Errata

Title & Document Type: 8921 Series Cell Site Test Set User's Guide (Dec94)

Manual Part Number: 08921-90022

Revision Date: December 1994

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, semiconductor products and chemical analysis businesses are now part of Agilent Technologies. We have made no changes to this manual copy. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A.

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

Support for Your Product

Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website:

www.tm.agilent.com

Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

Agilent Technologies

HP 8921 User's Guide

SERIAL NUMBERS

This manual applies directly to instruments with firmware versions:

A.14.00 and above.

HEWLETT PACKARD

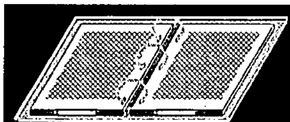
HP Part No. 08921-90022
Printed in U.S.A. December 30, 1994 (Rev. C)

Third Edition

Hewlett-Packard Company
Learning Products Department
24001 E. Mission
Liberty Lake, WA 99019-9599
U.S.A.

Rev B	Document Type/ Document Description	Document Name/ HP Part Number
Documentation for Manual Operation	**Test Set User Guide:** • Get Started-Front Panel operation, To access different screens. • Configuring-Setting up the Test Set, To set the screen intensity. • Operating Overview- More advanced operation, To use the analog meter format. • Product Description- Screen, field, & connector descriptions. • Error Messages- List of errors caused by front panel operation errors.	HP 8920 Users Guide/ 08920-90171 HP 8921A Users Guide/ 08921-90022
Documentation for Manual Operation	**Cellular Adapter User Guide:** • A simple operation example • Making Measurements- Instructions for performing a measurement • Troubleshooting Measurements- A "try this" approach to isolating unexpected measurement results • Product Description- Screen, field, & connector desriptions • HP-IB command listing for the cellular adapter • Theory of Operation- Block Diagram of the cellular adapter • Glossary	HP 83201A Users Guide/ 83201-90033 HP 83201B Users Guide/ 82301-90034 HP 83203A Users Guide/ 83203-90010 HP 83203B Users Guide/ 83203-90028
Documentation for Automated Operation	**Test Set Programming Guide:** • Test Set Architecture Overview • IEEE 488.1 Capablitites, Remote/Local Modes • HP-IB Programming Guidelines • IEEE 488.2 Common Commands Syntax/Usage • Status Reporting/Service Request/Passing Control • IBASIC Program Development	HP 8920, HP 8921 Programmers Guide/ 08920-90172
Documentation for Automated Operation	**IBasic Manual:** • IBASIC Programming Structure & Flow/Subprograms & Function Errors • IBASIC Interfacing Concepts/Entering & Outputting Data/Interface Descriptions • IBASIC Detailed Keyword Reference	HP Instrument Basic 1.0/ E2083-90000 HP Instrument Basic 2.0/ E2083-90005
Documentation for Repair & Calibration	**Assembly Level Repair:** • Troubleshooting • Repair • Calibration • Specifications • Service Screen • Block Diagram • Replaceable Parts Listing • Diagnostic Descriptions • Error Messages m:\manuals\boiler\pmap.drw	HP 8920,HP 8921 Assembly Level Repair/ 08920-90168 HP 83201A Assembly Level Repair/ 83201-90003 HP 83201B Assembly Level Repair/ 83201-90018 HP 83203A Assembly Level Repair/ 83203-90003 HP 83203B Assembly Level Repair/ 83203-90016

See other side for which documents are used with which products



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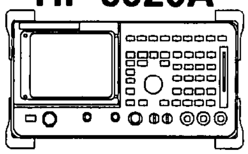
Documentation for each Product

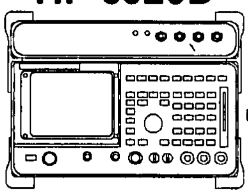
HP 8920A Products

HP 8920A



- HP 8920 User Guide
- HP 8920, HP 8921 Programming Guide
- HP Instrument Basic 1.0
- HP 8920, HP 8921 Assembly Level Repair

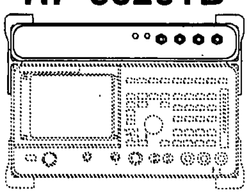
HP 8920D



HP 8920A
HP 83201A

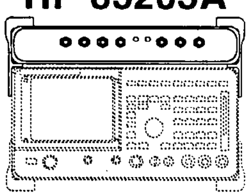
- HP 8920 User Guide
- HP 83201A User Guide
- HP 8920, HP 8921 Programming Guide
- HP Instrument Basic 1.0
- HP 8920, HP 8921 Assembly Level Repair
- HP 83201A Assembly Level Repair

HP 83201B



- HP 83201B User Guide
- HP 83201B Assembly Level Repair

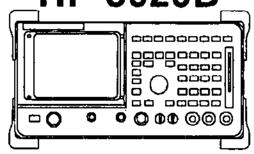
HP 83203A



- HP 83203A User Guide
- HP 83203A Assembly Level Repair

HP 8920B Products

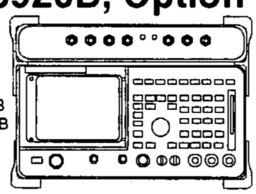
HP 8920B



- HP 8920 User Guide
- HP 8920, HP 8921 Programming Guide
- HP Instrument Basic 2.0
- HP 8920, HP 8921 Assembly Level Repair

HP 8920B, Option 500

HP 8920B
HP 83203B



- HP 8920 User Guide
- HP 83203B User Guide
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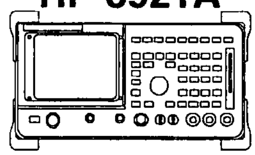
- HP Instrument Basic 2.0
- HP 8920, HP 8921 Assembly Level Repair
- HP 83203B Assembly Level Repair

HP 8921A Products

HP 8921A



- HP 8921A User Guide
- HP 8920, HP 8921 Programming Guide
- HP Instrument Basic 1.0
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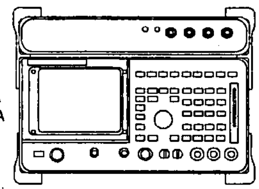
HP 8921D

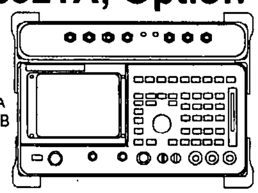
HP 8921A
HP 83201A



- HP 8921A User Guide
- HP 83201A User Guide
- HP 8920, HP 8921 Programming Guide
- HP Instrument Basic 1.0
- HP 8920, HP 8921 Assembly Level Repair
- HP 83201A Assembly Level Repair

HP 8921A, Option 600

HP 8921A
HP 83203B



- HP 8921A User Guide
- HP 83203B User Guide
- HP 8920, HP 8921 Programming Guide
- HP Instrument Basic 1.0
- HP 8920, HP 8921 Assembly Level Repair
- HP 83203B Assembly Level Repair

SAFETY CONSIDERATIONS

GENERAL

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

This product is a Safety Class I instrument (provided with a protective earth terminal).

SAFETY EARTH GROUND

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

CHASSIS GROUND TERMINAL

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

SAFETY SYMBOLS

⚠ Indicates instrument damage can occur if indicated operating limits are exceeded.

Indicates hazardous voltages.

Indicates earth (ground) terminal

Warning

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

Caution

The caution sign denotes a hazard. It calls attention to an operation procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

Warning

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnection the protective earth terminal will cause a potential shock hazard that could resulting personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection).

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

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

Servicing instructions are for use by service trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

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

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

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

Manufacturer's Declaration

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

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

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

Herstellerbescheinigung

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

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

DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name:	Hewlett-Packard Company
Manufacturer's Address:	Spokane Division 24001 E. Mission Ave. Spokane, WA 99220, USA

Declares that the product:

Product Name:	RF Communications Test Set
Model Number(s):	HP 8920A and 8921A
Product Options:	All

Conforms to the following product Specifications.

Safety: HD 401/IEC 348

```
EMC:   EN 55011 (1991)   /CISPR 11 (1990):  Group 1, Class A
       EN 50082-1 (1992)/IEC 801-2 (1991):  4kV CD,8kV AD
                        /IEC 801-3 (1984):  3V/m
                        /IEC 801-4 (1988):  1kV Power Lines
                                            0.5 kV Signal
                                            Lines
```

Supplementary Information:
The Product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

Spokane, Washington 9-15-93 Vince Roland

Date — Vince Roland, SKD Quality Mgr

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH. Dept.ZQ/Standards Europe, Herrenberger StraBe 130, D-7030 Boblingen (FAX: +49-7031-14-3143)

In This Book

The information in this manual applies to the HP 8920, 8921 family of products. The HP 8920, 8921 family products are referred to in this document as "Test Set." Model numbers are used only when information applies specifically to one model (such as HP 8920B only).

Chapter 1 - Get Started

This chapter describes the basic operation of the Test Set. It also provides a quick check that verifies that the Test Set is operating properly.

Chapter 2 - Configuring Your Test Set

This chapter describes various instrument configuration settings that affect the general operation of the instrument.

Chapter 3 - Operating Overview

This chapter contains detailed operating instructions and examples for using several instrument features.

Chapter 4 - Screen and Field Descriptions

This chapter contains reference information for each screen and its fields. Many of the descriptions contain signal flow diagrams that relate the screen's fields to the functions they perform.

Chapter 5 - Connector, Key, and Knob Descriptions

This chapter describes the purpose and use of each connector and control.

Chapter 6 - Modifications, Accessories, Manuals, Support

This chapter describes retrofit kits, accessories, manuals, and customer support available for your Test Set.

Error Messages

This section discusses error and operating messages.

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1 Get Started

1

Get Started

This Test Set contains several radio test instruments in one package. Controls for these instruments are arranged on several screens.

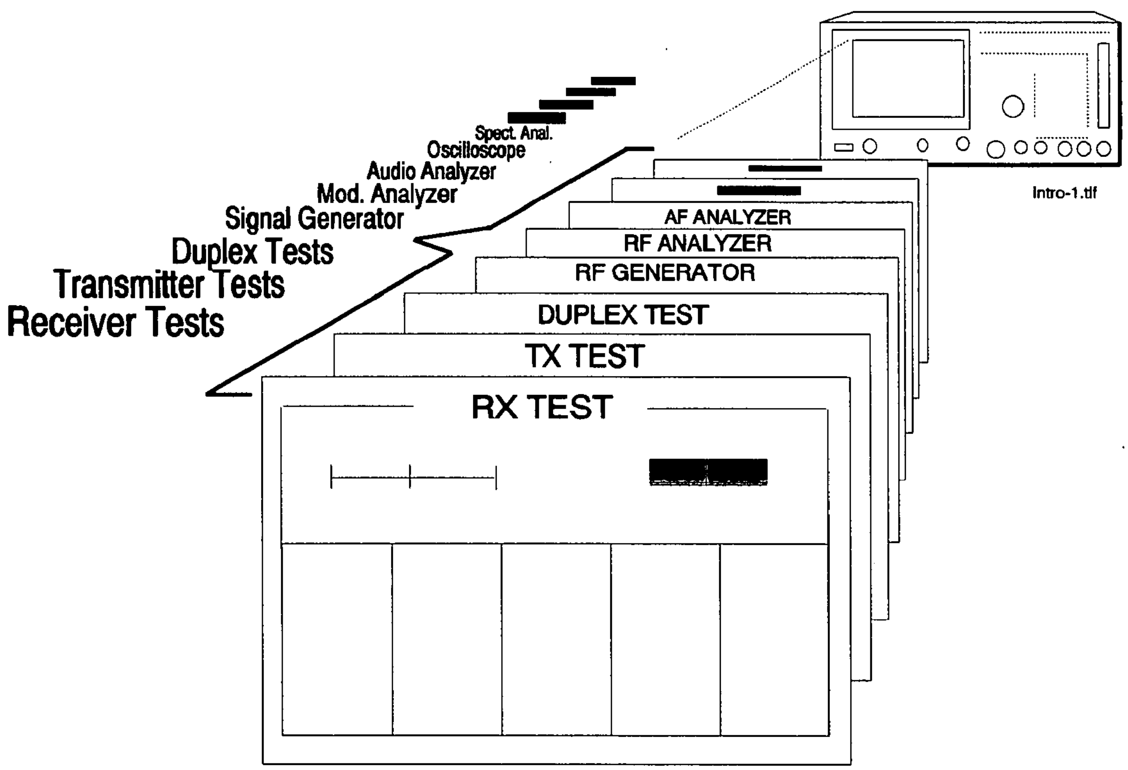


Figure 1-1. Overview of Screens

How Do I Access Different Screens?

The general-purpose radio-test screens are accessed using the SCREEN CONTROL keys:
(RX) (TX) (DUPLEX)

Screens that contain specific instrument functions, such as the RF Analyzer or Oscilloscope, are selected from the `To Screen` and `More` menus in the bottom right corner of the screen.

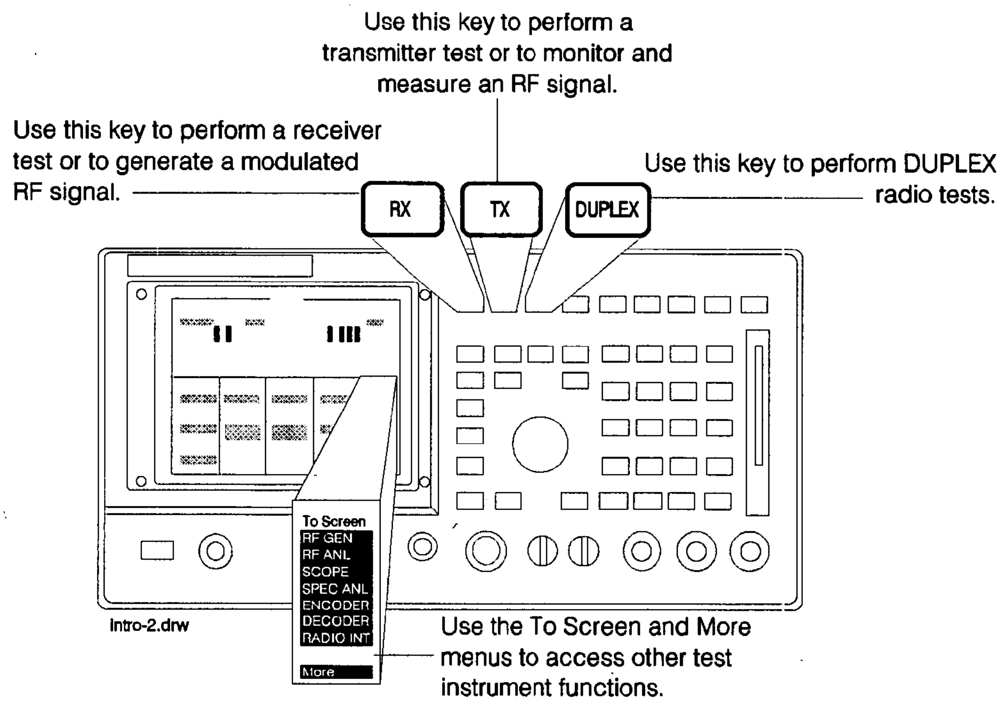


Figure 1-2. The "To Screen" and "More" Menus

Which Screen Should I Use?

Choosing a Screen

RX TEST	Use this screen to test receivers. You can generate RF signals, and measure various receiver audio parameters (SINAD, AF Frequency, AC Level ...).
TX TEST	Use this screen to test transmitters. Transmitter power, frequency, and frequency error are displayed, as well as several modulation measurements.
DUPLEX TEST	Use this screen to generate and analyze RF and audio signals. All the functions required to test most duplex radios are available in this screen.
`To Screen` Menu	Use the `To Screen` menu to access several other screens that generate and analyze RF and audio signals.
`More` Menu	Use the `More` menu to access additional screens. All the screens are described in Chapter 4.

What Controls the Instrument's Functions?

Each screen is divided into *fields* containing instrument settings or measurements. The Cursor Control 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.

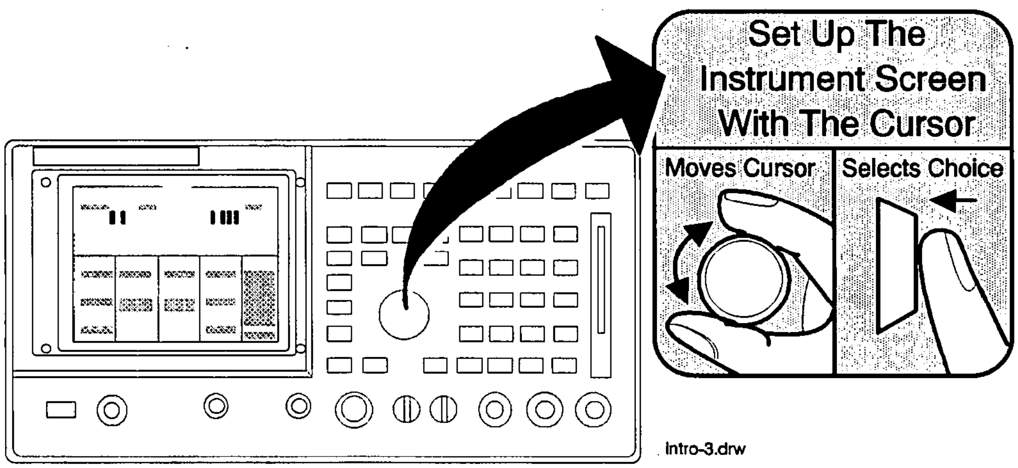


Figure 1-3. Move the Cursor to Select Fields or Change Screens

How Do I Change A Field's Setting?

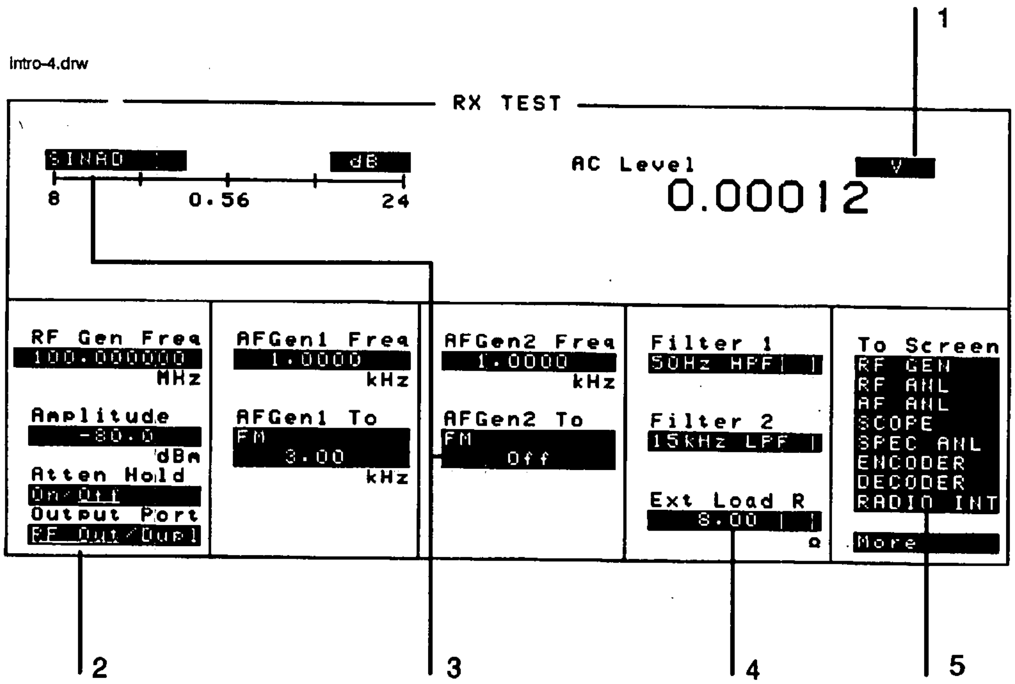


Figure 1-4. Different Types of Fields

1 - Units-of-measure can be changed to display measurements in different values or magnitudes. To change the units, position the cursor in front of the unit and press a key labeled with a different unit (such as W). If the new unit is valid, the measurement value is displayed in the new units. Refer "To Change the Measurement's Unit-of-Measure" in Chapter 3.

2 - Underlined immediate action fields provide a choice of two settings. Push the Cursor Control knob or the (ENTER) key to move the underline under the desired choice. The underlined setting is immediately activated when selected.

3 - One-of-many fields display a list of choices when selected. Select a new setting or measurement from the list. Refer to "Displaying Measurements" in Chapter 3.

4 - Numeric-entry fields contain values for settings like External Load Resistance and RF Generator Frequency. Change the value by first selecting the field and then turning the knob, or by positioning the cursor in front of the field and using the DATA keys to enter a number. Refer to "Entering and Changing Numbers" in Chapter 3.

5 - Immediate action fields perform a function when they are selected. For instance, when one of the entries in the `To Screen` menu is selected, the screen immediately changes to the new screen.

How do I Verify that the Test Set is Operating Properly?

If your Test Set powers-up and displays the **RX TEST** screen, but you suspect an instrument problem, use the Instrument Quick Check to verify operation of the basic instrument functions.

Instrument Quick Check

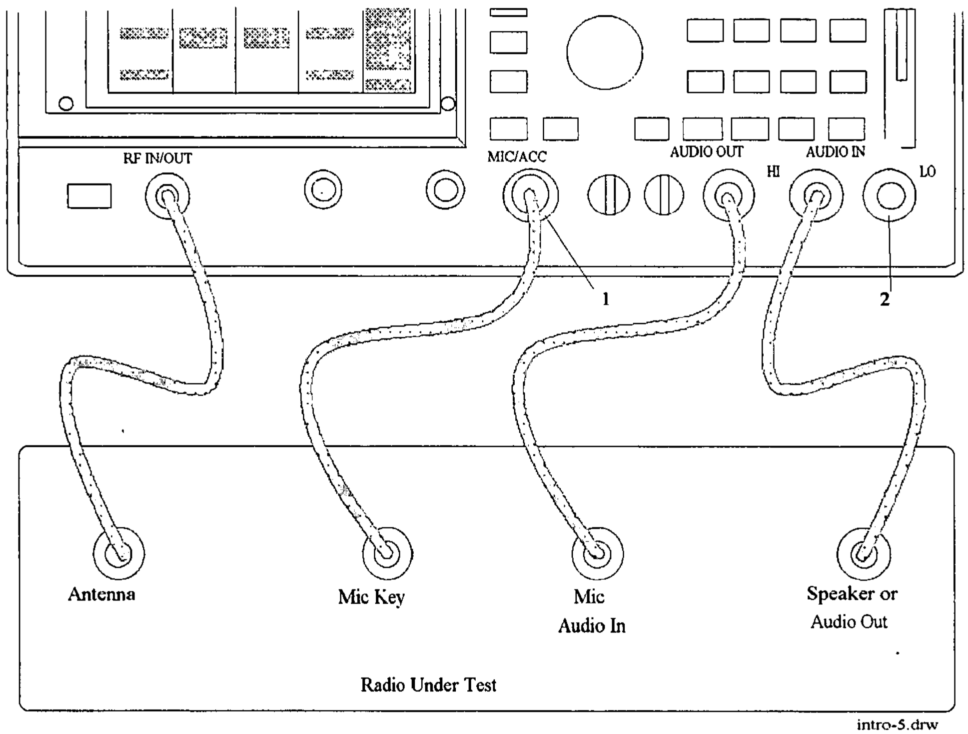
1. Remove any connected cables (except for AC or DC power).
2. Turn instrument power on (if it is not already on).
3. Press (PRESET).
4. Press ASSIGN (shifted function), (ENTER) to assign the pre-defined USER keys.
5. Press (DUPLEX), (k3), (+/-), (4), (6), (ENTER) to set the RF Generator `Amplitude`.
6. Press k5, and position the cursor in front of `FM Demod` at top of the `Choices` menu.
7. Press (ENTER) to select the FM Demodulator for the AF Analyzer's input.
8. Turn the VOLUME knob clockwise to hear a 1 kHz tone (default for AFGen1 Freq).
9. The `TX Frequency` display should indicate 100.000000 MHz.
10. FM Deviation should be about 2.1 kHz (RMS).
11. SINAD should be about 40 dB.
12. Access the **OSCILLOSCOPE** screen using the `To Screen` menu.
13. Two complete sinewave cycles should be displayed.
14. Deviation should be 3 kHz peak (1.5 units above the center line).
15. Access the **SPECTRUM ANALYZER** (if your instrument has this option) using the `To Screen` menu.
16. A 100 MHz FM carrier should be displayed.
17. The signal level should be approximately 0 dBm when reading the `Lvl` display. The level will vary with the marker's position.

If no failure is indicated by this test, but you still suspect a problem, refer to the Performance Tests information in the Assembly Level Repair Manual.

How Do I Connect My Radio?

Note The RF IN/OUT port should be used for all transmitter tests when the radio is connected directly to the Test Set. (Transmitter Power can only be measured using this port). Off-the-air measurements can be made using the highly-sensitive ANT IN port.

Caution *Overpower Damage* — Refer to the Test Set's front panel for maximum input power level. Exceeding this level can cause permanent instrument damage.



1. The MIC/ACC connector is described in chapter 5.
2. AUDIO IN LO is used with double-ended amplifiers. See chapter 4, AF ANALYZER, for details.

Figure 1-5. Connecting a Radio to the Test Set

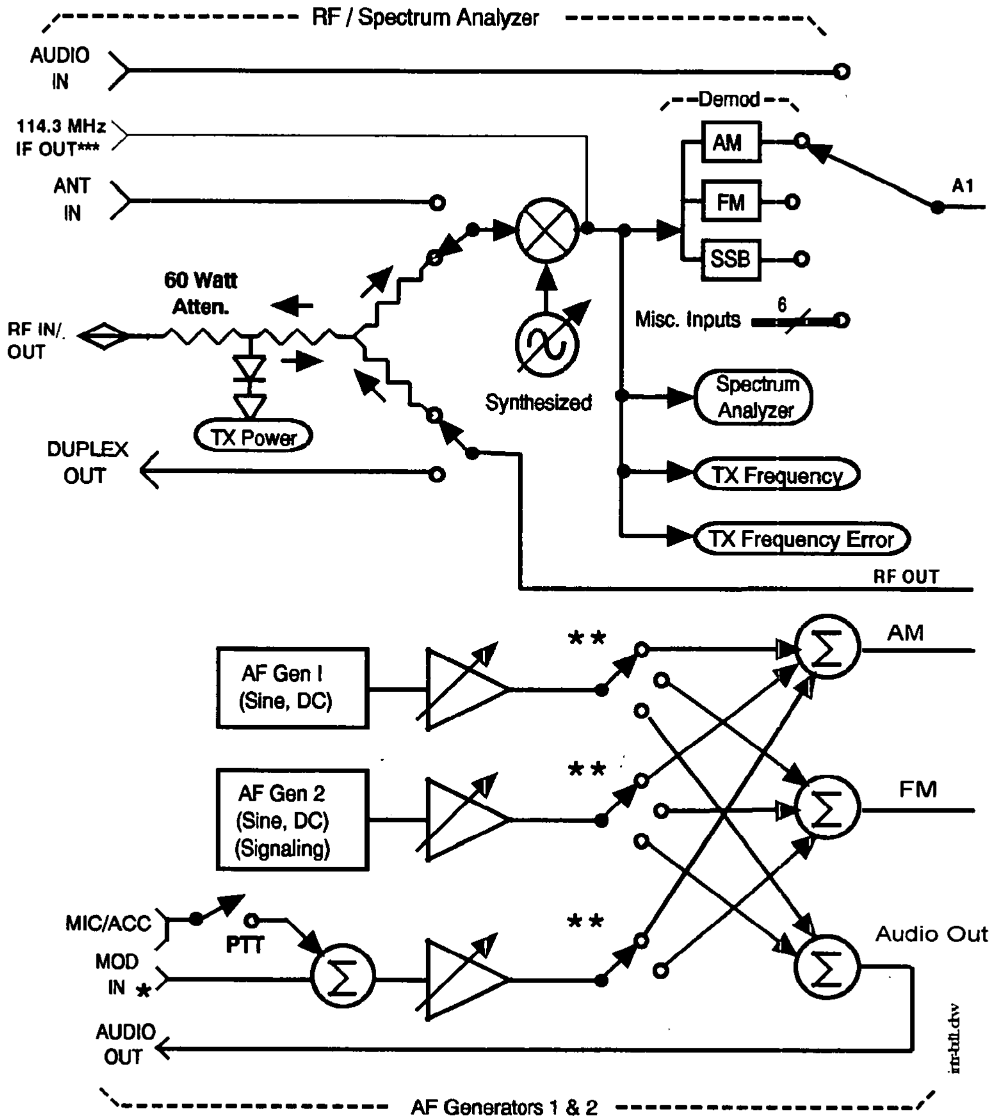
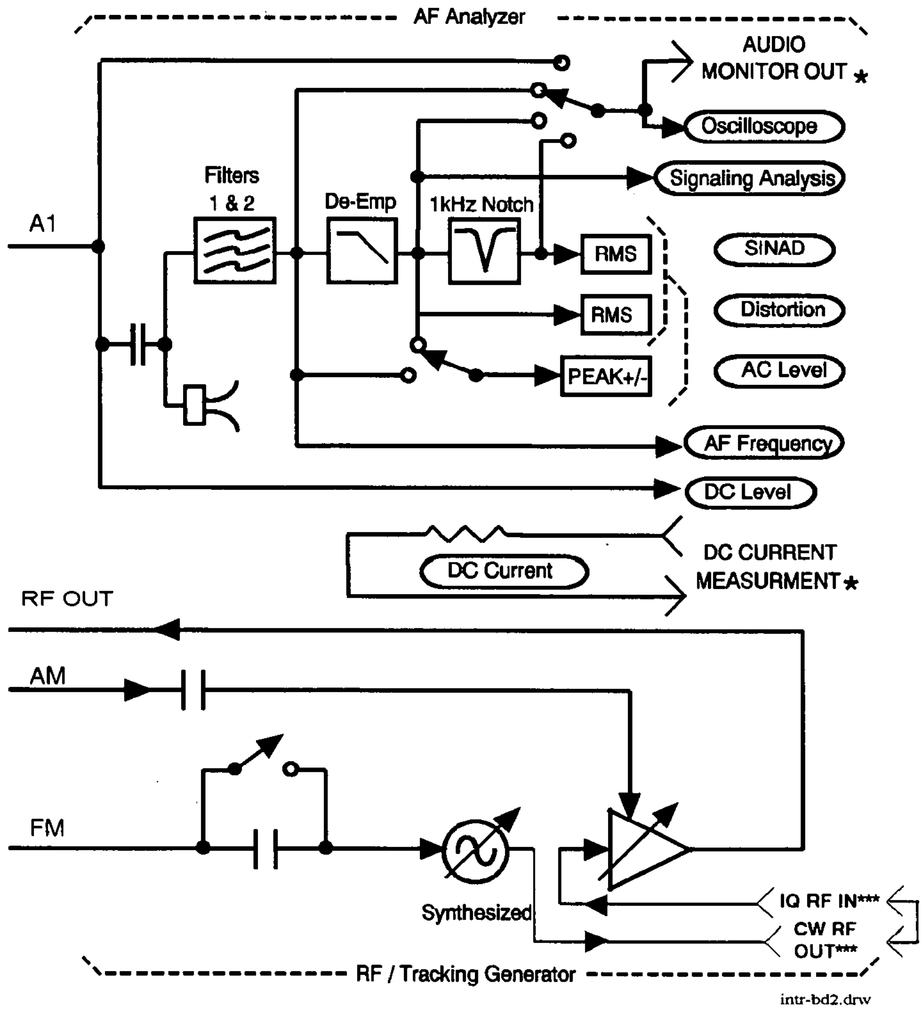


Figure 1-6. Instrument Functional Diagram (1 of 2)



* = Rear Panel Connection
** = No Simultaneous AM & FM
*** = Only on HP 8920A's with Option 050

= Measurements

Figure 1-7. Instrument Functional Diagram (2 of 2)

2 Configuring Your Test Set

2

Configuring Your Test Set

The **CONFIGURE** and **I/O CONFIGURE** screens contain a number of settings that are used to alter instrument operation and hardware communication settings. The HP-IB address, screen intensity, serial communication parameters, and several other settings, are changed in these screens.

Most **CONFIGURE** and **I/O CONFIGURE** screen entries are saved when the instrument is turned off.

The following configuration information discusses general operating information for some of the fields in these screens. Refer to Chapter 4 for more information on using the rest of these screen's functions.

To Set Screen Intensity

1. Access the **CONFIGURE** screen.
2. Select the `Intensity` field.
3. Rotate the knob to change the setting (1=dim, 8=bright).

To Set RF Voltage Interpretation (50Ω/emf)

1. Access the **CONFIGURE** screen.
2. Position the cursor in front of the `RFGen Volts` field.
3. Press the Cursor Control knob or press (ENTER) to select `50 ohm` or `emf`.

Voltage settings can control either:

- the voltage across a 50 Ω load, or
- the open circuit voltage (emf).

This setting affects the RF Generator and Tracking Generator amplitudes.

To Set the Date and Time

1. Access the **CONFIGURE** screen.
2. Select the `Date` field and use the DATA keys to enter the date in the format shown below the field.
3. Select the `Time` field and use the DATA keys to enter the time in the format shown below the field.

The Test Set has a built-in clock that keeps track of the date and time. It is powered by an internal battery to keep it operating when the instrument is off.

To Change the Beeper Volume

1. Access the **CONFIGURE** screen.
2. Select the `Beeper` field to display the volume choices.
3. Select the desired choice.

The beeper alerts you to important operating and measurement conditions. It beeps any time a message is displayed at the top of the screen. These messages warn you of conditions such as exceeding the RF input level or trying to set a field to an unacceptable value. Therefore, it is recommended that you do not disable the beeper.

To Verify or Change the Low Battery Setting

1. Access the **CONFIGURE** screen.
2. The current time setting is shown under the `Low Battery` field.
3. Select that field to display a list of setting choices.
   a. Select the desired time, or
   b. Select `Disable` to eliminate the Low Battery warning.

The Low Battery warning system is used to alert you when you have not used any front-panel controls within a specified amount of time. This setting is only used with DC power. It does not actually monitor the DC supply voltage. Since batteries are most often used for a DC supply, this function helps you conserve power by reminding you that the Test Set is still turned on.

When the specified time has elapsed between front-panel entries, the Beeper sounds and a message appears at the top of the screen alerting you to the condition.

This setting is saved when the instrument is turned off.

3 Operating Overview

3

Operating Overview

The information in this section discusses some frequently used operating features of the Test Set.

From reading Chapter 1, *Getting Started*, you should understand:

- What "fields" and "screens" are.
- How to use the Cursor Control knob to select different fields and screens.

Interaction Between Screens

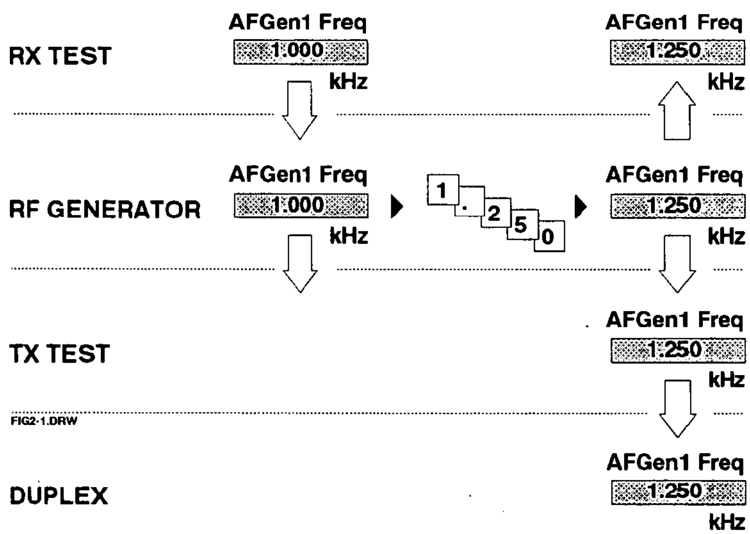


Figure 3-1. Example of How Global Fields Work

Most fields operate *globally*; changing the setting in any screen automatically changes that setting in *all* screens where it is available. `AFGen1 Freq` is an example of this field type.

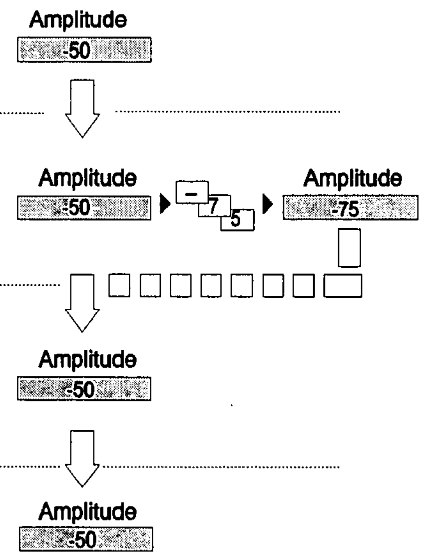
Priority fields give the **RX TEST** and **TX TEST** screens priority control of their settings. No matter what these fields were set to in other screens, if the **RX TEST** or **TX TEST** screen is accessed, the field changes to whatever it was last set to in these screens. The RF Generator `Amplitude` is an example of this field type. These fields and their preset values are listed in Table 3-1.

Using your Test Set, duplicate the steps in Figure 3-2 to demonstrate how the Priority fields operate.

Table 3-1. Priority RX TEST and TX TEST Fields

Priority Field	RX TEST	TX TEST
RF Gen Amplitude	Presets to −80 dBm (changeable)	Always Off
AFGen1 To	Presets to FM (changeable)	Always Audio Out
AF Anl In	Always Audio In	Presets to FM Demod (changeable)
Detector	Always RMS	Presets to Pk +− Max (changeable)
De-emphasis	Always Off	Presets to 750μs (changeable)
AF Anl Measurement	Presets to SINAD (changeable)	Presets to Audio Freq (changeable)

1. Access the RX TEST screen and set the Amplitude to -50 dBm.
2. Access the RF GENERATOR screen and change the Amplitude to -75 dBm.
3. Return to the RX TEST screen. Notice that the Amplitude changes back to -50 dBm.
4. Return to the RF GENERATOR screen. The Amplitude is no longer where you set it in step 2 (-75 dBm).



Since the RX TEST screen has priority control over this field, the RF GENERATOR screen's Amplitude setting changed when RX TEST was accessed.

Figure 3-2. Example of How Priority Fields Work

Displaying Measurements

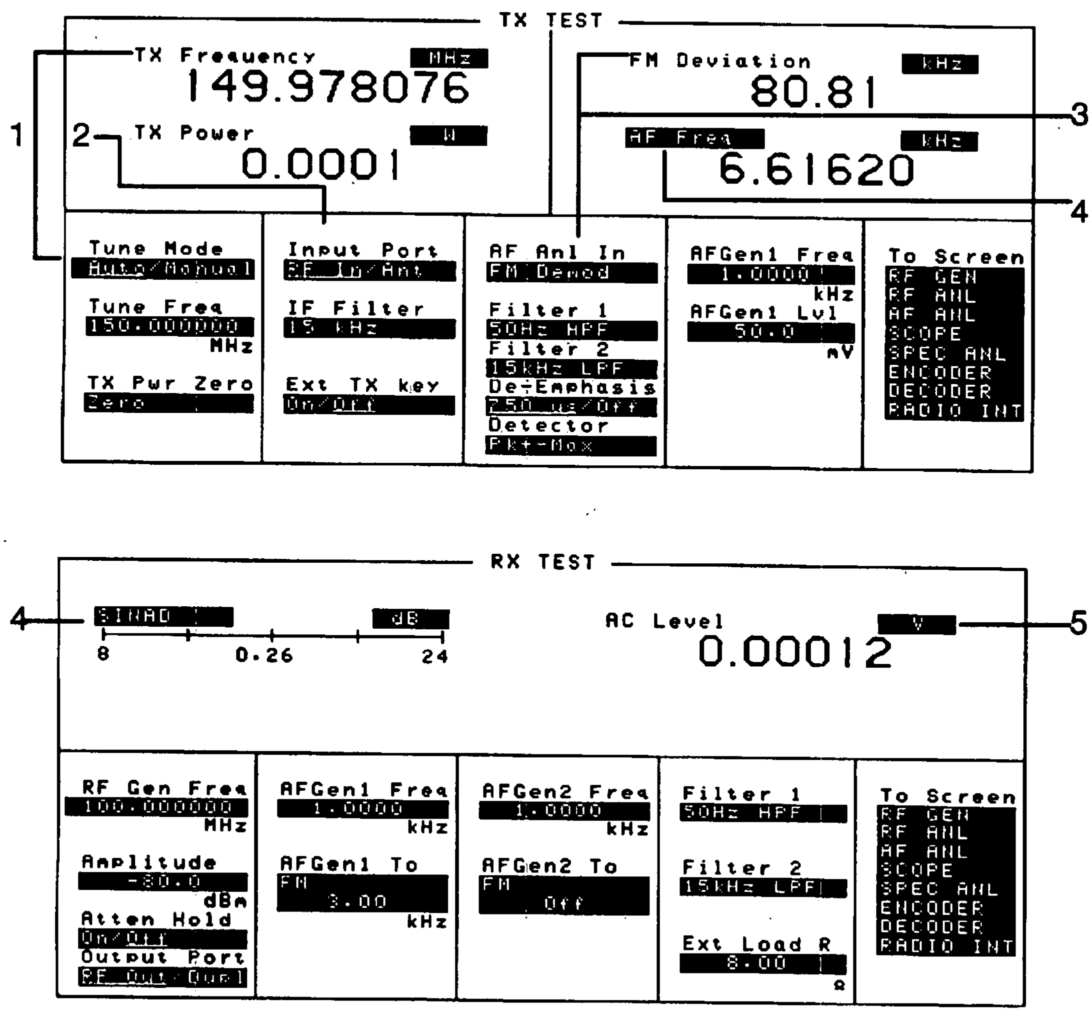


Figure 3-3. Where To Access Measurements

Displaying RF Measurements

Transmitter Frequency

TX Frequency is displayed when Tune Mode is set to Auto. (Refer to item (1) in figure 3—3.)

Transmitter Frequency Error

TX Freq Error is displayed when Tune Mode is set to Manual. (Refer to item (1) in figure 3—3.)

Transmitter Power

TX Power is only measured and displayed here when the Input Port is set to RF In (Refer to item (2) in figure 3—3). If Ant (Antenna) is selected, the measurement is replaced by four dashes (- - - -) .

You can measure low power levels on the Antenna port using the Spectrum Analyzer (optional on some Test Set models).

Refer to the TX Pwr Zero and TX Pwr Meas field descriptions for the **TX TEST** screen in chapter 4 for more information on measuring transmitter power.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the overpower circuit is triggered, remove the signal from the Antenna port and turn the Test Set off and on to reset it.

Displaying AF Measurements

FM Deviation, AM Depth, AC Level

The `AF Anl In` setting determines the AF Analyzer's input and the measurement displayed in the top right corner of the measurement area. These measurements are available in the **TX TEST**, **DUPLEX TEST**, **RF GENERATOR**, **RF ANALYZER**, and **AF ANALYZER** screens. [1] (Refer to item **(3)** in figure 3—3.)

Table 3-2.
AF Measurements Selected by AF Analyzer Input Setting

Measurement	AF Anl In Setting
FM Deviation	FM Demod, FM Mod
AM Depth	AM Demod, AM Mod
AC Level[1]	SSB Demod, Audio In, Radio Int, Ext Mod, Mic Mod, Audio Out

1 AC Level is also measured in the **RX TEST** screen, but always uses the AUDIO IN connector as the input. (Refer to item (5) in figure 3—3.)

SINAD, Distortion, SNR, AF Frequency, DC Level, DC Current

Selecting the currently-displayed measurement causes the `To Screen` menu to be replaced by a list of measurement choices. Select the new choice to replace the old measurement. These measurements are available in the **RX TEST**, **TX TEST**, **DUPLEX TEST**, **RF GENERATOR**, **RF ANALYZER**, and **AF ANALYZER** screens. (Refer to item **(4)** in figure 3—3.)

The Distortion measurement is only for a 1 kHz tone.

The SINAD measurement is normally shown using an analog-type meter and small digits, but can be changed to display in large digits only. (See "To Use the Analog METER Format").

DC Current can only be measured using the optional rear-panel DC CURRENT MEASUREMENT connections.

Selecting SNR (Signal/Noise Ratio) turns off the other audio measurement. Refer to the field description in Chapter 4 for more information on making this measurement.

AF Power

AF Power is measured in the **RX TEST** screen by specifying the external load resistance, `Ext Load R`, and changing the unit of measure for the `AC Level` measurement to **W** (Watts), **mW**, or **dBm**. (The milliwatt (mW) unit is selected by pressing [SHIFT], [ENTER].) Refer to item **(5)** in figure 3—3.

To Make Beat Frequency Measurements

To set up the DUPLEX TEST screen for beat frequency oscillator measurements, set the `AF Anl In` field to `SSB Demod` and manually adjust the `Tune Freq` field to the desired carrier frequency.

To Change the Measurement's Unit-of-Measure

1. Position the cursor in front of the present unit-of-measurement.
2. Press the key labeled with the desired unit.

All measurements allow you to change the associated unit-of-measure. For instance; the `TX Power` measurement is usually displayed in **W**atts, but can be changed to display in **mW**, **dBm**, **V**, **mV**, or **dBμV**.

Select **mW**by pressing (SHIFT), (ENTER).

For example; to display transmitter power in units of dBm instead of Watts:

1. Move the cursor in front of the unit-of-measure for the `TX Power` measurement (`W`).
2. Press (dBm). The measurement value is changed immediately to display in dBm.

To Use the Analog METER Format

1. Position the cursor in front of the unit-of-measure for the measurement you want to display.
2. Press (SHIFT), METER to display the **Meters** menu in the lower-right corner of the screen.
3. Select `On/Off` to display the meter.
4. Repeat steps 1 and 2 to enter each meter end point and the meter intervals.
5. Repeat steps 1, 2, and 3 to cancel the METER function.

The METER function displays an equivalent analog display. (This is the SINAD measurement's default state when the instrument is turned on or Preset). As the measurement is displayed graphically on the Meter, the value is also displayed in small digits below the Meter.

You can specify the high and low end points and display interval, or you can use the default Meter settings.

This function is only available for measurements displayed using the large digits, such as the measurements displayed in the **RX TEST** and **TX TEST** screens.

Entering and Changing Numbers

Values for numeric entry fields can be entered and changed using various methods, depending on your testing needs. The unit-of-measure for some of these fields can also be changed (such as changing the RF Generator `Amplitude` units from **dBm** to **μV**).

To Enter Numbers

1. Position the cursor in front of the numeric entry field to be changed.
2. Either:
   a. enter the number and unit-of-measure directly using the keypad, or
   b. press the Cursor Control knob or (ENTER) to highlight the field, and use the knob, or
   c. use the (⇩) (⇧) keys to increment or decrement the present value.

Number Formats

Numbers are entered using the decimal or hexadecimal system. The acceptable entries for each system are as follows:

- Decimal: 0-9, ., +/−, and EEX.
- Hexadecimal: 0-9 and A-F.

Entering Decimal Values

Decimal values are used for most numeric entry fields, such as the `RF Gen Freq` setting.

The (+/-) key is used for entering negative numbers. For example; when entering the RF Generator `Amplitude` you can enter this sequence to set the value to −47 dBm:
(+/-) (4) (7) (dBm)

(EEX) can be used when entering exponential notation. For example; to enter 1.25×10^3 kHz you could use the sequence:
(1) (.) (2) (5) (EEX) (3) (kHz)

Entering Hexadecimal Values

Hexadecimal (Hex) values are used for entering some signaling parameters in the **ENCODER**, such as AMPS `Filler` data, and for specifying remote communications parameters, such as the **RADIO INTERFACE** `Output Data`. No unit-of-measure is associated with these values.

Hexadecimal values are either entered from the keypad (A-F are SHIFted functions), or by using the Choices menu displayed when certain fields are selected (such as the AMPS `Filler`).

To Enter and Change the Unit-of-Measure

When a number is entered, the unit-of-measure is either specified or implied.

When the unit is implied, the current unit is used. For example; if the present `RF Freq` is 250 MHz, and you want to change it to 225 MHz, you would enter this sequence:
[2] [2] [5] [ENTER]

When the unit is specified, the units change to whatever you specify. For example; if the present `RF Gen Freq` is set to 250 MHz, and you want to change it to 455 kHz, you would enter this sequence:
[4] [5] [5] [kHz]

Changing the Unit-of-Measure for Settings

To change the present unit-of-measure, position the cursor in front of the field and press the key labeled with the desired unit. For example, position the cursor in front of the `RF Gen Freq` field and push [GHz] or [kHz] to display the setting in either of these units.

To Change the Increment/Decrement Settings

1. Move the cursor to the numeric entry field to be changed.
2. To change the current increment/decrement setting by a factor of 10, use the [INCR ÷10] or [INCR ×10] keys.
3. To set a specific increment/decrement value, press [INCR SET], and enter the desired value.
4. Use the [⇓] and [⇑] keys or cursor knob to change the field's value by the increment value you set.

Using the Pre-Defined Increment/Decrement Keys

The [INCR ÷10] and [INCR ×10] keys change the increment/decrement value by a factor of 10.

For example; if the `Tune Freq` presently changes by 10 MHz for every click of the knob or push of the [⇓] or [⇑] keys, pushing [INCR ×10] once changes the increment value to 100 MHz.

Specifying An Increment Value

The (INCR SET) key is used to assign a specific increment value. The increment value may use different units than the field you are incrementing/decrementing. For instance; if the RF Generator `Amplitude` setting is displayed in **dBμV**, you could increment in units of **dB** or **mV**.

To change the increment value;

- Move the cursor to the field to be changed.
- Press (INCR SET), and then enter the desired increment value and unit-of-measure.

Example of Setting an Increment Value

This example changes the `Tune Freq` in increments of 15 MHz.

1. Access the **TX TEST** screen and position the cursor in front of the `Tune Freq` field.
2. Press (1) (0) (0), (MHz) to set the frequency at 100 MHz.
3. Press (INCR SET), (1) (5), (MHz).
4. Turn the Cursor Control knob. The field's value changes by 15 MHz for each knob click.

Printing A Screen

To Print A Screen's Contents

1. Connect a printer to the appropriate rear-panel connector.
2. Access the **PRINT CONFIGURE** screen from the More menu and set the `Printer Port` field to the appropriate type of printer connection.
   - If HP-IB is selected, enter the HP-IB `Printer Address` of the printer.
3. Select the type of printer you are using in the `Model` field. If your printer is not listed, configure your printer to emulate one that is listed.
4. Enter a `Print Title` using the knob, if desired. This text will appear at the top of your printout.
5. Display the screen you want to print and press (SHIFT), PRINT.

To interrupt printing, select the `Abort Print` field on the **PRINT CONFIGURE** screen.

Using Measurement Limit Indicators

The LO LIMIT and HI LIMIT functions are used to define a measurement "window" to alert you to measurements that are outside these limits. When limits are assigned, **Lo** and/or **Hi** appear by the measurement.

A measurement that goes above or below the defined limits causes three things to happen:

1. A message appears at the top of the screen indicating a limit was exceeded.
2. The **Lo** or **Hi** indicator by the measurement flashes.
3. The Beeper beeps if it is has been enabled in the **CONFIGURATION** screen.

Limits are helpful when you can't watch the Test Set display while you are making an adjustment on the equipment you are testing or repairing. They are also a convenient way of alerting you to long-term measurement drift without having to observe the screen.

To Set A HI and/or LO LIMIT

1. Position the cursor in front of the unit-of-measure for the measurement you are setting limits for.
2. Press (SHIFT), LO LIMIT, and enter the measurements low limit value and unit-of-measure.[1]
3. Press (SHIFT), HI LIMIT, and enter the measurements high limit value and unit-of-measure.[1]

[1] The fundamental unit for the LIMITs does not have to be the same as the measurement's units. For instance; when measuring AC Level in Volts, you can set HI and LO LIMITs in units of dBm if desired.

To Reset or Remove Limits

To *reset* a limit that has been exceeded:

1. Position the cursor in front of the unit-of-measure for the measurement you assigned the limit to.
2. Press (SHIFT), LO LIMIT (or HI LIMIT), (ENTER); or press (MEAS RESET).

To *remove* a limit you have set:

1. Position the cursor in front of the unit-of-measure for the measurement you assigned the limit to.
2. Press (SHIFT), LO LIMIT (or HI LIMIT), (ON/OFF).

Example of Setting HI and LO LIMITs

This example sets limits for the `TX Freq Error` measurement. Limits are being set to indicate if a 100 MHz carrier varies more than ± 10 kHz.

1. Position the cursor in front of the unit-of-measure for the `TX FREQ ERROR` measurement (the default is `kHz`).
2. Press (SHIFT), LO LIMIT, (-) (1) (0), (kHz).
3. Press (SHIFT), HI LIMIT, (1) (0), (kHz).

Averaging Measurements

The AVG (average) function allows you to display the average value of a number of measurements. You enter the number of measurement samples used to calculate and display the measurement average. This dampens the effects of rapidly changing measurements, providing a more usable measurement display.

To Use Measurement Averaging

1. Position the cursor in front of the measurement's unit-of-measure.
2. Press (SHIFT), AVG. The default number of average samples is displayed below the measurement.
   a. Enter the desired number of measurement samples to be used for calculating the average, or
   b. Press (ON/OFF) to use the currently-displayed number of samples.
3. To turn Averaging off, position the cursor in front of the unit-of-measure and press (SHIFT), AVG, (ON/OFF).

When the Averaging function is first enabled, a numeric average is calculated and displayed each time a measurement is made. This continues until the specified number of samples is reached. From that point on, the Averaging function performs an exponential filtering operation that mimics an RC filter.

Because of the exponential response, any large measurement changes result in a displayed value that ramps up or down to the actual measured value.

Pressing (MEAS RESET) clears the measurement history for all measurements and starts the averaging process over.

For more information on the theory of this filtering technique, refer to the April 1986 issue of the *HP Journal*, page 24.

Example of Using Measurement Averaging

This example enables the SINAD measurement to be averaged using 25 samples.

1. Press (PRESET) and wait for the instrument to display the **RX TEST** screen.
2. Position the cursor in front of the unit-of-measure for the SINAD measurement (default is dB).
3. Press (SHIFT), AVG, (2) (5), (ENTER). Avg appears below the displayed measurement value to indicate that averaging is being used.

Setting A Measurement Reference

The REF SET function establishes a measurement reference point. This allows you to make a direct comparison between two measurement results, or between a measurement standard and the actual measurement results.

Referenced measurements are displayed in one of two ways, depending on the type of measurement:

Displayed value = Measurement − Reference. The difference between the measured value and the reference value is displayed in the same unit-of-measure.

or

Displayed value = Measurement ÷ Reference. A ratio of the measured value to the reference value is displayed in dB.

To Use the Present Value as a Reference

1. Position the cursor in front of the unit-of-measure for the measurement you want to set the reference for.
2. Press (SHIFT), REF SET, (ENTER).
3. `Ref` appears below the measurement.

The measurement displayed is now referenced to the measurement value present when the reference was set.

To Set a Specific Reference

1. Position the cursor in front of the unit-of-measure for the measurement you want to set the reference for.
2. Press (SHIFT), REF SET.
3. Enter the Reference value.
4. `Ref` appears below the measurement value to indicate a reference has been set.

The measurement displayed is now referenced to the value you entered.

Saving and Recalling Instrument Setups

The (SAVE) and (RECALL) functions allow you to store different instrument setups and retrieve them later, eliminating the task of re-configuring the Test Set.

The number of available SAVE registers depends on how many changes were made to the *BASE* instrument setup for each save. (See "BASE Settings".) The smaller the number of changes, the greater the number of SAVE registers that can be used (typically over 200).

SAVE/RECALL register settings can be saved to several types of mass storage. This allows you to "back up" the settings in case you need to clear them from memory (see "Memory Considerations")for running large programs, or when a firmware upgrade is performed. Refer to the `Save/Recall` field description for the **I/O CONFIGURE** screen in chapter 4.

To Save an Instrument Setup

1. Use the `More` menu to access the **I/O CONFIGURE** screen and select the media to store the settings to using the `Save/Recall` field. (The default is internal memory.)
2. Make any changes to the instrument that you want to SAVE in a register.
3. Press (SHIFT), SAVE.
4. Use the DATA keys or the `Save` menu at the bottom right of the screen to enter the SAVE register name.

To Recall an Instrument Setup

1. Use the `More` menu to access the **I/O CONFIGURE** screen and select the media to recall settings from using the `Save/Recall` field. (The default is internal memory.)
2. Press (RECALL).
3. Use the knob to select the desired setup to be recalled from the `Recall` menu at the bottom right of the screen.

Example of Saving and Recalling a Measurement Setup

This example SAVES changes made to the **RX TEST** screen, and then RECALLS them. The register is saved to wherever the `Save/Recall` field is set to (`Internal` memory - unless you have changed it).

1. Access the **RX TEST** screen and set the `RF Gen Freq` to 500 MHz.
2. Set `Amplitude` to -35 dBm.
3. Press (SHIFT), SAVE. A prompt appears at the top of the screen asking you to enter a name.
4. Using the DATA keys, press (1) (2) (3), (ENTER) to assign a name to these changes.

5. Press (PRESET) and wait for the instrument to return to normal operation.
6. If not already displayed, access the **RX TEST** screen. Notice that the `RF Gen Freq` and `Amplitude` settings are reset to their preset values.
7. Press (RECALL), (1) (2) (3), (ENTER). The `RF Gen Freq` and `Amplitude` are changed to the settings you saved in register 123 (500 MHz and -35 dBm).

To Remove (Clear) an Individual SAVE Register

1. Specify where the register is stored using the `Save/Recall` field on the **I/O CONFIGURE** screen.
2. Press (RECALL)
3. Use the knob to position the cursor in front of the register to be removed from the `Recall` menu at the bottom right of the screen. The register name and percentage of SAVE memory occupied by that register are indicated at the very top of the screen.
4. Press (ON/OFF). A prompt appears, asking if you want to delete the SAVE register.
5. Press (YES).

To Clear All SAVE Registers

- Press (RECALL).
- Use the knob to position the cursor in front of the `*Clr All*` entry in the `Recall` menu at the bottom right of the screen.
- Press the knob or (ENTER). A prompt appears at the top of the screen to verify that you want to clear all registers.
- Press (YES).

Register Names

You can use any number, letter, or combination of numbers and letters as a name for storing instrument settings. For instance; if you want to save a setup for testing a "Vulcan7" radio, you can save the setting as "VULCAN7".

Two register names are reserved for special purposes: POWERON and BASE.

POWERON Settings

When the Test Set is turned on, it uses a set of instrument setup parameters specified at the time of manufacture. You can have the instrument power up in a different state by making the desired changes to the original settings, and then saving them using the name POWERON.

The next time the instrument is turned on, the instrument returns to the state present when you saved the POWERON setting. For instance; if the **OSCILLOSCOPE** screen was displayed when POWERON was saved, it is the screen that is displayed when you turn the instrument on.

BASE Settings

The *BASE* register contains any field settings the user has SAVEd that are different from the instrument PRESET state. It establishes a reference point for all future SAVEs. (If a BASE is not SAVEd, the PRESET state is used as the reference.)

