed.

**dBm** The unit-of- measure for signal strength, measured in deciBels relative to one milliWatt.

**Digital Color Code (DCC)** One of four digital values (00, 01, 10, 11) transmitted by a base station on a forward control channel that is used to detect the correct link between a base station and a mobile station.

**Dipole antenna** An antenna with two radiators, or one radiator where the tap is typically connected in the center of the radiator.

**Directional Antenna** An antenna designed to optimally receive signals from less than 360 degrees. It also provides gain with respect to an omnidirectional antenna.

**Downlink** Forward link.

**Dropped call** The complete loss of the voice link. The call must be placed again.

**Electronic Serial Number(ESN)** The serial number assigned to a mobile station. It uniquely identifies the mobile station.

**Electrostatic discharge (ESD)** A transfer of electric charge from one place to another. Devices can be damaged by the energy transferred during the discharge.

**ESN** Electronic serial number.

# Glossary

**Field** An area on the CRT with an inverse video display where entries can be made.

**Firmware** Program information hard-coded into integrated circuits which controls an instrument.

**Flash Request** A message sent from the mobile station which indicates the mobile wants to invoke special processing.

**Forward Control Channel (FOCC)** A control channel used to transmit digital control information from a base station to a mobile station.

**Forward Link** The link between the base station and the mobile station. The base station communicates to the mobile on this link. Also called downlink.

**Forward Voice Channel (FVC)** A voice channel used from the base station to the mobile. Carries the analog voice and blank-and-burst data.

**Global Action Overhead Message** A message that may be attached to a system parameter overhead message. It can control a number of actions, including rescan, change to a new access channel, and reroute for overload control.

**Handoff** The act of transferring communication with a mobile station from one base station to another (or from one channel to another).

**Home System** The system to which the mobile station has subscribed.

**IBASIC** Instrument BASIC. A programming language used to control many Hewlett-Packard Instruments.

**Initialize** The process of formatting a card or disk prior to storing data.

**Local Control Status** A parameter that indicates whether the mobile station must respond to local control messages.

**Mobile Identification Number (MIN)** The identification number assigned to a mobile station. Analogous to a land-based telephone number.

**Mobile radio cell** The geographical area which is served by one cellular provider using one base station. The provider uses a network of cells to form a service area.

**Monopole antenna** An antenna with only one radiator, where the tap is attached to one end of the pole.

**Omnidirectional antenna** An antenna designed to optimally receive signals from a full 360 degrees.

**One-Time-Programmable Card (OTP card)** A card containing read-only memory, usually containing software such as C.A.L.M. Also known as ROM card.

**Order** A command sent to a mobile station from a base station.

**Overhead message** The portion of the transmissions in the control channel which relates to control and communication with the mobile station.

**Paging** The method by which a base station makes contact with a mobile station when a call has been placed to the mobile

station.

**Paging/Access Channel** A forward control channel that is used to page a mobile station and send orders.

**RAM card** A memory card containing non-volatile random-access memory, frequently used to store configuration information.

**Registration** The process by which a mobile station identifies its location and parameters to a base station.

**Registration ID (REGID)** A message that may be attached to a system parameter overhead message. It contains the registration ID information.

**Release** A process that the mobile station and the base station use to inform each other of a call disconnect.

**Remote Inverse** An option of the CONFIGURE TEST SET which will display (on the terminal only) the highlighted text in inverse video.

**Reverse Control Channel (RECC)** A control channel used to transmit digital control information from a mobile station to a base station.

**Reverse Link** The link between the mobile station and the base station. The mobile transmits its data over this link to the base. Also known as the uplink.

**Reverse Voice Channel (RVC)** A voice channel used from the mobile station to the base station. Carries the analog voice and blank and burst data.

**Roam** What the mobile station does when it is operating outside of its home system.

**ROM card** A memory card containing read-only memory, usually containing a software such as C.A.L.M. Also called OTP card (One-Time-Programmable card).

**RX TEST** One of several test screens in the HP 8921. Represents the screen that controls the transmission aspects of the HP 8921.

**SCM** Station Class Mark.

**Sensitivity (antenna)** The minimum signal that an antenna receives that can be detected.

**Sensitivity (receiver)** The minimum signal that can be detected and used within a receiver.

**Sensitivity Setting** The control on the C.A.L.M. software (in the Configure Test Set menu) which controls the input sensitivity of the HP 8921.

**SID** System identification of the service area.

**Signal strength** The measure of a signal's received power, typically recorded in dBm. (deciBels relative to one milliWatt)

**Signaling Tone (ST)** A 10 kHz tone transmitted by a mobile station to confirm orders, signal flash requests, and signal release requests. This signal can vary in duration.

**softkey** Any of the set of keys next to the CRT display which can be assigned to

certain special actions.

**Station Class Mark (SCM)** An identification of certain characteristics of a mobile station.

**Stream A** The portion of the overhead message which contains control data for mobiles which have MINs that are even numbered. Analogous to phone numbers which end in even numbers.

**Stream B** The portion of the overhead message which contains control data for mobiles which have MINs that are odd numbered. Analogous to phone numbers which end in odd numbers.

**Supervisory Audio Tone (SAT)** A tone (one of three frequencies: 6000, 5970, or 6030 Hertz) which is transmitted by the base station on the voice channel and transponded by a mobile station. It is used to confirm that the mobile station has connected to the desired base station on the voice channel.

**System A or System B** The two cellular phone systems within any given area. The frequency band allocated for cellular has been split to allow for competition.

**System Identification (SID)** A digital code transmitted to the mobile station by the base station in the System Parameter Overhead Message which identifies the home system of the mobile.

**System Parameter Overhead Message** A message which must be sent at regular intervals. It has two words, Word 1 and Word 2, and contains SID and other information.

**Telescoping antenna** An antenna, usually a monopole or dipole, which can collapse to a smaller length.

**Uplink** Reverse link.

**VMAC** Voice Mobile Attenuation Code.

**Voice channel** A channel provided for communication purposes. Used in either the forward or reverse paths, the voice channel typically carries analog voice and blank and burst signals.

**Voice channel assignment (VCA)** The act of providing a voice channel (forward and reverse) to a mobile station for communication purposes. Voice channels are typically assigned according to a pattern (algorithm) chosen by the system provider.

**Voice following** The process of tracking a mobile station call as the mobile moves from cell to cell.

**Voice Mobile Attenuation Code (VMAC)** A code used to define the initial mobile power level when assigning a mobile station to a voice channel.

**Word 1 or Word 2** The two portions of the system parameter overhead message. Word 1 contains the system identification. Word 2 contains registration fields and the number of paging and access fields.

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