When you SAVE an instrument setup, the new setup is compared to the BASE settings, and any *differences* are stored under the register name you supply. Because only differences are stored, a much larger number of instrument setups can be saved than if the contents of every field was saved.

When you RECALL an instrument setting, every field is reset to the BASE settings. The SAVED settings are then used to re-establish the desired instrument setup.

You can define your own BASE setting. If your desired settings are very different from the PRESET values, you may want to change the BASE register. This will decrease the amount of memory used to SAVE each setup, and allow you to SAVE many more setups.

Caution

Since each SAVE/RECALL register only contains the differences between the setup being saved and the present BASE register settings, changing the BASE results in all other saved setups being ERASED from memory (including the POWERON setting if one has been saved).

Unless you consistently change the same fields to the same value each time you use the instrument, you should probably not create your own BASE settings.

Memory Considerations

When the `Save/Recall` field of the **I/O CONFIGURE** screen is set to `Internal`, programs are saved to the same non-volatile RAM used to create RAM Disk(s) and run IBASIC programs. By saving a large number of instrument setups, you reduce the amount of RAM available to run programs. If you get a "memory overflow" message while trying to load a program, you must clear one or more SAVE/RECALL registers to free RAM space. When using an HP 8920A, you may have to install option 005 - 512 kByte RAM expansion, to have enough memory to run your application (the other Test Sets include this as standard memory).

Instrument Hardware Changes

Recalling a SAVEd register that uses a hardware option that has been removed (such as an audio filter) results in unspecified operation. Re-install the needed option before attempting to RECALL the associated register(s).

Using USER Keys

User keys instantly access instrument settings without using the knob. You can use USER keys to move quickly between fields on the same screen, and to access field settings that are not normally available on the screen you are using.

Local USER keys are used to move between settings on the screen that is displayed. When the USER key is pressed, the cursor instantly moves to, and selects, the assigned field; eliminating the need to turn and push the knob. Five Local USER keys are available for each screen: (k1),(k2), (k3), (k4), and (k5).

Five factory-assigned Local USER keys are available in each screen; however, using these keys removes any other Local USER keys you may have already set up.

Global USER keys are used to access settings that are not available on the current screen. Three Global USER keys are available: k1', k2', and k3'. (These are SHIFTed functions of the Local USER keys.)

When defining USER keys, the *ASSIGN* function is used to create key definitions; the *RELEASE* function removes the definitions. Re-ASSIGNing a USER key to a different field setting automatically Releases it from the setting it was previously associated with.

To Use the Pre-Assigned Local USER Keys

1. Press (SHIFT), ASSIGN, (ENTER). The numbers 1 through 5 appear in front of various fields. (See Figure 3-4.)
2. Press the different Local USER keys (k1 to k5) and notice how the cursor immediately moves to the corresponding field.
3. To stop using the default Local USER keys, press (SHIFT), RELEASE, (ENTER).

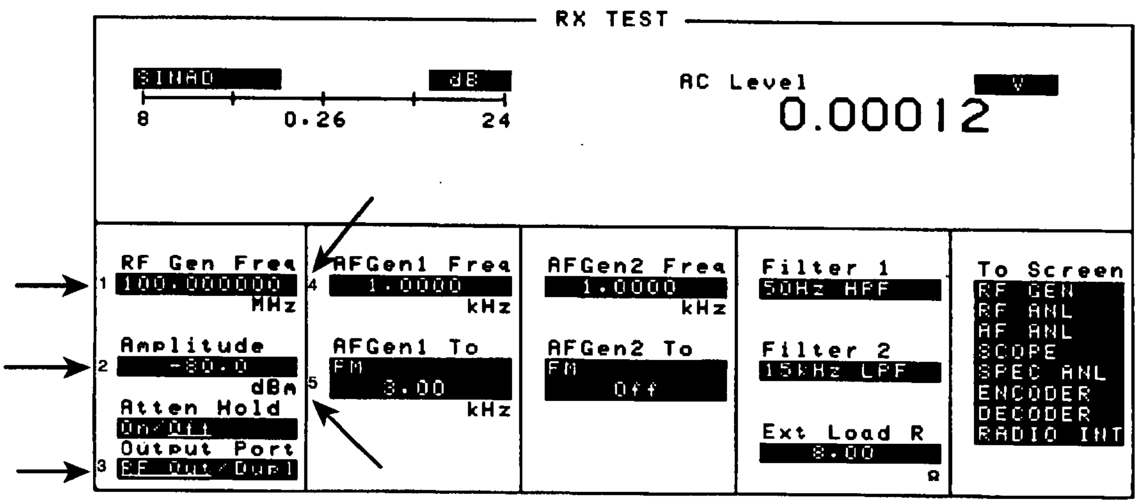


Figure 3-4. An Example of Pre-Assigned Local User Keys

To Assign Local USER Keys

1. Move the cursor to the field you want to assign a local USER key to.
2. Press (SHIFT), ASSIGN, and a local USER key (k1-k5). The USER key number appears in front of the field you assigned it to.

Example of Assigning a Local USER Key

Use this example to assign Local USER key (k1) to the `Filter 1` field in the **RX TEST** screen.

1. Access the **RX TEST** screen and position the cursor in front of the `Filter 1` field.
2. Press (SHIFT), ASSIGN, (k1). A small `1` appears next to the field indicating that USER key (k1) has been assigned to it.
3. Move the cursor to any other field on the screen and press (k1). The cursor immediately returns to the `Filter 1` field. The field is also highlighted to change the entry using the CURSOR CONTROL knob or arrow keys, (⇩) (⇧).

To Release Local USER Keys

1. Display the screen containing the USER key assignment to be removed.
2. Press (SHIFT), RELEASE, and the USER key (k1-k5).

To Assign Global USER Keys

1. Move the cursor to the field you want to assign a global USER key to.
2. Press (SHIFT), ASSIGN, (SHIFT), and a global USER key (k1' - k3'). Unlike a Local USER key, the USER key number *does not* appear in front of the field you assigned a Global USER key to. A prompt appears at the top of the screen confirming the key assignment.

Example of Assigning a Global USER Key

Use this example to assign Global USER key k1' to the `AF Anl In` field, and then access this field in the **OSCILLOSCOPE** screen.

1. Access the **AF ANALYZER** screen and position the cursor in front of the `AF Anl In` field.
2. Press (SHIFT), ASSIGN.
3. Press (SHIFT), k1'. Notice the prompt `Global User key 1 assigned.` at the top of the screen.
4. Access the **OSCILLOSCOPE** screen.
5. Press (SHIFT), k1'.

`AF Anl Input FM Demod` is displayed at the top of the screen (assuming the present input is set to FM Demod). To change the input, use the arrow keys, (⇓) (⇑), or press (ENTER) to access the `Choices` menu.

A field that is accessed using a Global USER key is only displayed at the top of the screen while it is being accessed. Moving the cursor to any other field in the screen causes the USER key field to disappear until it is accessed again.

To Release Global USER Keys

1. Move the cursor to the field with the Global USER key assigned to it.
2. Press (SHIFT), RELEASE, (SHIFT), and the USER key to be Released (k1'-k3').

Setting an RF Generator/Analyzer Offset

You can set a fixed frequency offset between the RF Generator and the RF Analyzer. This feature is convenient for testing radios with a fixed transmit/receive frequency offset.

To Set an RF Offset

1. Access the **CONFIGURE** screen.
2. Position the cursor in front of the `RF Offset` field, and press the Cursor Control knob, or press (ENTER) to turn the offset On or Off.
3. Select the `(Gen)-(Anl)` field and enter the frequency offset value.

Example of Setting an RF Offset

1. Access the **CONFIGURE** screen.
2. Set the `RF Offset` to `On`.
3. Enter an offset frequency (`(Gen)-(Anl)`) of 10 MHz.
4. Access the **DUPLEX** screen.
5. Set the `Tune Mode` to `Manual`. [1]
6. Select the `RF Gen Freq` field, and rotate the Cursor Control knob to vary the RF Generator frequency.
7. Notice that the `Tune Freq` value changes to maintain the 10 MHz difference between the generator and the analyzer.

[1] Manual tuning is used in this example to prevent possible unexpected Tune Frequency changes during the procedure.

Using Remote Control

The Test Set can be remotely controlled several ways:

- Using HP-IB control from a computer/controller.
- Using IBASIC programs on memory cards.
- Using an ASCII terminal connected to the Serial Port.

Using HP-IB Control

The Programmer's Guide contains information on writing HP-IB control programs for the Test Set. Programming examples and a syntax listing provide general HP-IB operation guidelines.

Running IBASIC Programs from Memory Cards

The documentation shipped with HP 11807 software packages explains how to run those programs from memory cards. Refer to the *HP 8920A,B HP-IB Programmer's Guide* (PN 08920-90172) for detailed information on using memory cards with your own IBASIC programs.

Using an ASCII Terminal

Connecting an ASCII terminal to the Serial Port allows you to remotely operate the Test Set by entering characters that represent each front-panel control.

Before you can use this feature, you must first set the required serial port settings in the **I/O CONFIGURE** screen, and make any hardware connections.

The Serial Port connections are described in Chapter 5.

To Configure for Serial Port Operation

1. Access the **I/O CONFIGURE** screen.
2. Set the `Serial In` field to `Inst`.
3. Set the `IBASIC Echo` field to `On`.
4. Set the `Inst Echo` field to `On`.
5. Set the remaining serial communications fields according to your terminal/computer's serial communication requirements. These fields include:
   a. Serial Baud
   b. Parity
   c. Data Length
   d. Stop Length
   e. Rcv Pace
   f. Xmt Pace
6. The Test Set now responds to the equivalent characters sent to it by the terminal/computer.

Equivalent Front-Panel Control Characters

The following table lists the terminal/computer keystrokes that equate to front-panel controls. *Each equivalent character must be preceded by the* **Escape** *key.*

For example, to remotely access the **CONFIGURE** screen, you type (Esc), (C) on your terminal/computer. (Be sure to use upper-case C for this example.)

Table 3-3. Equivalent Front-Panel Control Characters

Function	Equiv. ESC Character	Function	Equiv. ESC Character
CANCEL	!	A	X
PERCENT MHZ_V	(	EEX	Z
S_KHZ_MV	)	YES_ON_OFF	[
BACKSPACE	-	NO_PPM_W	]
ENTER	.	RX	a
RELEASE	0	TX	b
K1	1	DUPLEX	c
K2	2	PREV	d
K3	3	TESTS_MAIN	e
K4	4	LOCAL	f
K5	5	RECALL	g
K1_PRIME	6	MEAS_RESET	h
K2_PRIME	7	PRESET	i
K3_PRIME	8	INCR_DIV_10	j
ASSIGN	9	INCR_SET	k
KNOB_TURN_CCW	<	INCR_TIMES_10	l
KNOB_TURN_CW	>	DOWN	m
MSSG	A	UP	n
HELP	B	SEVEN	o
CONFIG	C	EIGHT	p
HOLD	D	NINE	q
PRINT	E	FOUR	r
ADRS	F	FIVE	s
SAVE	G	SIX	t
REF_SET	J	ONE	u
METER	K	TWO	v
AVG	L	THREE	w
LO_LIMIT	M	ZERO	x
HI_LIMIT	N	POINT	y
E	R	PLUS_MINUS	z
F	S	OHM_PCT_DEL_DBUV	{
B	U	DB_GHZ_DBM	|
C	V	MS_HZ_UV	}
D	W		

Alternate sequences for 5 commonly-used functions are also available. Hold down the (Cntl) (control) key and select the corresponding key for the desired function. (Example: (Cntl)/(H) moves the cursor to the left one space.)

ENTER - J or M

CANCEL - C

BACKSPACE - H

KNOB_TURN_CW - R

KNOB_TURN_CCW - L

4

Screen and Field Descriptions

This chapter provides reference information for each Test Set screen and its fields.

Signal flow diagrams associate the fields with what they do in the instrument (where applicable).

Additional information for the fields is listed after the diagrams.

Note

Since most of the measurements displayed are dependent on different field settings, the settings and values shown in the diagrams use the Test Set's PRESET conditions.

RX Test

RX TEST

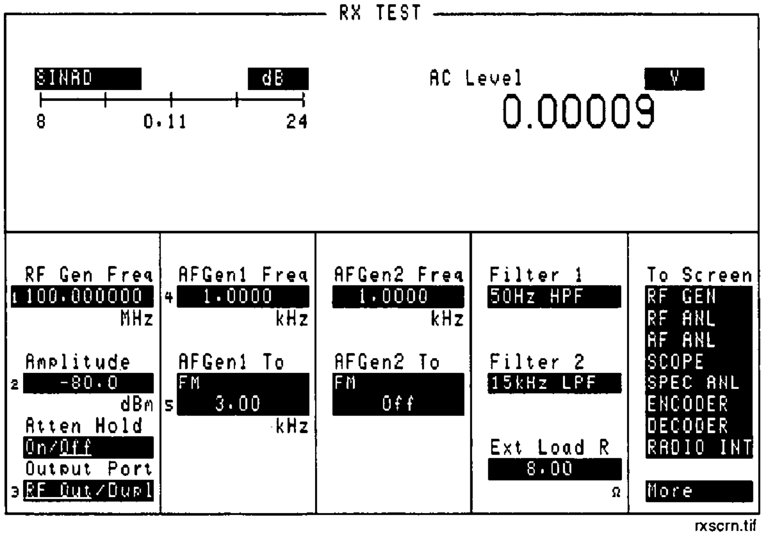


Figure 4-1. The RX Test Screen

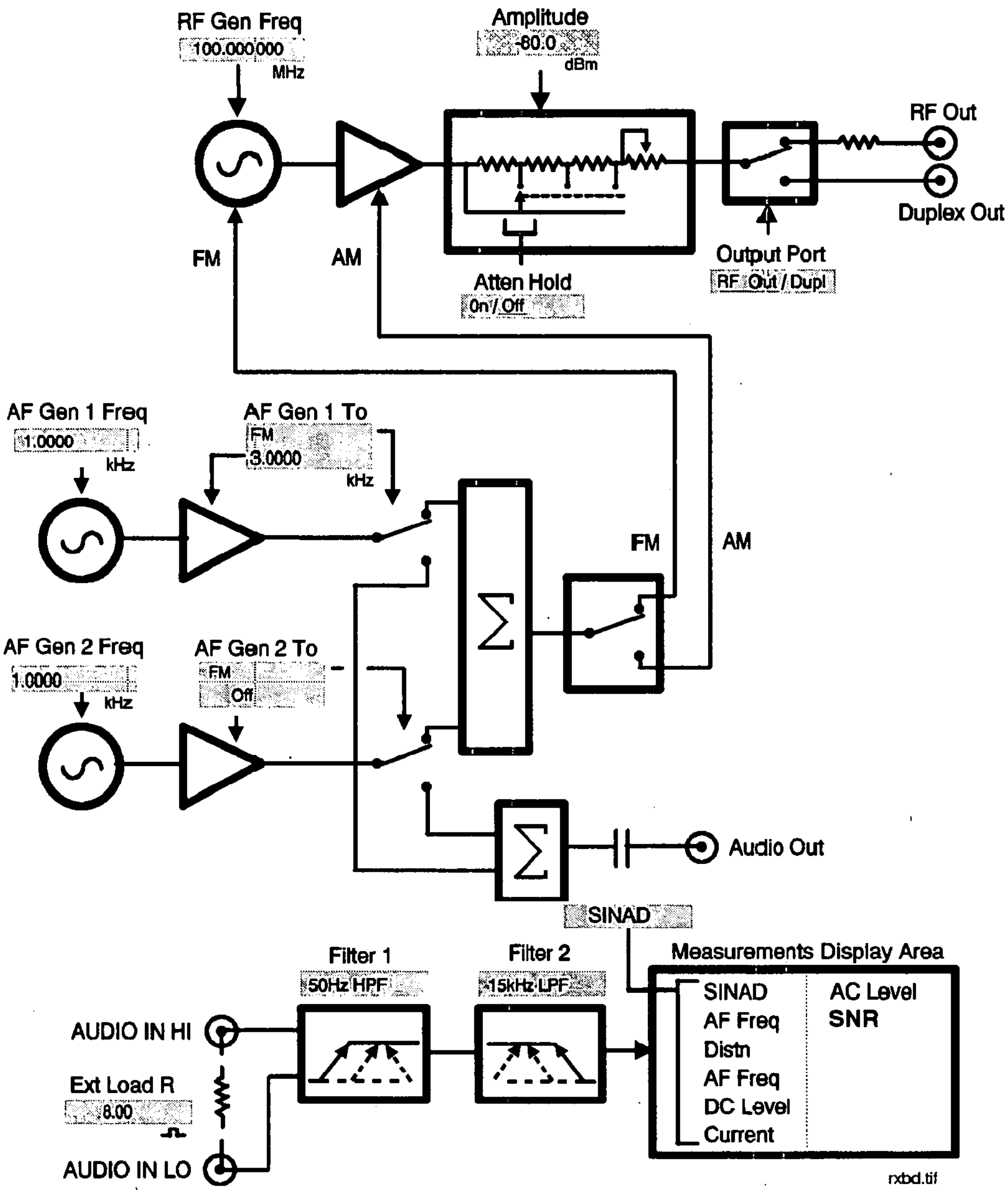


Figure 4-2. The RX TEST Fields and Their Functions

AC Level

This measurement displays either RMS potential (voltage) or audio power (Watts or dBm).

Operating Considerations

When the unit-of-measure is changed to measure AF power, the External Load Resistance must be specified. (Refer to the `Ext Load R` field description.)

The input for this measurement on this screen is always the AUDIO IN connectors.

See Also

"Entering and Changing Numbers" in Chapter 3.

AFGen1 Freq

Audio Frequency Generator 1 Frequency sets the frequency for the first audio frequency sinewave generator.

AFGen2 Freq

Audio Frequency Generator 2 Frequency sets the frequency for the second audio frequency sinewave generator. It can also be used to set the Function Generator frequency when the signaling Encoder is used.

This field is also used to control the Send/Stop functions for some Encoder modes. For example, when sending a tone sequence, this field is used to Send and Stop the sequence. The field name changes to `AFGen2` when this type of operation is used.

This field is removed from this screen when NMT encoding or decoding is used. (NMT programs can only be run from the **NMT Decoder** screen.)

See Also

ENCODER screen signaling modes.

AFGen1 To

Audio Frequency Generator 1 To is used to set two values:

- The upper field determines whether the AF signal modulates the RF Generator or is output through the AUDIO OUT connector.
- The lower field sets the amplitude (including `Off`). The AUDIO OUT level is set either in volts RMS (across a low-impedance output) or dBm, mW or W across a 600Ω load. Note: mW is selected by pressing (SHIFT), (ENTER)

Operating Considerations

The upper field is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3.

AFGen2 To

Audio Frequency Generator 2 To is used to set two values:

- The upper field determines whether the AF signal modulates the RF Generator, or is output through the AUDIO OUT connector.
- The lower field sets the amplitude (including `Off`). The AUDIO OUT level is always in volts RMS for standard *sinewave* operation across a low-impedance output.

If the Signaling option is installed, the sinewave can be set in units of RMS or Peak. This is done in the `Sine Units` field for the Function Generator. When non-sinewave waveforms are used, or if the upper field is set to AM or FM, the level is always expressed as a peak value.

See Also

ENCODER, Function Generator screen description.

Amplitude

RF Generator Amplitude adjusts the amplitude of the RF Generator.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

If a microphone is connected, and the Amplitude is `Off`, keying the microphone causes the Amplitude to turn on to its previous level until the microphone is no longer keyed.

See Also

`Atten Hold` field description
"Interaction Between Screens" in Chapter 3
"MIC/ACC" in Chapter 5

Atten Hold

Attenuator Hold prevents the fixed RF output attenuators from switching in and out, eliminating the brief loss of the output signal as the level is changed. This function is helpful when making squelch measurements.

Operating Considerations

When this function is set to `On`, the RF output level is restricted to a range of 15 dB around the present `Amplitude` setting. Attempting to set an amplitude outside the allowed range results in an error message and beep (if the Beeper is on). RF output level accuracy is uncalibrated outside the allowed range.

Ext Load R

External Load Resistance is used to calculate and display AF power dissipated in an external load resistance. Power is calculated using the voltage measured at the AUDIO IN connections and the resistance value you enter into this field.

See Also

`AC Level` field description

Filter 1 and Filter 2

Filters 1 and 2 select a variety of standard and optional filters. Selecting either field lists the choices available for that field.

See Also

AF ANALYZER screen description.

Output Port

RF Generator Output Port selects the desired port.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Caution

Applying reverse RF power to the DUPLEX OUT connector can damage the instrument. (A message is displayed when an over-power conditions occurs.) Whenever possible, use the RF IN/OUT connector when testing transceivers to prevent damage from accidental transmitter keying.

If a reverse power condition triggers the internal protection circuit, remove the reverse power signal and press [MEAS RESET] or turn the Test Set off and on to reset it.

RF Gen Freq

RF Generator Frequency sets the generator's frequency.

SINAD

This measurement field is used to select and display any one of the following measurements:

SINAD

Distortion

SNR (Signal to Noise Ratio)

AF Frequency

DC Level

Current - DC only (HP 8920A requires Current Measurement option)

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

SNR Operation:

- Selecting SNR turns off the other audio measurement.
- The RF Generator and AFGen1 must be set up to provide the radio's carrier. (AFGen1 is automatically turned on and off repeatedly during this measurement.)
- AFGen2 must be turned off.
- The radio's receiver's audio output must be connected to the AUDIO IN port (set the **AF Anl In** field to Audio In).

See Also

"Interaction Between Screens" in Chapter 3
"Displaying Measurements" in Chapter 3

TX Test

TX TEST

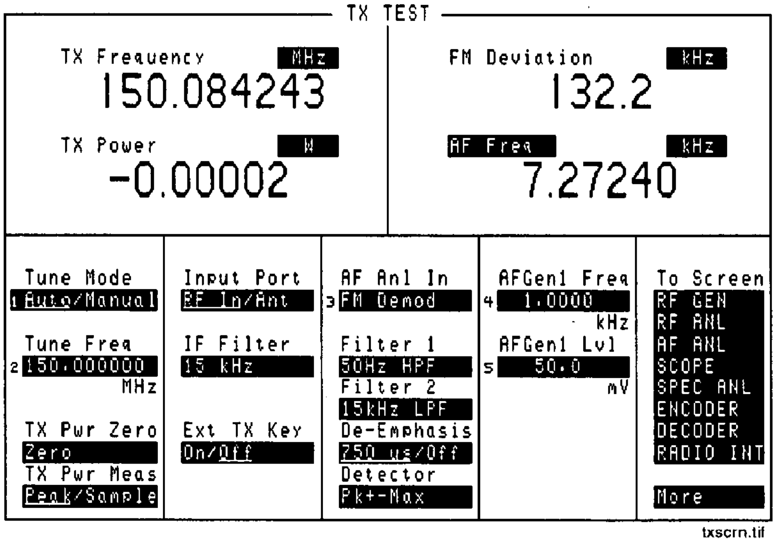


Figure 4-3. The TX Test Screen

TX Test Screen

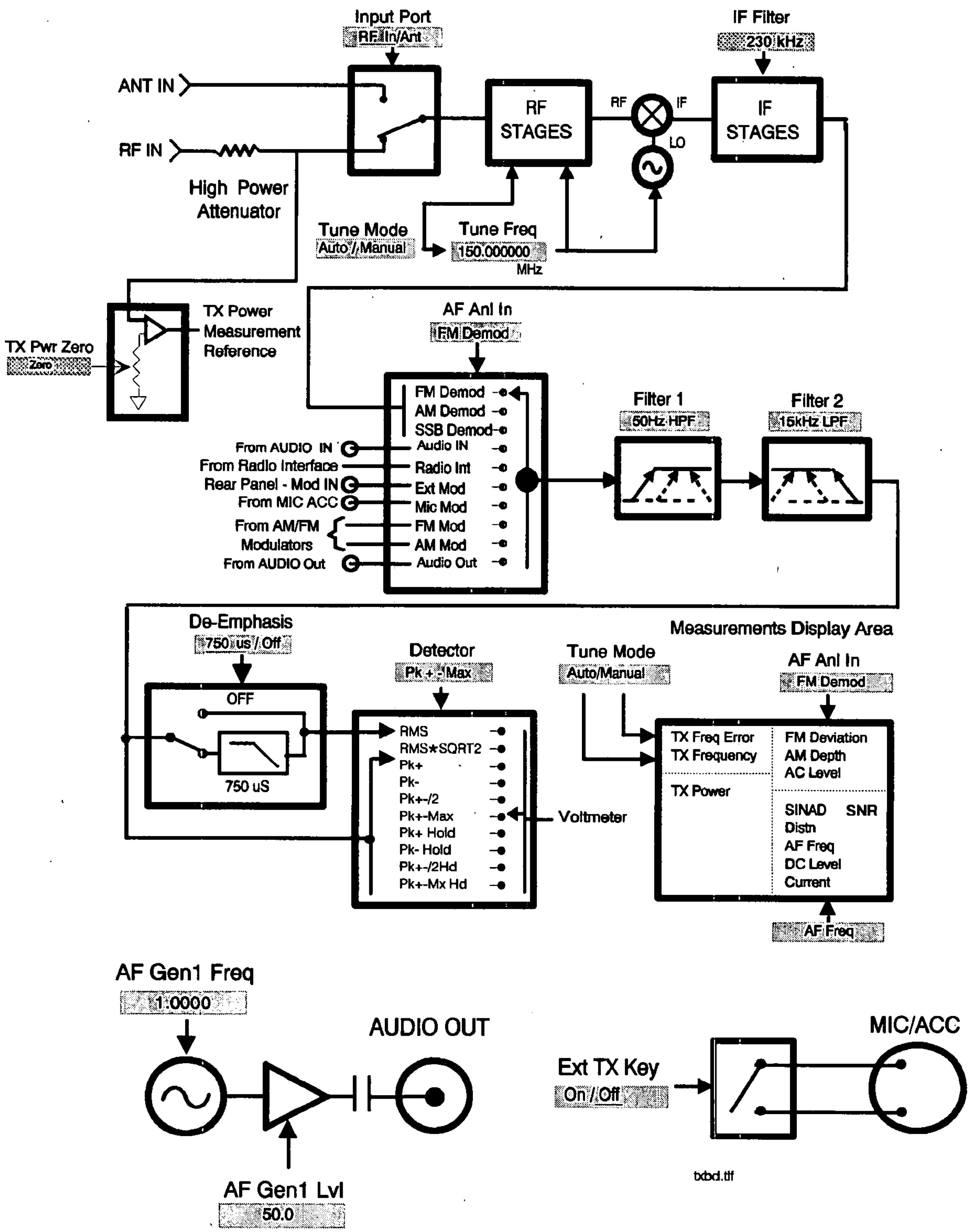


Figure 4-4. TX TEST Functional Block Diagram

AF Anl In

Audio Frequency Analyzer Input selects the input for the analyzer. When selected, this field displays a list of choices.

Signals can be analyzed from three different types of inputs:

- The output of the AM, FM, or SSB demodulators.
- The AUDIO IN, RADIO INTERFACE, MODULATION INPUT, MIC/ACC, and AUDIO OUT connectors.
- The signal present at the AM or FM modulators for the RF Generator.

Operating Considerations

Changing this field alters the upper AF measurement to the appropriate measurement type.

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3
"Displaying Measurements" in Chapter 3

AF Freq

This is the default measurement for this measurement field. Selecting this field displays the following measurement choices:

SINAD
Distortion
SNR (Signal to Noise Ratio)
AF Frequency
DC Level
Current - DC only (requires Current Measurement option)

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

SNR Operation

- Selecting SNR turns off the other audio measurement.
- The RF Generator and AFGen1 must be set up to provide the radio's carrier. (AFGen1 is automatically turned on and off repeatedly during this measurement.)
- AFGen2 must be turned off.
- The radio's receiver's audio output must be connected to the AUDIO IN port (set the `AF Anl In` field to `Audio In`).

See Also

"Interaction Between Screens" in Chapter 3
"Displaying Measurements" in Chapter 3

AFGen1 Freq

Audio Frequency Generator 1 Frequency sets the frequency for the first audio frequency sinewave generator.

AFGen1 Lvl

Audio Frequency Generator 1 Level sets the level out the AUDIO OUT connector in volts RMS (across a low-impedance output), or in mW, W, or dBm across a 600Ω load. Note: mW is selected by pressing (SHIFT), (ENTER).

Operating Considerations

In the TX screen, the signal is *always* output through the AUDIO OUT connector.

De-Emphasis

This setting selects or bypasses the 750 μs de-emphasis networks in the audio analyzer and speaker circuitry.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3

Detector

This setting selects the type of detector used when measuring and displaying AF signal levels.

Detector Types

- **RMS** displays the RMS value of signals.
- **RMS*SQRT2** displays the RMS value of a signal multiplied by $\sqrt{2}$.
- **Pk+** displays the positive peak value.
- **Pk−** displays the negative peak value.
- **Pk±/2** adds the positive and negative peak values and divides the sum by 2.
- **Pk±Max** compares the positive and negative peaks and displays the greater value (polarity is not indicated).
- **Pk+ Hold** displays and holds the positive peak value until the measurement is reset. To reset, press (MEAS RESET), or select a different detector, or re-select the same detector.
- **Pk− Hold** displays and holds the negative peak value until the measurement is reset. To reset, press (MEAS RESET), select a different detector, or re-select the same detector.
- **Pk±/2 Hold** divides the sum of the positive and negative peak values by 2, and displays the value until the measurement is reset. To reset, press (MEAS RESET), select a different detector, or re-select the same detector.
- **Pk±Mx Hold** compares the positive and negative peaks and displays the greater value until the measurement is reset. To reset, press (MEAS RESET), select a different detector, or re-select the same detector.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3

Ext TX key

This field controls a switch at the MIC/ACC connector. Its intended use is to "key" an external transmitter.

See Also

Figure 5-1

Filter 1 and Filter 2

Filters 1 and 2 select a variety of standard and optional filters. Selecting either field lists the choices available for that field.

See Also

AF ANALYZER screen description

FM Deviation

This is the default measurement for this field. The type of measurement listed here is dependent on the `AF Anl In` settings.

See Also

`AF Anl In` field description
"Displaying Measurements" in Chapter 3.

IF Filter

This field selects the desired IF Filter bandwidth for modulated signals being analyzed.

Input Port

This field selects the RF IN/OUT or ANT IN port for making RF measurements. The RF IN/OUT port must be used for making `TX Power` measurements on this screen.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

If the RF power at the RF IN/OUT port exceeds allowable limits, a loud warning signal sounds and a message appears at the top of the screen. If this occurs, disconnect the RF power, press (MEAS RESET), and allow the Test Set to cool off for ≈2 minutes before making any other measurements on this port.

The ANT IN (Antenna Input) connector provides a highly-sensitive input for very low level signals (such as "off the air" measurements). You cannot measure TX (RF) Power on this screen using the Antenna port. However, low-level RF power at the Antenna port can be measured using the optional Spectrum Analyzer.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage.

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press (MEAS RESET) or turn the Test Set off and on to reset it.

Tune Freq

RF Analyzer Tune Frequency sets the center frequency for the RF signal to be analyzed.

Operating Considerations

If the `Tune Mode` is set to `Auto`, the frequency is set by the Test Set by finding the strongest RF signal above −36 dBm within the full bandwidth of the RF Analyzer.

If the `Tune Mode` is set to `Manual`, the operator must enter the desired frequency.

See Also

`Tune Mode` field description

Tune Mode

This field selects Automatic or Manual tuning of the RF Analyzer.

`Auto` tuning causes the RF Analyzer to find the signal with the greatest amplitude >-36dBm, and set the Tune Frequency for that signal.

`Manual` tuning requires the operator to set the Tune Frequency for the RF signal to be analyzed.

Operating Considerations

Changing the `Tune Mode` also changes the RF frequency display. Automatic tuning enables the `TX Frequency` measurement. Manual tuning enables the `TX Freq Error` measurement.

After auto-tuning to the desired signal, select `Manual` tuning to prevent the `Tune Freq` from changing when the signal is no longer applied.

TX Freq Error/TX Frequency

This measurement area is used to display Transmitter Frequency Error or Transmitter Frequency.

See Also

`Tune Mode` field description

TX Power

Transmitter Power measures RF power at the RF IN/OUT port.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Only the RF IN/OUT port can be used for measuring TX Power on this screen. When the `Input Port` is set to `Ant`, four dashes (- - - -) appear in place of digits for this measurement.

Use the Spectrum Analyzer to measure low-level RF power (≤200 mW) at the Antenna port.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press MEAS RESET or turn the Test Set off and on to reset it.

See Also

`Input Port` field description (Operating Considerations)
`TX Pwr Meas` and `TX Pwr Zero` field descriptions for the **TX TEST** and **RF ANALYZER** screens.

TX Pwr Meas (HP 8920B Only)

The Transmitter Power Measurement field specifies how transmitter power measurements are made:

- **Peak** can be used to measure AM, FM, and un-modulated (CW) signals.
- **Sample** can be used to measure FM or CW signals with increased measurement speed. This method can only be used with signals having no amplitude modulation component.

Operating Considerations If you change this field, zero the power measurement (using the `TX Pwr Zero` field) before measuring power.

TX Pwr Zero

The **Transmitter Power Zero** function establishes a 0.0000 W reference for measuring RF power at the RF IN/OUT port.

Caution

RF power must not be applied while zeroing.

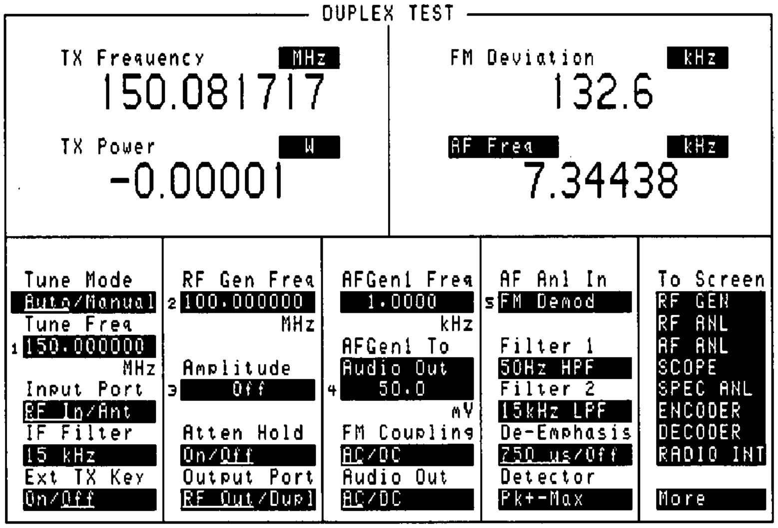
Operating Considerations

When power is applied to the RF IN/OUT connector, the temperature of the internal circuitry increases. This can cause changes in the `TX Power` measurement when low power levels are measured immediately following high-power measurements.

When alternately making high and low power measurements, always zero the power meter immediately before making the low-power measurements; this provides the best measurement accuracy.

Duplex Test

DUPLEX TEST



dxscrn.tif

Figure 4-5. The DUPLEX Test Screen

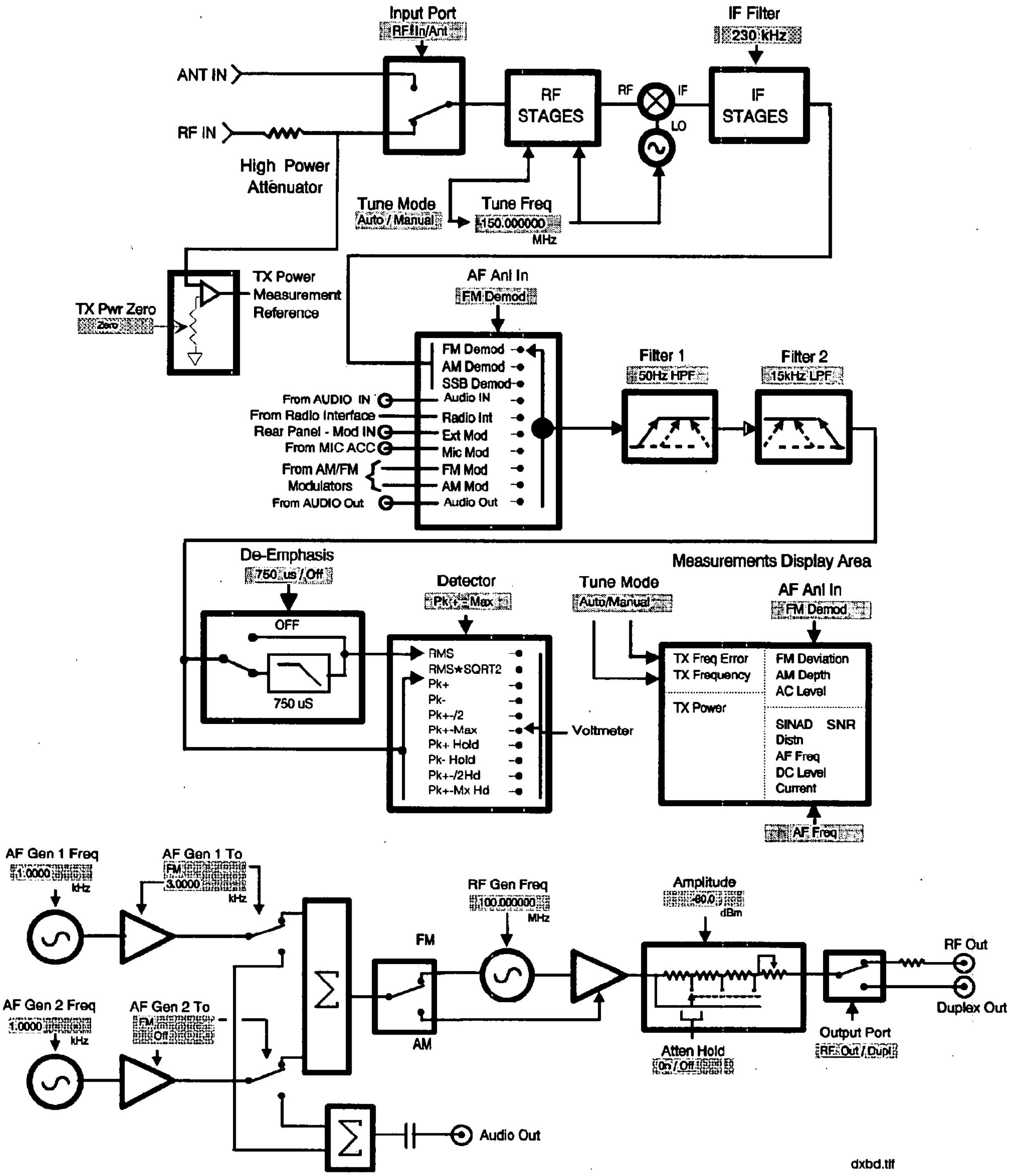


Figure 4-6. DUPLEX TEST Functional Block Diagram

AC Level

This is the default measurement for this field. The type of measurement shown is dependent on the `AF Anl In` settings.

See Also

`AF Anl In` field description
"Displaying Measurements" in Chapter 3

AF Anl In

Audio Frequency Analyzer Input selects the input for the analyzer. When selected, this field displays a list of choices.

Signals can be analyzed from three different types of inputs:

- The output of the AM, FM, or SSB demodulators.
- The AUDIO IN, RADIO INTERFACE, MODULATION INPUT, MIC/ACC, and AUDIO OUT connectors.
- The signal present at the AM or FM modulators for the RF Generator.

Operating Considerations

Changing this field causes the upper AF measurement to change.

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

`FM Deviation` field description
"Interaction Between Screens" in Chapter 3
"Displaying Measurements" in Chapter 3

`AF Freq` This is the default measurement for this field. Selecting this field displays the following measurement choices:

SINAD

Distortion

SNR (Signal to Noise Ratio)

AF Frequency

DC Level

Current - DC only

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

SNR Operation

- Selecting SNR turns off the other audio measurement.
- The RF Generator and AFGen1 must be set up to provide the radio's carrier. (AFGen1 is automatically turned on and off repeatedly during this measurement.)
- AFGen2 must be turned off.
- The radio's receiver's audio output must be connected to the AUDIO IN port (set the `AF Anl In` field to `Audio In`).

See Also

"Interaction Between Screens" in Chapter 3
"Displaying Measurements" in Chapter 3

AFGen1 Freq

Audio Frequency Generator 1 Frequency sets the frequency for the first audio frequency sinewave generator.

AFGen1 To

Audio Frequency Generator 1 To is used to set two values:

- The upper field determines whether the AF signal modulates the RF Generator, or is output through the AUDIO OUT connector.
- The lower field sets the amplitude (including `Off`). The AUDIO OUT level is always in volts RMS.

Operating Considerations

This is a priority control field.. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3

Amplitude

RF Generator Amplitude adjusts the amplitude of the RF Generator.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

If a microphone is connected, and the Amplitude is `Off`, keying the microphone causes the Amplitude to turn on to its previous level until the microphone is no longer keyed.

See Also

`Atten Hold` field description
"Interaction Between Screens" in Chapter 3
"MIC/ACC" in Chapter 5

Atten Hold

Attenuator Hold prevents the fixed RF output attenuators from switching in and out, eliminating the loss of the output signal as the level is changed. This function is helpful when making squelch measurements.

Operating Considerations

When this function is set to `On`, the RF output level is restricted to a range of 15 dB around the present `Amplitude` setting. Attempting to set an amplitude outside the allowed range results in an error message and beep (if the Beeper is on). RF output level accuracy is greatly degraded outside the allowed range.

Audio Out

Audio Out Coupling selects AC or DC coupling to the AUDIO OUT connector.

De-Emphasis

This setting selects or bypasses the 750 μs de-emphasis networks in the audio analyzer and internal speaker circuitry.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3

Detector

This setting selects the type of detector used when measuring and displaying AF signal levels.

Detector Types

- **RMS** displays the RMS value of signals.
- **RMS*SQRT2** displays the RMS value of a signal multiplied by $\sqrt{2}$.
- **Pk+** displays the positive peak value.
- **Pk−** displays the negative peak value.
- **Pk±/2** adds the positive and negative peak values, and divides the sum by 2.
- **Pk±Max** compares the positive and negative peaks and displays the greater value (polarity is not indicated).
- **Pk+ Hold** displays and holds the positive peak value until the measurement is reset. To reset, press [MEAS RESET], select a different detector, or re-select the same detector.
- **Pk− Hold** displays and holds the negative peak value until the measurement is reset. To reset, press [MEAS RESET], select a different detector, or re-select the same detector.
- **Pk±/2 Hold** divides the sum of the positive and negative peak values by 2, and displays the value until the measurement is reset. To reset, press [MEAS RESET], select a different detector, or re-select the same detector.
- **Pk±Mx Hold** compares the positive and negative peaks and displays the greater value until the measurement is reset. To reset, press [MEAS RESET], select a different detector, or re-select the same detector.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3

Ext TX key

This field controls a switch at the MIC/ACC connector. Its intended use is to "key" an external transmitter.

See Also

"MIC/ACC" in Chapter 5

FM Coupling

This field selects AC or DC coupling between the RF Generator's frequency modulator and the rear-panel MODULATION INPUT connector. This field also alters the FM modulator to allow DCFM from internal and external modulation sources.

FM Deviation

This is the default measurement for this field. The type of measurement listed here is dependent on the `AF Anl In` settings.

See Also

`AF Anl In` field description
"Displaying Measurements" in Chapter 3

IF Filter

This field selects the desired IF Filter bandwidth for modulated signals being analyzed.

Input Port

This field selects the RF IN/OUT or ANT IN connector for making RF measurements. The RF IN/OUT port must be used for making `TX Power` measurements on this screen.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

If the RF power at the RF IN/OUT port exceeds allowable limits, a loud warning signal sounds and a message appears at the top of the screen. If this occurs, disconnect the RF power, press MEAS RESET, and allow the Test Set to cool off for ≈2 minutes before making any other measurements on this port.

The ANT IN (Antenna Input) connector provides a highly-sensitive input for very low level signals (such as "off the air" measurements). You cannot measure TX (RF) Power on this screen using the Antenna port. However, low-level RF power at the Antenna port can be measured using the Spectrum Analyzer.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press MEAS RESET or turn the Test Set off and on to reset it.

Output Port

RF Generator Output Port selects the desired port.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Caution

Applying reverse RF power to the DUPLEX OUT connector can damage the instrument. (A message is displayed when an over-power conditions occurs.) Whenever possible, use the RF IN/OUT connector when testing transceivers to prevent damage from accidental transmitter keying.

If a reverse power condition triggers the internal protection circuit, remove the reverse power signal and press (MEAS RESET) or turn the Test Set off and on to reset it.

RF Gen Freq

RF Generator Frequency sets the generator's frequency.

Tune Freq

RF Analyzer Tune Frequency sets the center frequency for the RF signal to be analyzed.

Operating Considerations

If the `Tune Mode` field is set to `Auto`, the frequency is set by the instrument.

If the `Tune Mode` is set to `Manual`, the operator must enter the desired frequency.

See Also

`Tune Mode` field description

Tune Mode

This field selects Automatic or Manual tuning of the RF Analyzer.

`Auto` tuning causes the RF Analyzer to find the signal with the greatest amplitude above −36dBm, and set the Tune Frequency for that signal.

`Manual` tuning requires the operator to set the Tune Frequency for the RF signal to be analyzed.

Operating Considerations

Changing the `Tune Mode` also changes the RF frequency display. Automatic tuning enables the `TX Frequency` measurement. Manual tuning enables the `TX Freq Error` measurement.

After auto-tuning to the desired signal, select `Manual` tuning to prevent the `Tune Freq` from changing when the signal is no longer applied.

TX Freq Error/TX Frequency

This measurement displays Transmitter Frequency Error or absolute Transmitter Frequency, depending on the `Tune Mode` setting.

See Also

`Tune Mode` field description

TX Power

Transmitter Power measures RF power at the RF IN/OUT port.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Only the RF IN/OUT port can be used for measuring TX Power on this screen. When the `Input Port` is set to `Ant`, four dashes (- - - -) appear in place of digits for this measurement.

Use the Spectrum Analyzer to measure low-level RF power ($\leq$200 mW) at the Antenna port.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

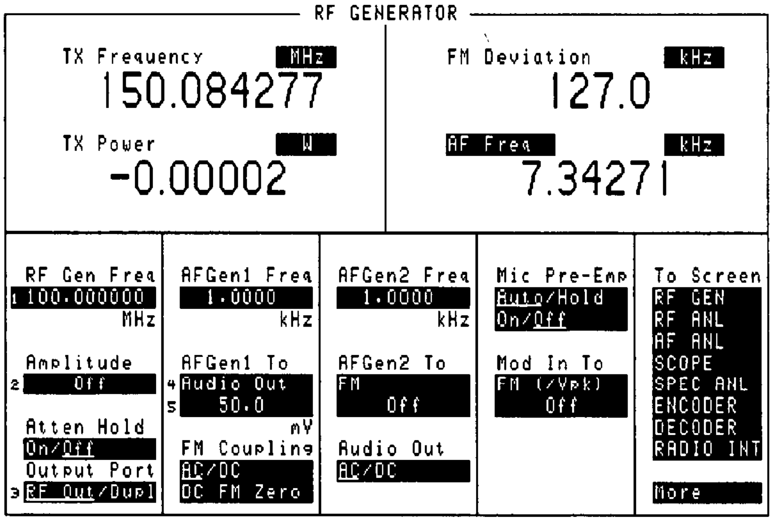
If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press [MEAS RESET] or turn the Test Set off and on to reset it.

See Also

`Input Port` field description (Operating Considerations)
`TX Pwr Meas` and `TX Pwr Zero` field descriptions for the **TX TEST** and **RF ANALYZER** screens.

RF Generator8

RF GENERATOR



rfgscrn.tif

Figure 4-7. The RF Generator Screen

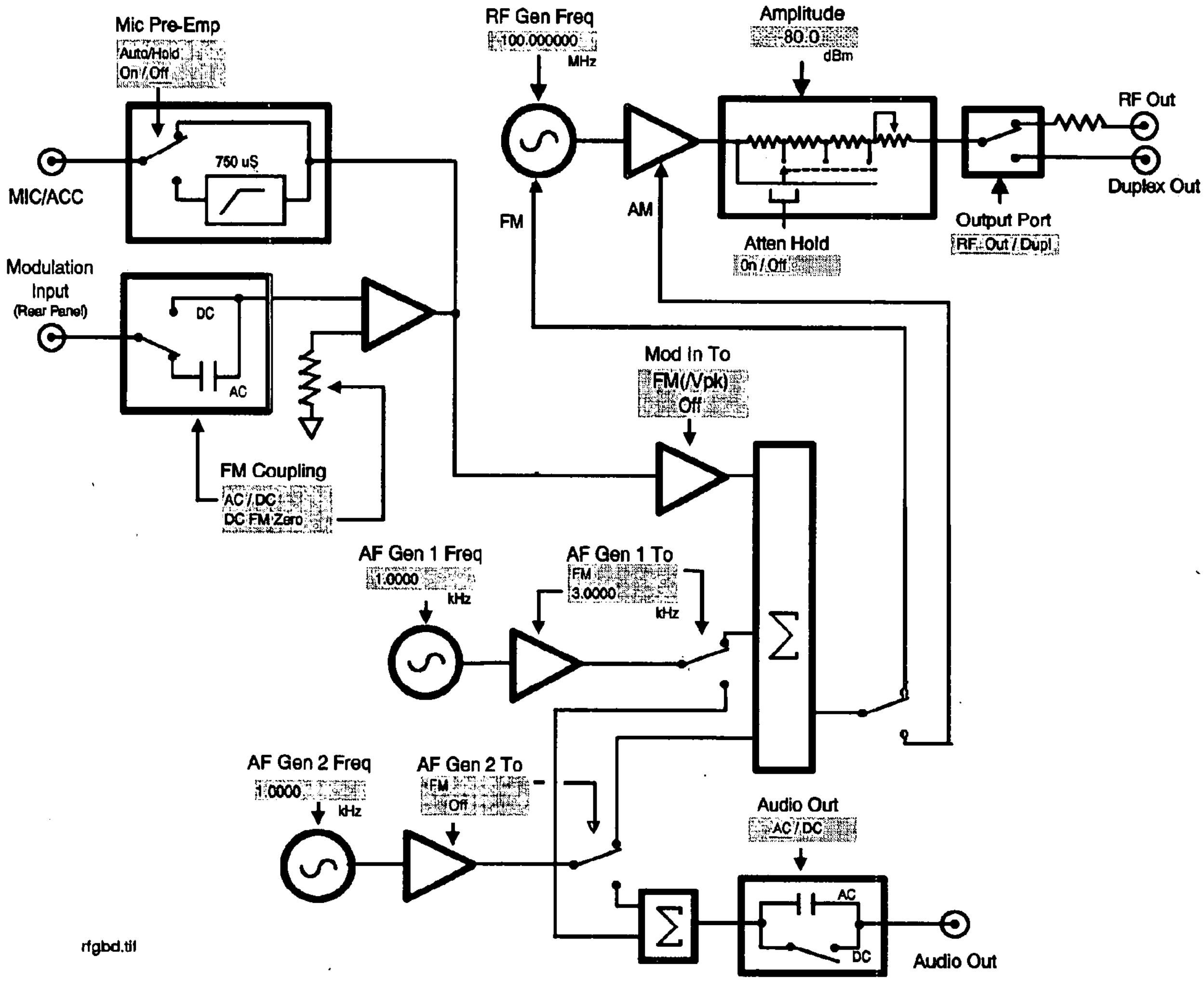


Figure 4-8. RF GENERATOR Functional Block Diagram

AC Level

This is the default measurement for this field. The type of measurement shown is dependent on what the `AF Anl In` field is set to in other screens.

See Also

`AF Anl In` field description for the **TX TEST**, **DUPLEX TEST**, or **AF ANALYZER** screen,
"Displaying Measurements" in Chapter 3

AFGen1 Freq

Audio Frequency Generator 1 Frequency sets the frequency for the first audio frequency sinewave generator.

AFGen2 Freq

Audio Frequency Generator 2 Frequency sets the frequency for the second audio frequency sinewave generator. It can also be used to set the Function Generator frequency when the signaling Encoder is used.

This field is also used to control the Send/Stop functions for some Encoder modes. For example, when sending a tone sequence, this field is used to Send and Stop the sequence. The field name changes to `AFGen2` when this type of operation is used.

This field is removed from this screen when NMT encoding or decoding is used. (NMT programs can only be run from the **NMT Decoder** screen.)

See Also

ENCODER screen signaling modes.

AFGen1 To

Audio Frequency Generator 1 To is used to set two values:

- The upper field determines whether the AF signal modulates the RF Generator, or is output through the AUDIO OUT connector.
- The lower field sets the amplitude (including `Off`). The AUDIO OUT level is always in volts RMS across a low-impedance output.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3

AFGen2 To

Audio Frequency Generator 2 To is used to set two values:

- The upper field determines whether the AF signal modulates the RF Generator, or is output through the AUDIO OUT connector.
- The lower field sets the amplitude (including `Off`). The AUDIO OUT level is always in volts RMS for standard *sinewave* operation across a low-impedance output.

If the Signaling option is installed, the sinewave can be set in units of RMS or Peak. This is done in the `Sine Units` field for the Function Generator. When non-sinewave waveforms are used, or if the upper field is set to AM or FM, the level is always expressed as a peak value.

See Also

ENCODER, Function Generator screen description.

Amplitude

RF Generator Amplitude adjusts the amplitude of the RF Generator.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

If a microphone is connected, and the Amplitude is `Off`, keying the microphone causes the Amplitude to turn on to its previous level until the microphone is no longer keyed.

See Also

"Interaction Between Screens" in Chapter 3

Atten Hold

Attenuator Hold prevents the fixed RF output attenuators from switching in and out, eliminating the loss of the output signal as the level is changed. This function is helpful when making squelch measurements.

Operating Considerations

When this function is set to `On`, the RF output level is restricted to a range above and below the present `Amplitude` setting. Attempting to set an amplitude outside the allowed range results in an error message and beep (if the Beeper is on). RF output level accuracy is greatly degraded outside the allowed range.

Audio Out

Audio Out Coupling selects AC or DC coupling to the AUDIO OUT connector.

FM Coupling

These fields provide two functions:

- The upper field specifies AC or DC coupling between the MODULATION INPUT connector and the RF Generator's FM modulator. This field also alters the FM modulator to allow DCFM from internal and external modulation sources.
- Selecting the lower field causes the instrument to offset any DC bias that may exist when DC coupling is selected.

Mic Pre-Emp

Microphone Pre-Emphasis determines whether the modulating signal from the MIC/ACC connector goes through or bypasses the 750 μs pre-emphasis network. Two fields are used:

- The upper field is used to specify whether you want the instrument to automatically turn pre-emphasis On during FM operation and off for other modulations (`Auto`), or leave the pre-emphasis switching to the user's operation (`Hold`).
- The lower field tells you whether pre-emphasis is On or Off (when `Auto` operation is selected), or allows you to manually turn pre-emphasis On or Off (if `Hold` is selected).

Mod In To

MODULATION INPUT To defines how an external modulation source is used with the RF Generator. Two fields are used:

- The upper field determines whether the rear-panel MODULATION INPUT signal is set for AM or FM modulation of the RF GENERATOR.
- The lower field sets the modulation sensitivity. For instance, if `FM (/Vpk)` is selected for the upper field, and you set the lower field to `1.0000 kHz`, the RF GENERATOR will deviate 1 kHz for every 1 Volt peak at the MODULATION INPUT connector.

In addition, the peak deviation produced by MIC signals will be approximately 1 kHz.

Output Port

RF Generator Output Port selects the desired port.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Caution

Applying reverse RF power to the DUPLEX OUT connector can damage the instrument. (A message is displayed when an over-power conditions occurs.) Whenever possible, use the RF IN/OUT connector when testing transceivers to prevent damage from accidental transmitter keying.

If a reverse power condition triggers the internal protection circuit, remove the reverse power signal and press [MEAS RESET] or turn the Test Set off and on to reset it.

RF Gen Freq

RF Generator Frequency sets the generator's frequency.

SINAD

This is the default measurement for this field. Selecting this field displays the following measurement choices:

SINAD
Distortion
SNR (Signal to Noise Ratio)
AF Frequency
DC Level
Current - DC only (requires Current Measurement option)

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

SNR Operation

- Selecting SNR turns off the other audio measurement.
- The RF Generator and AFGen1 must be set up to provide the radio's carrier. (AFGen1 is automatically turned on and off repeatedly during this measurement.)
- AFGen2 must be turned off.
- The radio's receiver's audio output must be connected to the AUDIO IN port (set the `AF Anl In` field to `Audio In`).

See Also

"Interaction Between Screens" in Chapter 3
"Displaying Measurements" in Chapter 3

TX Freq Error/TX Frequency

This measurement displays Transmitter Frequency Error or absolute Transmitter Frequency.

See Also

`Tune Mode` field description for the **DUPLEX TEST**, **TX TEST**, or **AF ANALYZER** screens.
"Displaying Measurements" in Chapter 3

TX Power

Transmitter Power measures RF power at the RF IN/OUT port.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Only the RF IN/OUT port can be used for measuring TX Power on this screen. When the `Input Port`[1] is set to `Ant`, four dashes (- - - -) appear in place of digits for this measurement.

Use the optional Spectrum Analyzer to measure low-level RF power (≤200 mW) at the Antenna port.

[1]The `Input Port` field is accessed on the **TX TEST**, **DUPLEX TEST**, and **RF ANALYZER** screens.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press [MEAS RESET] or turn the Test Set off and on to reset it.

See Also

`TX Pwr Meas` and `TX Pwr Zero` field descriptions for the **TX TEST** or **RF ANALYZER** screen.

RF Analyzer

RF ANALYZER

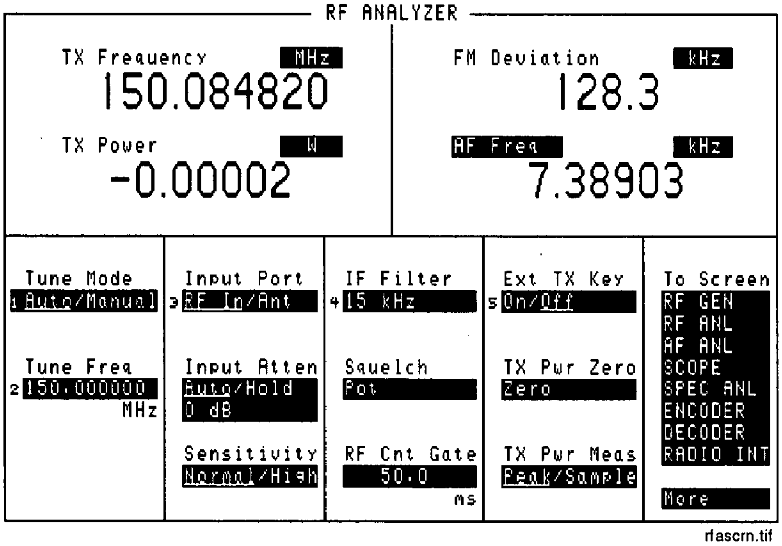


Figure 4-9. The RF Analyzer Screen

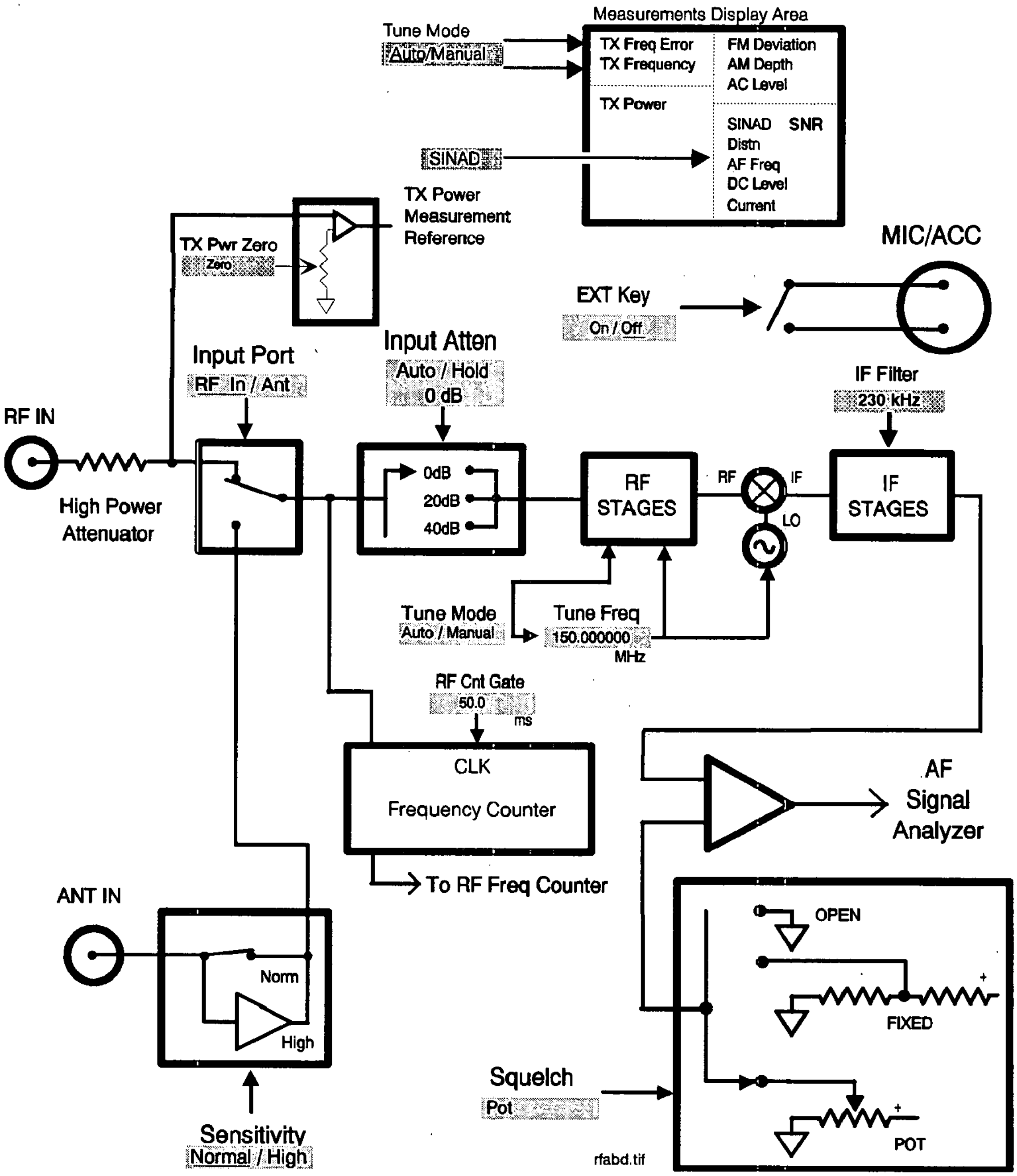


Figure 4-10. RF ANALYZER Functional Block Diagram

AC Level

This is the default measurement for this field. The type of measurement listed here is dependent on the `AF Anl In` settings.

See Also

`AF Anl In` field description in the **TX TEST**, **DUPLEX TEST**, or **AF ANALYZER** screens.
"Displaying Measurements" in Chapter 3

Ext TX key

This field controls a switch at the MIC/ACC connector. Its intended use is to "key" an external transmitter.

See Also

"MIC/ACC" in Chapter 5

IF Filter

This field selects the desired IF Filter bandwidth for modulated signals being analyzed.

Input Atten

Input Attenuation sets the amount of input attenuation for the RF IN/OUT and ANT IN connectors. This function controls two settings:

- The upper field determines if you want the instrument to set the attenuation automatically (`Auto`), or if you want to set the value manually (`Hold`).
- The lower field displays the present attenuation value, and is used to set the desired attenuation level when the upper area is set to `Hold`.

Note

Oscilloscope and Decoder Interference: After a signal is input, the RF autoranging function (`Auto`) takes a small amount of time to determine the required input attenuator setting. If your transmitter begins sending encoded information the instant it transmits, the initial encoded information may not be decoded during the autoranging process. The same situation can arise when trying to display the first part of the demodulated signal on the Oscilloscope.

When decoding a signaling sequence using the Decoder, or when trying to capture the initial modulation waveform of a signal on the Oscilloscope, set the upper field to `Hold` and set the lower field to an appropriate level for the signal being decoded (start with 40 dB).

Input Port

This field selects the RF IN/OUT or ANT IN port for making RF measurements. The RF IN/OUT port must be used for making `TX Power` measurements on this screen.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

If the RF power at the RF IN/OUT port exceeds allowable limits, a loud warning signal sounds and a message appears at the top of the screen. If this occurs, disconnect the RF power, press (MEAS RESET), and allow the Test Set to cool off for approximately 2 minutes before making any other measurements on this port.

The ANT IN (Antenna Input) connector provides a highly-sensitive input for very low level signals (such as "off the air" measurements). You cannot measure TX (RF) Power on this screen using the Antenna port. However, low-level RF power at the Antenna port can be measured using the optional Spectrum Analyzer.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press (MEAS RESET) or turn the Test Set off and on to reset it.

RF Cnt Gate

RF Counter Gate specifies how long the RF counter samples the signal before displaying the frequency. Specifying a shorter gate time may enable you to see frequency fluctuations that might not be seen using a longer gate time.

Sensitivity

RF Analyzer Sensitivity adds about 6 dB of sensitivity for the ANT IN port when `High` is selected.

Operating Considerations

Selecting `High` sensitivity may cause Spectrum Analyzer measurements to be uncalibrated when the ANT IN port is used (a message appears when this occurs).

High-level AM measurements may be distorted when `High` sensitivity is used with the ANT IN port.

Squelch

This setting determines the squelch operation when demodulating FM, AM or SSB signals. Three settings are available:

- **Pot** uses the front-panel SQUELCH knob for squelch level adjustment.
- **Open** disables squelch operation.
- **Fixed** sets the squelch to a fixed level, disabling the front-panel SQUELCH knob control.

Operating Considerations

Most measurement processes on this screen are not displayed if the incoming signal falls below the squelch level (with the exception of `TX Power`). The measurements are replaced by four dashes (- - - -) to indicate they have been 'squelched'.

The Decoder and Oscilloscope measurements are also disabled when the signal has been squelched.

Spectrum Analyzer measurements are not affected by the squelch setting (although squelch still affects whether the demodulated signal can be heard while viewing the RF signal).

Trying to read a squelched measurement using HP-IB will cause your program to halt until the squelch is either turned down, a measurement is made, or until a program time-out aborts the measurement process.

`SINAD` This is the default measurement for this field. Selecting this field displays the following measurement choices:

SINAD

Distortion

SNR (Signal to Noise Ratio)

AF Frequency

DC Level

Current - DC only (requires Current Measurement option)

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

SNR Operation

- Selecting SNR turns off the other audio measurement.
- The RF Generator and AFGen1 must be set up to provide the radio's carrier. (AFGen1 is automatically turned on and off repeatedly during this measurement.)
- AFGen2 must be turned off.
- The radio's receiver's audio output must be connected to the AUDIO IN port (set the `AF Anl In` field to `Audio In`).

See Also

"Interaction Between Screens" in Chapter 3
"Displaying Measurements" in Chapter 3

Tune Freq

RF Analyzer Tune Frequency sets the center frequency for the RF signal to be analyzed.

See Also

`Tune Mode` field description

Tune Mode

This field selects Automatic or Manual tuning of the RF Analyzer.

`Auto` tuning causes the RF Analyzer to find the signal with the greatest amplitude >-36 dBm, and set the Tune Frequency for that signal.

`Manual` tuning requires the operator to set the Tune Frequency for the RF signal to be analyzed.

Operating Considerations

Changing the `Tune Mode` also changes the RF frequency display. Automatic tuning enables the `TX Frequency` measurement. Manual tuning enables the `TX Freq Error` measurement.

After auto-tuning to the desired signal, select `Manual` tuning to prevent the `Tune Freq` from changing when the signal is no longer applied.

TX Freq Error/TX Frequency

This measurement area is used to display Transmitter Frequency Error or Transmitter Frequency.

See Also

`Tune Mode` field description

TX Power

Transmitter Power measures RF power at the RF IN/OUT port.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Only the RF IN/OUT port can be used for measuring TX Power on this screen. When the `Input Port` is set to `Ant`, four dashes (- - - -) appear in place of digits for this measurement.

Use the optional Spectrum Analyzer to measure low-level RF power ($\leq$200 mW) at the Antenna port.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press (MEAS RESET) or turn the Test Set off and on to reset it.

See Also

`Input Port` field description (Operating Considerations)
`TX Pwr Meas` and `TX Pwr Zero` field descriptions for the **TX TEST** and **RF ANALYZER** screens.

TX Pwr Meas (HP 8920B Only)

The Transmitter Power Measurement field specifies how transmitter power measurements are made:

- **Peak** can be used to measure AM, FM, and un-modulated (CW) signals.
- **Sample** can be used to measure FM or CW signals with increased measurement speed. This method can only be used with signals having no amplitude modulation component.

Operating Considerations If you change this field, zero the power measurement (using the `TX Pwr Zero` field) before measuring power.

TX Pwr Zero

The **Transmitter Power Zero** function establishes a 0.0000 W reference for measuring RF power at the RF IN/OUT port.

Caution

RF power must not be applied while zeroing.

Operating Considerations

When power is applied to the RF IN/OUT connector, the temperature of the internal circuitry increases. This can cause changes in the `TX Power` measurement when low power levels are measured immediately following high power measurements.

When alternately making high and low power measurements, always zero the power meter immediately before making the low power measurements to provide the best measurement accuracy.

AF Analyzer

AF ANALYZER

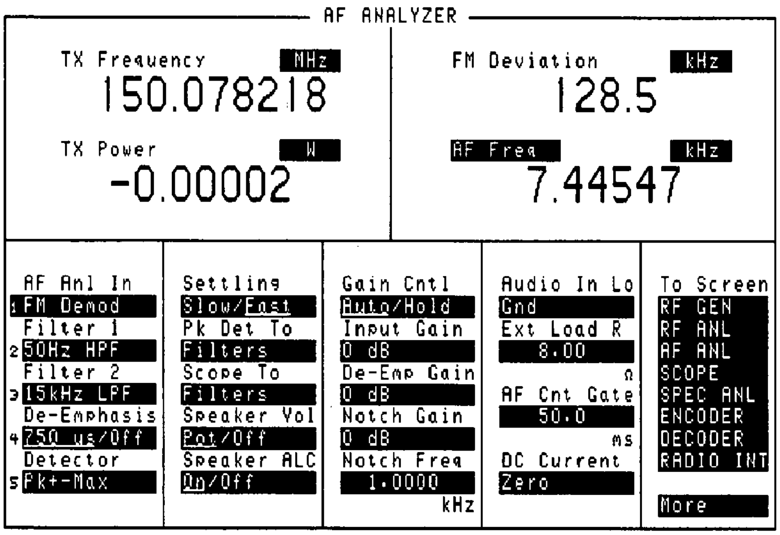


Figure 4-11. The AF Analyzer Screen

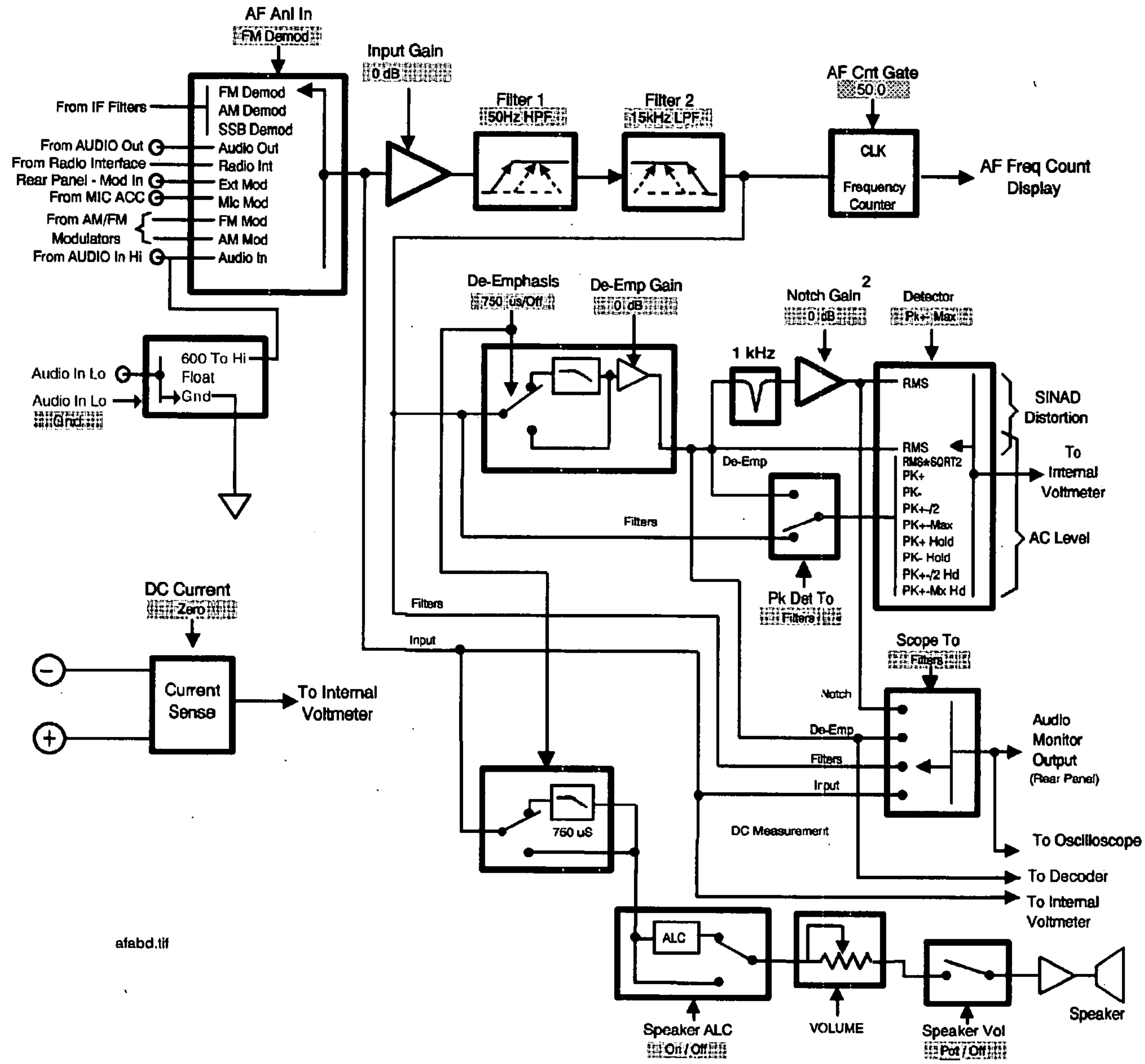


Figure 4-12. AF ANALYZER Functional Block Diagram[1]

[1]The `Settling`, `Gain Cntl`, and `Ext Load R` fields are not shown.
[2]Variable Frequency Notch if purchased.

AC Level

This is the default measurement for this field. The type of measurement listed here is dependent on the `AF Anl In` settings. Changing the unit-of-measure to `W` provides AF Power measurements.

See Also

`AF Anl In` field description
`Ext Load R` field description
"Displaying Measurements" in Chapter 3

AF Anl In

Audio Frequency Analyzer Input selects the input for the analyzer. When selected, this field displays a list of choices.

Signals can be analyzed from three different types of inputs:

- The output of the AM, FM, or SSB demodulators.
- The AUDIO IN, RADIO INTERFACE, MODULATION INPUT, MIC/ACC, and AUDIO OUT connectors.
- The signal present at the AM or FM modulators for the RF Generator.

Operating Considerations

Changing this field causes the upper AF measurement to change to display the appropriate measurement type.

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3
"Displaying Measurements" in Chapter 3

AF Cnt Gate

Audio Frequency Counter Gate specifies how long the AF counter samples the signal before displaying the frequency. Specifying a shorter gate time may enable you to see frequency fluctuations that might not be seen using a longer gate time.

Audio In Lo

AUDIO IN LO sets the AUDIO IN LO connector's state.

- `Gnd` causes the center pin of the connector to be connected directly to chassis ground.
- `Float` isolates the center pin of the connector from ground, providing a floating input to the AF Analyzer.
- `600 To Hi` establishes a 600Ω impedance between the center pins of the AUDIO IN LO and AUDIO IN HI connectors. Also, the `Ext Load R` field is removed, since the load is now fixed to 600Ω.

DC Current

DC Current Measurement Zero removes any measurement offset present before making a DC Current measurement (requires instrument option 003). The measurement is zeroed by positioning the cursor in front of `Zero`, and pressing (ENTER) or the Cursor Control knob.

Note

The current source must be disconnected before zeroing for accurate operation.

See Also

"SINAD, Distortion, SNR, AF Frequency, DC Level, DC Current" in Chapter 3
"Displaying Measurements" in Chapter 3
Chapter 5

De-Emp Gain

De-Emphasis Gain displays and selects the desired AF analyzer de-emphasis amplifier gain.

See Also

`Gain Cntl` field description

De-Emphasis

This setting selects or bypasses the 750 μs de-emphasis networks in the audio analyzer and speaker circuitry.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3

Detector

This setting selects the type of detector used when measuring and displaying AF signal levels.

Detector Types

- **RMS** displays the RMS value of signals.
- **RMS*SQRT2** displays the RMS value of a signal multiplied by $\sqrt{2}$.
- **Pk+** displays the positive peak value.
- **Pk−** displays the negative peak value.
- **Pk±/2** adds the positive and negative peak values, and divides the sum by 2.
- **Pk±Max** compares the positive and negative peaks and displays the greater value (polarity is not indicated).
- **Pk+ Hold** displays and holds the positive peak value until the measurement is reset. To reset, press (MEAS RESET), select a different detector, or re-select the same detector.
- **Pk− Hold** displays and holds the negative peak value until the measurement is reset. To reset, press (MEAS RESET), select a different detector, or re-select the same detector.
- **Pk±/2 Hold** divides the sum of the positive and negative peak values by 2, and displays the value until the measurement is reset. To reset, press (MEAS RESET), select a different detector, or re-select the same detector.
- **Pk±Mx Hold** compares the positive and negative peaks and displays the greater value until the measurement is reset. To reset, press (MEAS RESET), select a different detector, or re-select the same detector.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3

Ext Load R

External Load Resistance is used to calculate and display AF power. Power is calculated using the voltage measured at the AUDIO IN connections and the resistance value you enter into this field.

Operating Considerations

This field is not displayed when the `Audio In Lo` field is set to `600 To Hi`; the load resistance is internally fixed to 600Ω.

See Also

`AC Level` field description
`Audio In Lo` field description

Filter 1 and Filter 2

Filters 1 and 2 select a variety of standard and optional filters. Selecting either field lists the choices available for that field.

Gain Cntl

AF Analyzer Gain Control specifies whether the AF Analyzer gain settings are controlled automatically by AF autoranging (`Auto`), or by manual control (`Hold`).

The following settings are affected by AF autoranging:

- Input Gain
- De-Emp Gain
- Notch Gain

Operating Considerations

The normal mode of operation for this field is `Auto`, allowing the instrument to adjust the AF gain settings for optimum measurement accuracy.

This field can be set to `Hold` to disable the auto-ranging routines to increase measurement speed. However, this requires you to select the desired gain settings manually for each measurement.

Note

Decoder and Oscilloscope Interference: The AF autoranging function (`Auto`) takes a small amount of time to determine the attenuation settings for the AF Analyzer. If you are decoding an encoded signal, and your transmitter begins sending encoded information the instant it transmits, the initial encoded information may not be decoded during the autoranging process.

Use the `Auto` setting to establish the initial gain settings while the encoded signal is first being decoded, and then select `Hold` during the decoding process to retain the gain settings. The decoder should capture all encoded information the next time you transmit the signal.

Input Gain

This field displays and selects the desired AF Analyzer input amplifier gain. (Refer to the `Gain Cntl` field information.)

Notch Freq

This field is used to enter the center frequency for the Variable Frequency Notch Filter (optional on the HP 8920A and HP 8921A). It is typically used for Distortion and SINAD measurements at frequencies below or above the standard 1 kHz notch filter.

This field is not displayed if your Test Set does not have this feature.

Operating Considerations

When the `Notch Coupl` field on the **CONFIGURE** screen is set to `AFGen1`, this filter and the `AFGen1 Freq` field match their settings. A warning message is then displayed if you attempt to set the `AFGen1 Freq` value outside the 300 Hz to 10 kHz range of this filter. When the `Notch Coupl` field is set to `None`, this filter and `AFGen1 Freq` operate independently.

Notch Gain

This field displays and selects the desired AF Analyzer notch filter amplifier gain. This amplifier is only used for making SINAD and distortion measurements. (Refer to the `Gain Cntl` field information.)

Pk Det To

Peak Detector To selects the signal source for the peak detectors. This allows you to bypass certain sections of the AF analyzer's circuitry when making AC level measurements.

See Also

AF Analyzer function diagram at the start of this section.

Scope To

Oscilloscope To selects the signal source for the Oscilloscope. This allows you to bypass certain sections of the AF analyzer's circuitry when viewing and measuring a signal. It also allows you to select measurement paths that include additional gain stages, improving the oscilloscope's resolution when measuring low-level signals.

See Also

AF Analyzer function diagram at the start of this section.

Settling

This field selects the settling time for making AF measurements. Lower frequency signals require additional settling time (Slow). Higher frequency measurements require less settling time (Fast).

Operating Considerations

Use Slow for ≤200 Hz signals.
Use Fast for >200 Hz signals.

If the signal being measured is a composite of different frequencies above and below 200 Hz, you may have to select the appropriate filtering to analyze the desired signal component.

SINAD

This measurement field is used to select and display any one of the following measurements:

SINAD

Distortion

SNR (Signal to Noise Ratio)

AF Frequency

DC Level

Current - DC only (requires Current Measurement option)

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

SNR Operation

- Selecting SNR turns off the other audio measurement.
- The RF Generator and AFGen1 must be set up to provide the radio's carrier. (AFGen1 is automatically turned on and off repeatedly during this measurement.)
- AFGen2 must be turned off.
- The radio's receiver's audio output must be connected to the AUDIO IN port (set the AF Anl In field to Audio In).

See Also

"Interaction Between Screens" in Chapter 3

Speaker ALC

Speaker Automatic Level Control enables/disables the ALC function for the instrument's internal speaker. When `On` is selected, the speaker volume is independent of the signal level being measured. When `Off` is selected, the speaker volume is dependent on the signal level being measured.

Speaker Vol

Speaker Volume enables/disables the instrument's internal speaker. When `Pot` is selected, the VOLUME control knob operates normally. When `Off` is selected, the speaker is disconnected.

TX Freq Error/ TX Frequency

This measurement area is used to display Transmitter Frequency Error or Transmitter Frequency. The type of measurement displayed depends on the `Tune Mode` setting in the **TX TEST**, **DUPLEX TEST**, or **RF ANALYZER** screen.

See Also

"Displaying Measurements" in Chapter 3

TX Power

Transmitter Power measures RF power at the RF IN/OUT port.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Only the RF IN/OUT port can be used for measuring TX Power on this screen. When the `Input Port` is set to `Ant`, four dashes (- - - -) appear in place of digits for this measurement.

Use the optional Spectrum Analyzer to measure low-level RF power (≤200 mW) at the Antenna port.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press MEAS RESET or turn the Test Set off and on to reset it.

See Also

`Input Port` field description (Operating Considerations)
`TX Pwr Meas` and `TX Pwr Zero` field descriptions for the **TX TEST** or **RF ANALYZER** screens.

Oscilloscope

OSCILLOSCOPE

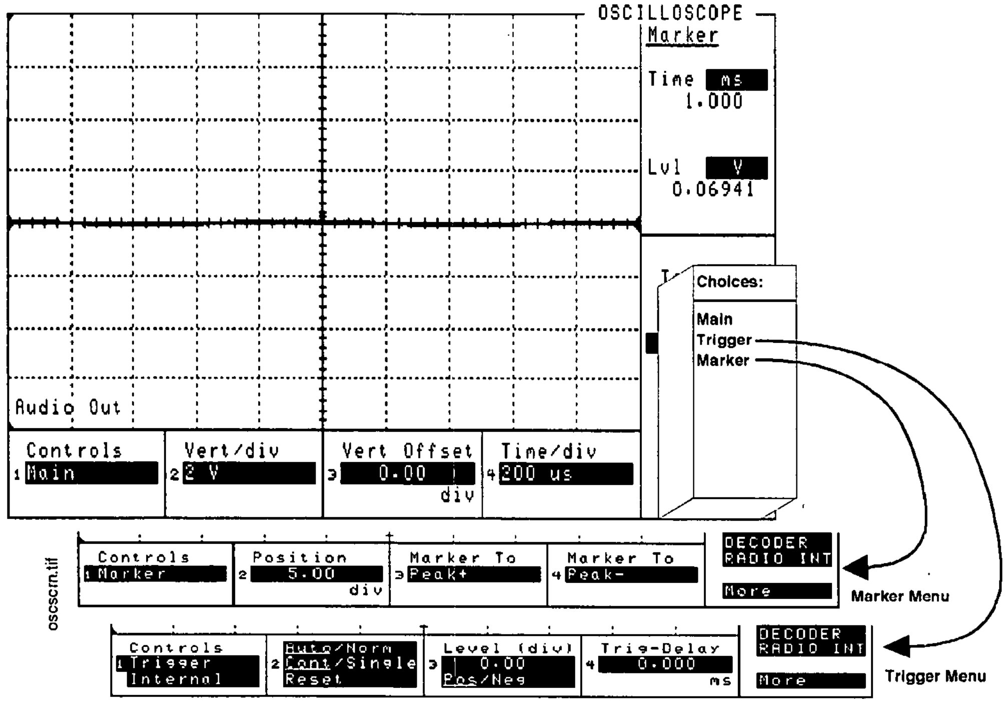


Figure 4-13. The Oscilloscope Screen and Menus

The **OSCILLOSCOPE** screen's controls are arranged by menu. The menus are accessed using the `Controls` field. The field descriptions are grouped by menu names.

Assigning global USER keys to the most-used functions on the menus allows you to access the functions without having to change menus during operation.

Selecting the Oscilloscope's Input

The oscilloscope's input is determined by the `AF Anl In` field setting in the **AF ANALYZER**, **TX TEST**, or **DUPLEX TEST** screens.

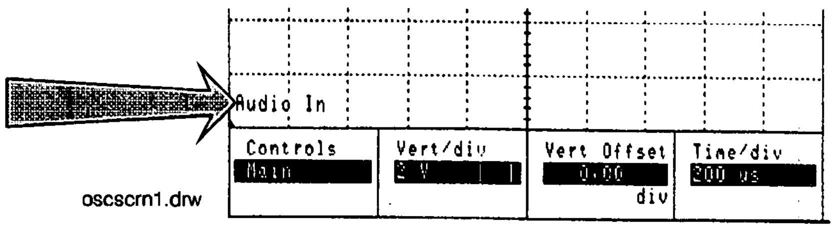


Figure 4-14. Oscilloscope Input Indicator

Using the `Scope To` Field

The `Scope To` field in the **AF ANALYZER** screen allows you to look at the signal at different stages in the AF Analyzer process. (Refer to the **AF ANALYZER** screen description to understand the different `Scope To` choices.)

Except for the `Input` setting, all the choices are capacitively coupled. If the signal to be measured is ≤ 1 Hz, use the `Input` setting to provide the needed DC coupling.

Marker Measurements

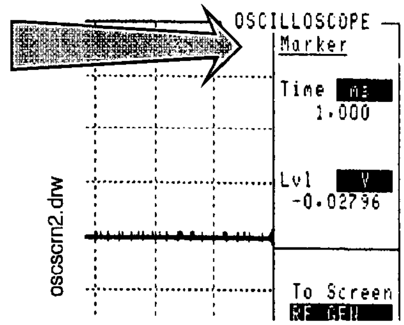


Figure 4-15.
Reading Measurement Results at the Oscilloscope's Markers

Marker: Lvl

This measurement field displays the signal level of the current marker position.

Operating Considerations

The unit-of-measure for this field is dependent on the source of the signal being measured. For instance; when measuring a signal from the AUDIO IN connector, the amplitude is measured in Volts. When looking at a signal from the FM Demodulator, the amplitude is given in units of kHz.

When the `Vert Offset` field is ≠0.00, the displayed marker level is referenced to the center line generated by the vertical offset feature, not the center line of the screen.

The REF SET function can be used with this measurement to display levels relative to a specific value. (See "Setting A Measurement Reference" in Chapter 3.)

Marker: Time

This measurement displays the time elapsed from the Trigger point to the current Marker position.

The REF SET function can be used with this measurement to display time relative to a specific position. (See "Setting A Measurement Reference" in Chapter 3.)

Oscilloscope Main Menu Fields

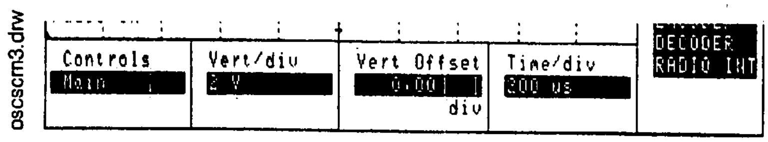


Figure 4-16. Oscilloscope Main Functions

Time/div

This field selects the horizontal sweep time per division.

Operating Considerations

The Time/div is selected from a list of choices.

Vert Offset

Vertical Offset moves the displayed signal above or below the oscilloscope's fixed centerline.

Operating Considerations

A centerline is displayed for the signal when an offset is used.

When the vertical offset is $\neq 0.00$, the marker level is referenced to the center line generated by the vertical offset feature, not the center line of the screen.

Vert/div

Vertical Sensitivity sets the vertical amplitude per division.

Operating Considerations

The value for this field is selected from a list of choices.

Depending on the AF Analyzer's `AF Anl In` setting, the units for this field may be in Volts, kHz, or Percent (AM). For example; if the `AF Anl In` field is set to `FM Demod`, the amplitude is displayed in kHz/div.

Oscilloscope Trigger Menu Fields

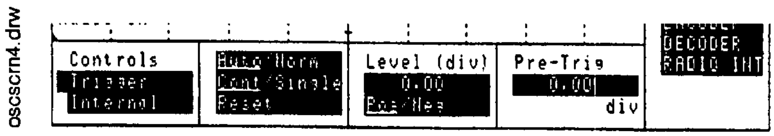


Figure 4-17. Oscilloscope Triggering

`Internal`

This field selects the trigger source.

- **Internal** uses the signal being displayed for triggering.
- **External** uses the rear-panel EXT SCOPE TRIGGER INPUT for triggering. This is a TTL level trigger ($\approx$ 2.5 V).
- **ENCODER** uses the optional signaling encoder for triggering. The Encoder must be sending its signal to trigger the oscilloscope.

`Auto/Norm`

This field specifies how the trigger level is set.

- **Auto** automatically triggers if a triggering signal is not detected within $\approx$50 ms of the last trigger.
- **Norm** requires a specific triggering signal before triggering.

Operating Considerations

Automatic triggering should be used for signals >20 Hz. Normal triggering should be used for signals $\leq$20 Hz.

Also, when measuring $\leq$1 Hz signals, you should set the `Scope To` field in the **AF ANALYZER** screen to `Input` to provide DC coupling to the oscilloscope's input.

`Cont/Single`

This field specifies whether the oscilloscope is continuously triggered (**Cont**), or if it is only triggered each time `Reset` is selected (**Single**).

Level (div)

This control is divided into two fields:

The upper field (`0.00`) sets the *Internal* trigger level as a function of vertical divisions. The trigger level is indicated by small pointers that appear on each side of the screen (only used for Internal triggering).

`Pos/Neg`
The lower field specifies whether triggering happens when the waveform being measured is positive-going (`Pos`), or negative-going (`Neg`).

Pre-Trig (Not HP 8920B)

This field specifies the number of horizontal divisions displayed previous to the trigger point. It allows you to see what the signal looked like before the trigger point.

When Pre-Triggering is used, the trigger point is indicated by small pointers that appear at the top and bottom of the screen.

Reset

(See `Cont/Single`).

Trig-Delay (HP 8920B Only)

The Trigger Delay is used to specify the time relationship between the trigger and displayed signal.

- **Positive** values delay the measurement trigger by a specific period. The delayed trigger point is the left edge of the screen.
- **Negative** values perform a pre-trigger function, displaying a section of the waveform before the trigger point. The trigger point is indicated by small pointers that appear at the top and bottom of the screen.

Operating Considerations

Negative Values
The maximum negative delay cannot exceed ten divisions of the current Time/Div setting. For example; if the `Time/Div` field is set to 1 ms, the maximum allowed negative delay is -10 ms. Larger negative numbers cause an `Excessive negative Trig-Delay will be trancated.` message.

Positive Values
For `Time/Div` settings of 50 μs/Div and smaller, the maximum delay is 400 ms.

For `Time/Div` settings of 100 μs/Div and larger, the maximum delay is 3200 ms.

Resolution
For delays of 400 ms and less, the resolution is 6.4 μs. For delays greater than 400 ms, the resolution is 51.2 μs. All entries are rounded to the nearest multiple of 6.4 μs or 51.2 μs (depending on the delay value).

Oscilloscope Marker Menu Fields

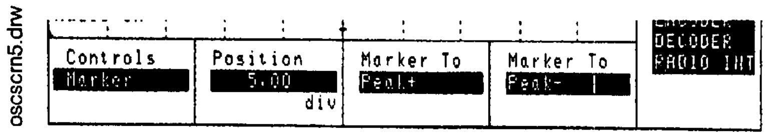


Figure 4-18. Setting Markers on the Oscilloscope

How The Oscilloscope Displays Measurements

The digital oscilloscope screen is 417 pixels wide. Several measurement samples may be taken for each pixel as a signal is processed (at 100 ns/sample). The number of samples depends on the sweep speed (`Time/div`), and can vary from several thousand to one sample per pixel. The level displayed for each pixel is the average level of the sample(s) taken for each pixel.

Marker To:

`Peak+`

Selecting this field causes the marker to move to the maximum value of the *average* level measured on the display.

`Peak-`

Selecting this field causes the marker to move to the minimum value of the *average* level measured on the display.

Because these functions look at the average value for each displayed pixel, the marker may not appear directly on the displayed peak of a noisy signal.

Position

This field indicates the number of scale divisions from the left side of the screen to the marker.

Use the DATA keys or Cursor Control knob to move the marker to any point on the displayed signal.

Spectrum Analyzer

SPECTRUM ANALYZER

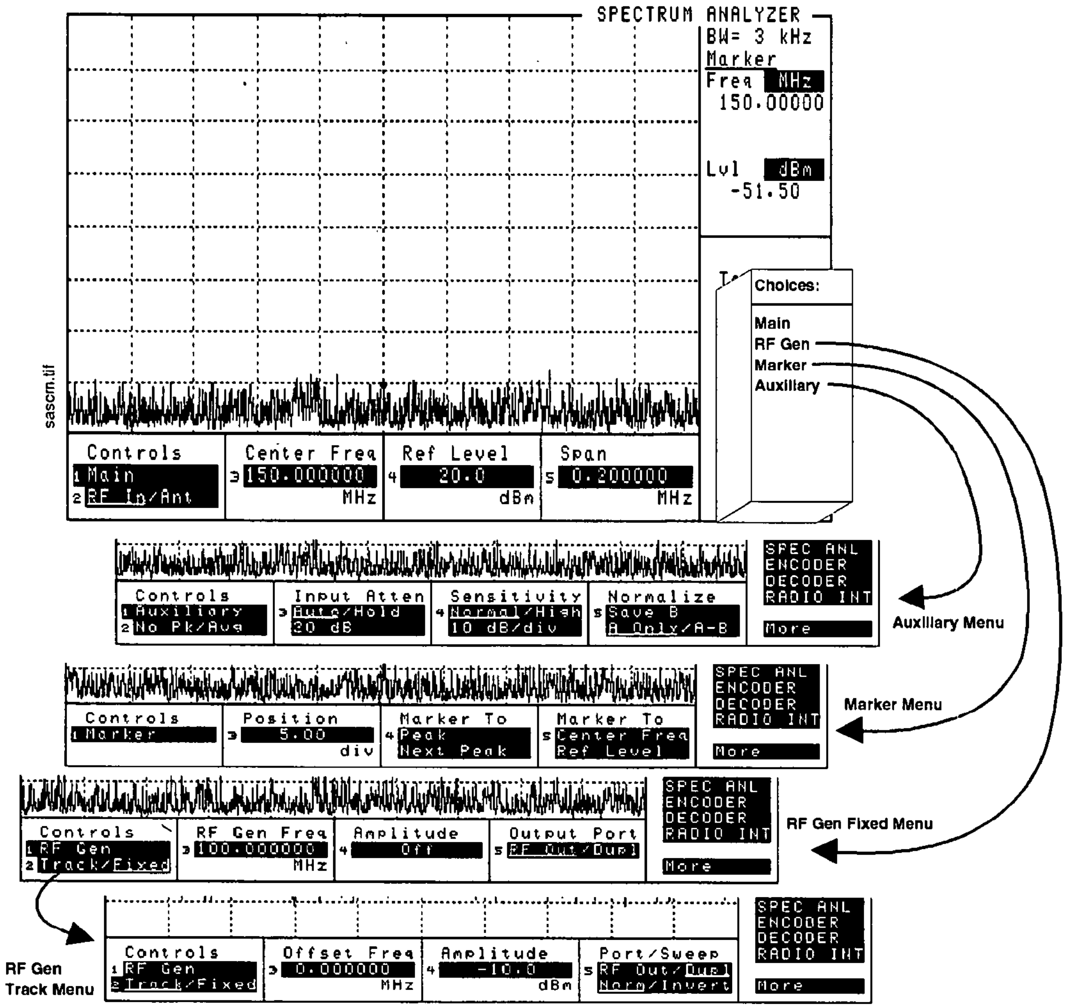


Figure 4-19. The Spectrum Analyzer Screen and Menus

Spectrum Analyzer Screen

The **SPECTRUM ANALYZER** screen's controls are arranged in four menus. The menus are accessed using the `Controls` field. The field descriptions are grouped by menu names.

Assigning global USER keys to the most-used functions on the menus allows you to access the functions without having to change menus during operation.

Automatic Calibration

During operation, the Spectrum Analyzer pauses for ≈2 seconds every 5 minutes to recalibrate itself. This does not affect the accuracy of displayed measurements, but does cause a brief interruption of the displayed information during the process.

Setting Resolution Bandwidth and Sweep Rate

The Resolution Bandwidth and Sweep Rate are determined by the Span setting, and cannot be set independently.

These settings are listed in the following table.

Relationship Between Span, Resolution Bandwidth, and Sweep Rate

Span	Resolution BW (kHz)	Sweep Rate
<50 kHz	0.3	28.6 kHz/second
<200 kHz	1.0	329.0 kHz/second
<1.5 MHz	3.0	3.0 MHz/second
<3 MHz	30.0	21.4 MHz/second
<18 MHz	30.0	36.3 MHz/second
<200 MHz	300.0	257.0 MHz/second
1 GHz	300.0	1.0 GHz/second

Marker Measurements

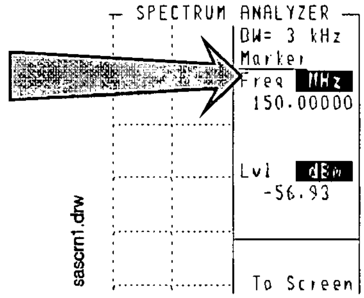


Figure 4-20. Reading Measurement Results at the Spectrum Analyzer's Markers

Marker: Freq

Marker Frequency displays the frequency at the marker's present position.

Marker: Lvl

Marker Level displays the amplitude at the marker's present position.

Operating Considerations

The Marker Level can be displayed in various units of measure.

See Also

"To Change the Measurement's Unit-of-Measure" in Chapter 3

Spectrum Analyzer Main Menu Fields

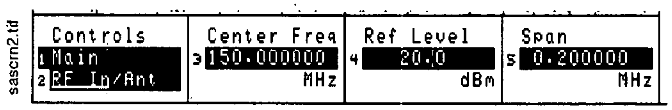


Figure 4-21. Spectrum Analyzer Main Functions

Center Freq

This field sets the tune frequency for the center of the screen.

Operating Considerations

This field also changes the frequency of the Tracking Generator and the RF Analyzer's center frequency when it is used.

Ref Level

Reference Level sets the amplitude reference level for the top line of the display. All signals displayed are referenced to this line.

Operating Considerations

The unit-of-measure for the reference can be changed as needed. For instance, 0 dBm, 0.224 V, 107.0 dBμV, and 0.00100 W can all be used to represent the same level.

`RF In/Ant`

This field selects the input port for the analyzer.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press (MEAS RESET) or turn the Test Set off and on to reset it.

Using the ANT IN port with the `Sensitivity` field is set to `High` can result in uncalibrated operation (a message appears on the screen when this happens). The purpose for the high sensitivity setting is to allow you to look and listen to very low level signals when absolute accuracy is not essential.

See Also

`Sensitivity` field description

Span

Sets the span of frequencies to be displayed on the screen.

Operating Considerations

When the Tracking Generator is used, the Span also defines the frequency sweep range.

Spans >1.5 MHz disable the AF Analyzer when the analyzer's **AF Anl In** field is set to FM Demod, AM Demod, or SSB Demod. This disables all the AF Analyzer's measurement and output functions. When the AF Analyzer's **AF Anl In** field is set to any of the other available inputs, such as Audio In or Ext Mod, the speaker and AUDIO MONITOR OUTPUT are not affected when the Spectrum Analyzer's Span is changed.

RF Generator Menu Fields: Fixed Operation

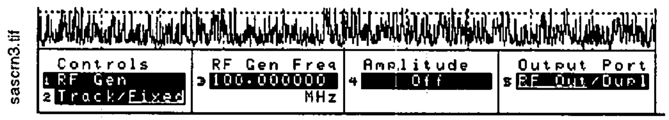


Figure 4-22. Using Spectrum Analyzer with the RF Generator

Amplitude

This field sets the amplitude of the RF Generator.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** screen overrides the Amplitude setting on this screen.

If a microphone is connected, and the Amplitude is `Off`, keying the microphone causes the Amplitude to turn on to its previous level until the microphone is no longer keyed.

See Also

"Interaction Between Screens" in Chapter 3

Output Port

This field selects the output port for the RF Generator.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Caution

Applying reverse RF power to the DUPLEX OUT connector can damage the instrument. (A message is displayed when an over-power conditions occurs.) Whenever possible, use the RF IN/OUT connector when testing transceivers to prevent damage from accidental transmitter keying.

If a reverse power condition triggers the internal protection circuit, remove the reverse power signal and press [MEAS RESET] or turn the Test Set off and on to reset it.

RF Gen Freq

This field sets the **RF Generator Frequency**.

RF Generator Menu Fields: Tracking Operation

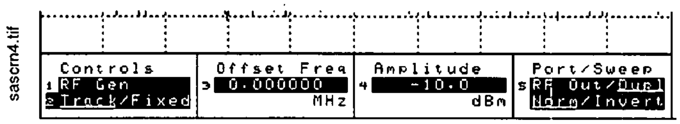


Figure 4-23. Using the Spectrum Analyzer with the Tracking Generator

The Tracking Generator performs a frequency sweep operation. The start and stop frequencies are determined by the Main Menu Span setting. This allows you to characterize devices (such as filter networks) over a wide span of frequencies.

An RF offset can be set between the Tracking Generator and the Center Frequency of the Spectrum Analyzer. This allows you to look at a signal that is related to a source whose frequency is outside of the displayed span.

Amplitude

This field sets the amplitude of the Tracking Generator.

Operating Considerations

This field operates independently of the RF Generator Amplitude settings in other screens.

If a microphone is connected, and the Amplitude is Off, keying the microphone causes the Amplitude to turn on to its previous level until the microphone is no longer keyed.

Offset Freq

RF Generator Frequency Offset sets the difference between the instantaneous frequencies of the Tracking Generator and the Center Frequency of the Spectrum Analyzer.

Operating Considerations

The offset can be a positive or negative value. When set to zero, the Tracking Generator produces a sweeping signal that matches the Spectrum Analyzer tune frequency.

Port/Sweep

This control performs two functions:

- The upper field specifies the output port of the Tracking Generator.
- The lower field specifies whether the Tracking Generator sweeps from low-to-high frequencies (Norm), or from high-to-low frequencies (Invert). (The Spectrum Analyzer always sweeps from low to high frequencies.) The swept frequency range is determined by the **Span** setting in the Spectrum Analyzer's Main Menu.

Operating Considerations

When using the Tracking Generator, if the output port is set RF Out, or the Main Menu **Input Port** is set to RF In, internal instrument coupling can occur. For the best isolation between the Tracking Generator and the Spectrum Analyzer, use Dupl for the output, and Ant for the input.

For measurements on high-power devices, such as amplifiers, use the RF IN/OUT port for the input.

Spectrum Analyzer Marker Menu Fields

sascm5.tif

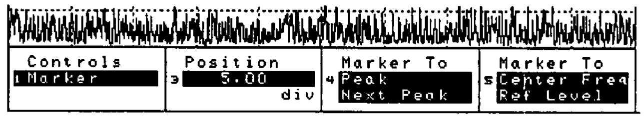


Figure 4-24. Setting Markers on the Spectrum Analyzer

Marker To:

- **Peak** moves the marker to the highest peak, and enters the location in the `Position` field.
- **Next Peak** moves the marker to the next peak to the right, and enters the location in the `Position` field.
- **Center Freq** changes the Center Frequency value to match the current position of the marker.
- **Ref Level** changes the Reference Level setting to match the current position of the marker.

Position

This field sets the marker position, referenced to the left side of the screen.

Spectrum Analyzer Auxiliary Menu Fields

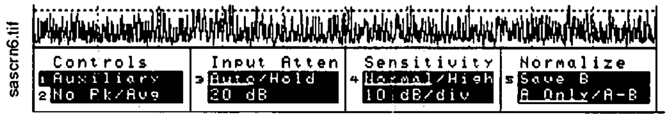


Figure 4-25. Spectrum Analyzer Auxiliary Functions

Input Atten

Input Attenuation sets the amount of input attenuation for the RF IN/OUT and ANT IN ports. This field performs two functions:

- The upper field determines if the instrument sets the attenuation (`Auto`), or if you want to set the value (`Hold`).
- The lower field displays the present attenuation value and is used to set the desired attenuation level when the upper area is set to `Hold`.

Operating Considerations

Maximum signal levels at each port are printed on the front panel.

Setting the upper field to `Hold` prevents the RF Auto-ranging process from interrupting Spectrum Analyzer operation when a signal if first measured. This can be helpful when you need to see the signal the instant the source is input, but requires you to set the needed amount of input attenuation.

Normalize

This area performs three display operations:

- `Save B` saves the currently-displayed trace for the A-B operation.
- `A only` provides a continuously-updated display (the "normal" mode of operation).
- `A-B` displays the difference between the trace saved using `Save B` and the currently-displayed trace. The comparison can yield either losses or gains in amplitude.

Operating Considerations

The A-B function works correctly only if the Center Frequency and Span settings are the same for both signals.

The Ref Level can be changed to move the trace below the top line of the display if the A-B function results in a gain.

The (HOLD) key can be used to "freeze" the display at any time. This allows you to view a trace before performing the Save or A-B functions.

No Pk/Avg

This field performs two functions:

Peak Hold (Pk Hold) prevents the Spectrum Analyzer from erasing the previous trace each time it sweeps. This causes the traces to 'build-up' on the screen until `Off`, `No Pk/Avg` or (MEAS RESET) is selected. This allows the capture of transient signals that are not displayed long enough to view during normal operation.

Video Averaging (Avg 1-100) enables the Spectrum Analyzer to display a trace representing the average of several measurements. The number of samples used for measurement averaging range from 1 to 100 (see below).

- `No Pk/Avg` Peak Hold and Video Average OFF
- `Pk Hold` Peak Hold ON
- `Avg [n]` Video Averaging over [n] measurements, where n = 1/2/3/4/5/10/20/50/100
- `Off` Peak Hold and Video Average OFF[1]

[1] `No Pk/Avg` and `Off` function identically. `Off` is provided to maintain backwards compatability with earlier firmware and software.

Operating Considerations

After capturing the desired signal, you can use the HOLD function ((SHIFT),(PREV)) to prevent additional signals from 'building-up' on the display.

The **Peak Hold** function is available with firmware revision A.06.01 or later. The **Video Averaging** function is available with firmware revision A.10.04 or later. The firmware revision is displayed on the **CONFIGURE** screen.

To upgrade your instrument, order firmware upgrade kit P/N 08920-61058.

Sensitivity

This area performs two functions:

- The upper field selects `Normal` or `High` sensitivity for the RF input. The `High` setting adds about 6 dB of sensitivity to the ANT IN port for looking at very low level signals. However, this setting can cause measurements to be uncalibrated (indicated by a message on the screen). `High` sensitivity can also cause high-level AM signals to be distorted.
- The lower field selects the vertical resolution of the display. You can choose from 1 dB, 2 dB, or 10 dB per graticule.[1]

[1] This function is not available on Test Sets with firmware revisions prior to version A.06.01 (the firmware revision is displayed in the upper-right corner of the **CONFIGURE** screen).

To upgrade the existing Spectrum Analyzer in an earlier instrument, order the following items:

Firmware upgrade: PN 08920-61058
Hardware upgrade: PN 08920-61826

Encoder

Signaling Encoder

The Encoder (AF Generator 2) uses several screens to generate various signaling formats. These screens are accessed by selecting ENCODER from the To Screen menu, and then selecting the Mode field.

The screen and field descriptions for each Encoder screen are listed in the following order:

- Function Generator
- Tone Sequence
- DTMF (Dual-Tone Multi-Frequency) Sequence
- CDCSS (Continuous Digital Controlled Squelch System)
- Digital Paging
- AMPS/NAMPS-TACS/NTACS
- NMT (Nordic Mobile Telephone)
- LTR (Logic Trunked Radio: Registered trademark of EF Johnson Company)
- EDACS (Enhanced Digital Access Communication System)
- MPT 1327 Trunked Radio

Note

Turn AFGen1 Off: When the Test Set is turned on, AFGen1 defaults to 3 kHz FM at a 1 kHz rate. This can interfer with many Encoder signaling formats also being used as an FM source. Therefore, we recommend you turn AFGen1 off on the **RX TEST**, **DUPLEX TEST**, or **RF GENERATOR** screen before using the Encoder.

Function Generator Encoder

The Function Generator provides single-tone audio frequency signals of various waveforms, amplitudes, and frequencies. It can be used to modulate the RF Generator, or it can be output through the front-panel AUDIO OUT connector.

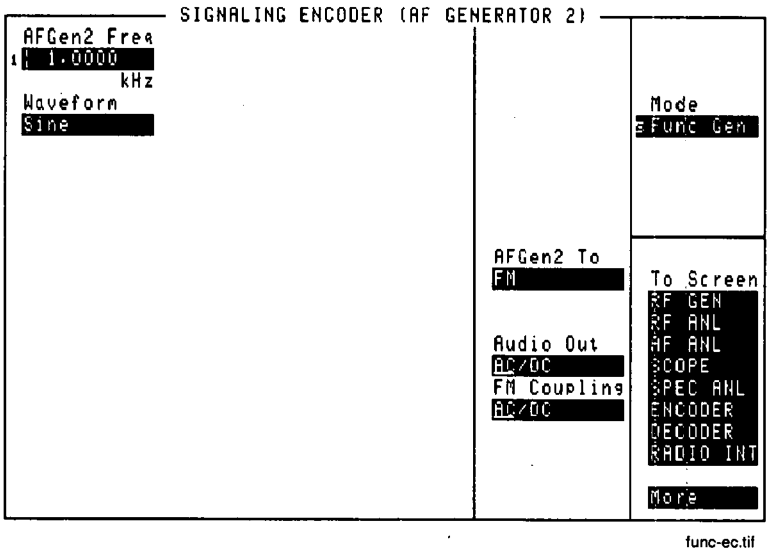


Figure 4-26. The Function Generator Encoder Mode Screen

AFGen2 Freq

Audio Frequency Generator 2 Frequency sets the tone frequency for the Function Generator.

AFGen2 To

Audio Frequency Generator 2 To contains two fields:

- The upper field determines whether the Function Generator modulates the RF Generator, or is output through AUDIO OUT.
- The lower field sets the amplitude (including `Off`).

Operating Considerations

When the `Waveform` field is set to `Sine`, and the signal is output to `Audio Out`, the amplitude can be set in units of RMS or Peak voltage. This is done in the `Sine Units` field that appears when `Audio Out` is selected. In all other cases, the amplitude is always set in Peak voltage.

Audio Out

Audio Out Coupling selects AC or DC coupling of the Function Generator to the AUDIO OUT connector when the upper `AFGen2 To` field is set to `Audio Out`.

FM Coupling

This field alters the FM modulator to allow DCFM from internal and external modulation sources. This field also selects AC or DC coupling between the RF Generator's frequency modulator and the rear-panel MODULATION INPUT connector.

Sine Units

This field specifies whether the signal's output is in units of RMS or Peak. This field is only present when the `AFGen2 To` field is set to `Audio Out`.

Waveform

This field selects the desired waveform for AF Generator 2. The available waveforms are:

∿ - sine wave

⊓⊔ - square wave

⋀⋁ - triangle wave

⊿ - ramp (positive-going and negative-going)

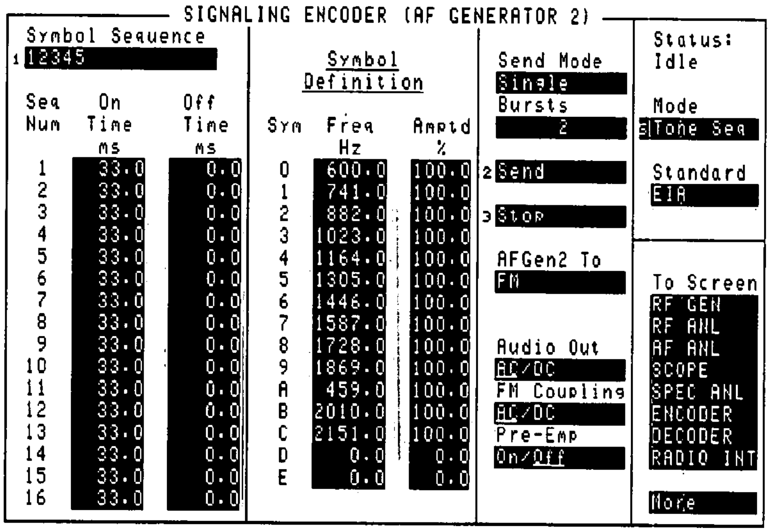
⎓ - DC±

Universal Noise

Gaussian Noise

Tone Sequence Encoder

The Tone Sequence Generator outputs sequences of tones of variable frequency, amplitude, and duration. It can be used to modulate the RF Generator, or can be output through the front-panel AUDIO OUT connector.



tone-ec.tif

Figure 4-27. The Tone Sequence Encoder Mode Screen

AFGen2 To

Audio Frequency Generator 2 To contains two fields:

- The upper field determines whether the tone sequence modulates the RF Generator, or is output through the front-panel AUDIO OUT connector.
- The lower field sets the amplitude (including `Off`).

Audio Out

Audio Out Coupling selects AC or DC coupling of the Tone Sequence Generator to the AUDIO OUT connector when the upper **AFGen2 To** field is set to `Audio Out`.

Bursts

This field defines the number of sequences output each time `Send` is selected. This function works only when the `Send Mode` field is set to `Burst`.

FM Coupling

This field alters the FM modulator to allow DCFM from internal and external modulation sources. This field also selects AC or DC coupling between the RF Generator's frequency modulator and the rear-panel MODULATION INPUT connector.

Pre-Emp

This field determines whether the encoder signal passes through or bypasses 750 μs pre-emphasis.

`Send`

Selecting this field causes the tone sequence to be output.

Send Mode

This field selects the output format used when `Send` is selected to output a sequence.

- **Single** outputs the entire sequence once.
- **Burst** outputs the sequence the number of times specified in the `Bursts` field.
- **Cont** causes the sequence to be output continuously until `Stop` is selected.
- **Step** allows you to output the sequence one tone at a time by pressing `Send` for each tone.

Standard

This field selects the Tone Sequence standard for your radio.

Stop

Selecting this field stops the sequence being output.

Symbol Definition

This table specifies three types of information:

- **Sym** - Symbol Numbers indicate the hexadecimal number that represents each tone when creating a tone sequence. These numbers cannot be changed.
- **Freq Hz** lists the tone frequency associated with each Symbol Number. The frequency values are preset for the `Standard` you are using. You can change the values using the DATA keys.
- **Amptd %** lists the relative amplitude for each tone. Amplitude is based on a percentage of the level shown in the `AFGen2 To` field.

Symbol Sequence

This area performs two functions:

- The `Symbol Sequence` field at the top of the screen is used to enter and edit the tone sequence. The sequence uses the Symbol Numbers (Sym) listed in the `Symbol Definition` table. A total of 16 symbols can be entered.
- Below the `Symbol Sequence` is the Sequence On/Off Times table. This table contains three entries.

  Seq Num identifies which *position* in the `Symbol Sequence` is affected by the On and Off times listed.

  On Time specifies the length of time a tone is output during the sequence.

  Off Time specifies the length of time a tone is off before the next tone in the sequence is output.

Operating Considerations

The Symbol Numbers can be entered directly, using the DATA keys, or by using the `Choices` menu that appears when this field is selected. The `Choices` menu is also used to edit an existing sequence.

The On and Off Times are changed using the DATA keys.

DTMF Sequence Encoder

The DTMF Sequence Generator creates Dual-Tone Multi-Frequency tone sequences of variable frequency, amplitude, and duration. It can be used to modulate the RF Generator, or can be output through the front-panel AUDIO OUT connector.

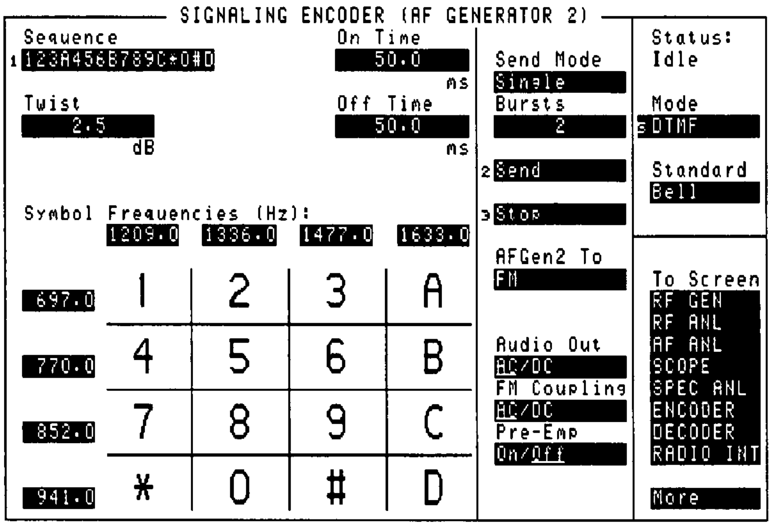


Figure 4-28. The DTMF Sequence Encoder Mode Screen

AFGen2 To

Audio Frequency Generator 2 To contains two fields:

- The upper field determines whether the DTMF sequence modulates the RF Generator, or is output through the front-panel AUDIO OUT connector.
- The lower field sets the amplitude (including `Off`).

The output level is the peak value for each tone pair, regardless of the `Twist` and `Pre-Emp` settings.

See Also

`Twist` field description

Audio Out

Audio Out Coupling selects AC or DC coupling of the DTMF Sequence Generator to the AUDIO OUT connector when the upper `AFGen2 To` field is set to `Audio Out`.

Bursts

This field defines the number of sequences output each time `Send` is selected. This function only works when the `Send Mode` field is set to `Burst`.

FM Coupling

This field alters the FM modulator to allow DCFM from internal and external modulation sources. This field also selects AC or DC coupling between the RF Generator's frequency modulator and the rear-panel MODULATION INPUT connector.

On Time

This field sets the length of time each DTMF tone is On during the sequence.

Off Time

This field sets the length of time each DTMF tones is Off during the sequence.

Pre-Emp This field determines whether the encoder signal passes through or bypasses 750 μs pre-emphasis. Pre-emphasis may be required when testing some FM receivers.

See Also

`Twist` field description

`Send` Selecting this field causes the DTMF sequence to be output.

Send Mode This field selects the format used when `Send` is selected to output a sequence.

- **Single** outputs the entire sequence once.
- **Burst** outputs the sequence the number of times specified in the `Bursts` field.
- **Cont** causes the sequence to be output continuously until `Stop` is selected.
- **Step** allows you to output the tones in a sequence one at a time by pressing `Send` for each tone.

Standard This field selects the DTMF standard used for your radio.

Stop Selecting this field stops the sequence being output.

Symbol Frequencies (Hz)

The 8 column/row frequencies are automatically entered by the `Standard` field setting. You can change the frequency values using the DATA keys.

Twist

Twist is the ratio of amplitudes (in dB) between the high frequency and low frequency tone in each DTMF pair. A positive value indicates a higher amplitude for the high frequency tones. A negative value indicates a higher amplitude for the low frequency tones.

The amplitude of the combined tones is set in the `AFGen2 To` field.

Twist and Pre-Emphasis Interaction

Twist and Pre-Emphasis affect the relative levels of the high and low tones within each symbol (tone pair). If pre-emphasis is off, twist sets the difference in deviation (in dB) between the high and low tones. If twist is off, pre-emphasis places a 6 dB per octave difference in deviation between the high and low tones. If both twist and pre-emphasis are on, the two effects are summed.

For most conditions, set `Twist` to 2.5 dB, `Pre-Emp` on, and 60% rated deviation (3 kHz for a typical 5 kHz deviation rated receiver).

Examples of Twist and Pre-Emphasis Interaction

Example 1: 3 kHz deviation, Twist = 0 dB, Pre-Emphasis off.
The level of each low tone and high tone individually generate 1.5 kHz deviation. The tones are summed to produce 3 kHz deviation.

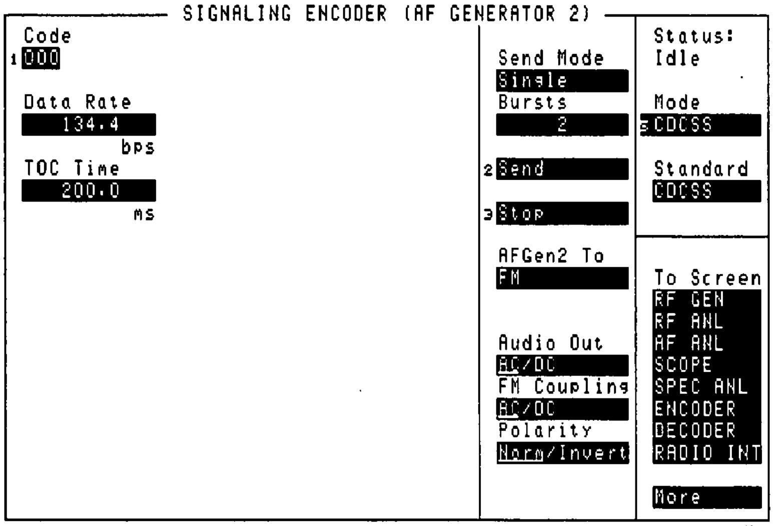
Example 2: 3 kHz deviation, Twist = 2.5 dB, Pre-Emphasis off.
The high tone has 2.5 dB (a factor of 1.334) more deviation than the low tone. The two tones are summed to produce 3 kHz peak deviation. Therefore, the low tone deviation is 1286 Hz and the high tone deviation is 1714 Hz.

Example 3: 3 kHz deviation, Twist = 0 dB, Pre-Emphasis on.
There is a 6 dB per octave difference between the high and low tones. For example, if sending a '1', which has a low tone of 697 Hz and a high tone of 1209 Hz, the high tone has a deviation of 1209/697 = 1.735 times the low tone's deviation. The high tone's deviation is then $20 \times \log(1209/967) = 4.78$ dB higher than the low tone. Since their sum must equal 3 kHz, the low tone deviation is 1097 Hz, and the high tone deviation is 1903 Hz.

Example 4: 3 kHz deviation, Twist = 2.5 dB, Pre-Emphasis on.
If sending a '1' (697 Hz low tone and 1209 Hz high tone), the high tone deviation is 1.334 (see example 2) $\times$ 1.735 (see example 3) $\approx$ 2.314 times the low tone deviation. Since the peak deviation of their sum is 3 kHz, the low tone deviation is 905.5 Hz and the high tone deviation is 2094.5 Hz.

CDCSS Encoder

The Continuous Digital Controlled Squelch System (CDCSS) encoder generates signals to test radios that use a digitally-encoded signal to turn squelch on and off. The encoder can be used to modulate the RF Generator, or it can be output through the front-panel AUDIO OUT connector.



cdcsen.tif

Figure 4-29. The CDCSS Encoder Mode Screen

The CDCSS Data Stream

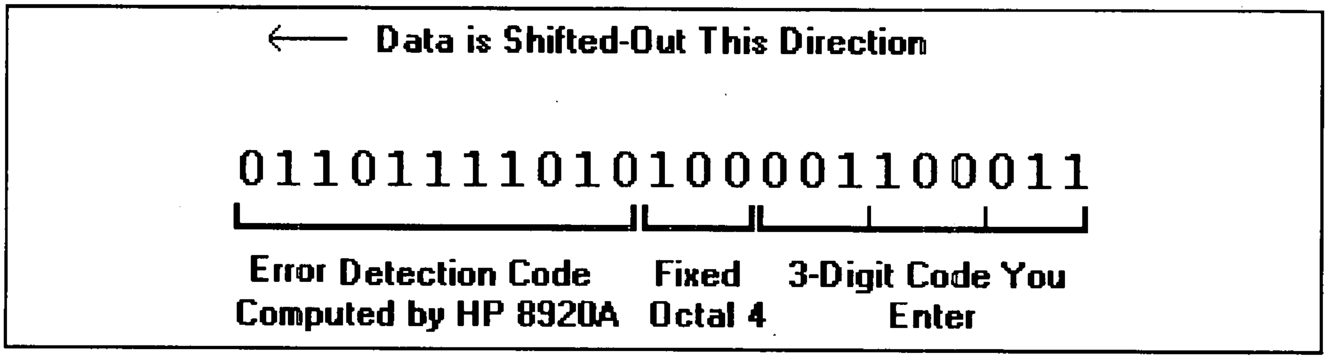


Figure 4-30. CDCSS Data Stream Bit Assignments

The CDCSS encoder creates a 23-bit digital data stream and Turn Off Code (TOC). The data stream consists of three parts:

- A 3-digit (9 bit) octal code you supply that corresponds to your radios digital squelch code number.
- A fixed octal 4 (coded 100).
- A mathematically-derived 11-bit error detection code.

The data stream is output serially, beginning with the Error Detection Code.

The Turn Off Code

The Turn Off Code is a tone burst that is output after the data stream has been output the desired number of times, or after a series of bursts has been interrupted using the `Stop` field.

AFGen2 To

Audio Frequency Generator 2 To contains two fields:

- The upper field determines whether the CDCSS Encoder modulates the RF Generator, or is output through AUDIO OUT.
- The lower field sets the amplitude (including `Off`).

Audio Out

Audio Out Coupling selects AC or DC coupling of the encoder to the AUDIO OUT connector when the upper `AFGen2 To` field is set to `Audio Out`.

Operating Considerations

The CDCSS encoder creates data streams using squarewaves. For optimum waveform quality, set this field to `DC` when using the AUDIO OUT connector. This is especially beneficial at low Data Rates.

Bursts

This field defines the number of data streams output each time `Send` is selected. This function works only when the `Send Mode` field is set to `Burst`.

Code

This field defines the 3 digit octal code used to identify the radio being accessed.

Data Rate

This field specifies how fast the data stream is output in bits-per-second.

This setting is also used to determine the Turn Off Code frequency (TOC frequency Hz = Data Rate in bps). Example: 1000 bps = 1 kHz

Operating Considerations

This field is also used by the CDCSS **SIGNALING DECODER** screen to approximate the data rate for the signal being decoded.

FM Coupling

This field alters the FM modulator to allow DCFM from internal and external modulation sources. This field also selects AC or DC coupling between the RF Generator's frequency modulator and the rear-panel MODULATION INPUT connector.

Operating Considerations

This field should be set to `DC` whenever the `AFGen2 To` field is set to `FM`; this provides better modulation response at low data rates.

Polarity

This setting determines the relationship between the data stream logic levels and the effect on the modulated signal.

This function is helpful to restore the proper data polarity when the transmitter, repeater, or receiver used in your communications system has an odd number of inversions; causing the received data to be inverted when decoded. (This is common when a signal is translated to a lower frequency using an LO whose frequency is higher than the signal's frequency; or when inverting amplifiers are used.)

Normal Operation
When this field is set to `Norm`, a logical high (1) causes the output level of the AF Generator to be more *positive*. A logical low (0) causes the level to become negative by the same amount.

Inverted Operation
When this field is set to `Invert`, a logical high (1) causes the output level of the AF Generator to be more *negative*. A logical low (0) causes the level to become positive by the same amount.

`Send`

Selecting this field causes the data stream to be output.

Send Mode

This field selects the output format used when `Send` is selected to output a sequence.

- **Single** outputs the entire sequence once.
- **Burst** outputs the sequence the number of times specified in the `Bursts` field.
- **Cont** causes the sequence to be output continuously until `Stop` is selected.

Standard

This field selects the digitally-coded squelch standard for your radio.

Stop

Selecting this field stops the data stream being output when the `Send Mode` is set to `Cont` or `Burst`. After this field is selected, the current repetition of the data stream is finished, and the Turn Off Code is output.

TOC Time

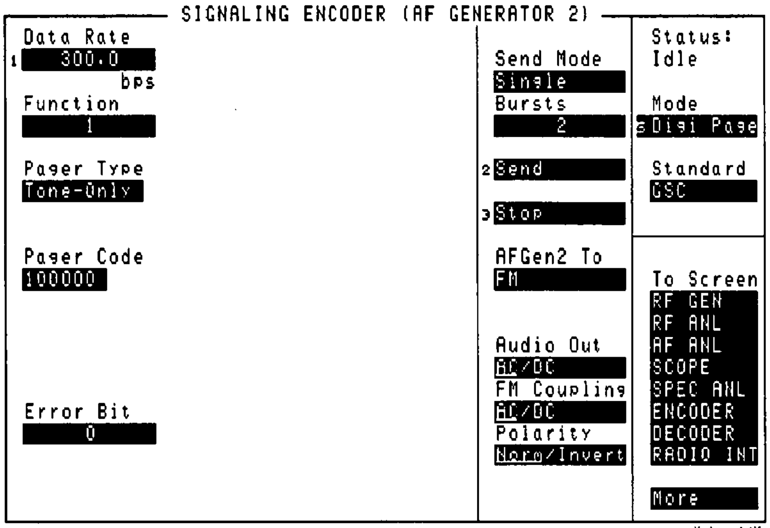
Turn Off Code Time defines the length of time the Turn Off Code is output.

Operating Considerations

This code is *always* the last information output before the encoder Status indicator changes from **Sending** to **Idle**; whether several bursts or only one data stream is sent. If no TOC is desired, set this field to **0.0000**.

Digital Paging Encoder

The Digital Paging Encoder outputs signals to test pagers using a variety of digital access formats and frequencies. The signal can be used to modulate the RF Generator, or can be output through the front-panel AUDIO OUT connector. FM is typcially selected, using the **RX TEST** screen to set up the RF Generator to generate the encoded carrier.



digi-en1.tif

Figure 4-31. The Digital Paging Encoder Mode Screen

AFGen2 To

Audio Frequency Generator 2 To contains two fields:

- The upper field determines whether the Digital Paging encoder modulates the RF Generator, or is output through AUDIO OUT.
- The lower field sets the amplitude (including `Off`).

Audio Out

Audio Out Coupling selects AC or DC coupling of the encoder to the AUDIO OUT connector when the upper `AFGen2 To` field is set to `Audio Out`.

Operating Considerations

This field should be set to `DC` for best results when using the AUDIO OUT connector and low Data Rates.

Bursts

This field defines the number of digital data streams output each time `Send` is selected. This function works only when the **Send Mode** field is set to `Burst`.

Data Rate

This field specifies how fast the data stream is output in bits-per-second. Common data rates; POCSAG 512, 1200: GSC (GOLAY) 300, 600.

Error Bit

This field enables you to cause an error for a specific bit in the encoded message stream.

FM Coupling

This field alters the FM modulator to allow DCFM from internal and external modulation sources. This field also selects AC or DC coupling between the RF Generator's frequency modulator and the rear-panel MODULATION INPUT connector.

Operating Considerations

This field should be set to `DC` whenever the **AFGen2 To** field is set to `FM`: this provides better modulation response at low data rates.

Function

This setting specifies which of the four types of messages to send. The pager's response is determined by the **Pager Type** field setting and the pager's configuration.

For example, when testing a POCSAG pager set for Tone-Only operation, functions 00 through 11 typically correspond to the pager beeping one to four times. If the pager is set for Alpha-Numeric operation, the functions correspond to a combination of the number of beeps and the type of message displayed by the pager.

Mssg Length

The **Message Length** field specifies the number of characters output from the **Pager Numeric/Alpha-Numeric** field.

This field is only displayed when the **Pager Type** is set to `Numeric` or `Alpha-Num`.

Pager Alpha-Numeric Message

This field specifies the message you are sending to an alpha-numeric format pager.

This field is only displayed when the **Pager Type** is set to `Numeric` or `Alpha-Num`.

Pager Code

This field is used to identify the individual code number (address) of the pager you are testing.

Pager Numeric Message

This field specifies the message you are sending to a numeric format pager.

This field is only displayed when the `Pager Type` is set to `Numeric` or `Alpha-Num`.

Pager Type

This field specifies the way your pager responds to a received signal: `Tone-Only`(beeps), `Numeric` (displays numbers), or `Alpha-Numeric` (displays numbers and other characters).

Polarity

This setting determines the relationship between the data stream logic levels and the effect on the modulated signal.

Normal Operation
When this field is set to `Norm`, a logical high (1) causes the output level of the AF Generator to be more *positive* (causing a positive frequency deviation when FM is used). A logical low (0) causes the level to become negative by the same amount (resulting in negative FM deviation).

Inverted Operation
When this field is set to `Invert`, a logical high (1) causes the output level of the AF Generator to be more *negative* (causing a negative FM deviation). A logical low (0) causes the level to become positive by the same amount (resulting in positive FM deviation).

`Send`

Selecting this field causes the entire data stream to be output (including the preamble, address, and message).

Send Mode

This field selects the output format used when `Send` is selected to output a sequence.

- **Single** outputs the entire sequence once.
- **Burst** outputs the sequence the number of times specified in the `Bursts` field.
- **Cont** causes the sequence to be output continuously until `Stop` is selected.

Standard

This field selects the digital paging standard for the pager being tested: POCSAG or GSC (Golay Sequential Code).

Stop

Selecting this field stops the data stream being output.

AMPS-TACS NAMPS-NTACS Encoder

AMPS = Advanced Mobile Phone Service.
NAMPS = Narrowband Advanced Mobile Phone Service.
TACS = Total Access Communications Systems.
JTACS = Total Access Communications System for Japan.
NTACS = Narrowband Total Access Communications Systems (NTACS is an extension of JTACS).

Using This Information

This screen is used to create various types of cellular telephone data streams. Selecting the `Standards` field displays a list of the supported signaling formats.

The theory and applications of cellular telephone systems are beyond the scope of this manual. The field descriptions describe their basic functions, and are not intended to be used as tutorial information.

If additional information is needed, refer to the many technical manuals available on the subject of cellular telephones.

Automated Test Software

Hewlett-Packard offers pre-written software packages to test your cellular phone in a fraction of the time normally required for manual testing. You can choose any combination of tests, from full parametric testing, to a single test. The software is shipped on a memory card that inserts directly into your Test Set, and comes with complete documentation and a blank SRAM memory card for storing your test procedures and test data.

Encoder/Decoder Interaction

The AMPS-TACS/NAMPS-NTACS Encoder acts like a base station transmitter, creating *Forward* Control and Voice channel information (FOCC/FVC). The AMPS-NAMPS-TACS/NTACS Decoder acts like a base station receiver, analyzing *Reverse* Control and Voice channel signals (RECC/RVC).

The Decoder uses the Encoder's `Data Rate` setting to specify how fast the incoming message is being sent. Therefore, when using the Decoder, you must first specify the Data Rate in the Encoder.

Control and Voice Channel Identifiers

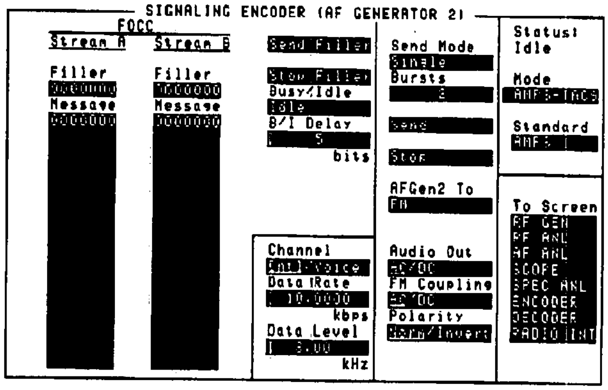
The Control and Voice channel fields are available in separate menus. The `Channel` field is used to select the `Cntl` (FOCC) or `Voice` (FVC) menu.

Fields available only in the Forward Control Channel menu have "(FOCC)" printed in the field title.

Fields available only in the Forward Voice Channel menu have "(FVC)" printed in the field title.

Encoder Mode Differences

The AMPS/TACS and NAMPS/NTACS Encoder modes use the same Forward Control Channel (FOCC) settings and output format. However, the Forward Voice Channel (FVC) information is different. Fields that are only used for either standard are noted in their descriptions.



amps-en1.tif

Figure 4-32. AMPS-TACS/NAMPS-NTACS - Forward Control Channel (FOCC)

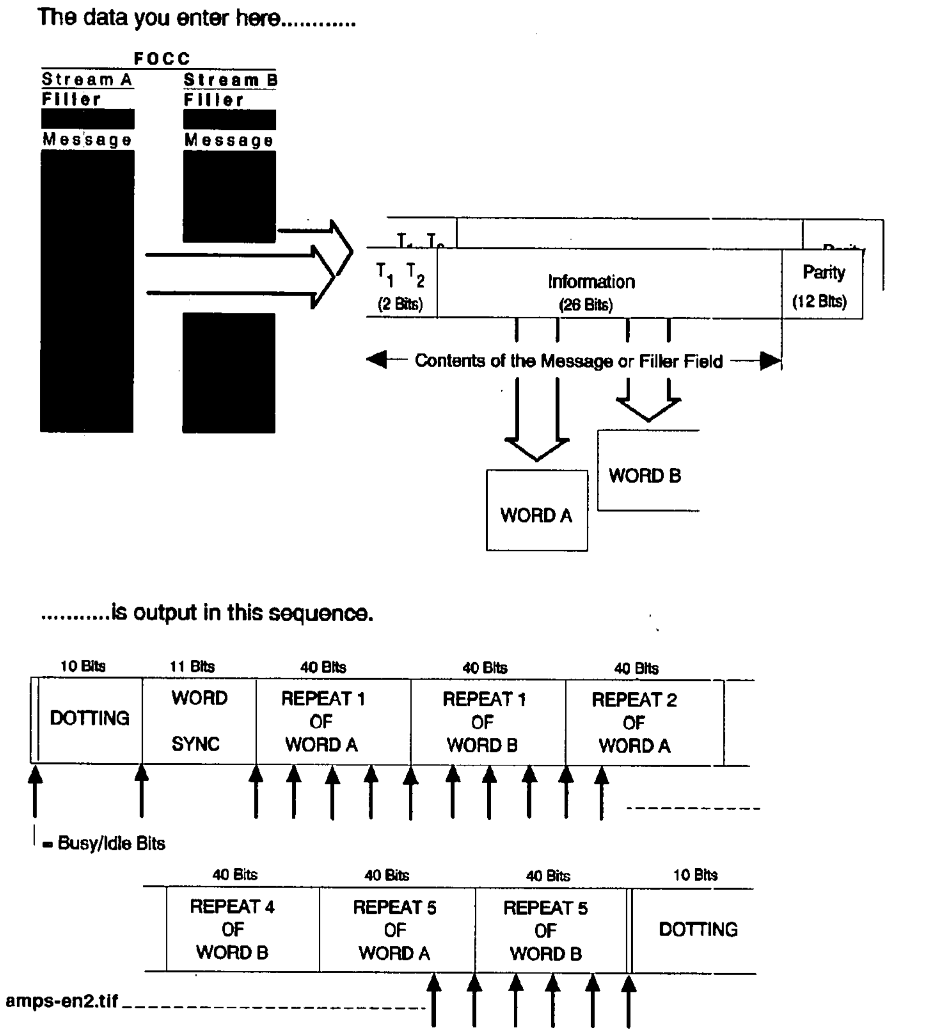


Figure 4-33. AMPS-TACS/NAMPS-NTACS FOCC Message and Filler Data Format

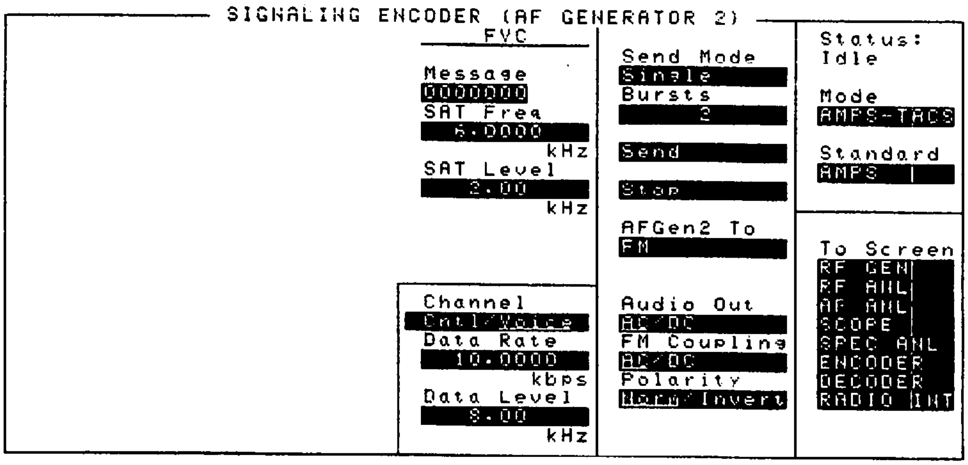
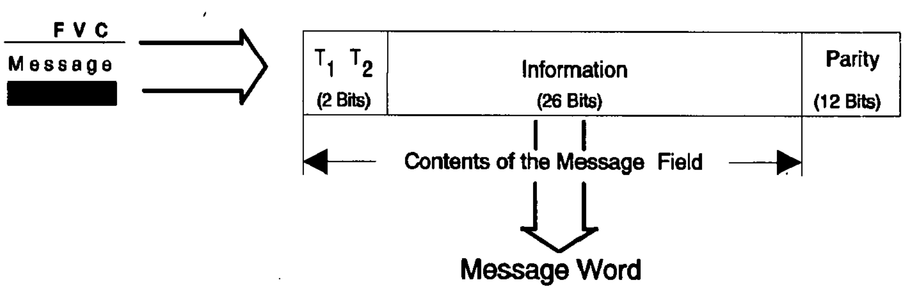


Figure 4-34. AMPS-TACS Forward Voice Channel (FVC) Encoder

The data you enter here............



...........is output in this sequence.

101 Bits	11 Bits	40 Bits	37 Bits	11 Bits	40 Bits
DOTTING	W.S.	REPEAT 1 OF WORD	DOTTING	W.S.	REPEAT 2 OF WORD

W.S.=Word Sync

37 Bits	11 Bits	40 Bits	37 Bits	11 Bits	40 Bits	37 Bits	11 Bits	40 Bits
DOTTING	W.S.	REPEAT 9 OF WORD	DOTTING	W.S.	REPEAT 10 OF WORD	DOTTING	W.S.	REPEAT 11 OF WORD

Figure 4-35. AMPS-TACS FVC Message Data Output Format

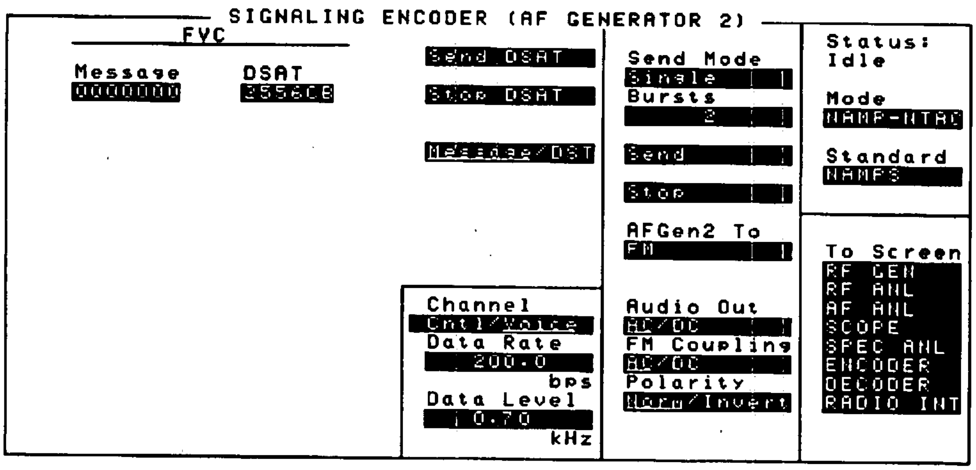


Figure 4-36. NAMPS-NTACS Mode - Forward Voice Channel (FVC) Screen

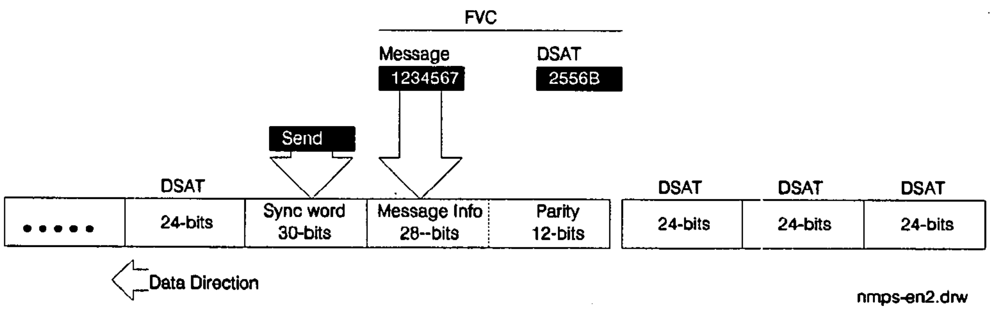


Figure 4-37. NAMPS-NTACS FVC Message Data Output Format

AFGen2 To

Audio Frequency Generator 2 To determines whether the data stream modulates the RF Generator, or is output through the AUDIO OUT connector.

Audio Out

Audio Out Coupling selects AC or DC coupling of the AF Generator to the AUDIO OUT connector when `AFGen2 To` is set to `Audio Out`.

Busy/Idle (FOCC)

This field selects the Busy/Idle status information to be included in the signaling sequence.

- **Idle** sets the Busy/Idle bits of the Forward Control Channel information to indicate an Idle state.
- **Busy** sets the Busy/Idle bits of the Forward Control Channel information to indicate a Busy state.
- **WS Delay** - Word Sync Delay prevents a Busy\Idle change until the Word Sync information has been received and a defined number of delay bits has been counted. The delay bit value is set in the `B/I Delay` field.
- **1stBitDly** - First Bit Delay causes the Busy/Idle Bit to be set after a bit has been received and a defined number of delay bits has been counted. The delay bit value is set in the `B/I Delay` field.

B/I Delay (FOCC)

Busy/Idle Delay determines the number of bits that are counted before a Busy/Idle bit changes from the Idle state to the Busy state. This function is used with the WS Delay and 1stBitDly settings in the `Busy/Idle` field.

Bursts

This field defines the number of times the Message data is output when `Send` is selected. This function only works when the `Send Mode` field is set to `Burst`.

Channel

This field selects the Forward Control Channel (FOCC) or Forward Voice Control (FVC) menus.

Data Level

This setting determines the signal level change that occurs when a logical high (1) or low (0) is output. The unit-of-measure used depends on the `AFGen2 To` setting. The direction of the output level change depends on the `Polarity` setting.

Data Rate

This setting determines the rate that the FOCC and FVC information are output.

Operating Considerations

This field specifies the data rate for the signal being decoded, and must be set before using the **AMPS-TACS/NAMPS-NTACS Decoder**.

DSAT (FVC)

This field is available only in NAMP-NTAC mode.

This field is used to specify the 24-bit Digital Supervisory Audio Tone (DSAT) sequence. The seven standard sequences are: 2556CB, 255B2B, 256A9B, 25AD4D, 26AB2B, 26B2AD, and 2969AB. (These codes are the inverse of the seven DST codes.)

DSAT is output continously when `Send DSAT` is selected, and is only stopped when `Stop DSAT` is selected. If Message or DST information is sent using `Send`, the DSAT signal is temporarily interrupted until that information has been sent. (The `Status:` field in the upper-right corner of the screen indicates what type of data is being sent.)

Filler (FOCC)

Each `Filler` field contains 7 hexadecimal characters representing the 2 Type bits and 26 Information bits of the Control Filler/Message word. The Dotting, Word Sync, and Parity bits are generated automatically.

Operating Considerations

The Control Filler is sent continuously when `Send Filler` is selected, or after a Control Message has been sent using `Send`. The Control Message is stopped whenever `Stop Filler`, **Filler**, **Channel**, **Data Rate**, **Polarity**, or **AFGen2** To is selected.

Both Filler fields must be full (seven digits) for the Forward Control Channel information to be structured correctly. Do not leave any blank spaces.

FM Coupling

This field alters the FM modulator to allow DCFM from internal and external modulation sources. This field also selects AC or DC coupling between the RF Generator's frequency modulator and the rear-panel MODULATION INPUT connector.

Message (FOCC)

Message Streams A and B specify various Forward Control Channel parameters.

Operating Considerations

Like the Filler information, the Message information can only be input in full (seven digit) lines. Also, Message Streams A and B must have the same number of lines in them.

Message (FVC)

This description applies to the AMPS-TACS mode.

The 7 hexadecimal characters of the FVC **Message** field represent the 2 Type bits and 26 Information bits in the FVC message Word.

The generation of Dotting, Word Sync, Parity, and the 11 repetitions of these parameters in the FVC Message Stream is done automatically.

Operating Considerations

The entire field must contain data, no blank spaces are allowed. SAT is turned off while the FVC message stream is being sent.

Message (FVC)

This description applies to the NAMP-NTAC mode.

The 7 hexadecimal characters (28 bits) of this FVC Message are combined with 12 Parity bits calculated by the Encoder to output a 40-character data stream. This information is output when the `Message/DST` field is set to 'Message', and `Send` is selected.

Operating Considerations

The entire field must contain data, no blank spaces are allowed. DSAT is turned off while the FVC Message Stream is being sent.

Message/DST (FVC)

This field is available only in NAMP-NTAC mode.

This field determines what type of data is sent when Send is selected:

1. Selecting Message causes the contents of the Message field to be output.
2. Selecting DST causes the Digital Signaling Tone sequence to be output. The sequence sent is the inverse of the sequence entered in the DSAT field, and is automatically determined by the Encoder.

   The DST values are: DAA934, DAA4D4, DA9564, DA52B2, D954D4, D94D52, and D69654.

Polarity

This setting determines the relationship between the signaling logic levels and the effect on the modulated signal.

Normal Operation
When this field is set to Norm, a logical high (1) causes the output level of the AF Generator to be more *positive*. The peak level is listed in the Data Level field. A logical low (0) causes the level to become negative by the same amount.

Inverted Operation
When this field is set to Invert, a logical high (1) causes the output level of the AF Generator to be more *negative*. The peak level is listed in the Data Level field. A logical low (0) causes the level to become positive by the same amount.

SAT Freq (FVC)

This field is available only in AMPS-TACS mode.

This field sets the **Supervisory Audio Tone Frequency**. This signal is sent continuously whenever the FVC is selected, except while the Message is being sent.

SAT Level (FVC: AMPS-TACS)

This field sets the **Supervisory Audio Tone Level**. The unit-of-measure depends on the `AFGen2 To` setting.

Operating Considerations

SAT is turned off while the FVC Message Stream is being sent.

`Send`

Selecting this field causes the FVC or FOCC Message to be output.

Operating Considerations

When sending an FOCC message stream, the contents of the `Filler` are continuously output after the message data has been sent. `Stop Filler` is used to stop the output.

`Send Filler` **(FOCC)**

Selecting this field causes the contents of the `Filler` fields for Stream A and Stream B to be output. The fillers continue to be output until `Stop Filler` is selected.

`Send DSAT` **(FVC)**

This field is available only in NAMP-NTAC mode.

Selecting this field causes the contents (24 bits) of the `DSAT` field to be continuously output until `Stop DSAT` is selected. If a Message or DST (Digital Signaling Tone) is sent by selecting `Send`, the DSAT (Digital Supervisory Audio Tone) data is output continuously *after* the Message is output.

Send Mode

This field selects the mode used when `Send` is selected to output the Message.

- **Single** outputs the entire message once.
- **Burst** outputs the Message the number of times specified in the `Bursts` field.
- **Cont** causes the message to be output continuously until `Stop` is selected.
- **Step** is not used in the AMPS-TACS mode.

Standard

This field selects the signaling standard used for your radio. The standard values used for each signaling format are automatically filled-in when the Standard is selected.

Stop

Selecting this field stops the Message being output.

`Stop DSAT` (FVC)

This field is available only in NAMP-NTAC mode.

Selecting this field stops the Digital Supervisory Audio Tone (DSAT) being output.

`Stop Filler` (FOCC)

Selecting this field stops the `Filler` information from being output after `Send Filler` or `Send` is used.

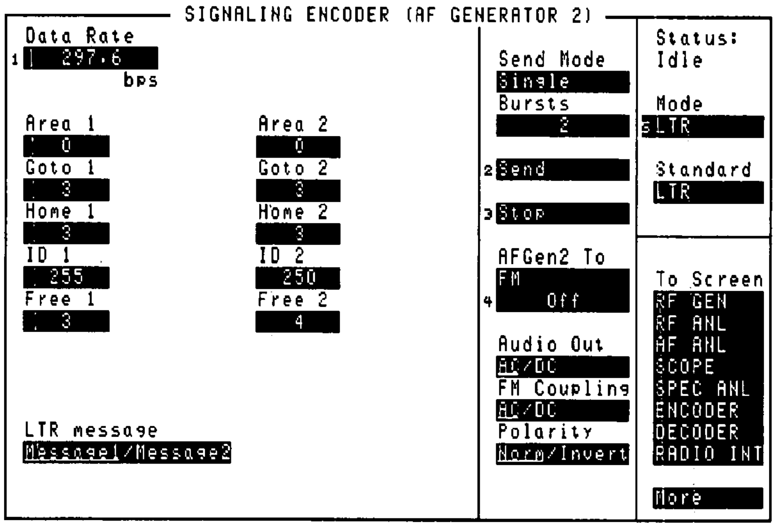
Nordic Mobile Telephone (NMT) Encoder

The Nordic Mobile Telephone (NMT) encoder generates signals to test radios for several NMT standards.

The operation of the NMT encoder is strongly dependent on functions used in the NMT **Decoder** screen. Therefore, operating and reference information for the **Encoder** screen is discussed in the *NMT Decoder* section of this chapter.

LTR Encoder

This Encoder mode is used to test trunked mobile radios that use the EF Johnson LTR® (Logic Trunked Radio) format. Two different trunking messages can be used (Message1 and Message 2) to allow you to change radio operation while the encoder is running.



ltr-en1.tif

Figure 4-38. The LTR Trunked Radio Encoder Mode Screen

← Data Direction

9 bits	1 bit	5 bits	5 bits	8 bits	5 bits	7 bits
SYNC	AREA	GO-TO REPEATER FOR CALLED RADIO	HOME CHANNEL OF CALLED RADIO	ID CODE OF CALLED RADIO	FREE REPEATER	ERROR CHECK BITS
	Area 1	Goto 1	Home 1	ID 1	Free 1	
	Area 2	Goto 2	Home 2	ID 2	Free 2	

ltr-en2.tif

Figure 4-39. How Message 1 & Message 2 Fields Are Used to Create Trunking Data

Radio Test Examples

The following procedures establish a receiver or transmitter trunked channel on the Home channel.

To Test Your Receiver

To establish a trunked receiver channel on the Home channel:

1. Connect the RF IN/OUT port of the Test Set to your radio's antenna port.
2. If you want to make audio measurements, connect your radio's speaker output to the Test Set's AUDIO IN port(s), and turn the Test Set's VOLUME up about half way.
3. Turn your radio's volume up about half way.
4. Turn your radio on, and select the channel to test.
5. Press (PRESET) (to establish a known instrument state for this procedure).
6. Access the **DUPLEX TEST** screen.
7. Set the `Tune Mode` field to `Manual`.
8. Set the `RF Gen Freq` field to the *receive* frequency for the selected channel. (Note that the PRESET function caused the `Amplitude` to be set to -80 dBm, and AFGen1 is set to 1 kHz FM with 3 kHz deviation. These settings should work with your radio to produce the audio tone.)
9. Access the **ENCODER** screen, and select the LTR mode.
10. Enter your Area Number (0 or 1) in the `Area 1` field.
11. Enter the Home Channel number in these fields: `Goto 1`, `Home 1`, and `Free 1`. (For example, if your radio's Home Channel is 2, enter 2 in all three fields.)
12. Enter the Receive ID number for your radio in the `ID 1` field.
13. Set the `Send Mode` field to `Cont`.
14. Set the `AFGen2 To` field to FM, 1 kHz.
15. Set the `FM Coupling` field to `DC`.
16. Select `Send` to continuously output the encoded signal.

You should hear the 1 kHz tone from your radio and/or the Test Set's speaker, indicating that the trunked channel has been established.

If you connected the radio's speaker to the AUDIO IN port(s), access the **DUPLEX TEST** screen to display the `AC Level` and `SINAD` measurements.

To make a 12 dB SINAD measurement -

1. Set `Filter 1` to `300Hz HPF` and `Filter 2` to `3kHz LPF`.
2. Decrease the `Amplitude` until ≈12 dB SINAD is displayed.
3. Use the AVG (average) function to stabilize the measurement by positioning the cursor in front of the SINAD `dB` field and pressing (SHIFT), (AVG), (ENTER).

To Test Your Transmitter

To establish a trunked transmit channel on the Home channel:

1. Connect the RF IN/OUT port of the Test Set to your radio's antenna port.
2. Turn your radio on, and select the channel to test.
3. Press PRESET (to establish a known instrument state for this procedure).
4. Access the **DUPLEX TEST** screen.
5. Set the `Tune Mode` field to `Manual`.
6. Enter the Home channel transmit frequency in the `Tune Freq` field.
7. Enter the Home channel receive frequency in the `RF Gen Freq` field.
8. Set `AFGen1 To` to `Off`.
9. Set the `AF Anl In` field to `FM Demod`.
10. Access the **ENCODER** screen, and select the LTR mode.
11. Set up Message 1 with idle message data -
    a. Enter your Area Number (0 or 1) in the `Area 1` field.
    b. Enter the Home Channel number in these fields: `Goto 1`, `Home 1`, and `Free 1`.
    c. Enter **255** in the `ID 1` field to establish an idle channel.
12. Set up Message 2 with transmit message data -
    a. Enter your Area Number (0 or 1) in the `Area 2` field.
    b. Enter the Home Channel number in these fields: `Goto 2`, `Home 2`, and `Free 2`.
    c. Enter the Transmit ID number for your radio in the `ID 2` field.
13. Set the `Send Mode` field to `Cont`.
14. Set the `AFGen2 To` field to FM, 1 kHz.
15. Set the `FM Coupling` field to `DC`.
16. Set the `LTR message` field to `Message1`.
17. Select `Send` to continuously output idle message.
18. Key the transmitter.
19. Select `Message2` in the `LTR message` field to tell your radio to transmit. If the transmitter fails to establish a transmit channel before time-out occurs, try again using these steps:
    a. De-key the transmitter
    b. Select Message 1
    c. Key the transmitter
    d. Select Message 2

Once a transmit channel is established, turn the Test Set's VOLUME up and speak into your radio's microphone. You should hear your voice out of the Test Set's speaker. Access the **DUPLEX TEST** screen to display the transmitter's Power and Frequency Error.

Performing Channel Changes

Testing the mobile's ability to change to other receive channels when commanded requires rapid RF Generator frequency changes. After the idle message on the Home Channel has been established (using Message 1), a message is sent to change channels (Message 2). The mobile must see the LTR-encoded carrier at the new channel frequency within a few seconds to establish the new channel. You can change the RF Generator frequency using a global USER key assigned to that field; having previously entered an increment value equal the required channel offset. This procedure must be done *very* quickly to work.

The best way to perform a channel change is to use an HP-IB or IBASIC program to change the RF Generator frequency to the new channel frequency immediately after the appropriate message has been output.

Automated Test Software

Hewlett-Packard offers pre-written software packages to test your LTR-format trunked radio in a fraction of the time normally required for manual testing. You can choose any combination of tests, from full transmitter and receiver testing, to a single test. The software is shipped on a memory card that inserts directly into your Test Set, and comes with complete documentation and a blank SRAM memory card for storing your test procedures and test data.

AFGen2 To

Audio Frequency Generator 2 To contains two fields:

- The upper field determines whether the LTR Encoder modulates the RF Generator, or is output through AUDIO OUT. (Normally set to FM for LTR signaling.)
- The lower field sets the amplitude (including `Off`). (Typically set to 1 kHz for LTR signaling.)

Area 1, Area 2

Enter the trunked system Area Number (0 or 1) programmed into your radio.

Audio Out

Audio Out Coupling selects AC or DC coupling of the LTR Encoder to the AUDIO OUT connector when the upper `AFGen2 To` field is set to `Audio Out`.

Bursts

This field defines the number of times Message 1 or Message 2 is output each time `Send` is selected. This function works only when the `Send Mode` field is set to `Burst`.

Data Rate

Enter the LTR signaling data rate used for your radio. The standard, and default value, is 297.6 bits-per-second.

FM Coupling

This field alters the FM modulator to allow DCFM from the LTR Encoder modulation source. This field should be set to `DC` when testing trunked radios.

This field also selects AC or DC coupling between the RF Generator's frequency modulator and the rear-panel MODULATION INPUT connector.

Free 1, Free 2

Enter the repeater number to *transmit* to when the radio is keyed. In the previous example, the Home Channel was used. When channel switching is performed, you would specify any of the other repeaters in the system.

Goto 1, Goto 2

Enter the repeater number to *receive* when the Message is sent.

Home 1, Home2

Enter the Home repeater number programmed into your radio.

ID 1, ID 2

Enter the Transmit or Receive ID number programmed into your radio.

LTR message

This field selects which message (Message1 or Message2) is output when `Send` is selected. The underlined message is output.

Polarity

This setting determines the relationship between the LTR Encoder data stream logic levels and the effect on the modulated signal.

When this field is set to `Invert`, a logical high (1) causes the output level of the AF Generator to be more *negative*. A logical low (0) causes the level to become positive by the same amount.

`Send`

Selecting this field causes the LTR Encoder to start modulating the RF Generator.

Send Mode

This field selects the output format used when `Send` is selected to output a sequence. `Cont` is typically used for LTR radio testing.

- **Single** outputs Message 1 or Message 2 once.
- **Burst** outputs the message the number of times specified in the `Bursts` field.
- **Cont** causes the message to be repeated continuously until `Stop` is selected.
- **Step** is not used with this Encoder mode.

Standard

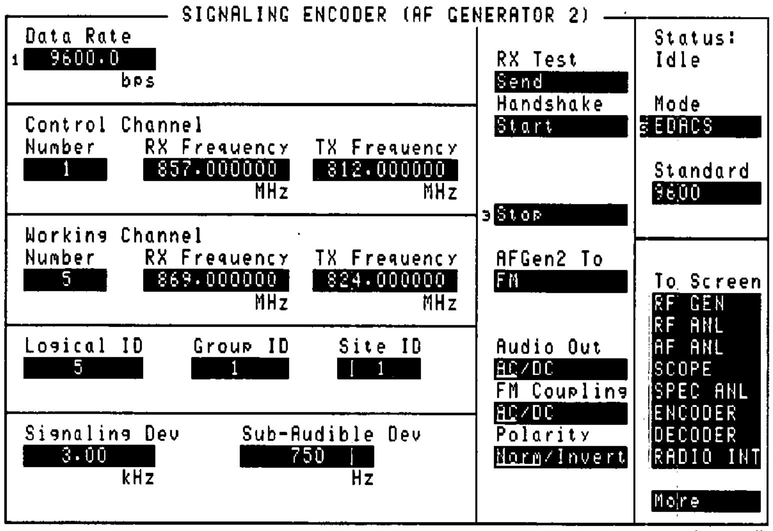
This field selects the trunked radio standard for your radio (as new standards are added).

Stop

Selecting this field stops the message being output when the `Send Mode` is set to `Cont` or `Burst`. After this field is selected, the current repetition of the message is finished.

EDACS Encoder

This encoder simulates an Ericsson\GE EDACS® (Enhanced Digital Access Communications System) repeater site to test trunked mobile radios using that format.



edac-en1.tif

Figure 4-40. The EDACS Trunked Radio Encoder Mode Screen

Automated Test Software

Hewlett-Packard offers pre-written software packages to fully test your EDACS radio in a fraction of the time normally required for complete manual testing. Under software control, you can perform receiver and transmitter tests on several channels in succession very quickly.

You can choose any combination of tests, from full transmitter and receiver testing, to a single test. The software is shipped on a memory card that inserts directly into your Test Set, and comes with complete documentation and a blank SRAM memory card for storing your test procedures and test data.

Testing EDACS Mobiles

When the mobile is turned on, it automatically tunes to its pre-programmed Control Channel frequency. The Test Set generates the Control Channel carrier and Site ID data using the RF Generator and the EDACS Encoder settings. (The RF carrier level for the Control Channel and Working Channel is adjusted using the `Amplitude` field on the **DUPLEX TEST** screen.) Once the mobile is receiving the Control Channel, the encoder can send a digital message to the mobile to go to a designated Working Channel for making receiver tests (this is called a 'handshake').

Testing the Mobile's Receiver

If the Working Channel's RF carrier level is high enough, the mobile's receiver un-squelches to allow the modulating signal (speech or a test tone) to be heard from your mobile's speaker.

If the audio output (speaker) connection of your mobile is connected to the AUDIO IN connectors of the Test Set, you can then make receiver audio quality measurements; such as distortion at 1 kHz and SINAD.

Testing the Mobile's Transmitter

The EDACS Encoder's information is used to help the EDACS Decoder receive and decode transmitted data from the mobile. After entering all of the information in the EDACS Encoder screen, the EDACS Decoder screen is accessed to get the mobile transmitting and to decode the digital data. With the transmitter keyed, you can access the **TX TEST** or **DUPLEX TEST** screen to measure `TX Power` and `TX Frequency` or `TX Freq Error`. You can also decode and display the transmitted data using the EDACS Decoder. (Refer to the EDACS Decoder section for more information on *EDACS Transmitter Testing*.)

Mobile Receiver Test Procedure

The following procedure establishes a Control Channel connection between the Test Set and your mobile, and then performs a handshake to pass the mobile to a Working Channel. Receiver measurements can then be made.

Note

Each EDACS radio is pre-programmed to access a specific Control Channel and one or more Working Channels. Other identification information is also pre-programmed into the mobile (such as the Logical ID and Group ID numbers). You cannot test an EDACS mobile without entering these values into the Encoder.

Press (PRESET) on the Test Set before continuing.

Connect the Mobile to the Test Set

1. Connect the mobile's antenna port to the Test Set's RF IN/OUT port.
2. Connect the mobile's audio output to the AUDIO IN **HI** port of the Test Set. (The AUDIO IN LO port is typically only used when the mobile's antenna port shield is not at the same potential as the audio output shield. See the **AF ANALYZER** screen, `Audio In Lo` field description.)
3. Turn the mobile on.

Get the Mobile Up on the Control Channel

1. Turn AF Generator 1 `Off` (to disable the default 3 kHz FM deviation). To do this, position the cursor in front of the `3.00` value in the `AFGen1 To` field on the RF Gen or Duplex screen and press (ON/OFF).
2. Select the `ENCODER` function from the `To Screen` menu.
3. Select the EDACS `Mode` to display the EDACS Encoder.
4. Select the standard used by the radio (4800 or 9600 bps).
5. Enter the `Control Channel` settings.
   a. The `Number` is the system Control Channel number programmed into your mobie.
   b. The `RX Frequency` is the Control Channel receive frequency for your mobile.
   c. The `TX Frequency` is the Control Channel transmit frequency for your mobile.

6. Enter the **Working Channel** settings.
   a. The **Number** is the Working Channel number (programmed into your mobile) that you want the mobile to be sent to.
   b. The **RX Frequency** is the mobile's receive frequency for the selected Working Channel.
   c. The **TX Frequency** is the mobile's transmit frequency for the selected Working Channel.
7. Enter the **Logical ID** number.
8. Enter the **Group ID** number.
9. Enter the **Site ID** number.
10. Select the Send field (under **RX Test**). The **Status:** field should now indicate **Control**.

    The Test Set should now be sending Control Channel Site ID information to the mobile, and the mobile should indicate that it is receiving the Control Channel data.
11. Select the **Handshake** field. This tells the mobile and RF Generator to go to the Working Channel frequencies. The mobile should now indicate that it is "busy", and is tuned to a Working Channel (this is a "receiver handshake"). The **Status:** field should now indicate **Working**.

Make Receiver Measurements

1. Press (RX) to access the **RX TEST** screen.
2. Turn AF Generator 1 On. (Position the cursor in front of the Off entry in the lower part of the **AFGen1 To** field, and press (ON/OFF).) The entry should now read 3.00. The Working Channel is now being modulated at a 1 kHz rate (**AFGen1 Freq**) with 3 kHz deviation (**AFGen1 To**) in addition to the subaudible EDACS signaling from the Encoder (AFGen2).
3. Set the volume control on your mobile to about half of full scale. (You may or may not hear the 1 kHz tone from your radio's speaker, depending on how the external speaker connection affects the speaker.)
4. Turn the VOLUME up the Test Set. You should be able to hear the 1 kHz tone.

Your mobile's SINAD is displayed, as well as the **AC Level** of the audio output. You can now change the RF Generator's **Amplitude** setting to check sensitivity, or select the SINAD measurement to list and access other available audio measurements.

AFGen2 To

The **Audio Frequency Generator 2 To** field is used to specify where the encoder's data is sent:

- **FM** is used to frequency modulate the RF Generator. This is the normally-used setting. (Refer to the `FM Coupling` field description.)
- **AM** is used to amplitude modulate the RF Generator (not generally used for EDACS signaling).
- **Audio Out** routes the data to the front panel AUDIO OUT connector. The signal could then be used as an external modulation source. (Refer to the `Audio Out` field description.)

Operating Considerations

The encoder's digital signal level is adjusted using the `Signaling Dev` and `Sub-Audible Dev` fields. Changing the `AFGen2 To` setting automatically alters the unit-of-measure for both of these fields (kHz, %, or mV).

Audio Out

The **Audio Out Coupling** field selects AC or DC coupling of the encoder to the AUDIO OUT connector. Because the EDACS Encoder sends low speed data, this field should be set to **DC** when the AUDIO OUT port is used. The `AFGen2 To` field must be set to `Audio Out` to use this function.

Control Channel, Number

This field is used to specify the Control Channel number for the EDACS system. (Typically 1 to 25.)

Control Channel, RX Frequency

This field is used to specify the Control Channel receive frequency for the mobile.

Control Channel, TX Frequency

This field is used to specify the Control Channel transmit frequency for the mobile.

Data Rate

This field sets the data rate (in bits-per-second) for the high speed signaling. The value can be changed using the keypad, or by selecting a value from the `Standard` field. However, the 9600 bps rate is the EDACS default, and should not be changed under most circumstances. (4800 is used for narrowband 900 MHz systems in the U.S.)

FM Coupling

This field is used to select AC or DC coupling of the encoder to the RF Generator when the AFGen2 To field is set to FM. Because the EDACS Encoder sends low speed data, this field should be set to **DC**.

Group ID

This field is used to specify the Group ID number for the trunked radio group your radio is set up to access.

Handshake

This field is used to get the mobile up on a Working Channel after it has accessed the Control Channel.

When start is selected, the encoder sends a digital message over the Control Channel to tell the mobile to go to the specified Working Channel (called a "channel assignment"). Immediately after the message is sent, the RF Generator and RF Analyzer frequencies are automatically changed to match the same Working Channel settings.

Operating Considerations

The Control Channel message must be transmitting before a handshake can be initiated. The Status: field indicates Control when the Control Channel is transmitting, and changes to Working when the Working Channel is being sent.

Logical ID

This field is used to specify the ID number of the calling radio. It should be set to the Logical ID of the radio being tested when performing transmitter tests. Generally, when performing receiver tests, it must be set to a Logical ID different from that of the radio being tested.

Polarity

This setting determines how the encoder's digital data modulates RF Generator. This field is usually set to Norm. Invert is used for narrowband systems. This field is automatically set to the correct polarity by the Standard field.

When this field is set to Invert, a logical high (1) causes the output level of the encoder to be *negative*. A logical low (0) causes the level to become positive. When using FM, the RF Generator would then produce a negative frequency deviation for a postive-going digital transition - the opposite of the normal mode of operation.

This field is automatically set to the correct polarity by the Standard field.

RX Test

When `Send` is selected, the Control Channel message is output at the RX Frequency specified in the `Control Channel` settings. The `Status:` field changes from `Idle` to `Control`, and the RF Analyzer is tuned to the Control Channel TX Frequency.

See Also

`Handshake` field description

Signaling Dev

This field is used to specify the high-speed data level. The unit of measure used depends on the `AFGen2 To` setting.

- When `AFGen2 To` is set to `FM`, the displayed units are **kHz** or **Hz**. This is the normally-used setting for testing EDACS radios.
- When `AFGen2 To` is set to `AM`, the displayed unit is %.
- When `AFGen2 To` is set to `Audio Out`, the displayed units are μ**V**, **mV**, or **V**.

See Also

`AFGen2 To` field description

Site ID

This field is used to specify the ID number of the repeater site being simulated by the encoder.

Standard

This field specifies the signaling standard used by the radio: 4800 bps (narrowband) or 9600 bps (wideband). In addition to telling the Encoder and Decoder which system is being used, this field presets the values of certain fields as shown in the following table.

Field	Standard	
	9600	**4800**
Data Rate	9600.0	4800.0
Signaling Dev	3.00	1.80
Sub-Audible Dev	750	350
(Encoder) Polarity	Norm	Invert

Status

This field indicates what the encoder is doing.

- **Idle** is displayed when no data is being sent.
- **Control** is displayed when Control Channel data is being output.
- **Working** is displayed when a handshake has been performed and Working Channel data is being sent.

Sub-Audible Dev

This field is used to specify the low speed data level. The unit of measure used depends on the `AFGen2 To` setting.

- When `AFGen2 To` is set to `FM`, the displayed units are **kHz** or **Hz**. This is the normally-used setting for testing EDACS radios.
- When `AFGen2 To` is set to `AM`, the displayed unit is %.
- When `AFGen2 To` is set to `Audio Out`, the displayed units are μ**V**, **mV**, or **V**.

See Also

`AFGen2 To` field description

`Stop`

This field is used to stop the Control Channel or Working Channel data from being output. The carrier continues to be output, but without the digital modulation.

Working Channel, Number

This field is used to specify the Working Channel number for the EDACS system. (Typically 1 to 25.)

Working Channel: RX Frequency

This field is used to specify the Working channel receive frequency for the mobile.

Working Channel: TX Frequency

This field is used to specify the Working Channel transmit frequency for the mobile.

MPT 1327 Encoder

This encoder is used to test trunked mobile radios that use the MPT 1327 standard. It is primarily intended to be controlled using IBASIC programs running on the Test Set's IBASIC controller or on an external controller.

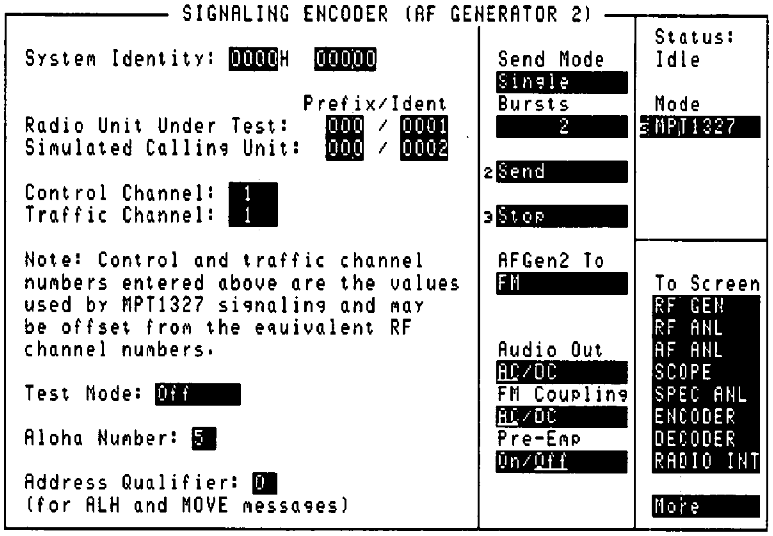


Figure 4-41. The MPT 1327 Trunked Radio Encoder Mode Screen

Manually Testing MPT 1327 Radios

MPT 1327 signals contain complex groupings of digital data that vary in format and function, depending on a number of system operating parameters.

To be able to test MPT 1327 radios using this screen, you must be familiar with the theory, applications, and specifications of the MPT 1327 system. You must also be familiar with IBASIC programming, since some of the required signaling commands are not available on the Encoder screen; they must be sent using IBASIC commands. (See *Undisplayed Controls* later in this section.)

The large volume of information required to explain the MPT 1327 system is beyond the scope of this manual. Documents explaining the structure and specifications of this system should be obtained from the radio communications regulatory agency of the appropriate country.

Using Automated Test Software

The HP 11807A Option 012 MPT 1327 Trunked Radio Tests software provides comprehensive automated tests of MPT 1327 radios. All Test Set RF, AF, and Encoder/Decoder controls are automatically set, requiring minimal operator inputs.

You can choose any combination of tests, from full transmitter and receiver testing, to a single test. The software is shipped on a memory card that inserts directly into your Test Set, and comes with complete documentation and a blank SRAM memory card for storing your test procedures and test data.

System Identity

The System Identity uses two areas to enter the system identity number as either a decimal or hexadecimal value. When a value is entered in either field, the corresponding value is automatically entered in the other field.

The first field is a four digit hexadecimal integer with leading zeros (H indicates the hexadecimal number base). It has the range 0 through $7FFF_{16}$ and its default is 0000_{16}.

The second field is a five digit decimal integer with leading zeros. It has the range 0 through 32767 and its default is 00000.

It is essential that the 15-bit system identity transmitted by the Test Set matches the system identity programmed into the RU (Radio Unit). If there is not a match, the RU will not recognize the forward control channel and no communication will be possible.

Radio Unit Under Test

The Radio Unit Under Test function uses two input fields; a 7-bit Prefix field and a 13-bit Ident field. This allows you to enter the prefix and identity of your RU (Radio Unit).

Each RU has a unique prefix/ident value, used to address messages to that RU only. An RU can also have a number of "group" prefix/ident values that it and several other RUs respond to.

The prefix is a three digit decimal integer with leading zeros. It has the range 0 through 127 and its default is 000.

The ident is a four digit decimal integer with leading zeros. It has the range 0 through 8191 and its default is 0001.

Simulated Calling Unit

The Simulated Calling Unit function uses two input fields; a 7-bit Prefix field and a 13-bit Ident field. This allows you to enter the prefix and identity of the calling unit.

To test an RU (Radio Unit) the Test Set simulates a Trunking System Controller (TSC). In some tests the Test Set simulates calls from a third party. For this purpose it is necessary to specify the simulated calling unit's number.

The simulated calling party could be any radio or line unit. It could also be one of the special idents indicating, for example, a system wide call or a call from a PABX or PSTN gateway.

The prefix is a three digit decimal integer with leading zeros. It has the range 0 through 127 and its default value is 000.

The ident is a four digit decimal integer with leading zeros. It has the range 0 through 8191 and its default value is 0002.

Control Channel

The `Control Channel` field allows you to enter the Control Channel number.

RUs (Radio Units) are programmed to look for Control Channel signaling on a restricted set of radio channels, known as the hunt group. It is essential that the channel number on which the Test Set transmits the control channel signaling matches one of the channels in the RU's hunt group. If there is not a match no communication will be possible.

The control channel is a four digit decimal integer without leading zeros. It has the range 0 through 1023 and its default value is 1.

Traffic Channel

The `Traffic Channel` field allows you to enter the traffic channel number. The traffic channel is a four digit decimal integer without leading zeros. It has the range 0 through 1023 and its default value is 1.

Test Mode

The `Test Mode` field is used to select how the encoder is used for tests:

Selection	Description
`Off`	In this mode the signaling hardware is disabled and does not transmit data.
`Control`	In this mode the signaling hardware is enabled and is re-transmitting a basic control channel structure as defined by the content of the filler buffer. (Refer to "Forward Control Channel, Message and Filler Buffers" for an explanation of the filler buffer). One or more timeslots in the filler pattern can be overlayed by messages from the control message buffer under control of the `Send` field.
`Traffic`	In this mode the signaling hardware is enabled. The filler pattern is not transmitted. Single or multi-timeslot messages can be transmitted from the traffic message buffer under the control of the `Send` field.
`1200Hz`	In this mode the signaling hardware is enabled and transmits a continuous 1200 Hz tone (equivalent to an FFSK transmission of continuous ones).
`1800Hz`	In this mode the signaling hardware is enabled and transmits a continuous 1800 Hz tone (equivalent to an FFSK transmission of continuous zeros).
`Dotting`	In this mode the signaling hardware is enabled and transmits alternating 1200 Hz and 1800 Hz tones (equivalent to an FFSK transmission of alternating ones and zeros).

Aloha Number

The `Aloha Number` field allows you to enter the aloha number. The aloha number defines the number of timeslots in the random access frames on the forward control channel. The value entered in this field is translated to a frame length according to Table 4-1.

The aloha number is a two digit decimal integer without leading zeros. It has a range 0 through 15 and its default value is 5.

Table 4-1. Aloha number encoding for 4-bit aloha numbers

Aloha Number	Frame length	Aloha Number	Frame length
0	Not a frame marker	8	8
1	1	9	9
2	2	10	10
3	3	11	12
4	4	12	15
5	5	13	19
6	6	14	25
7	7	15	32

Address Qualifier

The `Address Qualifier` field allows you to enter the address qualifier. The address qualifier is a bit mask. It indicates the number of bits in the ident field which have to be compared by an RU when it is deciding whether the `ALH` or `MOVE` message is addressed to that RU (Radio Unit).

The address qualifier is a two digit decimal integer without leading zeros. It has the range 0 through 20 and its default value is 0. A value of:

- 0 corresponds to no bits being compared (all RUs receive the `ALH` or `MOVE` message).
- 20 corresponds to all bits being compared (the `ALH` or `MOVE` being addressed to one specific RU).
- M between 0 and 20, sub-divide the RU population into 2^M subsets.

Undisplayed Controls

Some MPT 1327 controls are not displayed on the encoder screen; they are only accessed using IBASIC commands over HP-IB. These controls include the Delay parameter, the SYNC and SYNT synchronization codewords, and the Message and Filler buffers.

The controls listed in the remainder of this section are not displayed on the MPT 1327 Encoder screen.

Delay Parameter for Repeat Transmissions

This control is only available using IBASIC commands; it is not displayed on the MPT 1327 Encoder screen.

In the aloha message there is a bit field which indicates to the RU (Radio Unit) how long it should wait for a response from the TSC. If the RU does not receive a response within this period it should re-issue the request. This is generally set to a fixed value, determined by the protocol speed and the responsiveness of IBASIC. In some circumstances it may be useful to change this value.

Table 4-2. Delay Parameter to Actual Response Delay

Delay Parameter	Response delay
0	0
1	1
2	2
3	3
4	4
5	5
6	10
7	15

The delay parameter has a range 0 through 7, with a default value of 7.

This control is listed as `RDELay` in the HP-IB Syntax Diagrams in the *Programmer's Guide.*

Forward Control Channel Message and Filler Buffers

This control is only available using IBASIC commands; it is not displayed on the MPT 1327 Encoder screen.

The encoder screen `Test Mode` field selects the type of signal being transmitted by the signaling hardware (as explained in the previous section, "The Test Mode"). The most important modes are the `Control` and `Traffic` modes.

In the `Control` mode the Test Set continuously generates a slotted aloha forward control channel, as defined and controlled from IBASIC. In `Traffic` mode the Test Set generates individual messages, as defined and controlled from IBASIC.

These modes are central to testing MPT 1327 RUs. An RU must acquire and validate a control channel. It must also be instructed, by control channel signaling, to proceed to a traffic channel before any RF or audio measurements can be performed.

During testing it is necessary to generate the forward control channel continuously. Initially, for the RU to acquire and validate the control channel, for exchanging the necessary call setup signaling. Thereafter, for the RU to remain locked onto the control channel, awaiting exchange of further signaling. This also prevents the RU from re-entering control channel acquisition procedures.

The exception to this is when the RU under test is participating in a test call on a traffic channel. It is not necessary to maintain the control channel signaling during test calls as there is only one RU in the test environment and it is on a traffic channel.

As there is only one RU, the control channel signaling comprises a fixed slotted aloha sequence with occasional variations to send specific messages (such as requests for registration (`RQR`), broadcast messages (`BCAST`), ahoy messages (`AHY`)).

The filler buffer contains the repeating pattern of the forward control channel. It also contains a message buffer from which selected timeslots in the filler buffer can be replaced on a one-off or repeating basis.

The control channel filler buffer comprises 32 individual timeslots. It is accessed only via the HP-IB with the command:

`ENCoder:MPT1327:FILLer:DATA` *n*,*string*

Where:

- *n* is the location selector and has the range 1 through 32.
- *string* is a string containing a signaling language command defining the content of one timeslot. Some signaling language commands also define data codewords and therefore translate to data for two or three timeslots. The signaling language commands take the form of an assembly language, the syntax of which is defined in appendix A.

Note

In MPT 1327 an address codeword can be followed by up to four data codewords. A data codeword occupies half of one timeslot. The signaling language definition restricts the firmware to accept only two or four data codewords. An odd number of data codewords must be added to occupy a whole number of timeslots. For messages with an dd number of data codewords the padding word must be generated by IBASIC.

An example of the format is given in the sequence of commands below. It defines a two timeslot random access frame with a broadcast message, transmitted on channel 212 of system 4901_{16}.

```
ENC:MPT1327:FILL:DATA 1,'ALH 0,ALLI,212,0,0,2'
ENC:MPT1327:FILL:DATA 2,'ALH 0,ALLI,212,0,0,0'
ENC:MPT1327:FILL:DATA 3,'BCAST 2,#H4901,0,0'
```

The signaling commands from such strings are assembled into 48-bit address and data codeword message values.

For an address codeword message, the timeslot (128-bits) consists of a 64-bit Control Channel System Codeword (CCSC), followed by the address message, followed by a 16-bit parity word.

Data codeword messages are taken in pairs. Each has its own 16-bit parity word. The firmware is never supplied with an odd number of codewords. The resulting pair of 64-bit words is concatenated to again give 128-bits.

The resulting 128-bits are stored in the addressed location of the filler buffer. Figure 4-42, shows a signaling instruction being processed, and should clarify this explanation.

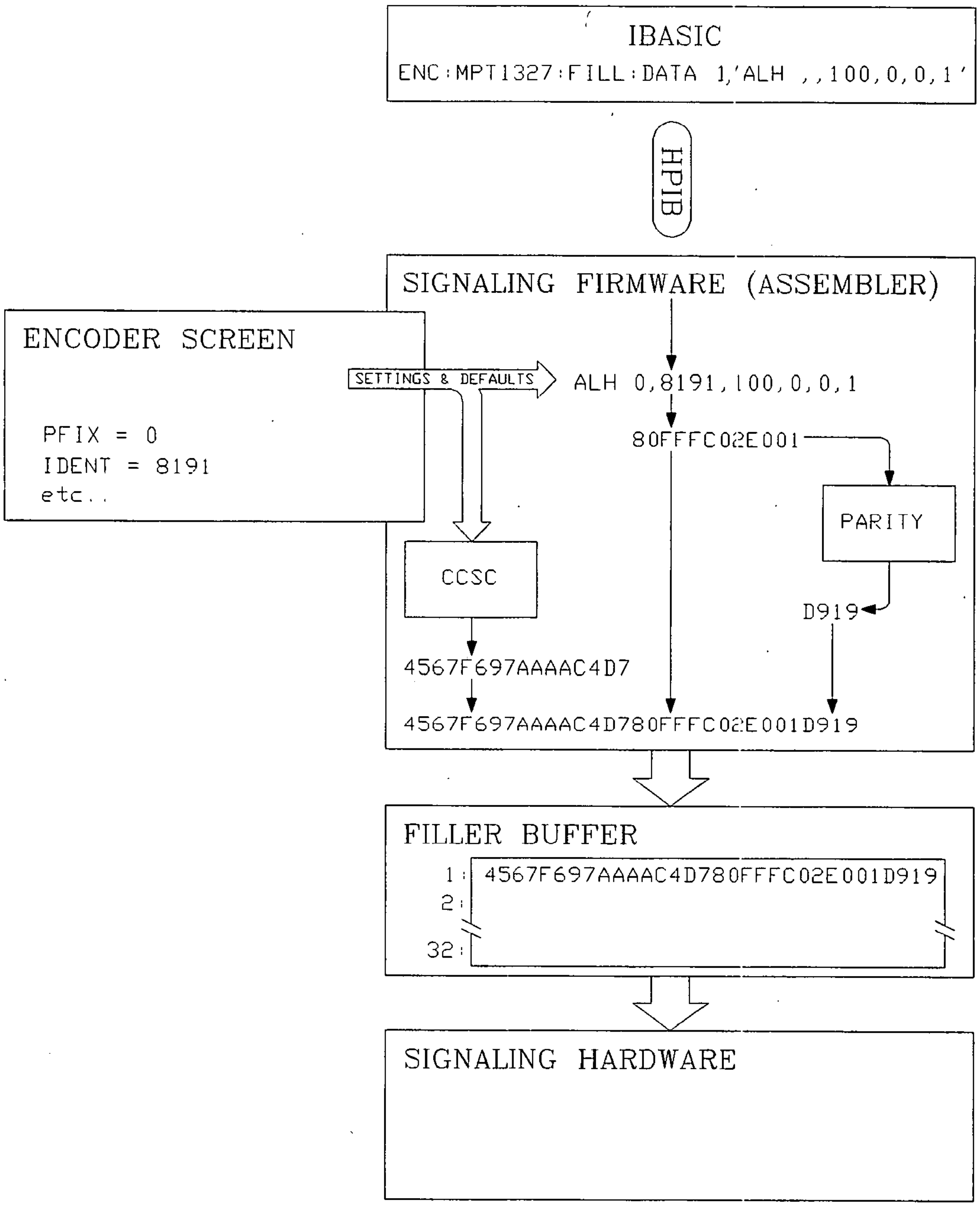


Figure 4-42. Sequence of Events in Assembling a Signaling Message

Forward Control Channel Message and Filler Buffers (cont'd)

If the signaling command has the data codeword extension, DCW2 or DCW4, subsequent timeslot locations are overwritten with the data codewords. If this results in a write to a timeslot greater than 32, the write will wrap back to timeslot one.

A new filler pattern typically comprises several commands to be written. Since each is written individually, the following update command is also needed to transfer data into the working filler buffer:

```
ENCoder:MPT1327:FILLer:UPDATe
```

To complete the command set for managing the filler buffer, the individual timeslot locations of the filler buffer are cleared by the command:

ENCoder:MPT1327:FILLer:CLEAR *n*

Where *n* selects the timeslot to be cleared and has the range 1 through 32.

The whole buffer is cleared by the command:

```
ENCoder:MPT1327:FILLer:RESET
```

When the **Test Mode** field is in **Control** mode the signaling firmware/hardware will cycle through the defined part of the filler buffer transmitting each 128-bit timeslot in turn. This is shown in Figure 4-43. Figure 4-43 also shows the control message buffer for comparison with Figure 4-44.

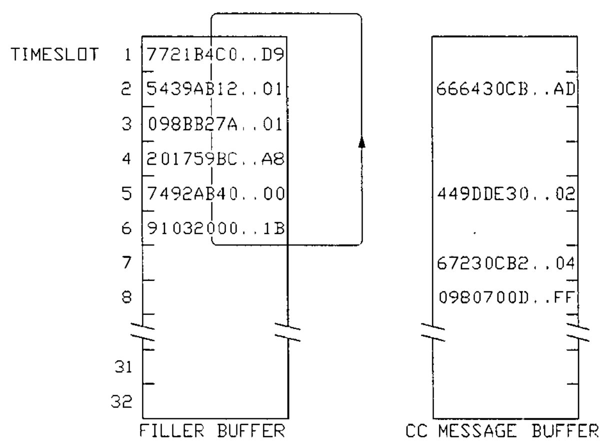


Figure 4-43. Forward Control Channel in `Control` **Mode and Not** `Sending`

The IBASIC test program occasionally alters the content of the forward control channel temporarily (for example to send an **ACKI** in response to an **RQS**). The message buffer enables IBASIC to do this, without having to reload the filler buffer.

The control channel message buffer (like the filler buffer), comprises of 32 locations, corresponding to the 32 timeslot capacity of the filler buffer. These are accessed via the HP-IB with the command:

`ENCoder:MPT1327:MESSage:CONTrol:DATA` *n*, *string*

Where:

- *n* is the location selector and has the range 1 through 32.
- *string* is a string containing a signaling command. The signaling command is assembled as for the filler buffer and written into the selected location. If the signaling command has one of the data codeword extensions (`DCW2` or `DCW4`), subsequent timeslot locations are overwritten with the data codewords.

The control channel message buffer is activated by the HP-IB command:

`ENCoder:SEND`

If the encoder is configured for single operation the message buffer contents will be sent once.

If the encoder is configured for Burst or Continuous operation the control channel message buffer can be de-activated by the HP-IB command:

`ENCoder:STOP`

The `ENC:STOP/ENC:SEND` command sequence is also an `UPDATE` command. New timeslot contents written using `ENC:MPT1327:MESS:CONT:DATA` are buffered until the `STOP/SEND` sequence causes the control message buffer to be updated.

Note

The encoder sending status can be monitored to establish when a message has been sent by looking at bit-8 "Encoder sending Aux Information" in the Hardware Status Register #1. For further information on the Hardware Status Register refer to the *Programmer's Guide.*

When the `Test Mode` field is in `Control` mode and the control message buffer is activated by `ENC:SEND`, the signaling firmware/hardware cycles through the defined part of the filler buffer. It transmits each 128-bit filler buffer timeslot in turn. This happens except where there is a message defined in the corresponding timeslot of the control message buffer. In this case the contents of the control message buffer are transmitted, as shown in Figure 4-44.

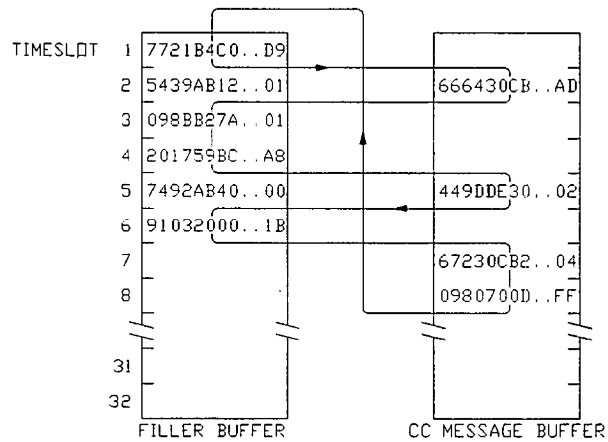


Figure 4-44. Forward Control Channel in `Control` Mode and `Sending`

Figure 4-44 shows that messages defined in contiguous timeslots, following the last timeslot defined in the filler message, are transmitted between each repeat of the filler pattern.

This can be used, for example, to insert a registration frame (**ALHR**) between the the normal filler frames.

The individual timeslot locations of the message buffer can be cleared by the command:

```
ENCoder:MPT1327:MESSage:CONTrol:CLEAR n
```

where *n* is the timeslot to be cleared and has the range 1 through 32.

In addition the whole message buffer can be cleared by the command:

```
ENCoder:MPT1327:MESSage:CONTrol:RESET
```

Traffic Channel Message Buffer

This control is only available using IBASIC commands; it is not displayed on the MPT 1327 Encoder screen.

When the RU under test moves to a traffic channel, the IBASIC test program needs to stop the transmission of the control channel signaling temporarily but still be able to send individual messages. (For example, to send a **CLEAR** message.)

Forward Control Channel Message and Filler Buffers (cont'd)

When `Test Mode` is set to `Traffic`, the control channel filler and message buffers are disabled, and a traffic channel message buffer is enabled. A message is sent from the traffic channel message buffer on demand by use of `ENC:SEND`. Only messages in message buffer timeslot one and any contiguous timeslots are sent. Refer to Figure 4-45.

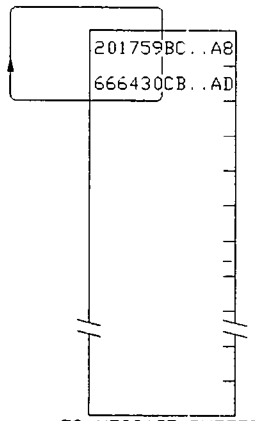


Figure 4-45. Traffic Channel Message Generation

Control and Traffic Channel Message Structures

This control is only available using IBASIC commands; it is not displayed on the MPT 1327 Encoder screen.

In both `Control` and `Traffic` mode the signaling transmissions commence with the standard link establishment time (LET), preamble and SYNC or SYNT pattern, and are terminated with a "hang-over" bit as shown in Figure 4-46 and Figure 4-47.

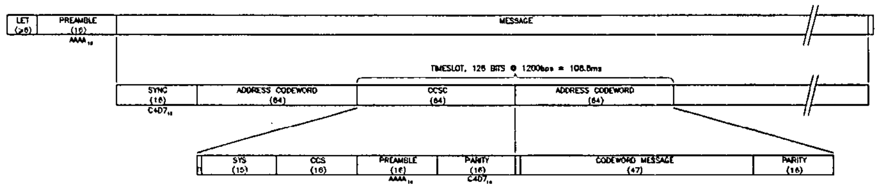


Figure 4-46. Forward Control Channel Message Structure

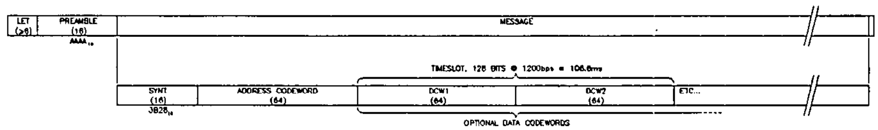


Figure 4-47. Traffic Channel Message Structure

Table 4-3 describes the signaling encoder as it is changed between the various test modes. Particular reference is made to how the control and traffic channel message structures are started and stopped.

Table 4-3. Signaling Mode Transitions Table

To From	Off	Control	Traffic	1200Hz	1800Hz	Dotting
Off	—	A	B	C	D	E
Control	F	—	H then B	F then C	F then D	F then E
Traffic	G	I then A	—	G then C	G then D	G then E
1200Hz	J	J then A	J then B	—	N	O
1800Hz	K	K then A	K then B	M	—	O
Dotting	L	L then A	L then B	M	N	—

A. Start the control channel with a 6-bit LET, PREAMBLE, SYNC. For the first address codeword (before the repeating SYS, CCS, PREAMBLE, PARITY, CODEWORD, PARITY structure), the codeword comes from the second half of the filler (or message) buffer timeslot 1.
B. Start the traffic channel with a LET, PREAMBLE, SYNT. Again the first codeword is taken from the timeslot 1 entry.
C. Turn on 1200 Hz sine wave starting at 0° phase.
D. Turn on 1800 Hz sine wave starting at 0° phase.
E. Turn on "dotting" with a '1' symbol. The starting phase may be 0° or 180°.
F. Continue to generate the control channel until the end of the filler buffer (and message buffer if messages are present) then produce a hang-over bit and stop. The hang-over bit repeats the last bit of the transmission.
G. Continue to generate the traffic channel until the message is completed then produce a hang-over bit and stop. The hang-over bit is followed by one "off" bit before the next sequence begins.
H. Stop control channel generation after the next bit.
I. Stop traffic channel generation after the next bit.
J. Turn off 1200 Hz sine wave on completion of the next symbol.
K. Turn off 1800 Hz sine wave on completion of the next symbol.
L. Turn off "dotting" on completion of the next '1010' symbol. Dotting is sent as the sequence '1010' rather than '10'. This makes the trace on the internal scope stable when triggered by the encoder since every second '1' starts on the opposite phase.
M. Make a phase continuous transition to 1200 Hz on completion of the next symbol.
N. Make a phase continuous transition to 1800 Hz on completion of the next symbol.
O. Make a phase continuous transition to "dotting" (starting with a '1' symbol) on completion of the next '1010' sequence.

Decoder

Signaling Decoder

The Decoder analyzes different data-encoded signaling formats. The format is selected in the `Mode` field in any of the Decoder's screens.

A list of standards for each format is displayed by selecting the `Standard` field in any screen.

A separate Screen and Field Description is given for each screen. The descriptions are listed in the following order:

- Function Generator
- Tone Sequence
- DTMF (Dual-Tone Multi-Frequency) Sequence
- CDCSS (Continuous Digital Controlled Squelch System)
- Digital Paging
- AMPS-TACS/NAMPS-NTACS
- NMT (Nordic Mobile Telephone)
- LTR (Logic Trunked Radio: Registered Trademark of EF Johnson Company)
- EDACS (Enhanced Digital Access Communications System)
- MPT 1327

The Decoder's Signal Source

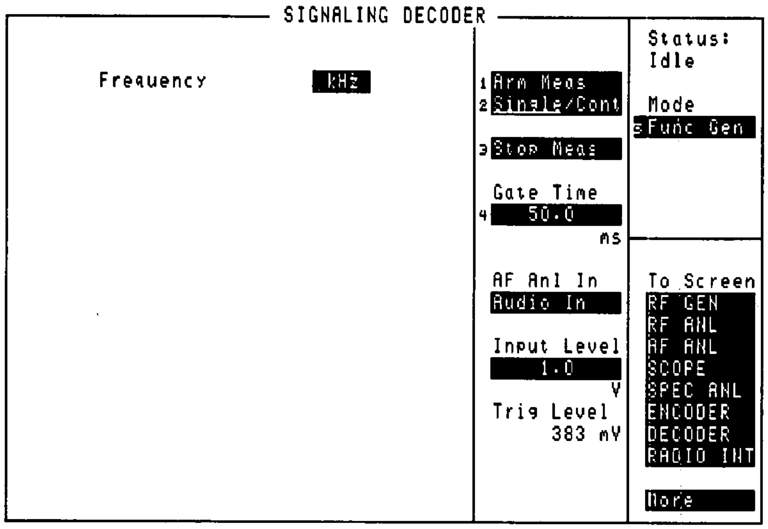
The Decoder *always* gets its signal immediately after the de-emphasis network of the AF Analyzer. De-emphasis can be turned on or off on the **AF ANALYZER** screen, or can be controlled while using the decoder by assigning a global USER key to the `De-Emphasis` field. Refer to the **AF ANALYZER** screen's fields and functions diagram.

Decoder Frequency Measurements

The Decoder uses a different timebase for frequency counting than the AF Analyzer. Therefore, their measurements may be different when measuring the same signal (by a very small amount).

Function Generator Decoder

The function Generator Decoder is an Audio Frequency counter that counts the same types of AC waveforms available for the Function Generator Encoder.



func-dec.tif

Figure 4-48. The Tone Sequence Decoder Screen

Decoding Considerations

Frequency measurements are affected by the `Filter1`, `Filter2`, `Settling`, and `De-Emphasis` settings in the **AF ANALYZER** screen.

Four dashes are displayed

`(----)`

if the incoming signal is out of range, or if the `Gate Time` is too long for the frequency being measured.

AF Anl In

Audio Frequency Analyzer Input selects the source of the signal to be analyzed.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in this screen.

See Also

"Interaction Between Screens" in Chapter 3

Arm Meas

Arm Measurement prepares the decoder to be triggered by an incoming signal when making `Single` measurements.

Frequency

This measurement displays the decoded signal's frequency.

Gate Time

This field specifies the minimum time the Decoder analyzes a signal after it has been triggered.

Input Level

This field specifies the signal level that you input (after de- emphasis if it is turned on). The higher the level of signal expected by the analyzer, the higher the Trigger Level is set.

Operating Considerations

The unit-of-measure is determined by the `AF Anl In` setting.

The input level should be set high enough to prevent false triggering, but low enough to allow triggering for fluctuating signal levels.

If de-emphasis is used (by setting the AF Analyzer's `De-Emphasis` field to `750 μs`), the `Input Level` should be set to about 1/5 of the measured signal's level. For example, a 1 kHz 1 Vpeak sinewave into the AF Analyzer input requires an `Input Level` of ≈.212 V to trigger correctly.

Stop Meas Selecting this field stops the analyzer when making single measurements.

Single/Cont This field specifies how you want the analyzer to be armed:

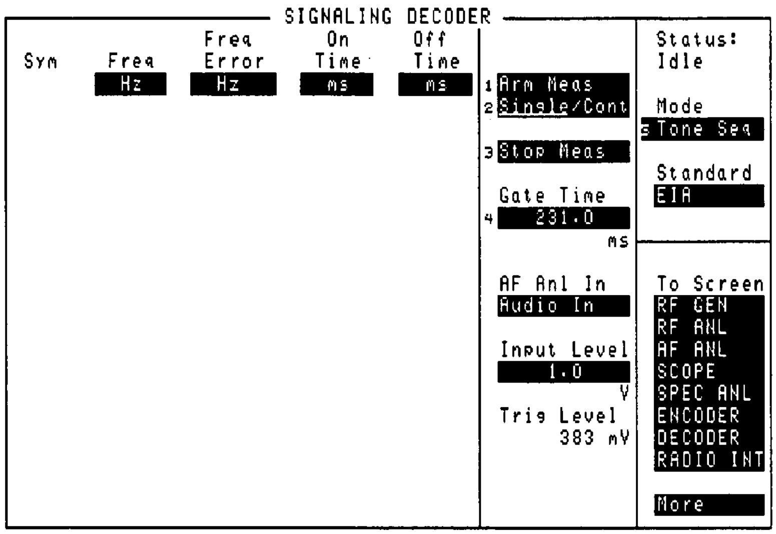
- **Single** is used to analyze and display the decoded information once each time `Arm Meas` is selected.
- **Cont** is used to automatically re-arm the analyzer and display the measurements on a continual basis until `Single` is selected.

Trig Level

The **Trigger Level** indicates the minimum signal level required to begin a measurement that has been "armed". The level is adjusted by changing the `Input Level` field setting.

Tone Sequence Decoder

The Tone Sequence Decoder analyzes sequential tone signals and displays the associated parameters.



tone-dec.tif

Figure 4-49. The Tone Sequence Decoder Screen.

AF Anl In

Audio Frequency Analyzer Input selects the source of the signal to be analyzed.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in this screen.

`Arm Meas`

Arm Measurement prepares the decoder to be triggered by an incoming signal when `Single` is selected.

Freq This measurement column lists the tone frequency for each Symbol received in the tone sequence.

Freq Error This measurement column lists the frequency difference between the tone frequency specified for each symbol in the Tone Sequence **ENCODER** screen and the frequency measured for each symbol in the Tone Sequence **DECODER** screen.

Operating Considerations

The **DECODER** and **ENCODER** `Standard` fields are interactive. The standard you choose in either field is automatically selected for the other.

Gate Time This field specifies how long the Decoder analyzes a signal after it has been triggered.

Input Level This field specifies the tone "On" signal level that you input (after de-emphasis if used). The higher the level of signal expected by the analyzer, the higher the Trigger Level is set.

Operating Considerations

The unit-of-measure is determined by the `AF Anl In` setting.

The input level should be set high enough to prevent false triggering, but low enough to allow triggering for every desired tone received.

If de-emphasis is used (by setting the AF Analyzer's `De-Emphasis` field to 750 μs), the `Input Level` should be set to about 1/5 of the measured signal's level. For example, a 1 kHz 1 Vpeak sinewave into the AF Analyzer input requires an `Input Level` of ≈.212 V to trigger correctly.

Off Time This measurement column lists the length of time each tone was Off prior to the next tone being received.

On Time This measurement column lists the length of time each tone was On.

Single/Cont

This field specifies how you want the analyzer to be armed:

- **Single** is used to analyze and display the decoded information once each time Arm Meas is selected.
- **Cont** is used to automatically re-arm the analyzer and display the measurements on a continual basis until Single is selected.

Stop Meas

Selecting this field stops the analyzer when making single measurements.

Sym

The **Symbol** column corresponds to the Tone Sequence Encoder's symbols assigned for each tone. As each tone is analyzed, the symbol that represents each tone is listed in this column.

Operating Considerations

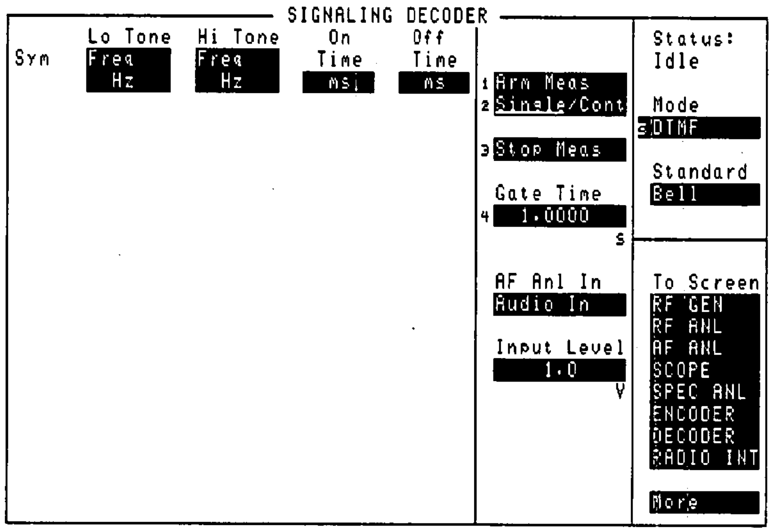
The symbol assigned to a received tone is based on the closest symbol frequency to that tone. If the frequency of the received tone is exactly half-way between two symbol frequencies, the symbol associated with the higher of the two frequencies is displayed.

Trig Level

The **Trigger Level** indicates the minimum signal level required to begin a measurement that has been "armed". The level is adjusted by changing the Input Level field setting.

Dual-Tone Multi-Frequency (DTMF) Decoder

The DTMF Sequence Decoder analyzes Dual-Tone Multi-Frequency tone sequences and displays the associated parameters.



dtmf-de2.tif

Figure 4-50. The DTMF Decoder Screen

Measurement Limits

Lo Tone: 680 - 960 Hz
Hi Tone: 1190 - 1660 Hz

Actual limits are typically slightly wider than this. However, the crossover point between Hi and Lo tone decoding is ≈1.1 kHz. If incoming tones approach this point, unreliable measurements may be displayed (frequency measurement errors and spurious off times).

AF Anl In

Audio Frequency Analyzer Input selects the source of the signal to be analyzed.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in this screen.

Arm Meas

Arm Measurement prepares the decoder to be triggered by an incoming signal when making Single measurements.

Gate Time

This field specifies how long the Decoder analyzes a signal after it has been triggered.

Input Level

This field specifies the signal level that you input (after de- emphasis if used). The higher the level of signal expected by the analyzer, the higher the trigger level is set.

Operating Considerations

The unit-of-measure is determined by the AF Anl In setting.

The input level should be set high enough to prevent false triggering, but low enough to allow triggering for fluctuating signal levels.

De-Emphasis Effects

De-Emphasis is a single-pole low-pass filter with a 212.2 Hz corner frequency. It is enabled/disabled using the De-Emphasis field on the **AF ANALYZER** screen. (Refer to the AF Analyzer's functional diagram.) The Input Level is the expected level at the output of the de-emphasis network.

Assuming a mean DTMF frequency of ≈1 kHz, decoding with de-emphasis on (set to 750 μs) requires the Input Level to be set to 212/1000 = 0.212 times the peak deviation, or about 1/5 the incoming level of the tone.

Examples of Input Level Settings

Example 1: Peak Deviation 3 kHz, De-Emphasis off.
Set the Input Level to 3 kHz.

Example 2: Peak Deviation 3 kHz, De-Emphasis 750 μs.
Set the Input Level to 3×0.212 = 636 Hz.

Hi Tone

This measurement field lists the frequency or frequency error for the high frequency tone in each tone pair. The measurement type is selected by selecting the `Freq` field to display a list of measurement choices.

Operating Considerations

Frequency Error is calculated by comparing the DTMF Encoder's frequency settings for each tone pair with the decoded frequencies.

Lo Tone

This measurement field lists the frequency or frequency error for the low frequency tone in each tone pair. The measurement type is selected by selecting the `Freq` field to display a list of measurement choices.

Operating Considerations

Frequency Error is calculated by comparing the DTMF Encoder's frequency settings for each tone pair with the decoded frequencies.

Off Time

This measurement column lists the length of time each tone pair was Off prior to the next tone being received.

On Time

This measurement column lists the length of time each tone pair was On.

`Single/Cont`

This field specifies how you want the analyzer to be armed:

- **Single** is used to analyze and display the decoded information once each time `Arm Meas` is selected.
- **Cont** is used to automatically re-arm the analyzer and display the measurements on a continual basis until `Single` is selected.

`Stop Meas`

Selecting this field stops the analyzer when making single measurements.

Sym

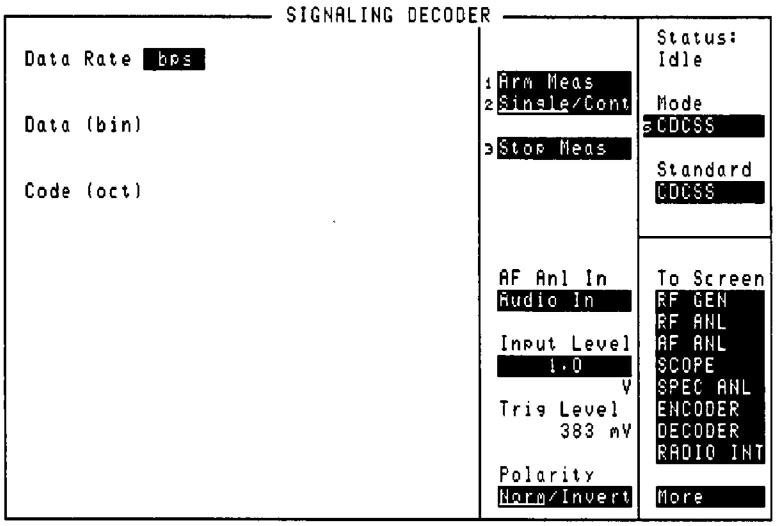
The **Symbol** column corresponds to the DTMF Encoder's symbols assigned for each tone pair. As each tone pair is analyzed, the corresponding symbol is listed in this column.

Operating Considerations

The symbol assigned is based on the closest symbol frequencies to that tone pair.

Continuous Digital Controlled Squelch System Decoder

The Continuous Digital Controlled Squelch System (CDCSS) Decoder analyzes digital data streams used to turn squelch on and off on digitally-controlled-squelch radios.



cdcs-de1.tif

Figure 4-51. The CDCSS Sequence Decoder Screen.

AF Analyzer Settings

For proper CDCSS decoder operation, make the following **AF Analyzer** screen settings:

- `Filter 1` to `<20Hz HPF` (Required)
- `Filter 2` to `3kHz LPF` (Recommended)
- `Settling` to `Slow` (Recommended)

Interpreting Decoded Data

Because CDCSS uses a continuously-repeating data stream, and there is no framing information to tell the receiver when the code word is going to be sent, the decoded data can result in several possible code combinations. This is why more than one code word may be listed in the `Codes (oct)` column after decoding.

AF Anl In

Audio Frequency Analyzer Input selects the source of the signal to be analyzed.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in this screen.

See Also

"Interaction Between Screens" in Chapter 3

Arm Meas

Arm Measurement prepares the decoder to be triggered by an incoming signal when `Single` is selected.

Code (oct)

This measurement field lists all of the code word combinations from the received data stream.

The top entry in this column is always one of the 83 standard (primary) industry codes or **NPC** (No Primary Code). All other possible code combinations are listed in numerical order after this entry.

If a Turn Off Code (TOC) is measured for a full sampling period, **TOC** is displayed with no other codes listed.

Data (bin)

This measurement field displays a 23-bit segment of the data stream being received.

After 23 bits have been received, the decoder shifts the bit sequence 23 times until all possible bit patterns have been analyzed. Any possible code words are displayed in the `Codes (oct)` column. Even if no code words are found, this field will still display the bit sequence that was received.

Operating Considerations

This field is blank if the only signal received during the decoder's latest sampling period is a Turn Off Code.

The final bit pattern displayed will not necessarily match any of the displayed Codes, since the bits are shifted 23 times during decoding.

Data Rate

This measurement field displays the data rate in bits-per-second for the data stream being received.

Operating Considerations

For accurate measurements, the `Data Rate` for the CDCSS **Encoder** should be set to the expected data rate for the signal being analyzed by the CDCSS **Decoder**.

Input Level

This field specifies the signal level that you input (after de- emphasis if used). The higher the level of signal expected by the analyzer, the higher the Trigger Level is set.

Operating Considerations

The unit-of-measure is determined by the `AF Anl In` setting.

The input level should be set high enough to prevent false triggering, but low enough to detect all valid zero-crossings of the incoming signal.

When using de-emphasis, the `Input Level` setting may need to be reduced significantly to properly decode the incoming signal. De-Emphasis is enabled/disabled using the `De-Emphasis` field on the **AF ANALYZER** screen.

Polarity

This field is used to match the polarity of the encoded signal being analyzed.

Normal Operation
When this field is set to `Norm`, a logical high (1) is displayed when a positive peak in the received signal is detected. A negative peak displays a logical low (0).

Inverted Operation
When this field is set to `Invert`, a logical low (0) is displayed when a positive peak in the received signal is detected. A negative peak displays a logical high (1).

Operating Considerations

Inverting amplifiers used in transmitters, receivers, and repeaters can cause an inversion of the modulating digital data. If the decoded signal does not display the expected results, change this field's setting to see if the signal may be getting inverted before being decoded.

`Single/Cont`

This field specifies how you want the analyzer to be armed:

- **Single** is used to analyze and display the decoded information once each time `Arm Meas` is selected.
- **Cont** is used to automatically re-arm the analyzer and display the measurements on a continual basis until `Single` is selected.

`Stop Meas`

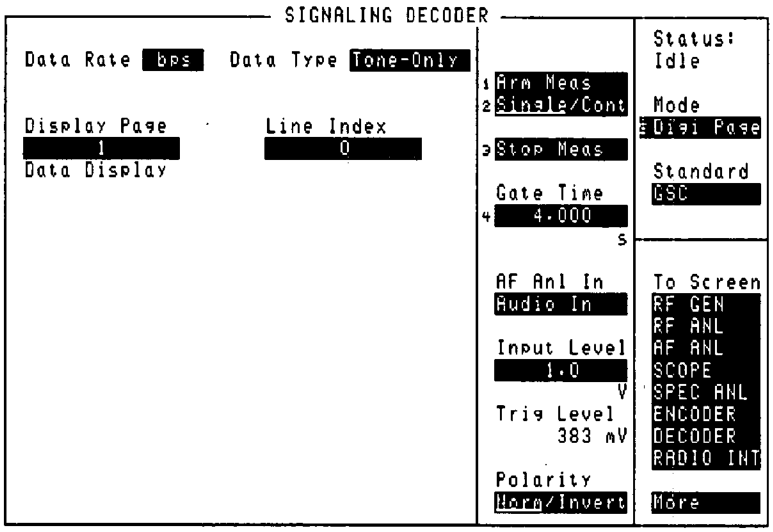
Selecting this field stops the analyzer when making a single measurement.

Trig Level

The **Trigger Level** indicates the minimum signal level required to begin a measurement that has been "armed". The level is adjusted by changing the `Input Level` field setting.

Digital Paging Decoder

The Digital Paging Decoder is used to test paging system transmitters using various formats, such as POCSAG and GSC (Golay Sequential Code). The `Tune Freq` field of the **TX TEST** screen is typically used to tune to the pager channel to be decoded.



digi-de1.tif

Figure 4-52. The Digital Paging Decoder Screen

AF Anl In — **Audio Frequency Analyzer Input** selects the source of the signal to be analyzed. This is typically set to `FM Demod` for off-the air decoding of pager transmitters.

Arm Meas — **Arm Measurement** prepares the decoder to be triggered by an incoming signal.

Data Display — This field displays up to three different decoded parameters after a message has been analyzed:

Pager code - the unique pager code number or 'address'.

Function - number representing one of the four types of signals that can be sent.

Pager data - information sent as a numeric or alpha-numeric message. This parameter is not displayed when tone-only formats are decoded.

Data Rate

This display field lists the Data Rate of the received signal in bits-per-second (bps).

Operating Considerations

This measurement relies on the **Digi Page Encoder** screen's `Data Rate` setting to function properly. Set that field to the expected incoming data rate for accurate measurements.

Display Page

This field is used to select a specific page of decoded data. More than one page of decoded data may be available when a batch of messages is receive during the specified `Gate Time`. The `Number of Pages` field indicates how many pages were decoded.

Gate Time

This field specifies how long the Decoder analyzes a signal after it has been triggered. Up to 65 seconds of Gate Time can be specified. The minimum gate time should be set long enough to allow the preamble and all necessary data bits to be captured.

If too much data is decoded during the Gate Time, the decoder buffer will overflow (an error message is displayed when this happens). Decrease the Gate Time if this error is displayed.

Input Level

Enter the expected data signal level in this field. The higher the level of signal expected by the analyzer, the higher the Trigger Level is set.

Operating Considerations

The unit-of-measure is determined by the `AF Anl In` setting.

The input level should be set high enough to prevent false triggering, but low enough to allow triggering for valid signals (typically about 3 kHz).

De-emphasis should not be used with this signaling format. Access the **AF ANALYZER** screen and set the `De-Emphasis` field setting to `Off`.

Number of Pages

See Also

`Display Page` field description.

Polarity

This setting is used to match the Polarity of the encoded signal being analyzed.

Normal Operation
When this field is set to `Norm`, a logical high (1) is displayed when a positive peak in the received signal is detected. A negative peak displays a logical low (0).

Inverted Operation
When this field is set to `Invert`, a logical high (1) is displayed when a negative peak in the received signal is detected. A positive peak displays a logical low (0).

`Single/Cont`

This field specifies how long you want the analyzer to decode incoming signals:

- **Single** tells the analyzer to display the information received during one `Gate Time`. Measurements are displayed until `Arm Meas` is selected again.
- **Cont** is used to automatically re-arm the analyzer and display new measurements on a continual basis until `Single` is selected. Previous measurement results are over-written by subsequent measurements.

Standard

This field is used to select the signaling standard for your pager. Various fields may be automatically added, removed, or changed for each standard.

`Stop Meas`

Selecting this field stops the analyzer when making single measurements.

Trig Level

The **Trigger Level** indicates the minimum signal level required to begin a measurement that has been "armed." The level is adjusted by changing the `Input Level` field setting.

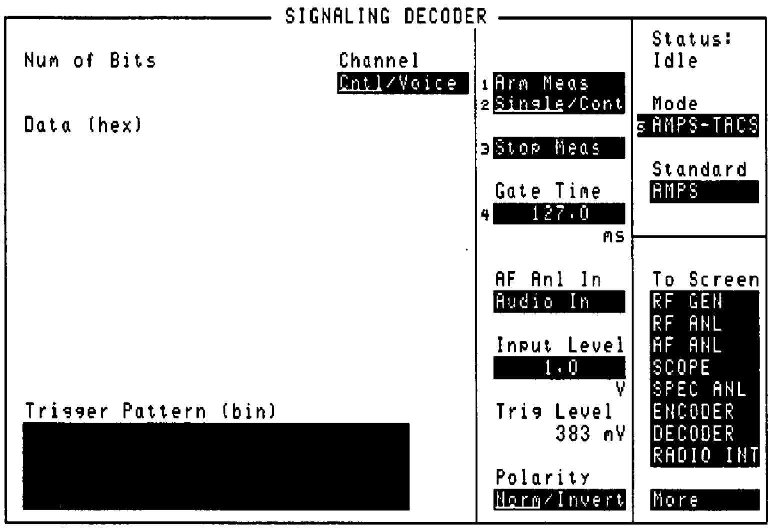
AMPS-TACS NAMPS-NTACS Decoder

The AMPS-TACS/NAMPS-NTACS decoder acts like a base station receiver by analyzing Reverse Control Channel (RECC) and Reverse Voice Channel (RVC) message streams for various cellular telephone formats.

The decoder can also be used to analyze Forward Control Channel (FOCC) and Forward Voice Channel (FVC) data from the base station.

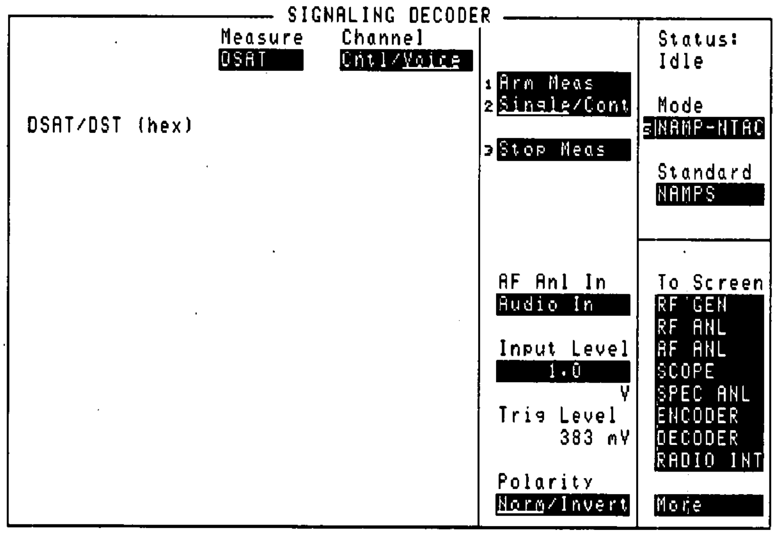
Decoder Mode Differences

The AMPS-TACS and NAMPS-NTACS Decoder modes are the essentially the same for analyzing Reverse Control Channel (RECC) information. However, the Voice Channel (RVC) information for NAMPS-NTACS is displayed differently than AMPS-TACS information. Fields and decoder measurements that are only used for either mode are noted in their descriptions.



amps-de1.tif

Figure 4-53. AMPS-TACS Ctrl/Voice and NAMPS-NTACS Ctrl Channel Decoder

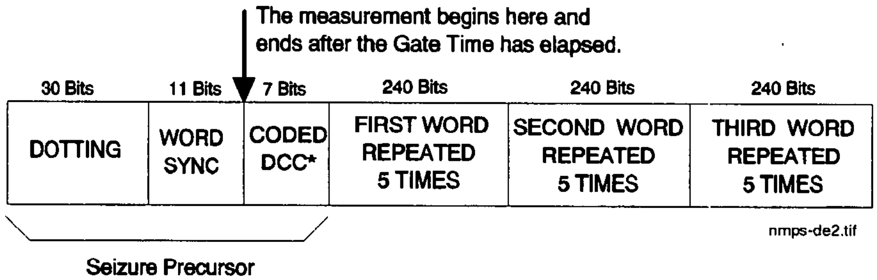


nmps-de1.tif

Figure 4-54. The NAMPS-NTACS Voice Channel Decoder

Interaction With the Encoder

The **Encoder** screen `Data Rate` field tells the Decoder how fast the incoming message is being sent. Set that field's value before using the AMPS-TACS or NAMPS-NTACS Decoder.



* Digital Color Code

Figure 4-55. Decoding the Reverse Control Channel (RECC) Data

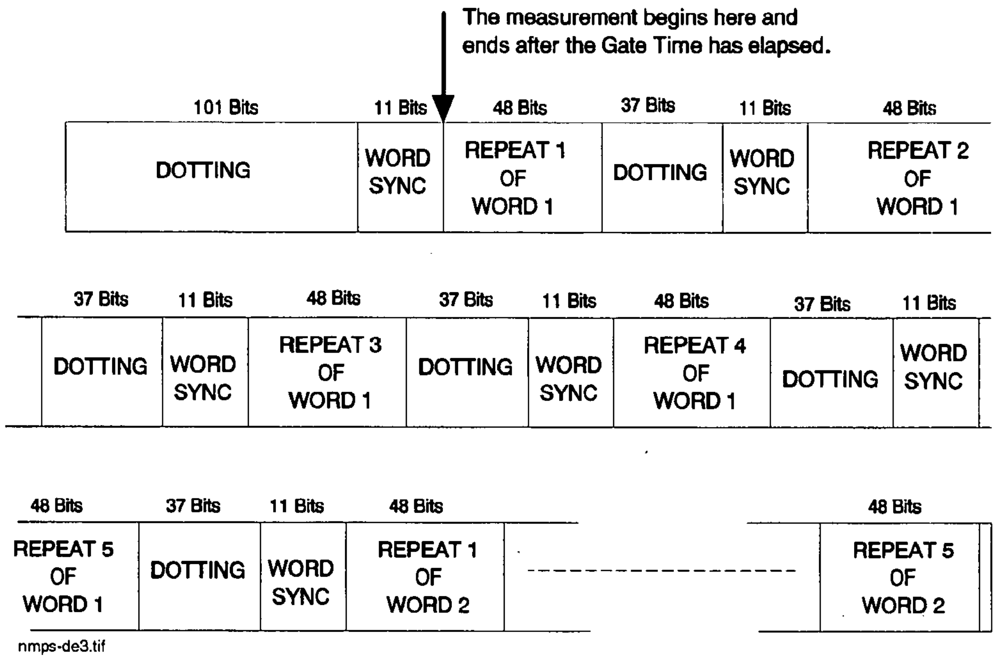


Figure 4-56. Decoding AMPS-TACS Reverse Voice Channel (RVC) Data

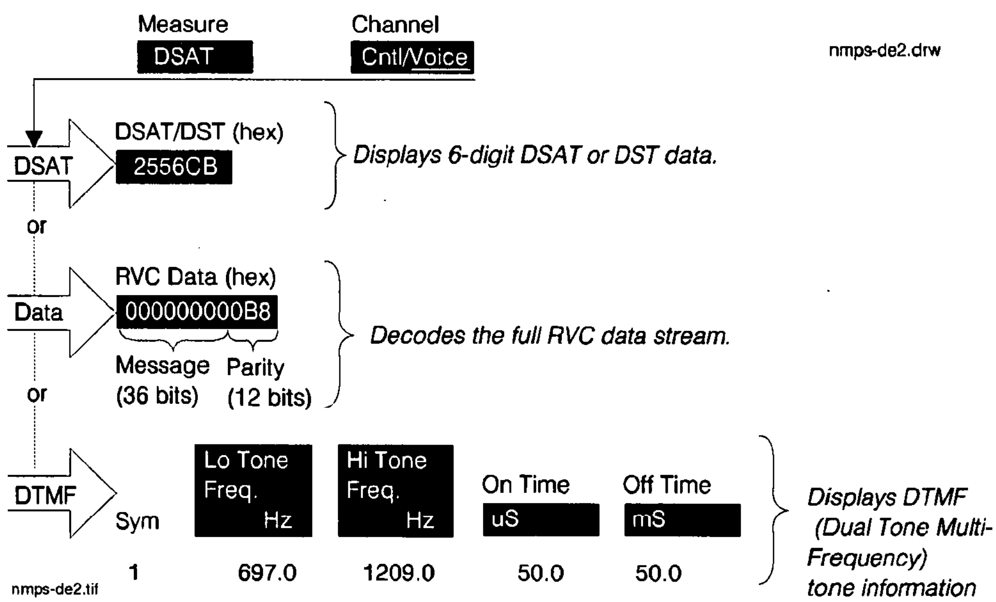


Figure 4-57. Decoding NAMPS-NTACS Reverse Voice Channel (RVC) Data

Interpreting Decoded Data

The following information refers to all Reverse Control Channel (RECC) measurements, and the AMPS-TACS Reverse Voice Channel (RVC) measurements. See the next section about NAMPS-NTACS RVC measurements.

After being armed, the measurement begins when the last bit of Word Sync has been received. All RECC measurents, and the AMPS-TACS RVC measurement, last for the period specified in the `Gate Time` field.

The received bits are displayed as hexadecimal (hex) characters. If the last bits received do not complete the last hex character, the received bits are used as the Most Significant Bits in the character, and the remaining bit positions are filled with zeros.

For example; if the last bits received are "01", two zeros are added to the right to produce the binary number 0100. The hexadecimal equivalent, 4, is displayed.

The first two hex characters of the RECC data displayed contain the 7-bit Digital Color Code of the Seizure Precursor. The characters are right-justified so the farthest bit to the left for the first hex character is always 0. The first word of the RECC message begins in the third hex character of the displayed data.

All bits of the RECC and RVC data streams received after the initial Word Sync are displayed, including Parity and additional Dotting and Word Syhc Sequences.

The Decoder does not check for any errors in the received data stream.

NAMPS-NTACS Reverse Voice Channel Measurements

Three types of RVC information can be decoded; selected using the `Measure` field.

- **DSAT** displays the 6-digit DSAT (Digital Supervisory Audio Tone) or DST (Digital Signaling Tone) number, depending on the type of signal being received. If the received number is not one of the 14 standard combinations (7 DSAT or 7 DST), the decoder displays a constantly changing number until one of the standard values is detected.
- **Data** displays the 36 Message bits and 12 Parity bits of the RVC message. The measurement begins when the last Sync Word bit is received, and ends after the last Parity bit is received. The measurement is re-triggered when the next Sync Word is received: there is no Gate Time function for this Decoder Mode.
- **DTMF** displays Dual-Tone Multi-Frequency tone pair frequencies and on/off times. These are tones that may be used to trigger connected equipment after a mobile to base station connection has been made (such as an answering machine or voice-mail system).

AF Anl In

Audio Frequency Analyzer Input selects the source of the signal to be analyzed.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in this screen.

Arm Meas

Arm Measurement prepares the decoder to be triggered by an incoming signal.

Channel

This field selects the type of data to decode: Reverse Control Channel (`Cntl`), or Reverse Voice Channel (`Voice`).

Data (hex) (AMPS-TACS)

This display field lists the decoded data serially as it is received. This field is labeled `RECC Data (hex)` for the NAMPS/NTACS mode, but performs the identical function.

Gate Time

This field specifies how long the Decoder analyzes a signal after it has been triggered. The longer the Gate Time, the greater the number of bits analyzed.

Operating Considerations

If the Gate Time is too long, the decoder's data buffer becomes full. A message is displayed instructing you to decrease the gate time.

This function is not used with the NAMPS/NTACS RVC decoder.

See Also

`Arm Meas` field description
`Num of Bits` field description

Input Level

This field specifies the expected data signal level (after de- emphasis if used). The higher the level of signal expected by the analyzer, the higher the Trigger Level is set.

Operating Considerations

The unit-of-measure is determined by the `AF Anl In` setting.

The input level should be set high enough to prevent false triggering, but low enough to allow triggering for valid signals. *This may require you to set the Input Level well below the expected level.*

Also, when using de-emphasis, the `Input Level` setting may need to be reduced significantly to properly decode the incoming signal. De-Emphasis is enabled/disabled using the `De-Emphasis` field on the **AF ANALYZER** screen.

Measure (NAMPS-NTACS: RVC)

This field selects the type of decoded data to display: DSAT or DST codes, Message data, or DTMF (Dual-Tone Multi-Frequency) tone data.

Num of Bits

This field lists the total number of bits displayed. This number is dependent on Data Rate of the signal being decoded, the `Gate Time` of the decoder, and the size of the decoder's data buffer.

Operating Considerations

The buffer has a maximum capacity of:

- 1584 bits for decoding Reverse Voice Channel (RVC) data streams.
- 1583 bits for decoding Reverse Control Channel (RECC) data streams.

This measurement is not available for NAMPS-NTACS RVC decoding.

See Also

`Gate Time` field description

Polarity

This setting is used to match the Polarity of the encoded signal being analyzed.

Normal Operation
When this field is set to `Norm`, a logical high (1) is displayed when a positive peak in the received signal is detected. A negative peak displays a logical low (0).

Inverted Operation
When this field is set to `Invert`, a logical high (1) is displayed when a negative peak in the received signal is detected. A positive peak displays a logical low (0).

RECC Data (NAMPS-NTACS: RECC)

This display field lists the decoded data serially as it is received. This is the same information that the AMPS-TACS `Data (hex)` measurement displays.

`Single/Cont`

This field specifies how long you want the analyzer to decode incoming signals:

- **Single** tells the analyzer to display the information received during one `Gate Time` (or after one measurement for NAMPS-NTACS RVC data).
- **Cont** is used to automatically re-arm the analyzer and display the measurements on a continual basis until `Single` is selected.

`Stop Meas`

Selecting this field stops the analyzer when making single measurements.

Trig Level

The **Trigger Level** indicates the minimum signal level required to begin a measurement that has been "armed." The level is adjusted by changing the `Input Level` field setting.

The input level should be set high enough to prevent false triggering, but low enough to allow triggering for valid signals. *This may require you to set the Input Level well below the expected level.*

Trigger Pattern (bin)

This field allows you to enter a specific bit pattern to 'filter' displayed information. The decoder only displays the received data when this binary pattern is encountered immediately after triggering. This is helpful when you only want to display messages containing very specific information.

The trigger pattern is entered as a sequence of ones, zeros, and dots. A dot will cause the decoder to trigger for either a one or a zero in that bit position in the received data stream.

Operating Considerations

This function is not available for decoding NAMPS-NTACS RVC information.

NMT Decoder/Encoder

The NMT Encoder and Decoder work together to test Nordic Mobile Telephone equipment used in a number of countries using different NMT standards. As each standard is selected, the Test Set configures the Encoder and Decoder to create and measure the corresponding RF carrier and digital data structure.

The **Encoder** screen is used to create the different signals used to communicate between the Mobile Station, Base Station, and Mobile Telephone Exchange. The signal is output under program control from the **NMT Decoder** screen.

The **Decoder** screen is used to load and run NMT test programs you create. The programs are used to transmit NMT-encoded signals to a device, and to evaluate received NMT signals.

Operating Steps

Manual NMT radio tests generally follow four basic steps:

1. Write your test program to send encoded information and evaluate received frames.
2. Enter the necessary information into the various Encoder and Decoder fields.
3. Make the required Test Set AF Analyzer, RF Analyzer, and RF Generator settings.
4. Load and run your program from the Decoder.

Note

Changing Standards : Each NMT standard affects several operating parameters for the **Encoder** and **Decoder** screens; however, there are no visual changes to the contents of either screen when standards are changed. You must be aware of these changes when manually testing radios using these screens.

Refer to the `Standard` and `Calling Channel Number` field descriptions for explanations on the effects of these fields.

Standard Equivalents

Only two standards are referred to in this section: STD450 and STD900. All other national standards are based on these two. If a field description says "only used with the STD900 standard", the field can also be used with other national standards listed under the STD900 equivalents below.

The following list identifies which national standards are based on STD450 and STD900:

STD450 Equivalents

- Austria
- Benelux
- Bulgaria
- Cro-Slav (Croatia-Slovenia)
- Hungary
- Malaysia
- Saudi 1
- Saudi 2
- Spain
- Thailand
- Turkey

STD900 Equivalents

- France (Uses the STD900 protocol at STD450 frequencies)

Manual Testing of NMT Radios

NMT signals contain complex groupings of digital data that vary in format and function, depending on a number of system operating needs.

To be able to test NMT radios using these screens, you must be familiar with the theory, applications, and specifications of the NMT systems. The large volume of information required to explain the NMT system is beyond the scope of this manual.

Documents explaining the structure and specifications for the different NMT standards should be obtained from the radio communications regulatory agency of the appropriate country.

Automated NMT Radio Tests

The HP 11807A Option 006 NMT Cellular Tests software for the HP 8920A provides comprehensive automated tests of NMT mobile stations. All Test Set RF, AF, and Encoder/Decoder settings are made automatically, requiring minimal operator inputs.

The test type and sequence, measurement specifications, and instrument settings are easily configured for the device being tested. Customized test procedures can be stored on external disks or memory cards for later use.

All HP 11807 Test Software packages include comprehensive documentation explaining hardware connections and software configuration and operation.

Terms Used in This Section

The following terms are used throughout this portion of the manual:

DUT - Device Under Test: The device being tested (MS, BS, or MTX).

Frames: Groups of digital information that comprise an NMT signal. (This manual assumes you understand the frame structure for the signals you need to create or analyze; any frame information provided is for reference purposes.)

MS - Mobile Station: The equipment used by a mobile subscriber.

BS - Base Station: The unit that provides the radio interface between one or more Mobile Stations and the Mobile Telephone Exchange.

MTX - Mobile Telephone Exchange: The unit that provides the interface between one or more Base Stations and the telephone network.

Standard: The set of frequency and data format standards used by different countries.

Required Test Set Settings

The following Test Set settings should be made before using the NMT Encoder/Decoder screens. These settings assume the Test Set is in its PRESET state.

RF Generator Settings

AFGen1 To: Audio Out and Off

AFGen2 To: FM and 3.5 kHz

RF Analyzer Settings

Tune Mode: Manual

Input Atten: Hold and 0 dB

Squelch: Fixed

AF Analyzer Settings

AF Anl In: FM Demod

Filter 1: 300Hz HPF

Filter 2: 15kHz LPF

De-Emphasis: Off

Initial NMT Encoder Settings

Mode: NMT

DUT: MS (for testing Mobile Stations)

Initial NMT Decoder Settings

Input Level: 3.0 kHz

Special Frame Suffixes

Some frame designations include a suffix to identify specific **Encoder** screen fields (such as **TC2** for Alternate Traffic Channel) or to indicate special frame values affected (such as the **S** suffix that indicates Battery Save information; example - 1aS).

The following suffixes are appended to some frame designations:

AC = Access Channel

CC = Calling Channel

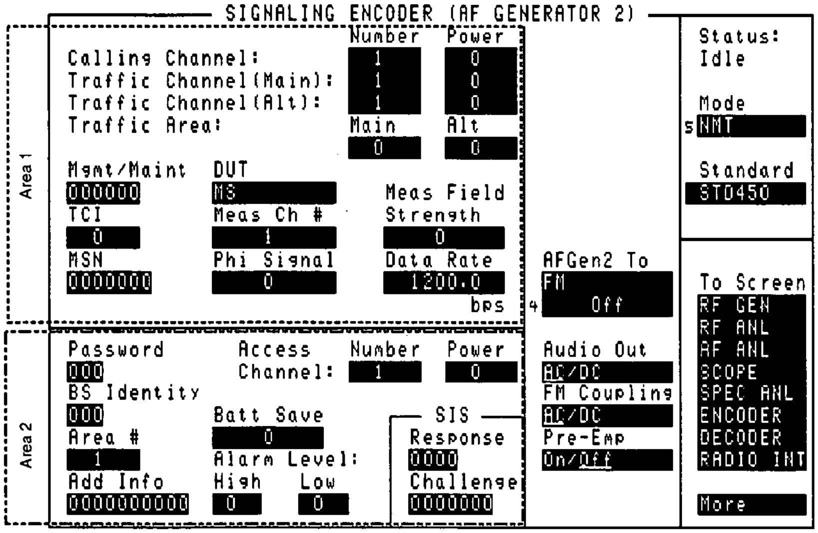
S = Battery Save

TA1 = Main Traffic Area

TA2 = Alternate Traffic Area

TC1 = Main Traffic Channel *TC2 = Alternate Traffic Channel

NMT Encoder



nmt-en1.tif

Figure 4-58. The NMT Encoder Screen

General Encoder Operation

The following are fields that are typically used for testing different types of NMT equipment.

Refer to the individual field descriptions for detailed information on each field's function and operating parameters.

Testing Mobile Stations
These fields are typically used to test an MS:

- Calling Channel: Number and Power
- Traffic Channel (Main): Number and Power
- Traffic Channel (Alt): Number and Power
- Traffic Area: Main and Alt
- DUT
- TCI (Tariff Class Information)
- MSN (Mobile Subscriber Number)
- Data Rate
- Access Channel: Number and Power
- Batt Save
- Area #
- Add Info
- SIS Challenge

Testing a BS or MTX
These fields are typically used to test a BS or MTX.

- Mgmt/Maint
- Meas Ch #
- Phi Signal
- Meas Field Strength
- Password
- BS Identity
- Alarm Level High and Low
- SIS Response

Fields Used With Different Standards
(Refer to Figure 4-58.)

Fields in the upper part of the screen (area 1) are used with all NMT standards. Fields in the lower part of the screen (area 2) are only used with the STD900 standard.

Access Channel Number

This field defines the channel number for the signal that initiates a call from the MS to the MTX.

Valid Entry Range: 1 - 2023

NMT Frames Affected: 3d, 3dTA2, 4b, 4bTA2, 10aAC

Operating Considerations

This field is only used with the STD900 standard.

This setting affects the RF generator and analyzer frequencies used when the TCHAN AC and RCHAN AC commands are used.

See Also

`Calling Channel` field description concerning valid Access Channel settings for each standard.

Access Channel Power

This field specifies the Access Channel's power setting. Each Power setting represents one of the four available levels allowed by the NMT standards.

Valid Entry Range: 0 - 3

NMT Frames Affected: 3d, 3dTA2, 4b, 4bTA2, 10aAC.

Operating Considerations

This field is only used with the STD900 standard.

Add Info

The **Additional Information** field contains various types of information, depending on the frame type. Several frame types contain Additional Information digits in the form H1 to H10, as outlined in the NMT system standards.

The following table shows the relationship between the **Add Info**, **Area #**, and **Batt Save** fields, and how they are used in frame data. (The H1 to H10 designations correspond to the frame digit assignments shown in the *NMT DOC. 900-1, Jan. 1985* standards.)

Table 4-4. NMT Additional Information Bits

Frames	Content of Additional Information Digits
1a,1a/, 1a//	H1H2H3H4H5H6H7H8H9H10 All from "Add Info" field
1aS, 1a/S, 1a//S	H1H2H4H5H6H7H8H9H10 From "Add Info" field H3 From "Batt Save" field
1b, 1bTA1, 1bTA2	H1H2H3H4H5H6H7 From "Add Info" field H8H9H10 From "Area #" field
1bS	H1H2H4H5H6H7 From "Add Info" field H3 From "Batt Save" field H8H9H20 From "Area #" field
2a, 2a/, 2a// 2e, 3b, 3bTA2, 3bTC2, 4, 4TA2, 4b, 4bTA2, 30	H1H2H3H4H5H6H7 Not Used. H8H9H10 From "Area #" field
2c, 2c/, 2c//, 2d, 2d/, 2d//, 2f	H1H2H3H4H5H6H7 Not used. H8H9H10 Fixed by standard as fictitious channel numbers.

Valid Entry Range: 0000000000 - FFFFFFFFFF (hex)

NMT Frames Affected: (Refer to the Frames column in the preceding table.)

Operating Considerations

This field is only used with the STD900 standard.

AFGen2 To

Audio Frequency Generator 2 To contains two fields:

- The upper field determines whether the NMT Encoder modulates the RF Generator, or is output through AUDIO OUT. *The lower field sets the amplitude (including `Off`).

Alarm Level Low

This field sets the lower trigger level for the signal strength measurement alarm for the Phi Signal.

Valid Entry Range: 0 - F (hex)

NMT Frames Affected: 20, 25.

Operating Considerations

This field is only used with the STD900 standard.

Alarm Level High

This field sets the upper trigger level for the signal strength measurement alarm for the Phi Signal.

Valid Entry Range: 0 - F (hex)

NMT Frames Affected: 20, 25.

Operating Considerations

This field is only used with the STD900 standard.

Area

The **Area Number** field identifies which MTX is used to call an MS. This identification prevents MS to BS calling problems caused by co-channel interference.

Valid Entry Range: 1 - 4

NMT Frames Affected: 1b, 1bS, 1bTA1, 1bTA2, 2a, 2a/, 2a//, 2e, 3bTA2, 3b, 3bTC2, 4, 4TA2, 4b, 4bTA2, 10a, 10aAC, 10b, 10c, 10d, 11a, 11b, 12, 30.

Operating Considerations

This information is used to encode the information in the last three digits of the `Add Info` field, rather than taking the information directly from that field.

This field is only used with the STD900 standard.

Audio Out

Audio Out Coupling selects AC or DC coupling of the encoder to the AUDIO OUT connector when the upper `AFGen2 To` field is set to `Audio Out`.

BS Identity

The **Base Station Identity** field provides the 3-digit hex code that identifies which BS an MTX is communicating with.

Valid Entry Range: 000 - FFF (hex)

NMT Frames Affected: 20, 21b, 21c, 22.

Operating Considerations

This field is only used with the STD900 standard.

Batt Save

The **Battery Save** field signifies the length of the battery saving period in 5 second increments. For example, a setting of **5** produces a 25 second period.

Valid Entry Range: 0 - 7

NMT Frames Affected: 1aS, 1a/S, 1a//S, 1bS

Operating Considerations

This field is only used with the STD900 standard.

Calling Channel Number

This field defines the channel number setting when initiating a call from the BS to the MS.

Valid Entry Range: 1 - 2023

NMT Frames Affected: 1a, 1a/, 1a//, 1aS, 1a/S, 1a//S, 1b, 1bS, 2a, 2a/, 2a//, 2b, 2b/, 2b//, 2c, 2c/, 2c//, 2d, 2d/, 2d//, 2e, 2f, 10a, 10d, 11b.

Operating Considerations

This setting affects the RF frequencies the RF generator and analyzer tune to when the TCHAN CC and RCHAN CC commands are used.

Each NMT standard has its own range of available channels. The following table lists the valid channel assignments for Calling, Traffic, and Access channels.

Table 4-5. Valid Channel Assignments

NMT Standard	Valid Channel Numbers
STD450	1 to 180
STD900	1 to 1000, 1025 to 2023

Calling Channel Power

This field specifies the Calling Channel's power setting. Each Power setting represents one of the four available levels allowed by the NMT standards.

Valid Entry Range: 0 - 3

NMT Frames Affected: 1a, 1a/, 1a//, 1aS, 1a/S, 1a//S, 1b, 1bS, 2a, 2a/, 2a//, 2b, 2B/, 2b//, 2c, 2c/, 2c//, 2d, 2d/, 2d//, 2e, 2f, 10a, 10d, 11b.

Data Rate

This field specifies the rate that the frames are output in bits-per-second. This field also sets the data rate expected by the NMT Decoder.

Valid Entry Range: 9.2 - 2400

DUT

The **Device Under Test** field defines **the device you are testing**.

Valid Entries: MS, BS, MTX

NMT Frames Affected: None

Operating Considerations

This field affects the RF generator and analyzer frequencies used for the NMT TCHAN and RCHAN program commands.

This field also affects how frames are interpreted by the Decoder when determining the type of frame being received.

FM Coupling

This field alters the FM modulator to allow DCFM from internal and external modulation sources. This field also selects AC or DC coupling between the RF Generator's frequency modulator and the rear-panel MODULATION INPUT connector.

Meas Ch

The **Measurement Channel Number** field specifies the channel whose signal strength is measured.

Valid Entry Range: 1 - 2023

NMT Frames Affected: 21b, 21c, 26.

See Also

`Calling Channel Number` field description for a list of valid channel numbers for each standard.

Meas Field Strength

This field specifies the Phi Signal strength measurement that is sent from the BS to the MTX.

Valid Entry Range: 0 - 99

NMT Frames Affected: 26

Mgmt/Maint

The **Management/Maintenance** field is used to send system status information.

Valid Entry Range: 000000 -FFFFFF (hex)

NMT Frames Affected: 22, 27, 28.

MSN

The **Mobile Subscriber Number** field specifies the unique seven digit code that identifies an MS.

Valid Entry Range: 0000000 - FFFFFFF (hex)

NMT Frames Affected: 2a, 2a/, 2a//, 2b, 2b/, 2b//, 2c, 2c/, 2c//, 2d, 2d/, 2d//, 2e, 2f, 3a1, 3a2, 3b, 3bTA2, 3bTC2, 3c, 3d, 3dTA2, 5a, 5b, 10a, 10aAC, 10b, 10c, 10d, 11, 11a, 11b, 12, 13a, 13b, 14a, 14b.

Phi Signal

This field specifies the ϕ signal frequency.

Valid Entry Range: 0 - F (hex)

NMT Frames Affected: 20, 21b, 21c, 25, 26.

Password

This field specifies the 3-digit code added to the end of the Mobile Subscriber Number to prevent unauthorized use of a subscriber number.

Valid Entry Range: 000 - FFF (hex)

NMT Frames Affected: 10b, 10c, 11a, 12.

Operating Considerations

This field is only used with the STD900 standard.

Pre-Emp

Pre-Emphasis, when used, attenuates the lower frequency tone (1200 Hz at 1200 bps) to 2/3 of the Gen2 To field level setting.

SIS Challenge

The **Subscriber Identity Security Challenge** field is used to confirm a subscriber's MS identity.

Valid Entry Range: 0000000 - FFFFFFF (hex)

NMT Frame Affected: 7

Operating Considerations

This field is only used with the STD900 standard.

SIS Response

The **Subscriber Identity Security Response** field is used to respond to the SIS Challenge to confirm a subscriber's MS identity.

Valid Entry Range: 0000 - FFFF (hex)

NMT Frame Affected: 16

Operating Considerations

This field is only used with the STD900 standard.

Standard

This field selects the NMT system standard for equipment you are testing. When a standard is chosen, the Test Set automatically alters several corresponding parameters.

Operating Considerations

Each standard affects the following conditions:

- The types of frames that can be sent.
- The range of valid channel numbers.
- The encoding of the frame data.
- The frequencies tuned to for the various channel settings when Chan commands are executed in an NMT program.
- The interpretation of received frames.

The following standards are available:

STD450: Transmit and receive frequencies are in the 453 to 467.5 MHz range.

STD900: Transmit and receive frequencies are in the 890 to 960 MHz range.

See Also

`Calling Channel` field description concerning valid channel settings for each standard.

TCI

The **Tariff Class Information** field is used to specify MS billing information to the MTX.

Valid Entry Range: 0 - 99

NMT Frames Affected: 5b, 13b.

Traffic Area - Alt

This field specifies the alternate Traffic Area code that identifies the Base Stations used to simultaneously transmit a calling signal to an MS.

Valid Entry Range: 0 - FF (hex)

NMT Frames Affected: 1bTA2, 3bTA2, 3dTA2, 4TA2, 4bTA2.

Traffic Area - Main

This field specifies the main Traffic Area code that identifies the Base Stations used to simultaneously transmit a calling signal to an MS.

Valid Entry Range: 0 - FF (hex)

NMT Frames Affected: 1a, 1a/, 1a//, 1aS, 1a/S, 1a//S, 1b, 1bS, 1bTA1, 2a, 2a/, 2a//, 2b, 2b/, 2b//, 2c, 2c/, 2c//, 2d, 2d/, 2d//, 2e, 2f, 3a1, 3a2, 3b, 3bTC2, 3c, 3d, 4, 4b, 5a, 5b, 7, 10a, 10aAC, 10b, 10c, 10d, 11a, 11b, 12, 20, 21b, 21c, 22, 30.

Traffic Channel (Alt) Number

This field specifies the Alternate Traffic Channel used for conversation after communications have been established.

Valid Entry Range: 1 - 2023

NMT Frames Affected: 3a2, 3bTC2, 3c.

Operating Considerations

This setting affects the RF generator and analyzer frequencies used when the TCHAN TC2 and RCHAN TC2, or TCHAN TCA and RCHAN TCA, programming commands are used.

See Also

`Calling Channel` field description concerning valid channel settings for each standard.

Traffic Channel (Alt) Power

This field specifies the power of the alternate Traffic Channel. Each Power setting represents one of the four available levels allowed by the NMT standards.

Valid Entry Range: 0 - 3

NMT Frames Affected: 3a2, 3bTC2, 3c.

Traffic Channel (Main) Number

This field specifies the main Traffic Channel used for conversation after communications have been established.

Valid Entry Range: 1 - 2023

NMT Frames Affected: 1bTA1, 1bTA2, 2b, 2b′, 2b″, 3a1, 3a2, 3b, 3bTA2, 3d, 3dTA2, 4, 4TA2, 5a, 5b, 7, 10b, 10c, 11, 11a, 12, 13a, 13b, 14a, 14b, 16, 20, 21b, 21C, 22, 25, 26, 27, 28, 30.

Operating Considerations

This setting affects the RF generator and analyzer frequencies used when the TCHAN TC1 and RCHAN TC1, or TCHAN TCM and RCHAN TCM, programming commands is used.

See Also

`Calling Channel` field description for a list of valid channel numbers for each standard.

Traffic Channel (Main) Power

This field specifies the power of the main Traffic Channel. Each Power setting represents one of the four available levels allowed by the NMT standards.

Valid Entry Range: 0 - 3

NMT Frames Affected: 1bTA1, 1bTA2, 2b, 2b′, 2b″, 3a1, 3a2, 3b, 3bTA2, 3d, 3dTA2, 4, 4TA2, 5a, 5b, 7, 10b, 10c, 11, 11a, 12, 13a, 13b, 14a, 14b, 16, 20, 21b, 21c, 22, 25, 26, 27, 28, 30.

NMT Decoder

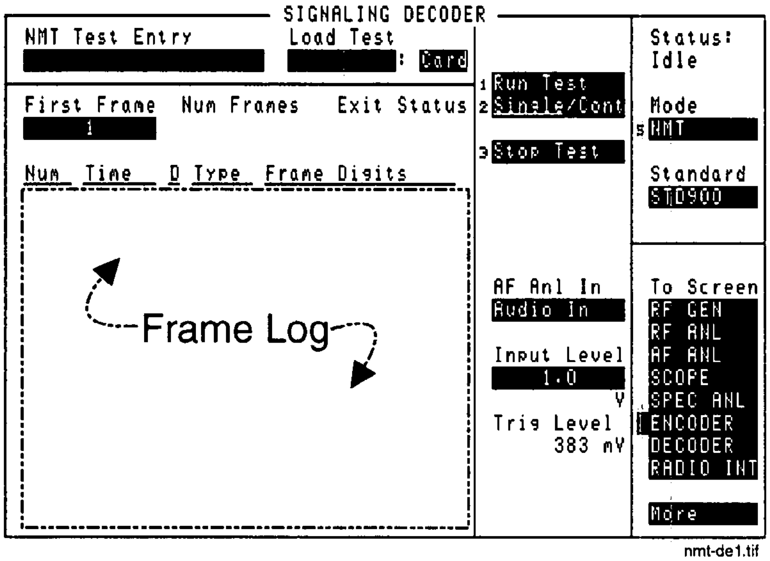


Figure 4-59. The NMT Decoder Screen

General Decoder Operation

The **NMT Decoder** screen has several uses:

- Entering NMT programming commands.
- Loading existing NMT tests from a variety of storage media.
- Running NMT tests.
- Decoding received NMT signals.

Frame Log

The Frame Log area lists the recorded frame information generated by the Encoder and received by the Decoder. Field descriptions for this area are listed together.

D

The **Direction** column tells if a frame was *transmitted* by the Encoder (**T**), or *received* by the Decoder (**R**).

Frame Digits

This column lists the information part of the recorded frames, displayed as hexadecimal digits.

Num

This column lists the reference numbers assigned to the recorded frames in the order they were transmitted and received.

Time

The times in this column indicate when each frame was transmitted or received after `Run Test` was selected. The times are listed in bit intervals that are dependant on the Data Rate.

For example, at a Data Rate of 1200 bps, one bit interval is equivalent to 0.833 ms (1/1200).

Type

This column lists the NMT standards **frame type** for each frame.

Operating Considerations

The received frame type is determined using the Decoder's `Standard` field setting, and the Encoder's `DUT` field setting. If these settings do not agree with the actual DUT and its standard, the received (R) frame types may not be correctly identified.

The transmitted frame type is determined by the `Send f` commands used in the NMT test program being executed.

AF Anl In

Audio Frequency Analyzer Input selects the input for the analyzer. When selected, this field displays a list of choices:

- The output of the AM, FM, or SSB demodulators.
- The AUDIO IN, RADIO INTERFACE, MODULATION INPUT, MIC/ACC, and AUDIO OUT connectors.
- The signal present at the AM or FM modulators for the RF Generator.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3
"Displaying Measurements" in Chapter 3

Exit Status

This field indicates which **EXIT n** command caused the program to stop running.

See Also

Refer to the 'EXIT n' command in the *NMT Test Entry Command Syntax* information in this section.

First Frame

The NMT decoder can record over 2000 frames, but only the last 500 frames can be displayed. This field specifies the first of 15 frames to be viewed.

Input Level

This field specifies the signal level that you input. The higher the level of signal expected by the analyzer, the higher the Trigger Level is set.

Operating Considerations

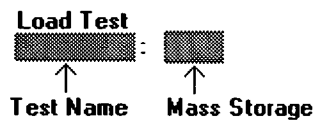
The unit-of-measure is determined by the `AF Anl In` setting.

The input level should be set high enough to prevent false triggering, but low enough to allow triggering for fluctuating signal levels.

De-emphasis can greatly affect the Input Level required for proper decoding. When decoding NMT data streams, you should turn de-emphasis off (controlled by the `De-Emphasis` field on the **AF ANALYZER** screen.)

Load Test

This double field is used to select and load NMT tests from a variety of mass storage devices. After the appropriate Mass Storage device is selected using the right field, the desired NMT test is selected using the left field.



Operating Considerations

Directly entering a command into the `NMT Test Entry` field automatically removes from memory any NMT test previously loaded using the `Load Test` field.

Num Frames

The **Number of Frames** field lists the number of frames in the Frame Log. When this number is >15, the `First Frame` field is used to view the other frames.

`Run Test`

Selecting this function executes (runs) the NMT test specified in the `Load Test` field or entered directly into the `NMT Test Entry` field.

`Single/Cont`

This field specifies how you want the test to be run:

- **Single** executes the NMT program and displays the decoded information once each time `Run Test` is selected.
- **Cont** continually re-runs the program, and displays the decoded information, until `Single` is selected.

`Stop Test`

Selecting this field interrupts the NMT test while running. If `Cont` is selected, the program automatically re-runs from the beginning.

Standard

This field specifies the NMT standard for the signal being decoded.

Operating Considerations

This setting alters the Decoder's function by specifying the expected frame structure and channel range for the incoming signal.

Trying to run a test with the wrong standard selected will result in incorrect decoded data, or display an operating error message.

See Also

`Calling Channel` field description for the NMT Encoder for a list of valid channel assignments.
Standard Equivalents at the beginning of the NMT section.

Trig Level

The **Trigger Level** indicates the minimum signal level required to begin a measurement. This level is adjusted by changing the `Input Level` field setting.

Creating NMT Tests

The NMT Encoder outputs signals using programs running in the NMT Decoder. This differs from the Test Set's other signaling Encoder functions that have a *Send* function to directly output their signals (such as DTMF and Tone Sequence).

To use the NMT Encoder and Decoder functions, you must first understand how tests are written.

Programming Overview

Special program commands are used by the Test Set to test NMT radios. These commands are used to send frames, perform simple branching and looping operations, change RF channels, and test received frame types.

The NMT Decoder has its own RAM to run programs. All NMT program commands must be entered into the Decoder's RAM before they can be executed. This can be done directly by entering commands one at a time into the `NMT Test Entry` field, or by loading a test program that has been created and saved on mass storage.

Note

NMT File Format: When storing NMT tests you have created, you **must** save them as ASCII files using the BASIC command 'SAVE' (and using the 'GET' command to retrieve them). Non-ASCII files cannot be retrieved using the **NMT Decoder** screen's `Load Test` field, and therefore cannot be run.

Creating NMT Tests
Tests can be created and saved using any of these methods:

- Writing programs on a connected external controller, downloading them into the Test Set's IBASIC RAM, and then storing them on mass storage.
- Using the **TESTS** screen's IBASIC Controller and the Cursor Control knob to enter programs line-by-line into IBASIC RAM, and then saving them on mass storage.
- Using the **TESTS** screen's IBASIC Controller and a connected terminal to enter programs line-by-line into RAM, and then saving them on mass storage.
- Using an IBASIC program that creates a file to output program commands.

Entering Tests Into The Decoder's RAM

NMT commands are entered into the Decoder's RAM using any of these methods:

- Using the `Load Test` field to load an existing test from mass storage.
- Using a connected terminal or Cursor Control knob to directly enter commands into the Decoder's `NMT Test Entry` field. *Using an IBASIC program that OUTPUTs commands to the `NMT Test Entry` field.

The most efficient method is to use a connected computer to write the program, store the program on a memory card, and then select the test from the memory card using the Decoder's `Load Test` field.

Using Direct Command Entry

The Decoder's `NMT Test Entry` field allows you to directly enter program commands into the Decoder's RAM. Program line numbers are not used, and no LIST or EDIT function is available for programs entered this way. This capability is provided to allow direct entry of small programs without the need of external equipment or the need to store the program for future use.

Program Example

This example program can be entered line-by-line into the `NMT Test Entry` field, and then run by selecting `Run Test`:

```
begin
set 1 5
10 send 1a
send 2a
repeat 1 10
exit 0
end
```

Note

Entering commands directly into the `NMT Test Entry` field causes any existing programs you have loaded to be removed from the Decoder's memory.

Also, programs entered into the `NMT Test Entry` field cannot be saved on mass storage.

Programming Using an External Computer

Writing programs on an external computer using BASIC allows you to write and edit the NMT program, and then store it on mass media (memory card, RAM disk, external disk).

Since some NMT syntax used are not valid BASIC language commands, a special program structure is required.

Program Structure

The following rules must be followed when writing NMT programs to be stored on mass media:

- All statements in the program must appear as BASIC comments, beginning with an exclamation point (!) following the line number. REM statements **cannot** be substituted for the (!) symbol.
- All statements desired as comments in the NMT program are indicated by a double exclamation point (!!) as the first entry following the line number.
- The first line of all NMT programs must be !!NMT, following the line number.
- When storing NMT programs, file names must begin with the letter 'n' (either lower or upper case). The 'n' is removed before the filename is shown in the menu for the `Load Test` field. (Example; a file saved as `nNMT1` appears as `NMT1`)

Program Example

The following example can be saved on mass storage, and then retrieved and run using the Decoder's `Load Test` field:

```
10    !!NMT
20    !BEGIN
30    !SET 1 5
40    !10 SEND 1A
50    !SEND 2A
60    !REPEAT 1 10
70    !EXIT 0
80    !END
```

Downloading Programs

Once programs are entered into the Test Set's IBASIC Controller RAM and saved on mass storage, they can be retrieved and run from the NMT Decoder.

Downloading A Program Into IBASIC Controller RAM
To copy a program from your BASIC computer to the Test Set's RAM, follow these steps:

1. Connect an HP-IB cable from your BASIC computer to the Test Set.
2. Load the program into your computer.
3. Set the HP-IB `Mode` field in the **Configure** screen to `Talk&Listen`.
4. Enter the following commands on your computer:

```
OUTPUT Addr;"PROG:DEL"
OUTPUT Addr;"PROG:DEF #0"
LIST #Addr
OUTPUT Addr;" "END
```

'Addr' is the HP-IB address of the Test Set.

The 'END' statement indicates that EOI is asserted with the last byte sent. (Refer to IEEE 488.2 standards for more information.)

Note

Although your NMT program is now in the Test Set's IBASIC program RAM, it can not be run from the **IBASIC Controller** screen, since IBASIC does not recognize the NMT commands. You must copy the program to mass storage before it can be run in the Decoder.

Copying Programs To Mass Storage
Programs copied to RAM Disk, External Disk, or Memory Cards require specific initialization and configuration procedures for proper storage and retrieval.

Refer to the *Programmer's Guide.*

Program Command Syntax

The following list describes the NMT command syntax and parameters. Commands can be entered directly into the Decoder's `NMT Test Entry` field, or used in test programs saved on mass storage.

All commands can be preceded by an integer as a label for branching purposes. These labels can range from 0 to 255.

BEGIN

Begin description of NMT test. This must always be the first command entered to describe a new NMT test program. It will initialize all internal memory associated with the NMT test and prepare the Test Set to accept the rest of the test program. It has no parameters.

END

End of the NMT test. This must always be the last command entered to describe an NMT test. It causes the program to be checked for valid label references and terminates the test entry process.

EXIT n

Stop the test and report exit status **n**.

Valid entries for the parameter **n** are integers from 0 to 10 and the following words (these may be in upper or lower case): PASSED, FAILED, ACCEPTED, REJECTED, INCOMPLETE.

EXITX n

Stop the test and report exit status **n**. Exchange the settings in the Main and Alternate Traffic Channel Number and Power fields.

Valid entries for the parameter **n** are integers from 0 to 10 and the following words (these may be in upper or lower case): PASSED, FAILED, ACCEPTED, REJECTED, INCOMPLETE.

GOTO l

Unconditionally jump to the label reference **l**.

Valid entries for the parameter **l** are integers from 0 to 255. The label reference must exist within the program or an error will occur after the END statement is entered.

All NMT test programs must contain an EXIT n, EXITX n, or GOTO l statement immediately before the END statement.

RCHAN c

Set the RF Analyzer to the correct frequency for NMT channel **c**.

Valid entries for the parameter **c** are as follows: CC, TC1, TCM, TC2, TCA and AC. TC1 and TCM are synonyms as are TC2 and TCA.

The frequency setting is determined by the channel number in the appropriate Encoder field, the selected DUT, and the selected Standard.

The parameter CC refers to Calling Channel; TC1 and TCM refer to Traffic Channel (Main); TC2 and TCA refer to Traffic Channel (Alternate); AC refers to the Access Channel.

TCHAN c

Set the RF Generator to the correct frequency for NMT channel **c**.

Valid entries for the parameter **c** are as follows: CC, TC1, TCM, TC2, TCA and AC. TC1 and TCM are synonyms as are TC2 and TCA.

The frequency setting is determined by the channel number in the appropriate Encoder field, the selected DUT, and the selected Standard.

The parameter CC refers to Calling Channel; TC1 and TCM refer to Traffic Channel (Main); TC2 and TCA refer to Traffic Channel (Alternate); AC refers to the Access Channel.

SEND f

Send the designated frame **f**.

Valid entries for the parameter f are as follows: 1A, 1A' or 1AP, 1A" or 1APP, 1AS, 1A'S or 1APS, 1A"S or 1APPS, 1B, 1BS, 1BTA1, 1BTA2, 2A, 2A' or 2AP, 2A" or 2APP, 2B, 2B' or 2BP, 2B" or 2BPP, 2C, 2C' or 2CP, 2C"or 2CPP, 2D, 2D' or 2DP, 2D" or 2DPP, 2E, 2F, 3A, 3A1, 3A2, 3B, 3BTA2, 3BTC2, 3C, 3D, 3DTA2, 4, 4TA2, 4B, 4BTA2, 5B, 6, 7, 10A, 10AAC, 10B, 10C, 10D, 11, 11A, 11B, 12, 13B, 15, 16, 21B, 21C, 22, 26, 27, 28 and 30.

Some of these frame types are only valid for certain NMT Standards. This will be checked when the program is run.

SEND f n

Send the designated frame **f** with the signal **n**. Valid entries for the parameter **f** with parameters **n** are as follows:

f	n
5a, 13a	Line signal number: 0 to 15, or 0 to F (hex)
14a, 14b	Digit signal value: 0 to 13, A to D(10 to 13), * and #.
20	Channel activation order: 0 to 15, or 0 to F (hex)
25	Channel status information: 0 to 15, or 0 to F (hex)

IF f l

If the received frame register contains the frame **f**, go to label **l**.

Valid entries for the parameter **f** include all the valid entries for **f** in the two SEND statements; however, the Special Suffixes discussed in the Encoder description are ignored by this instruction.

Valid entries for **l** are integers from 0 to 255. The specified label **l** must appear somewhere before the END statement of the program.

CLEAR

Clear the received frame register. This statement should appear before an **IF f l** statement in the test program.

SET n m

Set the counter **n** to the value **m**.

Valid entries for the parameter **n** are integers 1 and 2. Valid entries for **m** are integers from 0 to 255.

REPEAT n l

Decrement the counter **n** by one and go to the label **l** if the counter value is still greater than 0.

Valid entries for **n** are 1 and 2. Valid entries for **l** are integers from 0 to 255. The specified counter **n** must have been set with a **SET n m** statement previously in the test. The label **l** must appear somewhere in the test before the **END** statement.

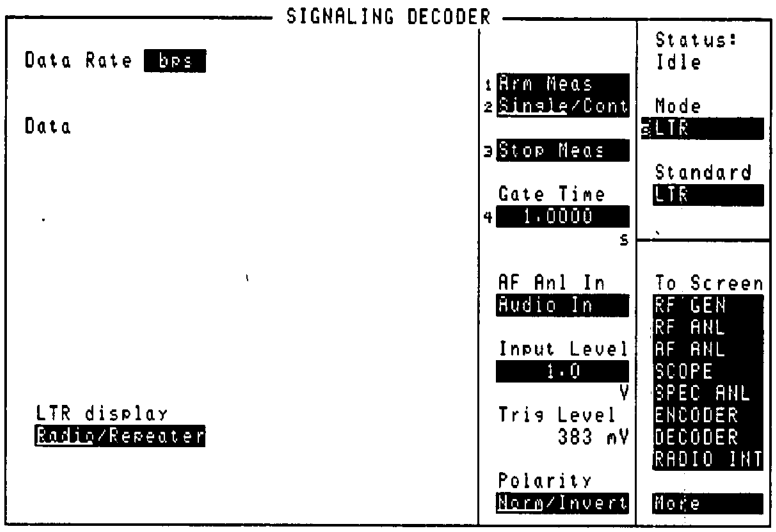
WAIT n

Wait **n** bits with no data being sent.

Valid entries for the parameter **n** are integers from 0 to 4095. The actual wait time depends on the `Data Rate` setting in bits-per-second on the NMT ENCODER.

LTR Decoder

This Decoder mode displays trunked signaling data for mobile radios and repeaters using the EF Johnson LTR® (Logic Trunked Radio) format.



ltr-de1.tif

Figure 4-60. The LTR Trunked Radio Decoder Screen

Decoding Mobile Radio Signaling Data

A transmit channel must be established before a mobile radio is tested (otherwise the transmitter will attempt to transmit but time-out and de-key automatically). A procedure for establishing a trunked transmit channel is provided in the previous LTR **Encoder** section.

After establishing a trunked transmit channel, keep the transmitter keyed and perform the following steps -

1. Access the Decoder, and select LTR for the `Mode`.
2. Set the `LTR display` field to `Radio`.
3. Set the `Single/Cont` field to `Single`.
4. Set the `AF Anl In` field to `FM Demod`.
5. Set the `Input Level` to 1 kHz.
6. Select `Arm Meas` to prepare the Decoder for triggering. *The transmitted data should be displayed after being 'computed'.

An `End of Data reached during decode.` message may be displayed at the top of the screen during decoding. Four conditions usually cause this message to be displayed:

- The `Gate Time` is too short to decode all the data. Increase this setting.
- The `Input Level` is set too low or too high. Change the level.
- The trunking data is inverted. Select `Invert` in the `Polarity` field.
- The LTR radio is not transmitting. Re-establish a transmit channel.

Decoding Repeater Signaling Data

1. Press (PRESET).
2. Access the **DUPLEX TEST** screen.
3. Set the `Tune Mode` to `Manual`.
4. Enter your repeater's transmit frequency in the `Tune Freq` field.
5. Select the `Input Port` (RF IN/OUT for direct transmitter-to-Test Set connections; Ant (Antenna) for off-the-air measurements).
6. Attach an antenna to the Test Set if you are making off-the-air measurements.
7. Access the **DECODER** and select the LTR mode.
8. Set the `LTR display` field to `Repeater`.
9. Select the triggering mode -
   a. Select `Single` to only decode and display the first valid transmitter data received. The decoder must be re-armed before another measurement can be made.
   b. Select `Cont` to continously monitor a repeater and display its transmitted data.
10. Set the `AF Anl In` field to `FM Demod`.
11. Set the `Input Level` to 1 kHz.
12. Select `Arm Meas` if you are using `Single` triggering. *The transmitted data is displayed after 'computing' is displayed in the `Status` field.

If no decoded data is displayed -

1. The repeater may not be transmitting.
2. The RF signal may be too low for off-the-air measurements. Use a better antenna, and/or set the **RF ANALYZER** screen's `Sensitivity` field to `High`.
3. The `Gate Time` may be too short. Increase the value.
4. The received data may be inverted. Set the `Polarity` field to `Invert`.
5. The `Trigger Level` may be too low or too high. Change the `Input Level` setting.

AF Anl In

Audio Frequency Analyzer Input selects the source of the signal to be analyzed (almost always `FM Demod` for LTR decoding).

Arm Meas

Arm Measurement prepares the decoder to be triggered by an incoming signal when set to make a Single measurement.

Data

This field displays decoded LTR data. The `LTR display` setting determines what type of data is decoded:

- Radio - displays the mobile's transmitted trunking data. Example;

```
Area  : 0
Goto  : 2
Home  : 2
ID    : 128
Free  : 31
```

- Repeater - lists the 20 possible repeater numbers in an LTR system. The data from the monitored repeater is displayed. If multiple radios try to access the repeater during decoding, the data sent to those radios by that repeater is also displayed.

  The data is displayed as a series of digits next to the number of the repeater that sent it. For example, a decoded message with a Goto number of 02 may look like this -

```
01:             02: 0020212806
03:             04:
04:             05:
~               ~
```

  This is interpreted as -

```
  02:        0     02     02    128    06
Repeater   Area   Goto   Home   ID    Free
```

Data Rate

This display field lists the Data Rate of the received signal.

Operating Considerations

This measurement relies on the **LTR Encoder** screen's `Data Rate` setting to function properly. Set that field to the expected incoming data rate for accurate measurements (typcially 297.6 bps).

Gate Time

This field specifies how long the Decoder analyzes a signal after it has been triggered.

Input Level

Enter the expected data signal level in this field (typically 1 kHz for LTR data). The higher the level of signal expected by the analyzer, the higher the Trigger Level is set.

Operating Considerations

The unit-of-measure is determined by the `AF Anl In` setting (**kHz** when the input is `FM Demod`).

The input level should be set high enough to prevent false triggering, but low enough to allow triggering for valid signals.

Polarity

This setting is used to match the Polarity of the encoded signal being analyzed.

Normal Operation
When this field is set to `Norm`, a logical high (1) is displayed when a positive peak in the received signal is detected. A negative peak displays a logical low (0).

Inverted Operation
When this field is set to `Invert`, a logical high (1) is displayed when a negative peak in the received signal is detected. A positive peak displays a logical low (0).

`Single/Cont`

This field specifies how long you want the analyzer to decode incoming signals:

- **Single** tells the analyzer to display valid LTR information received during one `Gate Time`.
- **Cont** is used to automatically re-arm the analyzer and display the measurements on a continual basis until `Single` is selected.

Standard

This field is used to select the trunked signaling standard for your radio (as new standards are added).

`Stop Meas`

Selecting this field stops the analyzer when making single measurements.

Trig Level

The **Trigger Level** indicates the minimum signal level required to begin a measurement that has been "armed." The level is adjusted by changing the `Input Level` field setting.

EDACS Decoder

This screen decodes the digital signaling data from an Ericsson GE EDACS® (Enhanced Digital Access Communications System) transmitter. This function is provided to test mobile radios, but it is not designed to test EDACS base stations.

Before transmitter measurements can be made, the EDACS Encoder screen must first be used to provide the necessary system information. (Refer to the *Encoder* section for information on setting up the EDACS Encoder.)

Four types of calls can be decoded: group, individual, emergency, and voice guard.

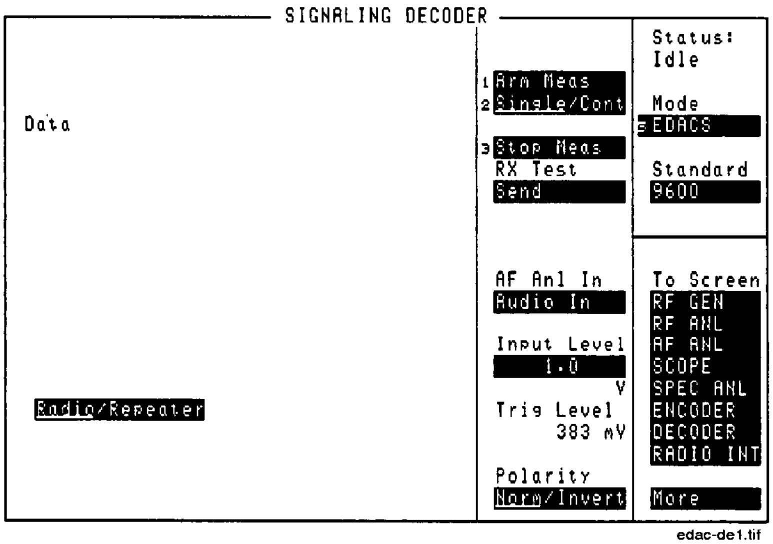


Figure 4-61. The EDACS Trunked Radio Decoder Screen

EDACS Transmitter Testing

When the mobile is turned on, it automatically tunes to its pre-programmed Control Channel frequency. The Test Set generates the Control Channel signal using the RF Generator and the `Control Channel` fields of the EDACS **Encoder**.

When the mobile is receiving the Control Channel, the transmitter can be keyed to send a Call Request message to go to a Working Channel. (The Working Channel settings are specified in the EDACS Encoder.)

After the mobile starts transmitting, the EDACS Decoder displays the decoded signaling data. You can then access the **DUPLEX TEST** screen to make modulation and RF carrier measurements.

Transmitter Test Procedure

This procedure establishes a Control Channel connection between the Test Set and your mobile. After the mobile locks to the Control Channel, the Decoder is armed and the mobile's transmitter is keyed to make measurements.

Note

Each EDACS radio is pre-programmed to access a specific Control Channel and one or more Working Channels. Other mobile and system identification information is also programmed into the radio. You cannot test an EDACS mobile without first entering these values into the **EDACS Encoder** screen.

Caution

Before testing your transmitter, read the MAX PWR limit printed under the Test Set's RF IN/OUT port. Exceeding this limit could damage your Test Set.

Preset the Test Set
Press (PRESET) on the Test Set to set all controls to a known state and display the **RX TEST** screen.

Connect the Mobile to the Test Set
Connect the antenna port of the mobile to the RF IN/OUT port of the Test Set.

Define the Control Channel Settings

1. Turn AF Generator 1 Off by positioning the cursor in front of the 3.00 value of the AFGen1 To field and pressing (ON/OFF).
2. Select the ENCODER function from the To Screen menu.
3. Select the EDACS Mode to display the EDACS Encoder.
4. Select the Data Rate using the Standard field. (4800 or 9600 bps)
5. Enter the Control Channel settings.
   a. The Number is your systems Control Channel number.
   b. The RX Frequency is the Control Channel receive frequency for your mobile.
   c. The TX Frequency is the Control Channel transmit frequency for your mobile.
6. Enter the Working Channel settings.
   a. The Number is the Working Channel number you want the mobile to be sent to.
   b. The RX Frequency is the mobile's receive frequency for the selected Working Channel.
   c. The TX Frequency is the mobile's transmit frequency for the selected Working Channel.
7. Enter the Logical ID number.
8. Enter the Group ID number.
9. Enter the Site ID number.

Prepare the Decoder for Transmitter Measurements

1. *Turn the SQUELCH control on the Test Set fully clockwise.*
2. Select Decoder from the To Screen menu to access the EDACS Decoder.
3. Set the AF Anl In field to FM Demod to demodulate the signal from your transmitter.
4. Set the Input Level field to about one third of the expected deviation. (For example, if your transmitter's deviation is 3 kHz, set the Input Level to about 1 kHz.)
5. Select the Arm Meas field to prepare the decoder. The Status: field should indicate Armed.
6. Select the Send field (under RX Test). This outputs the Control Channel information specified in the EDACS Encoder.

The mobile should indicate that it is receiving the Control Channel data.

Make Basic Transmitter Measurements

1. Key the mobile's transmitter and verify that its transmit indicator is on. The call type, Group ID, and Logical ID information transmitted by your mobile is displayed under the `Data` field.
2. With the transmitter still keyed, press (DUPLEX) to access the **DUPLEX TEST** screen. `TX Frequency` and `TX Power` are displayed.

Making Other Transmitter Measurements

By connecting Audio Frequency Generator 1 (AFGen 1) to your transmitter's microphone input, you can make calibrated modulation measurements; such as microphone sensitivity, modulation limiting, and transmitter frequency response.

To be able to make these measurements:

1. Connect the AUDIO OUT port of the Test Set to your mobile's microphone input.
2. Access the DUPLEX TEST screen.
3. Set the upper part of the `AFGen1 To` field to `Audio Out`.
4. Use the lower part of the `AFGen1 To` field to adjust the output level into the microphone line.
5. Use the `AFGen1 Freq` field to adjust the audio generator's frequency.

AF Anl In

This field selects the source of the signal to be decoded. FM Demod is normally used, since the data being decoded is usually the demodulated signaling data from an EDACS transceiver.

Arm Meas

Select this field to prepare the decoder to be triggered by transmitted signaling data. When selected, the Status: field indicates Armed.

Data

This area displays the decoded Call Request signaling data from your transmitter. The type of data displayed depends on the Radio/Repeater setting and the type of message decoded.

Input Level

This field is used to set the trigger level for the decoder. The displayed Trig Level changes as the Input Level is adjusted. This field is normally set to 1 kHz for EDACS decoding (assuming the AF Anl In field is set to FM Demod).

Operating Considerations

The units displayed (kHz, %, V) depends on the AF Anl In setting.

Polarity

This field is used to match the polarity of the data to be decoded. This field is usually set to Norm.

See Also

Polarity field description for the EDACS Encoder.

Radio/Repeater

This field specifies whether the decoder will trigger on the received sync word of a mobile signal (Radio), or on the sync word from a repeater (Repeater). It also specifies how the received data will be interpreted.

The Repeater function is not fully implemented at this time to provide base station decoding.

RX Test

When Send is selected, the Control Channel Site ID message is output at the RX Frequency specified in the Control Channel settings on the EDACS Encoder screen.

Single/Cont

This field specifies how you want to arm the decoder.

- Single requires you to manually arm the decoder (using the Arm Meas field) before each measurement is made.
- Cont automatically arms the decoder to make a measurement, and re-arms the decoder after a measurement is made.

Operating Considerations

To dis-arm the decoder in Single mode, select the Stop Meas field. The Stop Meas function is disabled when Cont is selected.

Standard

The Encoder Data Rate field must be set to the data reate expected formt eh radio or the repeater being decoded. This is best done by selecting the corresponding Standard on the Encoder screen.

See Also

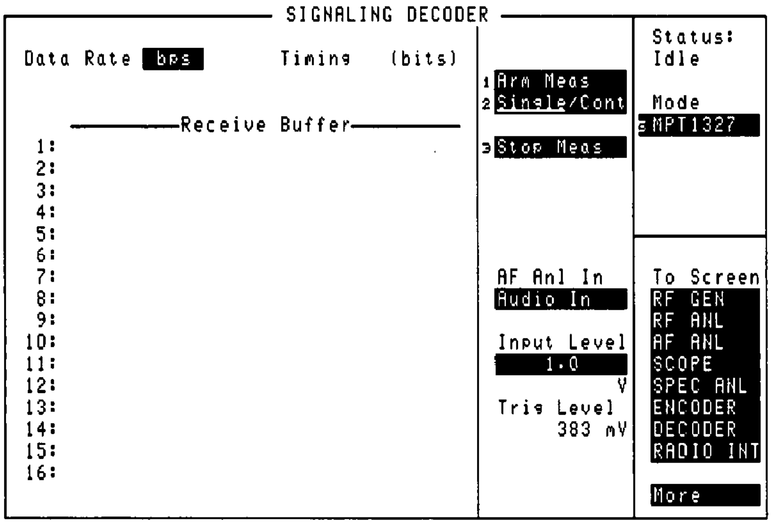
Standard field description for the EDACS Encoder.

Stop Meas

This field is used to dis-arm the decoder when making Single measurements. It is not used when making continuous (Cont) measurements.

MPT 1327 Decoder

The MPT 1327 Decoder screen is used with the MPT 1327 Encoder screen to decode and display MPT 1327 data streams. Like the MPT 1327 Encoder, the MPT 1327 Decoder is primarily intended to be controlled using IBASIC programs running on the Test Set's IBASIC controller or on an external controller.



mpt-de1.tif

The MPT 1327 Decoder Screen

Manually Decoding MPT 1327 Signals

To manually test MPT 1327 radios using this decoder, you must first set up the MPT 1327 Encoder to provide the necessary protocol to get the radio up on the correct channel. This requires a thorough knowledge of the MPT 1327 Encoder operation, including using the Undisplayed Controls accessed using IBASIC commands.

For these reasons, the following information generally assumes you are operating the decoder under IBASIC control.

Decoder Triggering

For MPT 1327 signaling detection, the decoder should be configured for repetitive retriggering using the HP-IB command:

```
TRIGger:MODE:RETRigger REPetitive
```

When the decoder is armed it is triggered whenever it receives the synchronization sequence appropriate to the test mode (selected on the MPT 1327 Encoder screen). Refer to Table 4-6.

Table 4-6. Triggering the MPT 1327 Decoder

Test Mode	Decoder Synchronization Sequence
Off	-
Control	SYNC
Traffic	SYNT
1200Hz	1111
1800Hz	0000
Dotting	1010

The SYNC and SYNT patterns are those defined for the MPT 1327 Encoder. (The defaults are $C4D7_{16}$ and $3B28_{16}$ respectively.)

When a synchronization sequence is recognized, the message is placed (timeslot aligned) into the receive buffer. The receive buffer is organized as 16 x 128 bit timeslots.

Decoder repetitive retriggering is used to minimize the decoder down-time between messages. It is therefore important to extract the messages from the decoder buffer as soon as possible after their arrival. This avoids the messages being overwritten by further signaling.

Detecting and Querying Messages

IBASIC can be informed about the arrival of a message in the decoder buffer. To do this, configure the HP-IB status registers to cause a service request (SRQ) on the negative transition event of bit 12, "Decoder Result Available" in the Hardware Status Register #1.

For further information on the Hardware Status Register refer to the *Programmer's Guide*.

The message is read from the decoder buffer by the command:

`MEASure:DECoder:MPT1327:BUFFer?`

This query returns a quoted string comprising the contents of one or more timeslots. The string is dis-assembled into the mnemonic form documented in appendix A. If more than one message is received, the individual messages are separated by semi-colons. If a timeslot contains data codewords, it is disassembled into the DCW extension. Examples of this are:

- Simple RQS from RU.
  `RQS 0,1,5,0`
- Cleardown from RU sent in three consecutive timeslots.
  `MAINT 0,1,283,3,0;MAINT 0,1,283,3,0;MAINT 0,1,283,3,0`
- SAMIS response to AHYC giving PSTN digits for call.
  `SAMIS 14391,83782;DCW #H080000000000,#H000000000000`

There are two other measurements available on the decoder screen:

- The Signaling Data Rate
  The signaling data rate measurement is the measured baud rate of the received message. It is most accurately measured on a "dotting" pattern.
- The Received Message Timing
  This measures the timing of the received message relative to the timeslots in the forward control channel. It has two modes of operation:
  - Slot timing mode
    This works in the **`Control`** test mode only, it is disabled in all other modes.

    The timing counter is reset at the end of every control channel timeslot. If a message is received, the time from the most recent slot end, to the start of the received message's preamble, is reported as the timing measurement result.

    In the slot timing mode it is not possible to determine whether the message was returned in the "correct" timeslot. (For example, if it is a response that should return in the timeslot immediately following the requesting forward message.) It is possible to check that the timing offset from the forward channel slot boundaries is within specification.

This mode is selected via the HP-IB with the command:

`DECoder:MPT1327:TIME:MODE 'SLOT'`

This is the default mode.

- Response timing mode
  This works in the `Control` and `Traffic` test modes, it is disabled in all other modes.

  In `Control` mode the timing counter is reset at the end of each message transmitted from the control channel message buffer. It is not affected by the on-going transmission of the control channel filler pattern.

  In the `Traffic` mode the timing counter is reset at the end of each message transmitted from the traffic channel message buffer. There is no background filler pattern.

  In the response timing mode both next slot and slot offset timing can be checked. The received message must however, be solicited by a forward message so that the timer is reset and the measurement is meaningful.

  This mode is selected via the HP-IB with the command:

  `DECoder:MPT1327:TIME:MODE 'RESPONSE'`

Radio Interface

RADIO INTERFACE (Option 020)

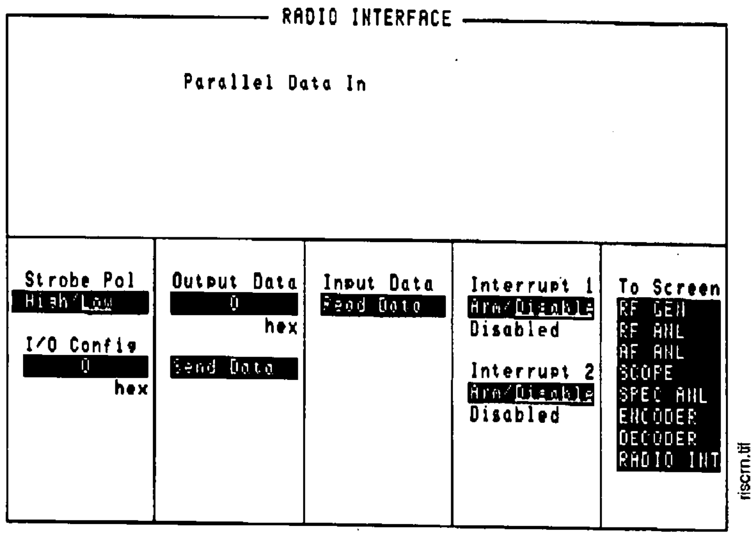


Figure 4-62. The Radio Interface Screen

The **RADIO INTERFACE** screen controls the digital functions of the rear-panel **RADIO INTERFACE** connector. You can set the bit values on the 16 parallel data pins, strobe the data out, designate pins as inputs, and clock data in. You can also arm the interrupt pins and determine if an interrupt has been tripped.

The fields on this screen can be set or read by IBASIC or HP-IB programs.

See Also

Chapter 5
Programmer's Guide

Input Data

This field triggers the Test Set to latch the data on the parallel data pins that have been designated as inputs.

Interrupt 1

This field arms or disarms the **Interrupt 1** pin. When it is armed, and the pin is pulled low by an external device, **Tripped** is displayed below the field.

Operating Considerations

The field can be queried directly in an IBASIC or HP-IB program, or it can be monitored with the HP-IB status reporting system. This is done by reading bit 5 of the status byte and then reading bit 13 of the Hardware 1 status register. The **Interrupt 1** pin can also be set as the HP-IB SRQ mask.

Once the interrupt has been tripped it must be re-armed. To do this, remove the low on the **Interrupt 1** pin and then select the **Interrupt 1** field once to `Disable` the interrupt and again to `Arm` it.

See also

Programmer' Guide

Interrupt 2

Same as **Interrupt 1** but, it applies to the **Interrupt 2** pin on the **RADIO INTERFACE** connector and bit 14 of the Hardware 1 status register.

I/O Config

This field designates which of the 16 parallel data pins will be used as inputs. Pins designated as inputs are pulled high internally. They can be left high for a logic 1 or pulled low for a logic 0.

Operating Considerations

A hexadecimal number that can range from 0000 to FFFF is entered in this field. Hex 0000 designates no pins as inputs, while hex FFFF designates all 16 pins as inputs.

To determine the number, convert the input pin's binary weight to hexadecimal, then add. Pin 19, D0, is the least significant bit. For example, if D0 through D7 are to be inputs and D8 through D15 are outputs the number to enter would be 00FF.

Output Data

This field sets the data to be output on the parallel data lines.

Operating Considerations

The data is entered as a hexadecimal number that can range from 0000 to FFFF. To determine the number convert the binary weight of the pins that you want to set high to hexadecimal, then add. Pin 19, D0, is the least significant bit. For example 0008 would set pin 22, D3, high and the rest of the pins low.

The field will show the entered value but the pins don't change until the **Send Data** field is selected.

Parallel Data In

This field displays the value on the parallel data pins when the **Parallel Data In** field is selected.

Send Data

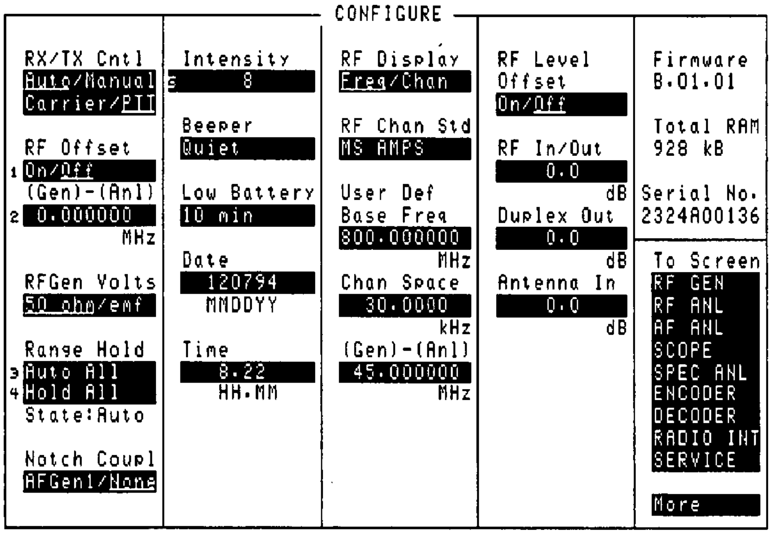
When selected, this field clocks the data in the **Output Data** field to the parallel data pins. It also outputs a pulse on the **Strobe** pin.

Strobe Pol

Strobe Polarity. This field sets the polarity of the pulse on the Strobe pin. This pulse occurs when the **Send Data** field is selected.

Configure

CONFIGURE



cnfgscrn.tif

Figure 4-63. The Configure Screen

The **CONFIGURE** screen defines a number of general operating functions, such as date and time, screen intensity, and beeper volume. It is also used to define some RF signal parameters, such as RF Generator/Analyzer offset, channel standards and characteristics, and signal loss/gain compensation.

Antenna In

This field is used to indicate losses or gains between the ANT IN port and the device under test.

Enter a **positive** value to indicate a gain (such as an amplifier). The Spectrum Analzyer Marker Level (`Lvl`) measurement is automatically reduced by that amount. (The Spectrum Analzyer **`Ref Level`** is automatically decreased by the same amount, so the trace position does not appear to change.)

Enter a **negative** value to indicate a loss (such as cable loss). The Spectrum Analzyer Marker Level (`Lvl`) measurement is automatically increased by that amount. (The Spectrum Analzyer **`Ref Level`** is automatically increased by the same amount, so the trace position does not appear to change.)

This field is only used when the **`RF Level Offset`** field is set to `On`.

See Also

`RF Level Offset` field description

Base Freq (User Defined)

The Base Frequency field sets the RF Generator reference for channel 1 when the **`RF Chan Std`** is set to `USER-DEF`, and the **`RF Display`** field is set to `Chan`.

For example, if your multi-channel radio's lowest **receive** channel frequency is 300 MHz, you would enter `300 MHz` in this field. You would also use the `Chan Space` and `(Gen)-(Anl)` to tell the Test Set where other transmit and receive channel frequencies are in relation to the Base Frequency, and whether or not the system is duplex.

Operating Considerations

The value of this field is only used if the **`RF Display`** field is set to `Chan`, and the **`RF Chan Std`** field is set to `USER-DEF`.

See Also

`Chan Space` field description
`(Gen)-(Anl)`(User Defined) field description
`RF Chan Std` field description
`RF Display` field description

Beeper

This field changes the audio beeper volume by selecting the desired level from a list of choices. The Beeper always beeps when the instrument is turned on, regardless of this setting.

Operating Considerations

The Beeper alerts you any time a message is displayed. Since a message may be removed from the screen before you notice it, it is better to leave the Beeper on to alert you to potential errors during operation.

The Beeper volume setting is retained when the instrument is turned off.

Chan Space (User Defined)

This field specifies the RF channel spacing when the `RF Display` field is set to `Chan`, and the the `RF Chan Std` field is set to `USER-DEF`.

For example, entering `25 kHz` causes a 25 kHz spacing between each channel. If the receive frequency for channel 1 is 150.500 MHz, channel 2's receive frequency would be 150.525 MHz.

Operating Considerations

The value of this field is only used if the `RF Display` field is set to `Chan`, and the `RF Chan Std` field is set to `USER-DEF`.

See Also

`(Gen)-(Anl)` field description
`RF Chan Std` field description
`RF Display` field description
`Base Freq` field description

Date

This field specifies the current date for the internal clock. The date can be read by a controller using HP-IB, and printed on test results.

The format is MMDDYY (Month Day Year), using two digits for each term. When entering months January through September (01-09), the leading zero is not displayed when entered. Example; May 5, 1993 is entered as 050593, but is displayed as 50593.

The internal clock still functions when the instrument is turned off.

Duplex Out

This field is used to indicate losses or gains between the DUPLEX OUT port and the device under test.

- Enter a **positive** value to indicate a gain (such as an amplifier gain). The RF Generator level is automatically set that amount **below** what is indicated in the RF Generator's `Amplitude` field. (Example; if this value is 10 dB, and the `Amplitude` field shows 0 dBm, the actual level out this port is −10 dBm.) The value at the output of the external amplifier should then be at the level indicated in the `Amplitude` field.
- Enter a **negative** value to indicate a loss (such as cable loss). The RF Generator level is automatically set that amount **above** what is indicated in the RF Generator's `Amplitude` field to compensate. The value at the opposite end of the cable (loss) should then be at the level indicated in the `Amplitude` field; unless the resulting RF Generator setting exceeds the maximum output level, then an error occurs - `Input value out of range`. In that case, reduce the `Amplitude` setting, or decrease the `Duplex Out` value.

This field is only used when the `RF Level Offset` field is set to `On`.

Firmware

This field displays the current firmware revision for your Test Set. The revision number is automatically changed when updated firmware is installed.

(Gen)-(Anl)

This field is used with the `RF Offset` field to specify the amount of frequency offset between the RF Generator and RF Analyzer.

This field is not displayed when the `RF Display` field is set to `Chan` (the offset is automatically set when using channel tuning).

See Also

"Setting an RF Generator/Analyzer Offset" in Chapter 3

(Gen)-(Anl) (User Defined)

This field defines the receiver-tranmsitter frequency offset when using User Defined channel operation.

Use a **positive** value when the radio's receive frequency is higher than the transmit frequency (such as 45 MHz)

Use a **negative** value when the radio's receive frequency is lower than the transmit frequency (such as −45 Mhz).

Operating Considerations

The value of this field is only used if the `RF Display` field is set to `Chan`, and the `RF Chan Std` field is set to `USER-DEF`.

See Also

`Chan Space` field description
`RF Chan Std` field description
`RF Display` field description

Intensity

This field adjusts the screen intensity from a setting of 1 (very dim) to 8 (bright). If the setting is set too low, the screen can no longer be read. If you can't read the screen, and you don't know where the cursor is (or even what screen is displayed!), press (PRESET), and re-access the **CONFIGURE** screen. The cursor automatically goes to this field at that point. Press (8), (ENTER) to set the maximum intensity, and re-adjust if desired.

This setting is retained when the instrument is turned off.

Low Battery

This setting is used during battery (DC) operation to alert you when no front-panel controls are used within the specified amount of time. The setting is changed by selecting this field, then choosing the setting from a list of choices.

This setting is retained when the instrument is turned off.

Notch Coupl

This field selects if the `Notch Freq` setting of the **AF ANALYZER** screen is coupled to the `AF Gen1 Freq` setting. When set to `None`, the notch filter and AF Generator 1 do not interact. When set to `AFGen1` (coupled), the settings track each other unless the AF Generator frequency is set outside the 300 Hz to 10 kHz limits of the Notch Filter (optional for the HP 8920A and HP 8921A).

Range Hold

These fields enable/disable several auto-ranging and auto-tuning routines.

Auto All enables these routines, providing automatic adjustment when making AF or RF measurements.

Hold All disables these routines, requiring you to manually set the affected settings.

The following fields are affected by the Range Hold field:

- RX/TX Cntl in the **CONFIGURE** screen.
- Tune Mode in the **TX TEST**, **DUPLEX TEST**, and **RF ANALYZER** screens.
- Input Atten in the **RF ANALYZER** and **SPECTRUM ANALYZER** screens.
- Gain Cntl in the **AF ANALYZER** screen. This field controls three AF gain setting fields:

  Input Gain

  De-Emp Gain

  Notch Gain

Operating Considerations

The Hold All setting is primarily used when the instrument is operated by remote control, such as in an automated test system.

Unless you have very specific reasons for disabling the automatic functions, you should set this field to Auto All when operating the instrument manually.

See Also

Programmer's Guide

RF Chan Std

Use the RF Channel Standard field to select the channel standard for the radio under test. The RF Generator and RF Analyzer frequencies are automatically set to correspond to the channel number entered in the `RF Channel` field. (`RF Channel` replaces the `Amplitude` and `Tune Freq` fields on several screens when channel tuning is used.)

Each standard has a prefix code that indicates what type of radio to test; Mobile Station (MS) or Land (base) Station (LS). For example, if you are testing an AMPS mobile, select `MS AMPS`.

For the NAMPS standards, a third letter is added indicating which frequency band is used: Upper, Middle, or Lower. For example, when testing a Mobile Station using the Lower band, choose `MSL NAMPS`. Testing a Land Station using the Upper band you would select `LSU NAMPS`.

The `USER-DEF` selection is used to define your own channel assignments. When selected, you enter the `Base Freq`, `Chan Space`, and `(Gen)-(Anl)` settings.

See Also

`Base Freq` field description
`Chan Space` field description
`(Gen)-(Anl)` field description

RF Display

This field selects the format for entering the RF Generator and RF Analzyer frequencies:

- When `Freq` is selected, you enter the RF Generator and RF Analyzer frequencies directly using the keypad or knob.
- When `Chan` is selected, the `RF Gen Freq` and `Tune Freq` fields on all screens are replaced by the `RF Channel` field, and only the channel number is entered and displayed.

Channel tuning eliminates the need to enter transmit and receive frequencies directly into the Test Set. Once the your radio's RF Channel Standard is selected, you only have to enter the channel number to automatically set the RF Generator and RF Analyzer to the correct frequencies.

Operating Considerations

When Channel tuning is used, the RF Analyzer is set to manual tuning. The `Tune Mode` field on the **TX TEST**, **DUPLEX TEST**, and **RF ANALYZER** screens is no longer displayed. As a result, the `TX Freq Error` measurement is displayed (since the `TX Frequency` measurement is only displayed when the `Tune Mode` field is set to `Auto`).

See Also

`RF Chan Std` field description

RF Gen Volts

This field specifies whether you want RF Voltages expressed as the voltage across a 50Ω load, or the open circuit voltage (emf).

Operating Considerations

This setting affects the RF Generator and Tracking Generator Amplitudes.

RF In/Out

This field is used to indicate losses or gains between the RF IN/OUT port and the device under test.

- Enter a **positive** value to indicate a gain (such as an amplifier gain). When the RF IN/OUT port is used as an output, the RF Generator (or Tracking Generator) level is automatically set that amount **below** what is indicated in the RF Generator's `Amplitude` field. (Example; if this value is 10 dB, and the `Amplitude` field shows 0 dBm, the actual level out this port is − 10 dBm.)

  When this port is used as an input, the `TX Power` measurement and Spectrum Analyzer Marker Level (`Lvl`) are automatically **reduced** by that amount.

- Enter a **negative** value to indicate a loss (such as cable loss). The RF Generator (or Tracking Generator) level out this port is automatically set that amount **above** what is indicated in the RF Generator's `Amplitude` field to compensate.

  When used as an input, the `TX Power` and Spectrum Analyzer Marker (`Lvl`) measurements are **increased** by that amount.

This field is only used when the `RF Level Offset` field is set to `On`.

Duplex Testing

This field is used when the RF IN/OUT connector is only used as an input OR only used as an output; not doing both at the same time (Duplex testing).

If you need to use the RF Level Offset functions when testing Duplex radio's, use the DUPLEX OUT connector and `Duplex Out` field for the RF Generator function, and the RF/IN OUT connector and `RF IN/OUT` field for the RF Analzyer function.

See Also

`RF Level Offset` field description

RF Level Offset

This field enables/disables the effects of the `RF In/Out`, `Duplex Out`, and `Antenna In` fields below it.

- When set to `Yes`, the RF Generator amplitude and RF Analyzer power measurement are offset by the values entered in these fields.
- When set to `Off`, the values in these fields are ignored.

See Also

`Antenna In` field description
`Duplex Out` field description
`RF In/Out` field description

RF Offset

This field enables/disables the RF Generator–RF Analyzer offset specified in the `(Gen)-(Anl)` field below it. (Don't confuse this field with the `(Gen)-(Anl)` field used for channel tuning.)

Operating Considerations

When an RF Offset is used, changing the RF Generator frequency or RF Analyzer tune frequency automatically alters the other setting. On screens where both fields are not shown (such as the **RX TEST** and **TX TEST** screens), you will not see the corresponding field change.

See Also

"Setting an RF Generator/Analyzer Offset" in Chapter 3

RX/TX Cntl

This function controls automatic screen changes between the **RX TEST** and **TX TEST** screens during radio testing. It is divided into two fields:

The `Auto/Manual` field enables/disables automatic switching between the **RX TEST** and **TX TEST** screens under certain testing conditions.

- `Auto` allows automatic screen changes between the **RX TEST** and **TX TEST** screens while testing radios.
- `Manual` requires you to select the **RX TEST** or **TX TEST** screen when performing radio tests.

The `Carrier/PTT` field specifies the condition that will cause automatic screen changes.

- `Carrier` causes the instrument to automatically switch from the **RX TEST** screen to the **TX TEST** screen when an RF carrier is detected. The screen returns to **RX TEST** when the carrier is no longer detected.
- `PTT` (Push To Talk) causes the instrument to automatically switch from the **TX TEST** screen to the **RX TEST** screen when a microphone connected to the MIC/ACC connector is keyed. The screen changes back to **TX TEST** when the microphone is no longer keyed.

Operating Considerations

If `Auto` and `Carrier` are used together, the screen may continuously change between **RX TEST** and **TX TEST**. This only occurs if the RF IN/OUT port is used with the RF Generator **`Amplitude`** set >−35 dBm (a much higher level than is typically used for receiver tests). To prevent this problem, set the **`Amplitude`** <−35 dBm or `Off`, or use the DUPLEX OUT port for the RF Generator's output.

Caution

The Test Set can be damaged by connecting a reverse power signal to the DUPLEX OUT port of >200 mW.

Serial No.

This field displays the serial number of the Test Set.

Time

This field sets the time-of-day for the instrument's 24 hour clock. (Example; 4:53 PM is entered `16:53`)

Operating Considerations

The internal clock still functions when the instrument is turned off.

Total RAM

This field displays the total amount of RAM available for IBASIC programs and save/recall registers.

Service

SERVICE

Note

This screen is used for component-level troubleshooting by the manufacturer. This method of troubleshooting is not currently supported outside of the factory.

To access the **SERVICE** screen, you must first access the **CONFIGURE** screen, then select `Service` from the `To Screen` menu in the bottom right corner.

This screen allows you to monitor individual circuit node measurements and change various MUX and DAC Latch settings for isolating faulty modules.

Counter Connection

This field selects the desired circuit node to connect to the frequency counter.

Frequency

This measurement field displays the frequency measurement for the circuit node shown in the `Counter Connection` field.

Gate Time

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

Latch This field is used to alter the circuit latches that control a variety of operations. The value of the selected latch is displayed and changed in the `Value` field.

RAM Initialize Selecting this field clears all SAVE registers and test programs that may be in RAM, and resets all latches to their factory power-up configuration.

Operating Considerations

If you have saved one or more instrument setups using the SAVE function, using this function will permanently remove them.

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

Voltage This measurement field displays the voltage measurement for the circuit node shown in the `Voltmeter Connection` field.

Voltmeter Connection This field selects the desired circuit node for voltage measurements. The reading is displayed in the `Voltage` measurement field.

MESSAGE

The **MESSAGE** screen lists any error or operation messages that have occurred since the instrument was turned on.

The type of error and the time it occurred are listed. If one error occurs more than once before a different error is encountered, the number of times it occurred, and when it occurred, are displayed.

All messages are shown until the entire display is filled. If enough errors occur, the **MESSAGE** screen will scroll the first messages past the top of the screen. These messages cannot be retrieved.

See Also

Error Messages

TESTS Screens

The **TESTS** screens are the also referred to as the "Tests Subsystem"; a group of screens used to create, edit, and run automated test programs. Using program control, the Test Set can run radio tests by itself and control other instruments using the optional HP-IB or Serial Port. The HP 11807A Radio Test Software is an example this type of operation.

Tests can be run from memory cards, the Test Set's internal ROM or RAM, or from an external disk drive.

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

For detailed (step-by-step) instructions about using the **TESTS** screens. See your Radio Test Software's documentation or the Test Set's *Programmer's Guide*.

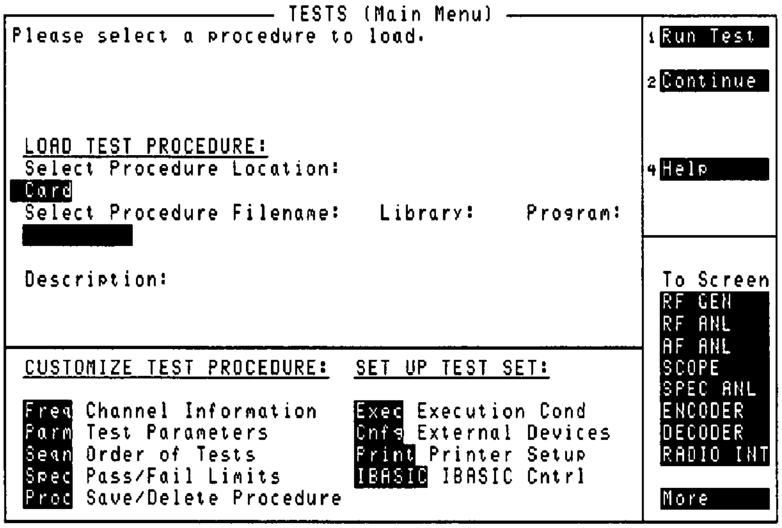
Tests Subsystem Screens

When you press (TESTS), you access the main **TESTS** screen. The other screens of the subsystem are accessed using the CUSTOMIZE TEST PROCEDURE: or SET UP TEST SET: lists at the bottom of this screen.

TESTS Subsystem Screens

- **Main Menu** is used load a test procedure from a disk, RAM, ROM or memory card. It is also used to access the other screens in the Tests Subsystem.
- **Channel Information** is used to specify transmitter and receiver frequency information for the radio being tested and to enter squelch and signaling information.
- **Test Parameters** is used to tell the Test Set the requirements of the test system for testing your radio.
- **Order of Tests** is used to define a test sequence from a list of possible tests.
- **Pass/Fail Limits** is used to specify the upper and lower limits for each test point. If a limit is violated during a test, an "F" appears next to the test value to indicate a failure.
- **Save/Delete Procedure** is used to save and delete test procedures.
- **Execution Conditions** is used to control which test results are output and where the results are printed (CRT/printer). This screen also controls whether tests run continuously or singly, and whether the test continues or stops after a failure is detected.
- **External Devices** is used to specify what types of external equipment are connected to the Test Set and their addresses. It is also used to specify where to store test result data.
- **Printer Setup** is used to control which test results are output and where the results are printed. This screen is also used for basic formatting of the printout (lines per page and form feeds). Printer port and printer model number are also chosen on this screen.
- **IBASIC Cntrl** is used to run IBASIC programs. This screen is also used as a "stand-alone" IBASIC computer. See the **Instrument BASIC Programmer's Guide** for information about writing your own tests for the Test Set.

TESTS (Main Menu)



tstmain.tif

Figure 4-64. The TESTS (Main Menu) Screen.

Cnfg External Devices Selecting this field displays the TESTS (External Devices) screen.

Continue This field is used to restart a paused test.

Description This field displays a description of the file chosen in the `Select Procedure Filename` field.

Exec Execution Cond Selecting this field displays the TESTS (Execution Conditions) screen.

Freq Channel Information

Selecting this field displays the TESTS (Channel Information) screen.

IBASIC IBASIC Cntrl Selecting this field displays the TESTS (IBASIC Controller) screen.

Library This field displays the library information of the file chosen in the `Select Procedure Filename` field.

Parm Test Parameters Selecting this field displays the TESTS (Test Parameters) screen.

Print Printer Setup Selecting this field displays the TESTS (Printer Setup) screen.

Proc Save/Delete Procedure

Selecting this field displays the TESTS (Save/Delete Procedure) screen.

Program This field displays program information for the file chosen in the `Select Procedure Filename` field.

Run Test Selecting this field loads and runs the test chosen in the `Select Procedure Filename` field.

Select Procedure Filename

This field is used to select the file you want to load from the location chosen in the `Select Procedure Location` field.

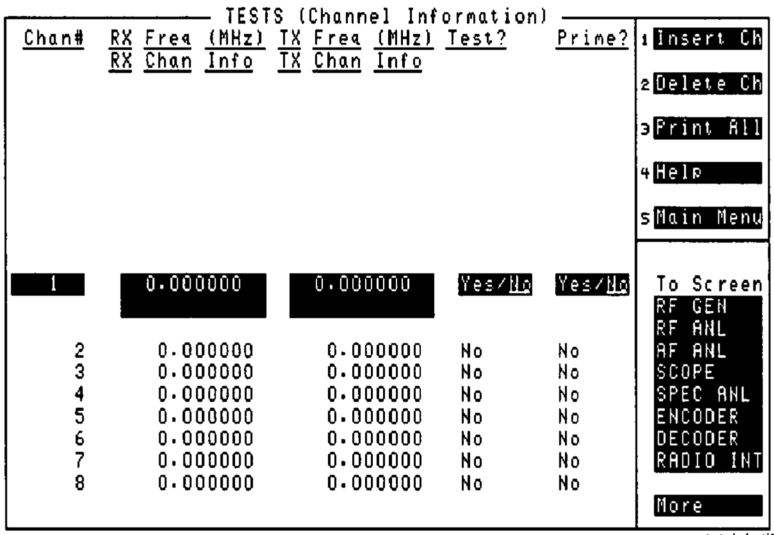
Select Procedure Location

This field is used the select the location of the procedure to load. Procedures can be loaded from disk, card, ROM, or RAM.

Seqn Order of Tests Selecting this field displays the TESTS (Order of Tests) screen.

Spec Pass/Fail Limits Selecting this field displays the TESTS (Pass/Fail Limits) screen.

TESTS (Channel Information)



tstcinfo.tif

Figure 4-65. The TESTS (Channel Information) Screen.

This screen displays the channel frequencies to be tested.

Delete Ch

This field allows you to delete a channel from the frequency table at the bottom of the screen.

Insert Ch

This field allows you to enter a new channel in frequency table at the bottom of the screen.

Operating Considerations

You are required to specify if the test channel is a "prime test channel". Prime test channels are the radio channels primarily used by the radio operator; they are the channels you are the most concerned about testing.

Use the `RX Chan Info` or `TX Chan Info` fields if the channel requires a tone code or frequency for testing radios that have CTCSS (Continuous Tone-Controlled Squelch System) squelch.

For example, if your radio uses a CTCSS tone of 91.5 Hz, you could enter the tone frequency in both RX and TX channel information fields as `CT FR91.5` or you could enter the tone code itself as `CT ZZ`. The specific entries are described in your HP 11807A software manual.

TESTS (Channel Information) Screen

When testing cellular radios, the Channel Information is the channel number you are testing (don't confuse this with the **Chan#** field used to list channels on this screen). When the cellular radio channel number is entered, the HP 11807A software automatically sets the channel frequencies when testing. You do not need to enter the RX and TX frequencies because they correspond directly to the channel numbers.

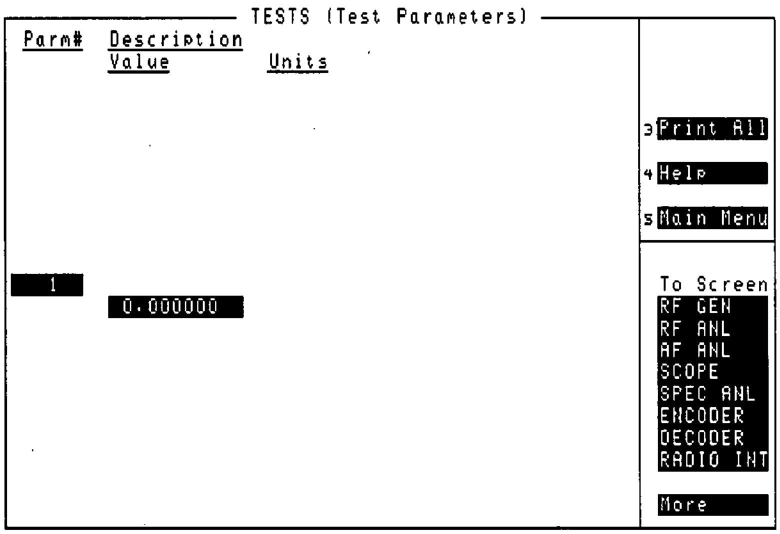
Note

Enter a "−1" in the RX and TX test frequency fields to have all subsequent channels ignored when testing is started.

Print All This field allows you to print the Test Set's screen image.

Main Menu Selecting this field returns you to the **TESTS (Main Menu)** screen.

TESTS (Test Parameters)



tstparam.tif

Figure 4-66. The TESTS (Test Parameters) Screen.

Test Parameters are used to define operating and testing characteristics to match those of the radio being tested (audio-load impedance, audio power, power-supply voltage, and so forth).

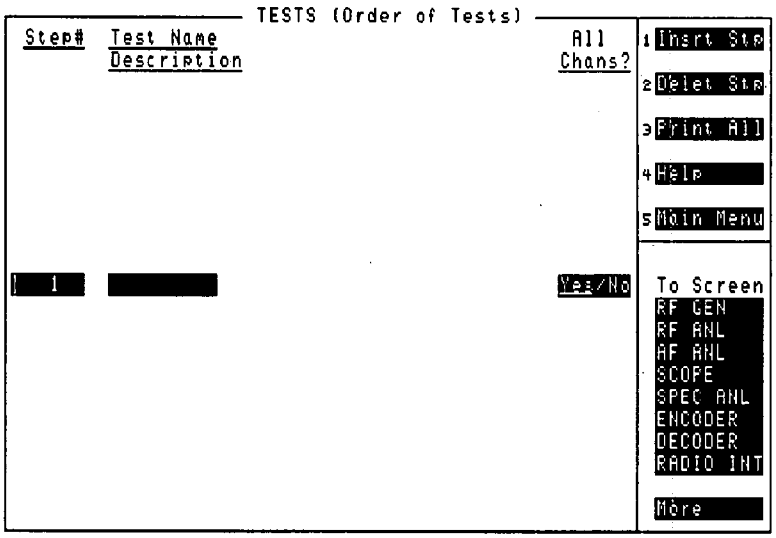
By selecting the `Parm#`, `Value`, or `Units` fields and using the data and units keys, you can modify or enter parameters.

Note The tests you select determine the parameters that are required. Your radio test documentation provides details if you are using HP 11807 software.

Print All This field allows you to print the Test Set's screen image.

Main Menu Selecting this field returns you to the **TESTS (Main Menu)** screen.

TESTS (Order of Tests)



tstorder.tif

Figure 4-67. The TESTS (Order of Tests) Screen.

The order of tests is set up by selecting one or more tests from the complete list of available tests (such as a selecting a subset of an entire HP 11807A package). The TESTS (Order of Tests) menu lets you select the radio tests you want to perform and the order in which the tests are done.

Tests can be selected in any order; but to reduce testing time, you should strategically organize the test sequence. Tests requiring operator intervention (changing volume, channels, and so forth) should be grouped together. If you are using HP 11807 software, see its documentation to see which parameters go with each test.

All Chans? This field allows you to choose if a new test is to be run on all channels (yes) or only on prime channels (no). Prime channels are specified on the **TESTS (Channel Information)** screen. The underlined entry is the active choice.

Delet Stp This field allows you to delete a step from the test list at the bottom of the screen.

Insrt Stp This field allows you to enter a step in the test list at the bottom of the screen.

Operating Considerations

When inserting a new test, you must select the `Step#` where you want to insert a new test. When inserted, the new test forces the current test (at that step #) down one step, and a duplicate of the current test is inserted. This duplicate is overwritten when the new test is selected.

See Also

Programmer's Guide

Main Menu Selecting this field returns you to the **TESTS (Main Menu)** screen.

Print All This field allows you to print the Test Set's screen image.

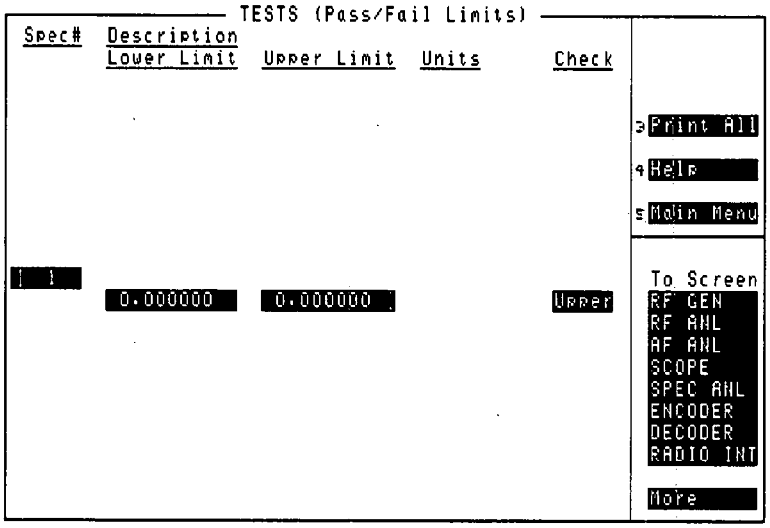
Step# The `Step#` field lists the order of selected tests for the current procedure.

Operating Considerations

Use the knob, ⇧, or ⇩ key to select the step where you want to delete, replace, insert a test.

Test Name This field displays the names of the tests available from the software package or program currently selected. As you turn the knob, the `Test Name` for the corresponding step appears above the test `Description`.

TESTS (Pass/Fail Limits)



tstpass1.tif

Figure 4-68. The TESTS (Pass/Fail Limits) Screen.

Pass/Fail limits are the radio manufacturer's upper and lower limits used by the Test Subsystem. For a radio to pass a test, the measured value must fall within the test's limits. Tests results can be compared to only the lower limit, only the upper limit, both the upper and lower limits, or no limits (None). (Pass/Fail limits are sometimes referred to as specifications.)

Note

The tests you select determine the specifications that are required. The HP 11807 documentation provides details if you are using HP 11807 software.

Check This field is used to select whether the test will verify only upper, only lower, both, or none of the specified limits.

Operating Considerations

Selecting both upper and lower limits increases test time, but may be required for some tests.

Lower Limit This field is used to set the lower limit to be compared with the measured results. If the measured result is below this limit, the test will fail.

Main Menu Selecting this field returns you to the **TESTS (Main Menu)** screen.

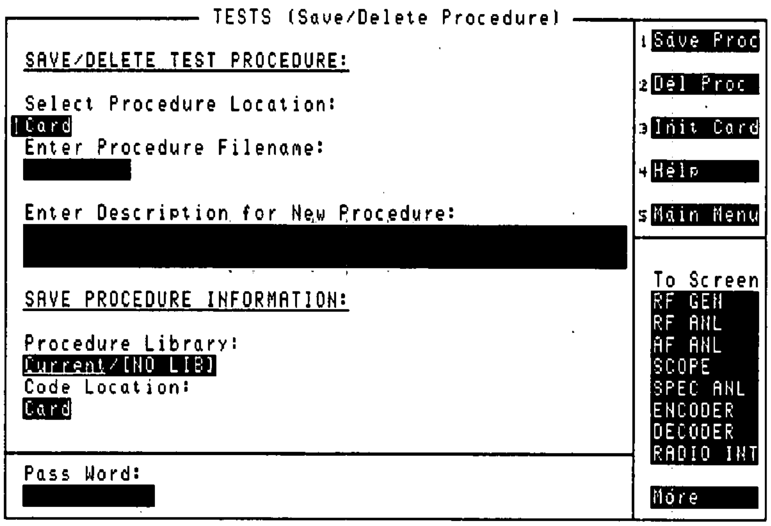
Print All This field allows you to print the Test Set's screen image.

Spec# The `Spec#` field lists the order of selected pass/fail limits for the current procedure.

Units The `Units` column indicates the unit-of-measure used for the limits (%, dBm, kHz, and so forth).

Upper Limit This field is used to set the upper limit to be compared with the measured results. If the measured result is above this limit, the test will fail.

TESTS (Save/Delete Procedure)



tstsvdel.tif

Figure 4-69. The TESTS (Save/Delete Procedure) Screen.

After selecting a test sequence and defining the appropriate specifications, parameters, frequencies, and system configuration, you can save all that information as a Procedure File for later use.

This screen is also used to delete procedures.

Code Location

This field is used to select where the program (code file) for the test procedure is stored. Code files are the main program files of the software, containing all of the test subroutines. If an HP 11807 memory card is catalogued, the code file is preceded by a lower-case **c**.

Enter Procedure Filename

This field is used to enter the name of the file you want to save or delete.

Operating Considerations

When you save a procedure file, you can use any name with up to 9 characters.

You can also delete previously-saved files to be able to re-save a file using the same file name.

The media must be initialized before a file can be saved. Refer to the *Programmer's Guide*

Main Menu

Selecting this field returns you to the **TESTS (Main Menu)** screen.

Pass Word

The `Pass Word` field allows you to access a secured test procedure file. Test procedures are secured using the `SECURE_IT` program in ROM. On the HP 8920B, load and run the ROM `IB_UTIL` program to access the `SECURE_IT` program. On the HP 8920A and HP 8921A this program is directly accessed from the ROM list of choices.

See Also

ROM Programs, Securing a Test Procedure

Procedure Library

This field is used to select whether the new test procedure will use the current test's library or no library. All HP 11807 Test Procedures must be saved with a test library. Other IBASIC programs may not require an associated library file.

Library files contain **all** of the channel, parameter, and test name information used with the code file. If an HP 11807 memory card is catalogued, the library file is preceded by a lower-case **l**.

Select Procedure Location

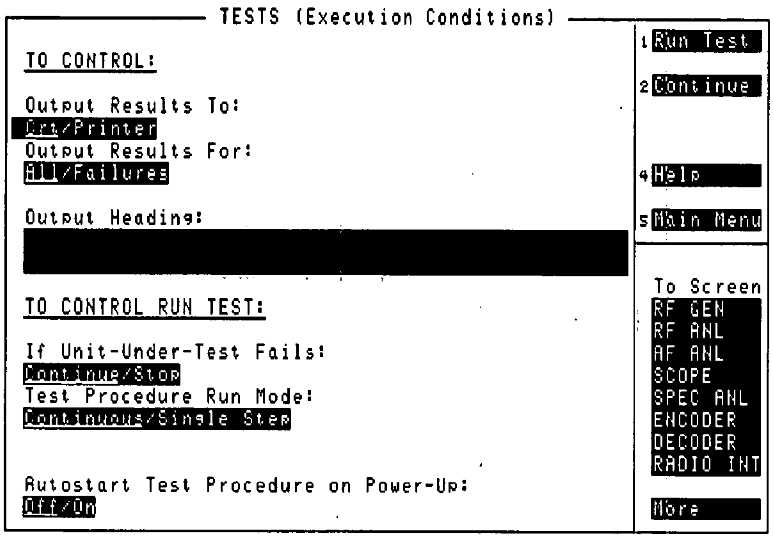
This field is used the select where a new procedure will be saved, or the location from which a procedure will be deleted. Procedures can be saved to, or deleted from, disk, card, or RAM.

Operating Considerations

Procedure files contain a subset of the library file. This is where you save all of your own frequency, parameter, test sequence, specification, and system configuration information. A procedure file is not a directly-executable file for HP 11807 tests; it requires the code and library files to be present before running.

To save a file to an external disk drive, you must enter drive's HP-IB address into the `External Disk Specification` field on the TESTS (External Devices) screen.

TESTS (Execution Conditions)



tstexecl.tif

Figure 4-70. The TESTS (Execution Conditions) Screen.

The **TESTS (Execution Conditions)** screen determines how tests are run.

Autostart Test Procedure on Power-Up

When set to `On`, this field automatically loads and runs the specified procedure whenever the Test Set is turned on. If this field is set to `Off` or the specified procedure cannot be loaded for any reason (such as, memory card not inserted, disk drive not connected), the Test Set will default to its normal power-on state.

Continue

This field is used to restart a paused test.

If Unit-Under-Test Fails

This field selects what happens if the measured results do not meet criteria for passing the current test. The underlined entry is the active choice.

- `Continue` continues with testing even though a test in the test sequence fails to meet its test specification limits. When this occurs, an error is listed on the test-results printout and/or is displayed on the CRT.
- `Stop` stops the test when a "failure" occurs and requires operator intervention before testing proceeds.

Main Menu

Selecting this field returns you to the **TESTS (Main Menu)** screen.

Output Heading

This field allow you to enter a heading for the test results printout (or CRT display).

Output Results To

This field selects where test results are output. The underlined entry is the active choice.

- CRT displays test results on the Test Set's CRT.
- Printer displays test results on the Test Set's CRT and outputs them to a printer. (The printer information must first be entered on the TESTS (Printer Setup) screen.)

Output Results For

This field selects which test results are output. The underlined entry is the active choice.

- `All` outputs all test results on to the location selected in the `Output Results To` field.
- `Failures` outputs only the results of tests which fail.

Run Test

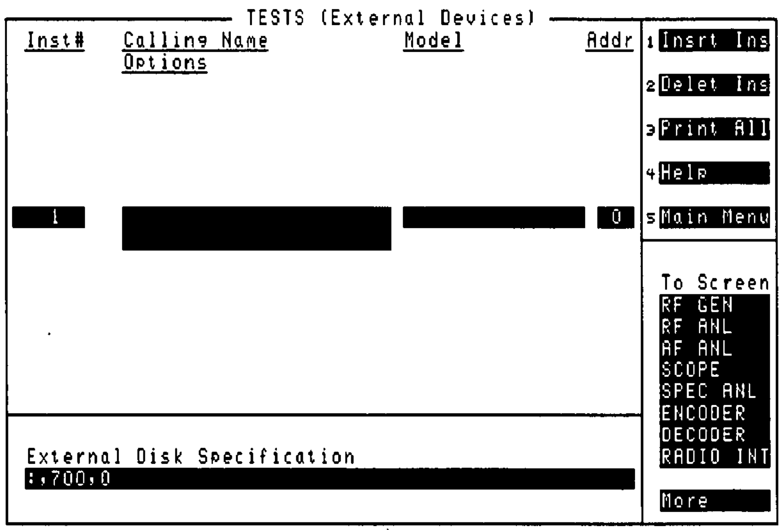
Selecting this field loads and runs the test chosen in the Select Procedure Filename field on the TESTS (Main Menu) screen.

Test Procedure Run Mode

This field selects how the test will be run. The underlined entry is the active choice.

- Continuous runs the tests in the test sequence one after another without stopping. Testing pauses only if the operator is required to interact with the UUT or Test Set. Interactions such as changing UUT channels and setting squelch and audio levels cause testing to pause. Selecting Stop in the If Unit-Under-Test Fails field may also stop a test.
- Single Step runs the tests in the test sequence one at a time. The operator is promted to press Continue to proceed with testing.

TESTS (External Devices)



tstextdv.tif

Figure 4-71. The TESTS (External Devices) Screen.

The Tests Subsystem can only access external devices if they have been configured. Most external devices use the HP-IB port for control. A serial printer can be connected to the serial port for printing test results.

Note

HP-IB Mode: The `Mode` field on the **I/O CONFIGURE** screen must be set to `Control` to access connected HP-IB instruments.

Addr This field is used to enter the instrument's remote address. For HP-IB instruments, enter the full 3-digit address (such as **704**).

Calling Name The `Calling Name` field is used to enter the instrument's function (in upper-case letters). For example, `PRINTER`, `POWER SUPPLY`, `DATA COLLECTION` (disk drive), and so forth.

Delet Ins This field allows you to delete an instrument from the list at the bottom of the screen.

Use the knob, ⇧, or ⇩ key to select the step where you want to delete an instrument.

External Disk Specification

This field is used when storing and loading procedures on an external disk.

Operating Considerations

The HP-IB path entered in the `External Disk Specification` field is used by the `Select Procedure Location` field on the **TESTS (Main Menu)** screen when `Disk` is selected.

Insrt Ins This field allows you to enter an instrument in the list at the bottom of the screen.

Use the knob, ⇧, or ⇩ key to select the step where you want to insert an instrument.

See Also

Programmer's Guide

Inst# The `Inst#` field lists the number of external devices that are configured for the tests in the current procedure.

Main Menu Selecting this field returns you to the **TESTS (Main Menu)** screen.

Model This field is used to enter the instrument's model number. There is no specific syntax for entering model numbers into this field.

Options This field is used to enter the instrument's option number(s) if any.

Operating Considerations

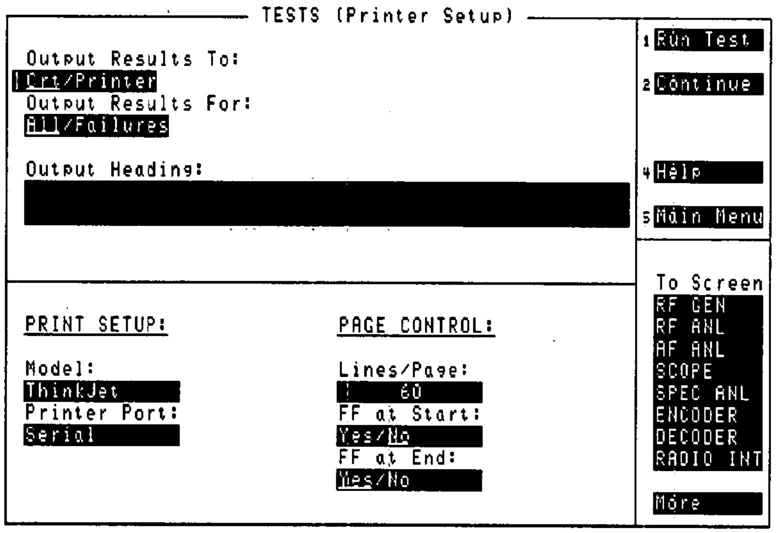
This field may be left blank, or otherwise may include other calling name options, for example:

Printer options – `LN=#,START,END`
Where `#` is the number of lines on each page.
Where `START` causes a form feed at the start of each printout.
Where `END` causes a form feed at the end of each printout.

Data collection options – `NN`
Where `NN` is the number of records (file size) for the mass-storage location where data will be collected on disk or memory card. The default record size is "80".

Print All This field allows you to print the Test Set's screen image.

TESTS (Printer Setup)



tstprint.tif

Figure 4-72. The TESTS (Printer Setup) Screen.

The **TESTS (Printer Setup)** screen determines how tests are run.

Continue This field is used to restart a paused test.

FF at End This field is used to specify if you want a Form Feed at the end of printing. The underlined entry is the active choice.

FF at Start This field is used to specify if you want a Form Feed at the start of printing. The underlined entry is the active choice.

Lines/Page This field is used to specify how many lines are printed per page.

Main Menu Selecting this field returns you to the **TESTS (Main Menu)** screen.

Model This field is used to specify the type of printer used. If your printer is not listed in the `Choices` menu when you select this field, configure your printer to emulate one of those that is listed.

Output Heading This field allow you to enter a heading for the test results printout (or CRT display).

Output Results To This field selects where test results are output. The underlined entry is the active choice.

- CRT displays test results on the Test Set's CRT.
- Printer displays test results on the Test Set's CRT and outputs them to a printer.

Output Results For This field selects which test results are output. The underlined entry is the active choice.

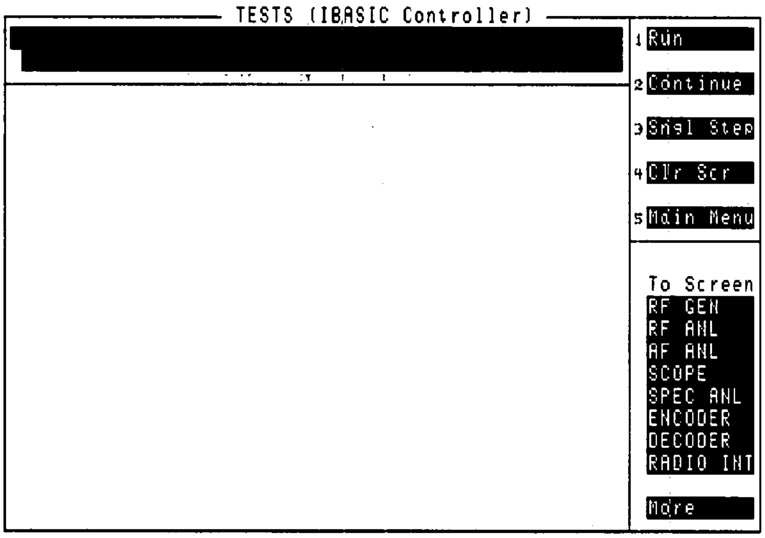
- `All` outputs all test results on to the location selected in the `Output Results To` field..
- `Failures` outputs only the results of tests which fail.

Printer Address This field is used to specify the address of an HP-IB printer. This field is only displayed if the `Printer Port` field is set to HP-IB.

Printer Port This field is used to select the port your printer is connected to.

Run Test Selecting this field loads and runs the test chosen in the `Select Procedure Filename` field on the TESTS (Main Menu) screen.

TESTS (IBASIC Controller)



tstibasc.tif

Figure 4-73. The TESTS (IBASIC Controller) Screen.

The IBASIC controller is used to run IBASIC programs. This screen is also used as a "stand-alone" IBASIC computer. See the Instrument BASIC documentation for information about writing your own tests for the Test Set.

If you need to perform a simple IBASIC operation, such as a SAVE or GET function, you can enter commands one at a time. To do this, access the **TESTS (IBASIC Controller)** screen and use the knob to enter commands.

Refer to the *Programmer's Guide* for information about using the **TESTS (IBASIC Controller)** screen to write and store your own tests.

Clr Scr This field is used clear the IBASIC controller screen.

Continue This field is used to restart a paused test.

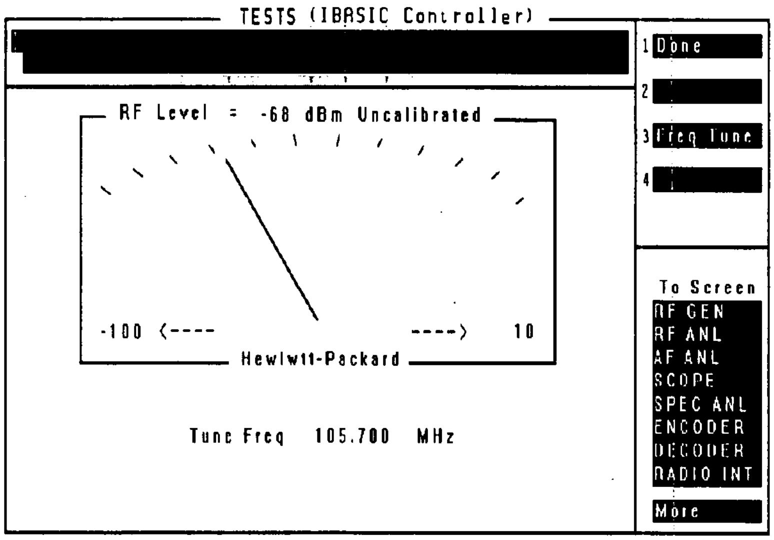
Main Menu Selecting this field returns you to the **TESTS (Main Menu)** screen.

Run Selecting this field runs the IBASIC program.

Sngl Step This field allows you to step through an IBASIC program line-by-line.

ROM Programs

Using the Signal Strength Meter



sigmeter.tif

Figure 4-74. Signal Strength Meter Screen

The Signal Strength Meter is accessed by loading and running the `LVL_MTR` ROM program.

1. Select the **TESTS (Main Menu)** screen.
2. Move the cursor to the `Select Procedure Location` field and choose `ROM`.
3. Move the cursor to the `Select Procedure Filename` field and select `LVL_MTR`.
4. Press K3 and enter the tune frequency (in MHz), then press (ENTER). Do not press a units (MHz, kHz, Hz) key. MHz is the default unit and cannot be changed.

The ANT IN port is always the signal source.

Securing a Test Procedure

The pass word option for securing a test procedure is accessed by loading and running the SECURE_IT ROM program. This program is accessed by running the IB_UTIL program (HP 8920B), or by directly selecting it from the Choices menu (HP 8920A and HP 8921A).

1. Select the **TESTS (Main Menu)** screen.
2. Select the Select Procedure Location field and choose ROM.
3. Select the Select Procedure Filename field.
   a. For the HP 8920A and HP 8921A, select SECURE_IT from the list of programs. Press Run Test to run the procedure; follow the directions to secure the desired information.
   b. For the HP 8920B, select IB_UTIL from the list of programs. Press Run Test to display a list of procedures; select SECURE_IT and follow directions to secure the desired information.

Clearing RAM

RAM can be cleared using the RAM_MNG program in the Test Set's ROM. This program clears **all** RAM, including any SAVE/RECALL registers saved to Internal(see the Save/Recall field description for the **I/O CONFIGURE** screen).

This program is accessed by running the IB_UTIL program (HP 8920B), or by directly selecting it from the Choices menu (HP 8920A and HP 8921A).

1. Select the **TESTS (Main Menu)** screen.
2. Select the Select Procedure Location field and choose ROM.
3. Select the Select Procedure Filename field.
   a. For the HP 8920A and HP 8921A, select RAM_MNG from the list of programs. Press Run Test to run the procedure; follow directions to clear RAM.
   b. For the HP 8920B, select IB_UTIL from the list of programs. Press Run Test to display a list of procedures; select RAM_MANAGER and follow directions to clear RAM.

To preserve the SAVE/RECALL registers, don't use the RAM_MNG program. Instead, load a different test program to clear the previous test from RAM, and then re-load the desired test.

Help

HELP

The **HELP** screen is used to access tutorial information for a wide variety of instrument functions.

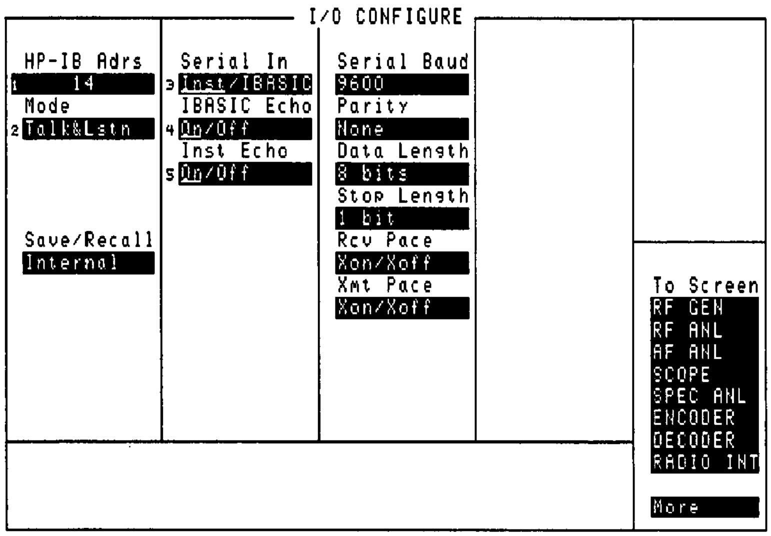
After this screen is accessed, push the Cursor Control knob to display the "Help Index". The knob is then used to select the desired topic.

Once you have accessed the desired Help information, you can return to the "Help Index" by pushing the Cursor Control knob.

To exit the **HELP** screen and return to the previous screen, press (PREV).

I/O Configure

I/O CONFIGURE



ioconfigr.tif

Figure 4-75. The I/O Configure Screen

The **I/O CONFIGURE** (Input/Output) fields are used to specify HP-IB and serial communications settings (HP 8920A must be equipped with option 003).

This screen is accessed by selecting the `More` field (directly below the `To Screen` menu), and selecting `IO CONFIG`.

Data Length

This field specifies the number of bits used for each word of serial data when using the rear-panel Serial Port.

This setting is retained when the instrument is turned off.

HP-IB Address

This field is used to display and change the HP-IB address of the Test Set.

Operating Considerations

The address can be set from 0 to 30 using the DATA keys, or by pushing then turning the Cursor Control knob.

This setting is retained when the instrument is turned off.

IBASIC Echo

This field enables/disables screen and error message echoing from IBASIC.

This setting is retained when the instrument is turned off.

Inst Echo

This field enables/disables character and screen echoing when using an external ASCII RS-232 terminal or computer to enter or edit IBASIC programs.

This setting is retained when the instrument is turned off.

Mode

This field sets the HP-IB operating mode.
`Talk&Lstn` is used for "normal" HP-IB operation.

`Control` is used to control external instruments using the Test Set.

This setting is retained when the instrument is turned off.

Parity

This field specifies the serial communication Parity setting when using the optional rear-panel Serial Port.

This setting is retained when the instrument is turned off.

Rcv Pace

The **Receive Pace** field is used when receiving serial data.

- `Xon/Xoff` lets the Test Set "talk" to the transmitting device to alter the rate of the data being sent.
- `None` disables the Xon/Xoff function.

This setting is retained when the instrument is turned off.

Save/Recall

This field specifies which memory device the Test Set accesses when the SAVE and RECALL functions are used.

- **Internal** is a section of internal RAM. RAM is also used for running IBASIC programs, which may require you to delete the Save/Recall registers if the program is very large.
- **Card** is the front-panel MEMORY CARD slot. A "Save/Recall Device is not Present" message is displayed if you try to SAVE or RECALL an instrument setup when a write-able memory card is not installed in the Test Set.
- **RAM** refers to RAM Disks that you can create on internal RAM. Refer to the *Programmer's Guide* for information on creating RAM Disks. This is part of the same memory used when "internal" is specified, and may have to be erased when loading very large IBASIC programs. A "Save/Recall Device is not initialized" message is displayed if you try to SAVE or RECALL an instrument setup when a RAM disk has not been created.
- **Disk** is used with external disk drives. The `Mode` field must be set to `Control` to access the drive. Also, the HP-IB address of the drive must be entered in the `External Disk Specification` field of the **TESTS (External Devices)** screen.

Serial Baud

This field selects the baud rate for serial communications when using the optional rear-panel Serial Port. Selecting this field displays a list of baud rate choices.

This setting is maintained after the instrument is turned off.

Serial In

This field selects the destination of characters received by the Test Set on the Serial Port.

- **Inst** configures the serial port to connect to an external ASCII terminal or computer to enter IBASIC programs, or to control the Test Set using an external keyboard.
- **IBASIC** is used to allow the IBASIC controller to read the serial port while a program is running.

Operating Considerations

If a serial printer is connected, the PRINT command causes the printer to take control of the serial port until printing is done.

This setting is maintained after the instrument is turned off.

See Also

Programmer's Guide

Stop Length

This field specifies the number of stop bits used for serial communications when using the optional rear-panel Serial Port. Selecting this field displays a list of stop bit choices.

This setting is maintained after the instrument is turned off.

Xmt Pace

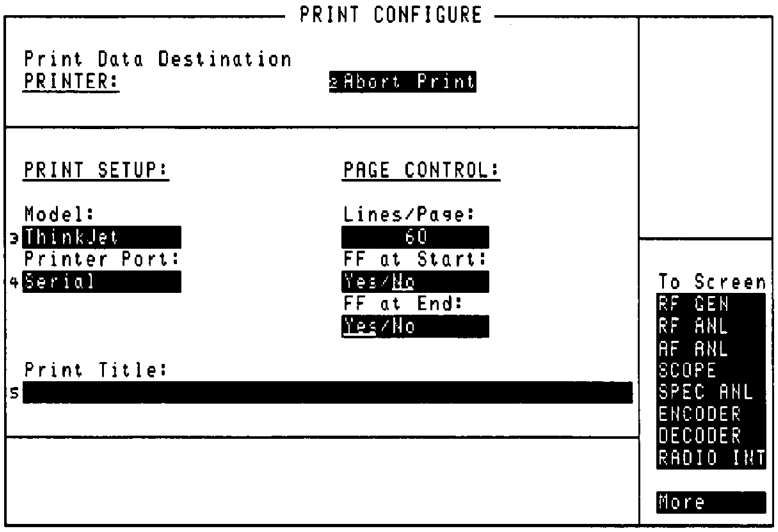
The **Transmit Pace** field is used when transmitting serial data.

- `Xon/Xoff` lets the receiving device "talk" to the Test Set to alter the rate of the data being sent.
- `None` disables the Xon/Xoff function.

This setting is maintained after the instrument is turned off.

Print Configure

PRINT CONFIGURE



prntconf.tif

Figure 4-76. The Printer Configuration Screen

Note This screen is displayed on HP 8920As only if your instrument has Option 103 (standard on all other Test Set models).

This screen configures the Test Set to print **screen images** with your printer. Images are printed using either the front-panel (SHIFT) PRINT function or the `Print All` User Key available on some TESTS environment screens.

Refer to your HP 11807 software manual for information on how to use your printer to print automated **test results**.

`Abort Print` Select this field to interupt the print in progress.

FF at End This field is used to specify if you want a Form Feed at the end of printing.

FF at Start This field is used to specify if you want a Form Feed at the start of printing.

Lines/Page This field is used to specify how many lines are printed per page.

Model

This field is used to specify the type of printer used. If your printer is not listed in the `Choices` menu when you select this field, configure your printer to emulate one of those that is listed.

Printer Address

This field is used to specify the address of an HP-IB printer. This field is only displayed if the `Printer Port` field is set to HP-IB.

Print Data Destination

This field will be used in the future to select whether the data is formatted specifically for printers or for some other device (such as a computer). At this time the only selection is `Printer`.

Printer Port

This field is used to select the port your printer is connected to.

Print Title

This field is used to enter up to 50 characters to be displayed at the top of the print.

Adjacent Channel Power

ADJACENT CHANNEL POWER

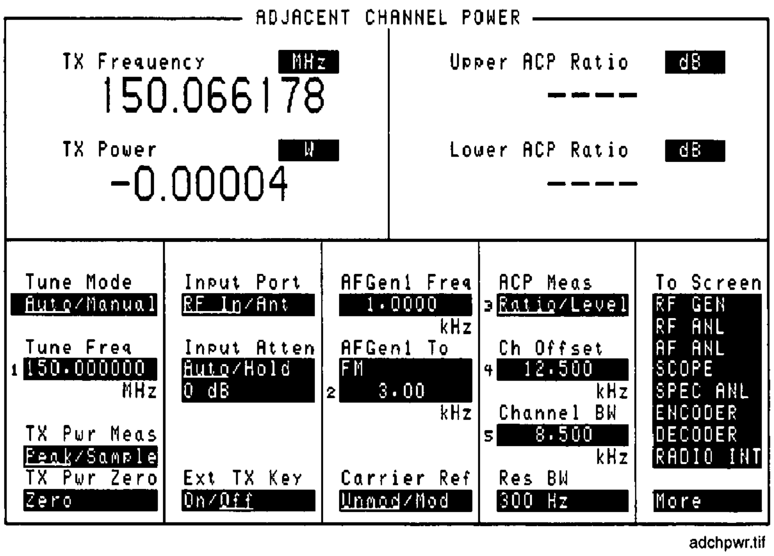


Figure 4-77. The Adjacent Channel Power Screen

Note

This screen is displayed on HP 8920As and HP 8920Bs Option 102, Spectrum Analyzer.

This feature is standard on HP 8921As.

This screen is used to measure Adjacent Channel Power. This is a measurement of the power of signals at a specific channel spacing above and below the RF Analyzer's center frequency.

This screen is accessed by selecting the `More` field (directly below the `To Screen` menu), and selecting `AD CH PWR`.

How the Test Set Measures Adjacent Channel Power (ACP)

When you access this screen, the Test Set automatically starts a multi-step process for measuring ACP:

1. AFGen1 is turned off if the `Carrier Ref` field is set to `Unmod`.
2. The amplitude of the center frequency (`Tune Freq`) is measured to establish a reference.
3. AFGen1 is turned back on if it was previously turned off.
4. The power in each of the adjacent channels is analyzed.
5. Adjacent Channel Power is calculated and displayed. This value can be displayed as an absolute power level or as a ratio referenced to the center frequency's level.

Note

Which Input Port to Use:

The TX Power measurement is used to calculate absolute Adjacent Channel Power. Since TX Power can only be measured using the RF IN/OUT Port, you must use this port to measure ACP **Level**. ACP **Ratio** can be measured using either the RF IN/OUT or the ANT IN port.

Measuring ACP on AM Transmitters:

When measuring AM signals, the reference level must be measured on an **unmodulated** carrier; so the `Carrier Ref` field must be set to `Unmod`. After the reference is measured, the power in the adjacent channels must be measured **with modulation**. This requires the modulating signal to be turned off and on repeatedly as measurements are being calculated and displayed.

Since the Test Set automatically turns AFGen1 on and off when the `Carrier Ref` field is set to `Unmod`, you must use AFGen1 and the AUDIO OUT port as the modulation source for making AM ACP measurements.

ACP Meas

This field selects the format for displaying upper and lower adjacent channel power levels.

- **Ratio** displays the power levels relative to the power around the center frequency (`Tune Freq`). Levels can be displayed in dB or as a percentage (%).
- **Level** displays the absolute power levels in mW, W, dBm, V, mV, and dBμV.

Operating Considerations

`TX Power` and `ACP Level` can only be measured through the RF IN/OUT port. Four dashes are displayed for these measurements when the `Input Port` is set to ANT IN.

`ACP Ratio` can be measured on either the ANT IN port or RF IN/OUT port.

Refer to "How the Test Set Measures Adjacent Channel Power (ACP)" at the earlier in this section.

AFGen1 Freq

Audio Frequency Generator 1 Frequency sets the frequency for the first audio frequency sinewave generator.

AFGen1 To

Audio Frequency Generator 1 To is used to set two values:

- The upper field determines whether the AFGen1 signal modulates the RF Generator or is output through the AUDIO OUT connector.
- The lower field sets the amplitude (including `Off`). The AUDIO OUT level is always in volts RMS.

Operating Considerations

This is a priority control field. Accessing the **RX TEST** or **TX TEST** screen overrides any changes made to this field in other screens.

See Also

"Interaction Between Screens" in Chapter 3

Carrier Ref

Use the Carrier Reference field to indicate whether the carrier (Tune Freq) being measured should be unmodulated or modulated when making the ACP reference measurement. (Refer to "How the Test Set Measures Adjacent Channel Power (ACP)" earlier in this section.)

Operating Considerations

- FM transmitters can be measured with the carrier modulated or unmodulated.
- For AM transmitters, the carrier must be measured while **unmodulated**. AFGen1 and the AUDIO OUT port must be used as the modulation source whenever Unmod is selected.

Channel BW

Use the Channel Bandwidth field to specify the bandwidth of the carrier and adjacent channels to be measured. (See Figure 4-78)

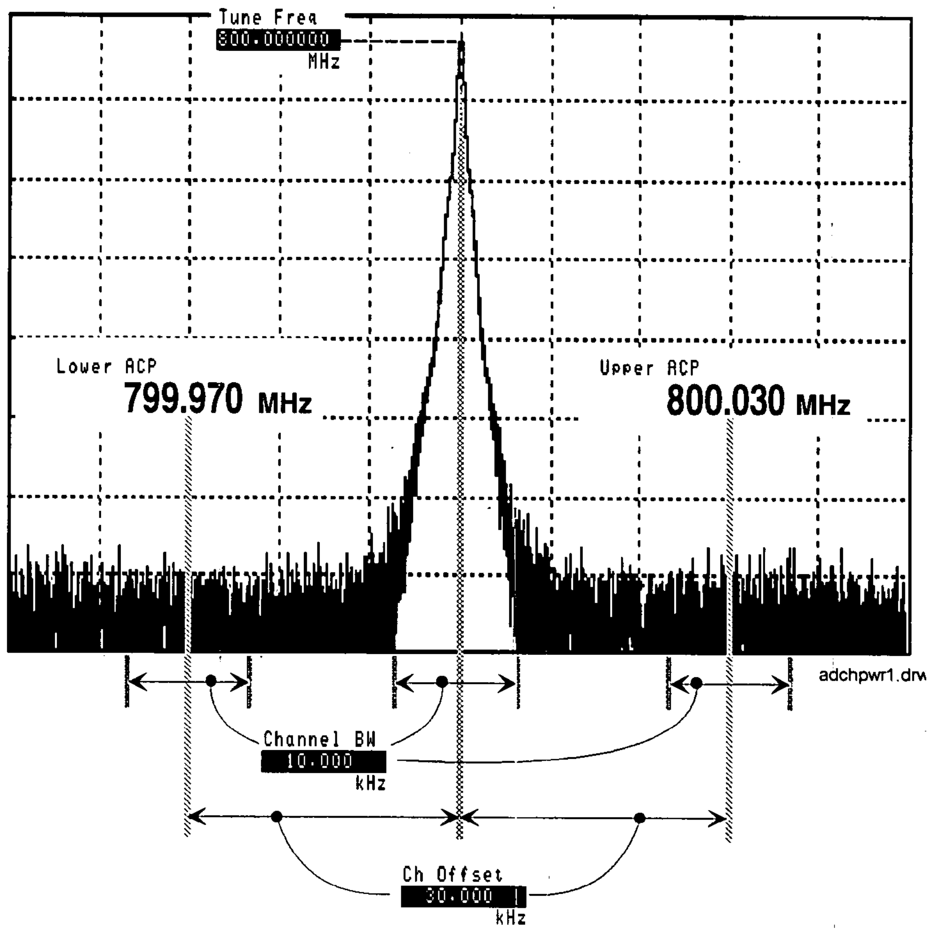


Figure 4-78. Relationship between Tune Freq, Ch Offset, and Channel BW fields.

Ch Offset

Use the Channel Offset field to enter the frequency difference between the `Tune Freq` setting and the center of the adjacent channels you want to measure. This is an absolute value; only positive values can be entered. (See Figure 4-78)

Ext TX key

This field controls a switch at the MIC/ACC connector. Its intended use is to "key" an external transmitter.

See Also

"MIC/ACC" in Chapter 5

Input Atten

Input Attenuation sets the amount of input attenuation for the RF IN/OUT and ANT IN connectors. This function controls two settings:

- The upper field determines if you want the instrument to set the attenuation automatically (`Auto`), or if you want to set the value manually (`Hold`).
- The lower field displays the present attenuation value, and is used to set the desired attenuation level when the upper area is set to `Hold`.

Operating Considerations

Input Attenuator auto-ranging can interfere with oscilloscope or signaling decoder operation under ceratin conditions. Refer to the **AF Analyzer** screen's description of this field for additional information.

Input Port

This field selects the RF IN/OUT or ANT IN port for making RF measurements. The RF IN/OUT port must be used for making `TX Power` or `ACP Level` measurements on this screen.

Operating Considerations

Power levels for each port are printed on the Test Set's front panel. If the RF power at the RF IN/OUT port exceeds allowable limits, a loud warning signal sounds and a message appears at the top of the screen. If this occurs, disconnect the RF power, press (MEAS RESET), and allow the Test Set to cool off for approximately 2 minutes before making any other measurements on this port.

The ANT IN (Antenna Input) connector provides a highly-sensitive input for very low level signals (such as "off the air" measurements). You cannot measure TX (RF) Power or ACP Level on this screen using the Antenna port.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press (MEAS RESET) or turn the Test Set off and on to reset it.

Lower and Upper ACP [Ratio:Level]

These two measurements display the amount of power in signals above and below the `Tune Freq` signal. The level is displayed as a ratio (referenced to the power around the `Tune Freq`) or as an absolute value.

See Also

`ACP Meas` field description.

Res BW

The Resolution Bandwidth field selects the IF filter used when measuring the power of the carrier and the adjacent channels.

Operating Considerations

Using a narrower bandwidth filter (300 Hz) slows the measurement, but rejects carrier leakage and out of channel spurs well. Using a wider bandwidth filter (1 kHz) speeds measurements, but may allow unwanted spurs and carrier leakage to be integrated into the measurement when measuring at the edges of the selected Channel Bandwidth.

Tune Freq

RF Analyzer Tune Frequency sets the center frequency for the RF signal to be analyzed.

See Also

Tune Mode field description.

Tune Mode

This field selects Automatic or Manual tuning of the RF Analyzer.

Auto tuning causes the RF Analyzer to find the signal with the greatest amplitude >-36 dBm, and set the Tune Frequency for that signal.

Manual tuning requires the operator to set the Tune Frequency for the RF signal to be analyzed.

Operating Considerations

Changing the Tune Mode also changes the RF frequency display. Automatic tuning enables the TX Frequency measurement. Manual tuning enables the TX Freq Error measurement.

TX Freq Error/TX Frequency

This measurement displays Transmitter Frequency Error or absolute Transmitter Frequency.

See Also

Tune Mode field description.

TX Power

Transmitter Power measures RF power at the RF IN/OUT port.

Operating Considerations

Only the RF IN/OUT port can be used for measuring TX Power on this screen. When the `Input Port` is set to `Ant`, four dashes (- - - -) appear in place of digits for this measurement.

Use the Spectrum Analyzer (optional on some Test Set models) to measure low-level RF power ($\leq$200 mW) at the Antenna port.

TX Pwr Meas (HP 8920B Only)

The Transmitter Power Measurement field specifies how transmitter power measurements are made:

- **Peak** can be used to measure AM, FM, and un-modulated (CW) signals.
- **Sample** can be used to measure FM or CW signals with increased measurement speed. This method can only be used with signals having no amplitude modulation component.

Operating Considerations If you change this field, zero the power measurement (using the `TX Pwr Zero` field) before measuring power.

TX Pwr Zero

The **Transmitter Power Zero** function establishes a 0.0000 W reference for measuring RF power at the RF IN/OUT port.

Caution

RF power must not be applied while zeroing.

Operating Considerations

When power is applied to the RF IN/OUT connector, the temperature of the internal circuitry increases. This can cause changes in the `TX Power` measurement when low power levels are measured immediately following high power measurements.

When alternately making high and low power measurements, always zero the power meter immediately before making the low power measurements to provide the best measurement accuracy.

5

Connector, Key, and Knob Descriptions

Connector Descriptions

ANT IN

The **Antenna Input** is used for analyzing low-power RF signals ($\leq$200 mWatts), and is typically used for off-the-air measurements. This port can be selected in the **TX TEST**, **DUPLEX TEST**, **RF ANALYZER**, or **SPECTRUM ANALYZER** screens.

Caution

Connecting a signal of >200 mW to the Antenna port can cause instrument damage (although internal protection circuits can typically withstand a short-duration signal of 1 or 2 Watts).

If the over-power circuit is triggered (signified by a warning message at the top of the screen), remove the signal from the Antenna port, and press (MEAS RESET) or turn the Test Set off and on to reset it.

Operating Considerations

Input impedance = 50Ω

TX Power cannot be measured using this port; use the RF IN/OUT port. However, low power levels can be measured using this port with the Spectrum Analyzer.

Additional sensitivity for this port is available using the `Sensitivity` field in the **RF ANALYZER** and **SPECTRUM ANALYZER** screens.

AUDIO IN

Two connectors are used to input audio signals to the AF Analyzer:

- **HI** is the main audio signal input connection.
- **LO** is used for the audio signal reference. Three choices are available using the **AF ANALYZER** screen's `Audio In Lo` field:
  - Gnd - connects the center pin through ≈100Ω to chassis ground.
  - Float - provides a floating input.
  - 600 To Hi - provides a 600Ω internal load to match an audio source with an output impedance of 600Ω.

The measured level is the potential between the HI and LO center pins. The shells of both connectors are at chassis ground.

Operating Considerations

Input impedance:
Switchable between 1 MΩ in parallel with 95pF, or 600Ω floating.

This port is selected as the AF Analyzer's input using the `AF Anl In` field in the **TX TEST** screen, **DUPLEX TEST** screen, **AF ANALYZER** screen, and various **ENCODER** screens. This port is always the AF Analyzer's input when the **RX TEST** screen is displayed.

Signals input to the AF Analyzer are routed through different filters, amplifiers, and detectors that affect the displayed measurement.

Caution

The maximum level between the HI and LO center pins is 42 V peak (≈ 30 Vrms). Exceeding this value can cause permanent instrument damage.

See Also

AF ANALYZER screen and field description in chapter 4.

AUDIO MONITOR OUTPUT

This connector provides an external output from various tap points in the AF Analyzer.

Operating Considerations

The `Scope To` field in the **AF ANALYZER** screen determines the source of this signal.

The level is not affected by the front-panel VOLUME knob.

Output impedance <1 kΩ

See Also

AF ANALYZER screen and field description in chapter 4.

AUDIO OUT

This port is used to output signals from AF Generators 1 and 2, including the Encoder functions.

Operating Considerations

The output level is set by the AF Generators, and is not affected by the front-panel VOLUME control.

Output impedance <1Ω
Maximum output current = 20 mA peak
Maximum reverse voltage = 12 V peak

AC/DC coupling is selected using the `Audio Out` field. This field is available in the **DUPLEX TEST** screen, **RF GENERATOR** screen, and various **ENCODER** screens.

⏚ (Chassis Ground)

The rear-panel chassis ground terminal provides a general chassis connection, as well as providing a safety ground when DC power is used.

Warning

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

CRT VIDEO OUTPUT

This connector provides a signal for using an external video monitor. The signal provides a duplicate of the Test Set's screen.

Operating Considerations

A multi-sync monitor must be used to match the video sync rate of 19.2 kHz. Example monitors include - Mitsubishi Diamond Scan, NEC 3D, Leading Edge CMC-141M, and Sony CPD-1302.

DC CURRENT MEASUREMENT

Note: This connector is optional on the HP 8920A.

These connectors are used in series with a DC supply and load to provide a 0 to 10 amp DC current meter.

Operating Considerations

The DC Current meter is designed to measure *positive* current (the connector's polarity is marked on the rear panel). Negative current of ≤10 amps will not damage the instrument, but will cause inaccurate positive current measurements (due to magnetic memory within the current-sensing element).

To re-calibrate the current meter after negative current has been applied:

1. Connect a 10 amp positive current.
2. Disconnect the current.
3. Access the **AF ANALYZER** screen.
4. Select the `DC Current` `Zero` field to zero the meter.

See Also

Displaying Measurements in chapter 3.

DC INPUT

This female connector is used with a DC supply to provide power to the instrument. The male counterpart to this connector is included in the *Connector Kit* accessory. (See *Accessories* in chapter 6.)

The following HP parts can also be ordered to assemble the male counterpart to this connector:
Connector housing: 1251-4782 (1 required)
Connector contacts: 1252-0385 (2 required)

Warning

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

Digital Test Connections

Control I/O, CW RF OUT, DET OUT, IQ RF IN, 114.3 MHz OUT

The following connectors are only used when an HP cellular adapter (such as an HP 83203B) is connected to the Test Set to perform digital modulation tests. These connectors are optional on HP 8920As and HP 8920Bs.

1. **Control I/O** provides control of the cellular adapter.
2. **CW RF OUT** routes the RF carrier to the cellular adapter. *If a cellular adapter is not present, a jumper must be used to connect this port to the IQ RF IN port.*
3. **DET OUT** routes the average power detector's signal to the AUX DSP IN of the cellular adapter for making average power measurements. This port may not be used with all models of cellular adapter.
4. **IQ RF IN** routes the RF carrier from the cellular adapter back into the Test Set. *If a cellular adapter is not present, a jumper must be used to connect this port to the CW RF OUT port.*
5. **114.3 MHz IF OUT** provides the down-converted RF signal to the cellular adapter.

DUPLEX OUT

This connection is an output for the RF Generator and Tracking Generator.

Operating Considerations

Output impedance = 50Ω

The RF Generator's output is selected in the `Output Port` field. This field is available in the **RX TEST**, **DUPLEX TEST**, **RF GENERATOR**, and **SPECTRUM ANALYZER** screens.

Caution

Connecting an RF source of >200 mW to this connector can permanently damage the instrument.

EXT SCOPE TRIGGER INPUT

This connector provides an external oscilloscope trigger.

Operating Considerations

Input threshold ≈ 2.5 V
Maximum Input level ≈ 20 V peak
Input impedance is:

100 kΩ for signals ≤5.6 V peak
5 kΩ for signals >5.6 V peak

When measured with no load on the input, a 5 Volt level is present on the connector due to the internal pull-up resistor design.

See Also

OSCILLOSCOPE screen and field description in chapter 4.

HEADPHONE (HP 8921A only)

This port furnishes an alternate audio monitor output from the speaker circuit. It allows you to listen to signals in a noisy environment (such as a cell site). The front-panel VOLUME knob controls the level.

Operating Considerations

Output impedance ≈ 1 kΩ

HP-IB

Note: This connector is optional on the HP 8920A.

This connector allows communication between the Test Set and other instruments or computers using the Hewlett-Packard Interface Bus (HP-IB).

See Also

I/O CONFIGURE screen and field description in chapter 4, Programmer's Guide

MEMORY CARD Slot

This front-panel opening is where memory cards are inserted.

See Also

Programmer's Guide

MIC/ACC

This 8-pin DIN connector is used for several functions:

- MIC IN is used to modulate the RF Generator when the KEY IN line is grounded. This signal is summed with the external MODULATION INPUT signal. The `Mod In To` field of the **RF GENERATOR** screen sets the type of modulation (AM or FM) and sensitivity (%AM/Vpk or kHz/Vpk) for this connection.
- KEY IN provides control of the RF Generator's output state (on or off) and automatic switching between the **TX TEST** and **RX TEST** screens (if the **CONFIGURE** screen `RX/TX Cntl` functions are set to `Auto` and `PTT`). Screen switching occurs when this line is grounded.
- KEY OUT1 and KEY OUT2 provide a switch path to control external equipment (such as keying a transmitter). KEY OUT1 and KEY OUT2 are connected when the `Ext TX key` field is set to "On".

Caution

Do not exceed 50 Vdc (open circuit) or 250 mA dc (closed circuit) between Key Out1 and Key Out2. Damage to internal components may result.

To Use the Microphone

To modulate the RF Generator using the optional microphone (08920-61059):

1. Connect the microphone to the MIC/ACC connector.
2. Access the **RF GENERATOR** screen.
3. Enter the carrier frequency in the `RF Gen Freq` field.
4. Enter the RF Generator `Amplitude`.
5. Select the `Output Port` (RF IN/OUT or DUPLEX OUT).
6. Connect the selected output port to your receiver or antenna.
7. Using the `Mod In To` field -
   a. Select the type of modulation: `FM (/Vpk)`
   b. Enter the modulation sensitivity to a 1 Vpeak signal (usually 1 kHz for microphone use). (See the `Mod In To` field description in chapter 4 **RF Generator** screen description).
8. Key the microphone to transmit.

MIC/ACC Operating Considerations

MIC IN specifications:
Input impedance = 100 kΩ
Maximum input level = 10 V peak
Full scale input = 10 mV
Bandwidth is limited to 3 kHz.

The MIC IN signal is filtered and amplified to provide a stable deviation-limited signal to the RF Generator.

750 μs microphone pre-emphasis is selected in the **RF GENERATOR** screen.

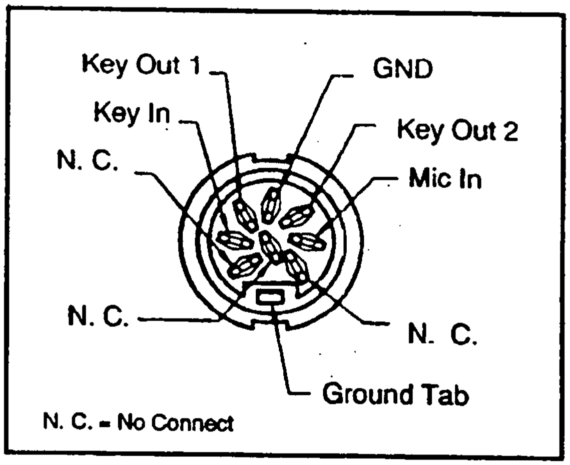


Figure 5-1. MIC/ACC Connections

See Also

RF GENERATOR, RF ANALYZER, and CONFIGURE screen descriptions in chapter 4.

MODULATION INPUT

This connector provides an external modulation connection to the RF Generator.

Operating Considerations

Input impedance = 600Ω
Maximum input level = 12 V peak
Full scale input = 1 V peak

The `Mod In To` field of the **RF GENERATOR** screen sets the type of modulation (AM or FM) and sensitivity (%AM/Vpk or kHz/Vpk) for this connection.

This signal is summed with the microphone MIC IN signal from the MIC/ACC connector.

The `FM Coupling` field in the **RF GENERATOR**, **DUPLEX TEST**, and various **ENCODER** screens selects AC or DC coupling of this signal for FM operation.

Parallel Port

Note: This port is optional on the HP 8920A.

This port is used with printers requiring a parallel interface when printing screen images or test results. Set the `Printer Port:` field (on the **PRINT CONFIGURE** screen or **TESTS (Printer Setup)** screen) to `Parallel` to print to this port. Use address **15** when sending data to this port from IBASIC programs.

Pin numbers are embossed on the connector. Pin assignments are as follows:

1. nStrobe
2. Data 1 (Least Significant Bit)
3. Data 2
4. Data 3
5. Data 4
6. Data 5
7. Data 6
8. Data 7
9. Data 8 (Most Significant Bit)
10. nAck
11. Busy
12. PError
13. Select
14. nAutoFd
15. nFault
16. nInit
17. nSelectIn
18. Signal Ground (nStrobe)
19. Signal Ground (Data 1 and Data 2)
20. Signal Ground (Data 3 and Data 4)
21. Signal Ground (Data 5 and Data 6)
22. Signal Ground (Data 7 and Data 8)
23. Signal Ground (Busy and nFault)

24. Signal Ground (PError, Select, and nAck)
25. Signal Ground (nAutoFd, nSelectIn, and nInit)

RADIO INTERFACE

Note: This connector is optional on all Test Sets.

This connector provides parallel and serial communications between the Test Set and external radio equipment. Audio and transmitter control lines are also provided.

Serial and parallel communication parameters are entered in the **RADIO INTERFACE** screen. This screen is only available if the Radio Interface option is installed.

The audio signal from this connector is input by setting the `AF Anl In` field to `Radio Int`. (The `AF Anl In` field is available in the **TX TEST**, **DUPLEX TEST**, and **AF ANALYZER** screens, as well as various **DECODER** screens.)

Radio Interface Operating Considerations

Connector type: D-Subminiature, 37 pin.

The pin numbers are listed on the connector.
Pin assignments:

1 - GND

2 - No Connection

3 - Audio Out

4 - Key Out2 (See MIC/ACC Connector description.)

5 - Audio Input

6 - Key Out1 (See MIC/ACC Connector description.)

7 - Power: −12.6 V (current limited by internal 100Ω, 2 W resistor)

8 - Power: +12.6 V (current limited by internal 100Ω, 2 W resistor)

9 - Data Level: Either +12 volts or +5 volts is supplied by the radio under test to indicate the HI (1) logic level it uses for serial/parallel communications. If no signal is supplied, the logic level defaults to 5 volts.

10 - Serial Data Out

11 - Serial Clock Out

12 - Serial Strobe Out

13 - Parallel Strobe Out

14, 15 - Serial Status/Interrupt Input

16 - Serial Data In

17 - Serial Shift Load Out

18 - Serial Expansion Clock Out

19 through 34 - Parallel Data IN/Out. Pin 19 is LSB, Pin 34 is MSB.

35, 36, 37 - No Connection.

See Also

RADIO INTERFACE screen and field descriptions in chapter 4.

RF IN/OUT

This Type-N connection is used to output signals from the RF Generator, and to input RF signals.

Caution

Over-Power Damage — Refer to the Test Set's front panel for maximum input power level. Exceeding this level can cause permanent instrument damage.

If the RF power at the RF IN/OUT port exceeds allowable limits, a loud warning signal sounds and a message appears at the top of the screen. If this occurs, disconnect the RF power, press (MEAS RESET), and allow the Test Set to cool off for ≈2 minutes before making any other measurements on this port.

Operating Considerations

This port must be used when measuring TX (RF) Power.

Signals ≤200 mWatts can be input to the ANT IN connector for all RF measurements except TX Power.

This port can be selected in the **TX TEST**, **DUPLEX TEST**, **RF ANALYZER**, or **SPECTRUM ANALYZER** screens.

See Also

Displaying Measurements in chapter 3.

SERIAL PORT

Note: This connector is optional on the HP 8920A.

This 6-pin, RJ-11 dual serial port is used to input and output serial data for entering programs, printing tests results and screen images, and sending test results to a connected controller, disk drive, or terminal.

Operating Considerations

The serial communications settings are defined on the **I/O CONFIGURE** screen.

Note

Using Port B: The second serial port (B) is only used with IBASIC programs to communicate with base stations or other equipment when the primary serial port is used for printing or data collection. Port B cannot be used for printing screens, and its communication settings can only be changed using IBASIC commands (listed in the Programmer's Guide).

Unless you are writing IBASIC programs that require serial printing *and* other serial data transfer at the same time, we recommend that you only use the primary port (A).

The IBASIC Controller sends and receives data to the serial ports using address **9** for the primary port, and **10** for Port B. For example, to enter data from the primary serial port into a program variable named SDATA, you could use the command:

```
ENTER 9;SDATA
```

To send data from your program out of the primary serial port, you could use the command:

```
OUTPUT 9;SDATA
```

Use an RJ-11/25-pin RS-232 adapter (HP P/N 98642-66508) and RJ-11 cable (HP P/N 98642-66505) to connect the Test Set to a serial printer or terminal/computer.

Note

RJ-11 Connectors: RJ-11 cables and adapters can be wired several ways. If you buy a cable or adapter other than the HP parts listed, verify the connections for the pins indicated in the following table before connecting cables to the instruments.

The following table lists connections for the primary serial port (address 9). When using both ports at the same time, you need to locate or fabricate an adapter to provide the necessary connections.

Test Set RJ-11 Serial Port		Terminal/PC 25-Pin RS-232		Terminal/PC 9-Pin RS-232
Pin 2 (RX)	to	pin 2 (TX)	or	pin 3 (TX)
Pin 5 (TX)	to	pin 3 (RX)	or	pin 2 (RX)
Pin 4 (GND)	to	pin 7 (GND)	or	pin 5 (GND)

Serial Port Connections

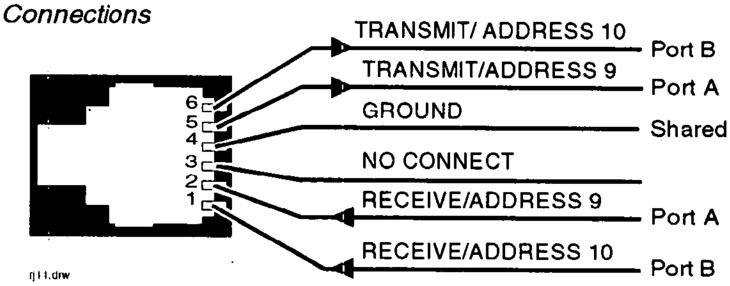


Figure 5-2. RJ-11 Serial Port Connections

10 MHz REF INPUT

This connection allows you to input an external reference.

Operating Considerations

Input frequency = 1, 2, 5, or 10 MHz
Input level >0.15 V rms
Input impedance ≈ 50 Ω

When a valid signal is applied to the 10 MHz REF INPUT, the Test Set automatically switches from internal to external reference.

This signal is used as a reference for, and directly affects, these functions:

RF Generator Frequency (including the Tracking Generator)

RF Frequency Counter

AF Frequency Counter

RF Analyzer Tune Frequency

Spectrum Analyzer Center Frequency

AF Generators 1 and 2, and the Decoder's frequency counter, are not affected using an external reference; they use their own reference.

Note

The reference output frequency is always 10 MHz, independent of the selected input reference frequency.

10 MHz REF OUTPUT

This connector furnishes a 10 MHz reference for external instruments.

Operating Considerations

Waveform = sinewave
Output frequency = 10 MHz
Output level >0.5 V rms
Output impedance ≈ 50 Ω

Note

The reference output frequency is always 10 MHz, independent of the selected input reference frequency.

Key Descriptions

DATA Keys

The DATA keys have four main uses:

- The (0) to (9), (.), (+/-), and A to F keys are for entering and changing values.
- (ENTER) is used to select a field or screen, and to enter numbers when the unit-of-measure is not specified. This function is identical to pressing the cursor control knob.
- (ON/OFF) is used to enable and disable measurements, and to turn numeric fields (such as `Amplitude`) on and off.
- YES and NO are used to confirm selected operations before they are executed.
- EEX ((SHIFT), (+/-)) is used for entering numbers using scientific notation.
- The remaining keys in this area are for entering and changing the unit-of-measure for measurements or field entries.

See Also

Entering and Changing Numbers in chapter 3.

DATA FUNCTIONS Keys

- (INCR ÷ 10), (INCR SET), and (INCR X10) are used to change the increment/decrement value when changing field values.
- (⇧) and (⇩) increment/decrement field values. These keys are also used to select alternate field entries without displaying the `Choices` menu used by some fields. They are also used to move the cursor in String Entry fields (such as the `Print Title` field on the **I/O CONFIGURE** screen).
- LO LIMIT ((SHIFT), (⇩)) and HI LIMIT ((SHIFT), (⇧)) and set measurement end points. Exceeding the end points causes screen prompts to blink until they are reset.
- REF SET ((SHIFT), (INCR ÷10)) is used to enter or remove a measurement reference for relative AF and RF measurements.
- METER ((SHIFT), (INCR SET)) enables/disables the analog bar-graph meter function for measurements using large digits (such as the **RX TEST** and **TX TEST** screen measurements).
- AVG ((SHIFT), (INCR X10)) enables/disables measurement averaging.

See Also

Entering and Changing Numbers , *Using Measurement Limit Indicators*, *Setting a Measurement Reference*, *Displaying Measurements*, and *Averaging Measurements* in chapter 3.

INSTRUMENT STATE Keys

- (LOCAL) returns the instrument to manual control after HP-IB control is used.
- (RECALL) lists any instrument setups that were saved.
- (MEAS RESET) clears the measurement "history" for all of the instrument's measurement algorithms (such as the Averaging function) to re-start all measurements that are in progress.
- (PRESET) restores most instrument settings to their factory default states, (although most **CONFIGURE** screen changes are not affected). Instrument self-diagnostics are not run at this time.
- ADRS ((SHIFT), (LOCAL)) displays the HP-IB address of the Test Set.
- SAVE ((SHIFT), (RECALL)) stores instrument setups.

See Also

Saving and Recalling Instrument Setups in chapter 3.

SCREEN CONTROL Keys

- (RX), (TX), (DUPLEX), (TESTS), MSSG, HELP, and CONFIG access several instrument control and information screens.
- (PREV) accesses the previous screen.
- HOLD ((SHIFT), (PREV)) stops all measurements. Selecting HOLD again resumes measurements.
- PRINT ((SHIFT), (TESTS)) prints the entire contents of the displayed screen, the time and date, and any `Print Title` defined in the **PRINT CONFIGURE** screen.

See Also

Printing a Screen in chapter 3
Screen and Field Descriptions in chapter 4.

Miscellaneous Keys and Buttons

- (SHIFT) is used to select the blue-labeled functions listed above some keys (such as PRINT, CONFIG, RELEASE, EEX ...).
- (CANCEL) is used to cancel an entry in progress, or stop a running IBASIC program. For example; if you press (RECALL) to recall an instrument setup, and then decide not to recall a setting, pressing (CANCEL) exits the recall procedure.
- (⇐) (backspace) is used to move the cursor to the left when entering numbers in a field, such as `RF Gen Freq`. Each press of this key moves the cursor one place to the left, erasing the previous character.
- The rear-panel AC/DC button setting selects the instrument's power source. The power source must be changed with the Test Set turned off.
- (POWER) turns the instrument power on and off. Several **CONFIGURE** screen settings, and all SAVE/RECALL registers, are retained by battery back-up when power is disconnected.

USER Keys

These keys are used to instantly access fields without using the Cursor Control knob or changing screens.

See Also

Using USER Keys in chapter 3.

Knob Descriptions

- Cursor Control has three functions:

  Moving the cursor.

  Selecting fields, screens, and settings from a list of choices.

  Changing numeric field values.

- VOLUME controls the speaker volume for monitoring the AF Analyzer's selected input. The volume is also affected by the `Speaker Vol` and `Speaker ALC` fields in the **AF ANALYZER** screen.

- SQUELCH adjusts the squelch level when demodulating AM, FM, or SSB signals. The squelch level is affected by the `Squelch` field in the **RF ANALYZER** screen.

See Also

RF ANALYZER and AF ANALYZER screen and field descriptions in chapter 4.

6 Modifications, Accessories, Manuals, & Support

6

Modifications, Accessories, Manuals, Support

Modifications

This section includes information regarding:

- Hardware Upgrades/Modifications
- Firmware Upgrades
- Accessories
- Manuals (English and non-English)
- Radio Test Software
- Power Cables
- Sales and Service Support

Hardware Upgrades and Modifications

You can install several options in your Test Set or have Hewlett-Packard install them for you. If you want HP to install the options, contact the nearest regional sales office listed at the end of this chapter.

Note

Some options may not be available depending on which model number you have. One or more options may already installed in your instrument. Refer to the table below for specific information.

Hardware Upgrades and Modifications

Description	HP 8920A	HP 8920B	HP 8921A
Option 001 High Stability Timebase	R01	R01	standard
Option 003 HP-IB/RS-232/DC Current Measurements	R03	R03	standard
Option 004 Tone/Digital Signaling	R04[1]	R04[1]	standard
Option 005 512K RAM Memory Expansion	R05[2]	R05	standard
Option 007 Low-level RF Power Measurements	R07[3]	08920-61097[3]	not available
Option 008 Medium-level RF Power Measurements	R08[4]	R08[4]	not available
Option 010 400 Hz High Pass Filter[5]	R10	R10	not available
Option 011 CCITT Weighting Filter[5]	R11	R11	R11
Option 012 4 kHz Bandpass Filter[5]	R12	R12	R12
Option 013 C-Message Filter[5]	R13	R13	standard
Option 014 6 kHz Bandpass Filter[5]	R14	R14	standard
Option 019 Variable Frequency Notch	R19	R19	R19
Option 020 Radio Interface Card	R20	R20	R20
Option 050 Dual-mode Rear Panel Connectors[6]	R50[7]	R50	standard
Option 102 Spectrum Analyzer with Tracking Generator	R02[8]	R02	standard

1 Includes Op/Sys and Signaling ROMs, Mod Distribution and Signaling assemblies.

2 Instruments with serial prefix 3247A or below contain 256K RAM for Option 005.

3 Reduces maximum input power from 100W to 4W.

4 Reduces maximum input power from 100W to 10W.

5 A maximum of two filters options can be added to an instrument.

6 Included high stability timebase and improved residual FM performance.

7 Retrofit kit can only be installed in instruments with serial prefix 3248A and above.

8 Retrofit kit does not include firmware. 1, 2, 10 dB resolution requires firmware revision A.06.01 or later. ACP (Adjacent Channel Power) measurement capability requires revision A.12.01, or later.

Firmware Upgrades

Firmware Upgrades

Description	HP 8920A	HP 8920B	HP 8921A
Operating System and Signaling[1] ROMs	R58	R58	R58

1 Option 004 Tone/Digital Signaling.

External Monitor

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.

Accessories

Accessories

Description	HP 8920A	HP 8920B	HP 8921A
Telescoping Antenna	08920-61060	08920-61060	08920-61060
Microphone	08920-61059	08920-61059	08920-61059
DC Battery Pack (24V)	08920-80027	08920-80027	08920-80027
Battery Charger	08920-80028	08920-80028	08920-80028
CRT Sun Shade	08920-61051	08920-61051	08920-61051
Connector Kit (one each: DC power, MIC/ACC, RS-232↔RJ-11, and radio interface connectors)	08920-61061	08920-61061	08920-61061
DC Power Connector Housing (Qty 1)	1251-4782	1251-4782	1251-4782
DC Power Connector Contacts (Qty 2)	1252-0385	1252-0385	1252-0385
System Rack Mount Flange Kit (Option 908)	5061-4846	5061-4846	5061-4846
Rack mount kit[1] for HP 8920D or HP 8921D	08921-61037	08921-61037	08921-61037
Padded Carrying Case	1540-1130	1540-1130	1540-1130
Hardshell Transit Case	08920-90033	08920-90033	08920-90033
Passive Oscilloscope Probe (1 MΩ/7.5pF 10:1)	HP 10435A	HP 10435A	HP 10435A
Passive Oscilloscope Probe (High Z/40pF 1:1)	HP 10438A	HP 10438A	HP 10438A
Passive Oscilloscope Probe (High Z/64pF 1:1)	HP 10439A	HP 10439A	HP 10439A
RF Detector Probe (100 kHz to 700 MHz)	HP 34301A	HP 34301A	HP 34301A
Resistor Divider Probe Kit	HP 54006A	HP 54006A	HP 54006A
Power Splitter (DC to 3 GHz, 50Ω)	HP 11850C	HP 11850C	HP 11850C
32 KByte SRAM[2] Memory Card	HP 85700A	-	HP 85700A
64 KByte SRAM[2] Memory Card (PCMCIA)	-	HP 83230A	-
128 Kbyte SRAM[2] Memory Card	HP 85702A	-	HP 85702A
256 Kbyte SRAM[2] Memory Card	HP 85704A	-	HP 85704A
256 Kbyte SRAM[2] Memory Card (PCMCIA)	-	HP 83233A	-
512 Kbyte SRAM[2] Memory Card	HP 85705A	-	HP 85705A
1 Mbyte SRAM[2] Memory Card (PCMCIA)	-	HP 83231A	-
128 Kbyte OTP[3] Memory Card	HP 85701A	-	HP 85701A
256 Kbyte OTP[3] Memory Card	HP 85703A	-	HP 85703A
512 Kbyte OTP[3] Memory Card	HP 85706A	-	HP 85706A

1 Allows rack mounting of Cellular Adapter (example: HP 83201A) to HP 8920/8921.

2 SRAM = Static Random Access Memory

3 OTP = One Time Programmable (PROM).

Manuals (English and non-English)

Manuals

Description	Language	Option	HP 8920A	HP 8920B	HP 8921A
Quick Reference Manual[1]	English	-	08920-90010	08920-90010	08920-90010
Quick Reference Card[1]	English	-	08920-90014	08920-90014	08920-90014
HP 8920 User's Guide	English	-	-	08920-90171	-
HP 8921 User's Guide	English	-	-	-	08921-90022
Instrument BASIC Language Reference	English	-	E2083-90000	E2083-90000	E2083-90005
Programmer's Guide	English	-	08920-90172	08920-90172	-
Assembly Level Repair Manual	English	-	08920-90168	08920-90168	08920-90168
Applications Handbook	English	-	08920-90126	08920-90126	-
Quick Reference Manual[2]	Japanese	ABJ	08920-90016	-	-
User's Guide	Japanese	ABJ	-	-	-
Quick Reference Manual[2]	Spanish	ABE	08920-90017	-	-
User's Guide	Spanish	ABE	08920-90097	-	-
Quick Reference Manual[2]	French	ABF	08920-90018	-	-
Quick Reference Manual[2]	German	ABD	08920-90019	-	-
Quick Reference Manual[2]	Italian	ABZ	08920-90020	-	-
User's Guide	Italian	ABZ	08920-90123	-	-
Quick Reference Manual[2] (Traditional Chinese for Taiwan)	Chinese	AB0	08920-90021	-	-
User's Guide (Traditional Chinese for Taiwan)	Chinese	AB0	08920-90098	-	-
Applications Handbook (Traditional Chinese for Taiwan)	Chinese	AB0	08920-90146	-	-
Quick Reference Manual[2] (Simplified Chinese, PRC)	Chinese	AB2	08920-90022	-	-
User's Guide (Simplified Chinese, PRC)	Chinese	AB2	08920-90156	-	-
Applications Handbook (Simplified Chinese, PRC)	Chinese	AB2	08920-90147	-	-
Quick Reference Manual[2]	Korean	AB1	08920-90023	-	-
Applications Handbook	Korean	AB1	08920-90145	-	-
Quick Reference Manual[2]	Finnish	ABX	08920-90039	-	-

1 Shipped inside instrument impact cover

2 Each non-English Quick Reference Manual includes a Quick Reference Card, and a Quick Start Label.

Radio Test Software

The Radio Test Software performs automated tests on radios used in various radio communication systems. Each test package is contained on an individual memory card.

The HP 11807A Radio Test Software performs automated tests on radios used in various radio communication systems. This software is used primarily with the HP 8920A.

The HP 11807B Cell Site Test Software performs automated tests on cell site base stations. This Software is used with the HP 8921A.

Note

Memory Expansion — All HP 11807A software products require the **HP 8920A** to be equipped with instrument option 005—512 kilobyte RAM expansion.

HP 11807A Software for HP 8920A

Option 001	North Americal FM Tests
Option 002	European PM Tests
Option 003	AM Tests
Option 004	AMPS-NAMPS Cellular Tests[1]
Option 005	TACS Cellular Tests[1]
Option 006	NMT Cellular Tests[1]
Option 007	JTACS-NTACS Cellular Tests[1]
Option 008	NADC Dual Mode Cellular Tests[2]
Option 009	NADC Dual Mode Cellular Tests[2]
Option 010	LTR Trunked Radio Tests (Includes conventional FM test capability.)[1]
Option 011	EDACS Trunked Radio Tests[1]
Option 012	MPT 1327 Trunked Radio Tests
Option 100	System Support Tests (frequency scanning, cable fault location, field strength, intermodulation products programs).[1]

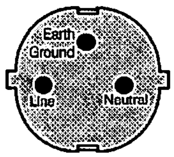
1 HP 8920A requires Option 004 Tone/Digital Signaling

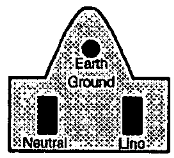
2 Requires an HP 83201A Dual Mode Cellular Adapter

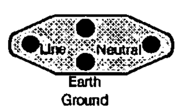
HP 11807B Software for HP 8921A

Option 040	Motorola Test Software
Option 041	General Electric Test Software
Option 042	Ericsson GE Cell Site Software
Option 043	AT&T Test Software
Option 044	Northern Telecom Test Software
Option 050	System Analysis/Call Following Software
Option 052	Ericsson TACS Cell Site Software

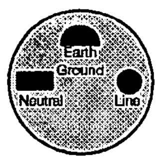
Power Cables

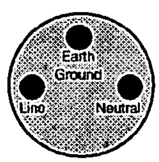
Plug Type	Plug Descriptions male/female	HP Part # (cable & plug)	Cable Descriptions
 **IEC 83 C4, 250 V**	Straight/Straight Straight/90°	8120-1689 8120-1692	79 inches, mint gray 79 inches, mint gray
Used in the following locations			
Afghanistan, Albania, Algeria, Angola, Armenia, Austria, Azerbaijan, Azores Bangladesh, Belgium, Benin, Bolivia, Boznia-Herzegovina, Bulgaria, Burkina Faso, Burma, Burundi, Byelarus Cameroon, Canary Islands, Central African Republic, Chad, Chile, Comoros, Congo, Croatia, Czech Republic, Czechoslovakia Denmark, Djibouti East Germany, Egypt, Estonia, Ethiopia Finland, France, French Guiana, French Indian Ocean Areas Gabon, Gaza Strip, Georgia, Germany, Gozo, Greece Hungary Iceland, Indonesia, Iran, Iraq, Israel, Italy, Ivory Coast Jordan Kazakhstan, Korea, Kyrgystan Latvia, Lebanon, Libya, Lithuania, Luxembourg Macedonia, Madeira Islands, Malagasy Republic, Mali, Malta, Mauritania, Miquelon, Moldova, Mongolia, Morocco, Mozambique Nepal, Netherlands, Netherlands Antilles, Niger, Norway Oman Pakistan, Paraguay, Poland, Portugal Rep. South Africa, Romania, Russia, Rwanda Saudi Arabia (220V), Senegal, Slovak Republic, Slovenia, Somalia, Spain, Spanish Africa, Sri Lanka, St. Pierre Islands Sweden, Syria Tajikistan, Thailand, Togo, Tunisia, Turkey, Turkmenistan USSR, Ukraine, Uzbekistan Western Africa, Western Sahara Yugoslavia Zaire			

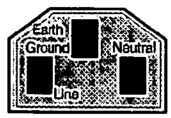
Plug Type	Plug Descriptions male/female	HP Part # (cable & plug)	Cable Descriptions
 **UL 1681, 125 V**	Straight/Straight Straight/90° Straight/Straight	8120-1378 8120-1521 8120-1751	90 inches, jade gray 90 inches, jade gray 90 inches, jade gray
Used in the following locations			
American Samoa Bahamas, Barbados, Belize, Bermuda, Brazil, Caicos, Cambodia, Canada, Cayman Islands, Columbia, Costa Rica, Cuba Dominican Republic Ecuador, El Salvador French West Indies Guam, Guatemala, Guyana Haiti, Honduras Jamaica Korea Laos, Leeward and Windward Is., Liberia Mexico, Midway Islands Nicaragua Other Pacific Islands Panama, Philippines, Puerto Rico Saudi Arabia (115V,127V), Suriname Taiwan, Tobago, Trinidad, Trust Territories of Pacific Islands Turks Island United States Venezuela, Vietnam, Virgin Islands of the US Wake Island			
JIS C 8303, 100 V	Straight/Straight Straight/90°	8120-4753 8120-4754	90 inches, dark gray 90 inches, dark gray
Used in the following locations			
Japan Only			

Plug Type	Plug Descriptions male/female	HP Part # (cable & plug)	Cable Descriptions
 **SEV 1011-195, 250 V**	Straight/Straight Straight/90°	8120-2104 8120-2296	79 inches, gray 79 inches, gray
Used in the following locations			
Switzerland			

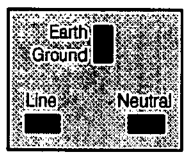
Plug Type	Plug Descriptions male/female	HP Part # (cable & plug)	Cable Descriptions
 NEMA6-15P, 250 V	Straight/Straight	8120-0698	90 inches, black
Used in the following locations			
Peru			

Plug Type	Plug Descriptions male/female	HP Part # (cable & plug)	Cable Descriptions
 SR 107-2-D1, 250 V	90°/Straight 90°/90° Straight/Straight	8120-2956 8120-2957 8120-3997	79 inches, gray 79 inches, gray 79 inches, gray
Used in the following locations			
Denmark Greenland			

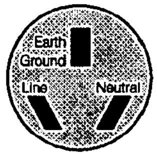
Plug Type	Plug Descriptions male/female	HP Part # (cable & plug)	Cable Descriptions
 IEC 83 B1	Straight/Straight Straight/90°	8120-4211 8120-4600	79 inches, mint gray 79 inches, mint gray
Used in the following locations			
Botswana India Lesotho Malawi South-West Africa (Namibia), Swaziland Zambia, Zimbabwe			

<table>
<tr><th>Plug Type</th><th>Plug Descriptions
male/female</th><th>HP Part #
(cable & plug)</th><th>Cable Descriptions</th></tr>
<tr><td>

CEE 22, 250 V</td><td>Straight/Straight
Straight/Straight
Straight/90°
Straight/90°</td><td>8120-1860
8120-1575
8120-2191
8120-4379</td><td>60 inches, jade gray
30 inches, jade gray
60 inches, jade gray
15.5 inches, jade gray</td></tr>
<tr><td colspan="4">Used in the following locations</td></tr>
<tr><td colspan="4">System Cabinets</td></tr>
</table>

<table>
<tr><th>Plug Type
(Male)</th><th>Plug Descriptions
male/female</th><th>HP Part #
(cable & plug)</th><th>Cable Descriptions</th></tr>
<tr><td>

BS 1363A, 250 V</td><td>90°/Straight
90°/90°</td><td>8120-1351
8120-1703</td><td>90 inches, mint gray
90 inches, mint gray</td></tr>
<tr><td colspan="4">Used in the following locations</td></tr>
<tr><td colspan="4">Bahrain, British Indian Ocean Terr., Brunei
Canton, Cyprus
Enderbury Island, Equatorial Guinea
Falkland Islands, French Pacific Islands
Gambia, Ghana, Gibraltar, Guinea
Hong Kong
Ireland
Kenya, Kuwait
Macao, Malaysia, Mauritius
Nigeria
Qatar
Seychelles, Sierra Leone, Singapore, Southern Asia, Southern Pacific Islands, St. Helena, Sudan
Tanzania
Uganda, United Arab Emirates, United Kingdom
Yeman (Aden & Sana)</td></tr>
</table>

Plug Type	Plug Descriptions male/female	HP Part # (cable & plug)	Cable Descriptions
 AS 3112, 250 V	Straight/Straight Straight/90°	8120-1369 8120-0696	79 inches, gray 80 inches, gray
Used in the following locations			
Argentina, Australia China (People's Republic) New Zealand Papua New Guinea Uruguay Western Samoa			

HP Support for Your Instrument

Parts and service for your Test Set can be ordered by contacting the nearest HP regional sales office listed at the end of this chapter.

Customer Training

Hewlett-Packard offers customers a variety of training materials and classes that explain the theory and applications of many HP products. Contact your HP regional sales office to arrange training for you or your group.

REGIONAL SALES AND SERVICE OFFICES

EASTERN USA Hewlett-Packard Co. 2101 Gather Rd **ROCKVILLE**, MD 20850 Tel: (301) 258-2000	**EASTERN USA** Hewlett-Packard Company Service Center 150 Green Pond Road Rockaway, NJ 07866 Tel: (201) 586-5400	**MIDWESTERN USA** Hewlett-Packard Co. 5201 Tollview Drive **ROLLING MEADOWS** IL, 60008 Tel: (708) 342-2000
SOUTHERN USA Hewlett-Packard Co. 1995 North Park Place **ATLANTA**, GA 30339 Sales: (404) 955-1500 Fax: (404) 980-7292 Service: (404) 850-2544 Fax: (404) 955-1500	**SOUTHERN USA** Hewlett-Packard Company Service Center 930 E. Campbell Road Richardson, TX 75081 Tel: (214) 699-4331	**WESTERN USA** Hewlett Packard Company Service Center 301 E. Evelyn Avenue Mountain View, CaL 94041 Tel: (415) 694-2000 Fax: (415) 694-0601
WESTERN USA Hewlett Packard Company 24 Inverness Place East Englewood, CO 80112 Tel: (303) 649-5512 Fax: (303) 649-5787	**WESTERN USA** Hewlett-Packard Co. 1421 S. Manhattan Ave. **FULLERTON**, CA 92631 Tel: (714) 999-6700 Fax: (714) 778-3033 Service: (714) 758-5490	**UNITED STATES OF AMERICA** Customer Information Center Tel: (800) 752-0900 6:00 AM to 5:00 PM Pacific Time Parts Direct: 1-800-227-8164
SOUTH EAST EUROPE Hewlett-Packard Ges. m.b.h. Liebigasse 1 P.O. Box 72 A-1222 **VIENNA**, Austria Tel: 43 222 2500 0 Telex: 13 4425	**EUROPEAN MULTICOUNTRY REGION** Hewlett-Packard S.A. P.O. Box 95 150, Route dv Nant_dl_AVRIL CH-1217 Meyrin 2 **GENEVA** Switzerland Tel: (41/22)780-8111 Fax: (41/22)780-8542	**NORTHERN EUROPE** Hewlett-Packard Nederland B.V. Startbaan 16 1187 XR **AMSTELVEEN** The Netherlands P.O. Box 667 Tel: 31/20 5476911 X 6631 Fax: 31-20-6471825NL
ASIA Hewlett-Packard Asia Ltd. 22-30/F Peregrine Tower Lippo Center 89 Queensway, Central **HONG KONG** G.P.O. Box 863 Hong Kong Tel: 852-848-7777 Fax: 852-868-4997	**JAPAN** Yokogawa-Hewlett-Packard Ltd. 3-29-21, Takaido-Higashi Suginami-Ku, **TOKYO** 168 Tel: 81 3 3331-6111 Fax: 81 3 3331-6631	**INTERNATIONAL SALES BRANCH HEADQUARTERS** Hewlett-Packard S.A. 39, Rue Veyrot P.O. Box 365 1217 Meyrin 1 **GENEVA**, Switzerland Tel: 41-22-780-4111 Fax: 41-22-780-4770

REGIONAL SALES AND SERVICE OFFICES (continued)

AUSTRALIA/
NEW ZEALAND
Hewlett-Packard Ltd.
P.O. Box 221
31-41 Joseph St.
BLACKBURN, Victoria 3130
Tel: (61/3) 895-2895
Fax: (61/3) 898-9257

CANADA
Hewlett-Packard (Canada) Ltd.
5150 Spectrum Way
MISSISSAUGA, Ontario L4W
5G1 Canada
Tel: (416) 206-4725
Fax: (416) 2-6-4739

CANADA
Hewlett-Packard Company
Service Center
17500 Transcanada Highway
S. Serv Road
Kirkland, Quebec
H9J 2X8
Canada
Tel: (416) 206-3295

CANADA
Hewlett-Packard LTD
Service Center
11120 178 Street
Edmonton, Alberta
T5S 1P2
Canada
Tel: (403) 486-6666
Fax: (403) 489-8764

LATIN AMERICA
Hewlett-Packard Company
LAHQ CO.Lomas de virreyes
11000 **MEXICO** D.F.
Mexico
Tel: (52/5)326-4000
Fax: (52/5)202 7718

UNITED KINGDOM
Hewlett Packard Ltd.
Cain Road
BRACKNELL
Berkshire, RG121HN,UK
Tel: 44-344 360000
Fax: 44-344-363344

Error Messages

General Information About Error Messages

Information concerning error messages displayed by the Test Set may be found in one of the following manuals:

- *HP 8920 or HP 8921 User's Guides*
- *HP 8920, 8921 Programmer's Guide*
- *HP 8920, 8921 Assembly Level Repair Manual*
- *HP Instrument BASIC User's Handbook*:
  - HP 8920A or HP 8921A: *HP Instrument BASIC Users Handbook* (HP P/N E2083-90000)
  - HP 8920B: *HP Instrument BASIC Users Handbook Version 2.0* (HP P/N E2083-90005)

The format of the displayed message determines which manual contains information about the error message. There are four basic error message formats:

- Positive numbered error messages
- IBASIC error messages
- HP-IB error messages
- Text only error messages

The following paragraphs give a brief description of each message format and direct you to the manual to look in for information about error messages displayed in that format.

Positive Numbered Error Messages

Positive numbered error messages are generally associated with IBASIC. Refer to the *HP Instrument BASIC User's Handbook* for information on IBASIC error messages.

Positive numbered error messages take the form: `ERROR XX <error message>`

For example:

`Error 54 Duplicate file name`

or

`Error 80 in 632 Medium changed or not in drive`

IBASIC Error Messages

IBASIC Error Messages are associated with IBASIC operation. IBASIC error messages can have both positive and negative numbers. Refer to the *HP Instrument BASIC User's Handbook* for information on positive numbered error messages. Refer to the HP-IB Error Messages section of the *HP 8920, HP 8921 Programmer's Guide* for information on negative numbered error messages (the error message associated with a negative number is the same for HP-IB errors and IBASIC errors).

IBASIC error messages take the form: `IBASIC Error: -XX <error message>`

For example:
`IBASIC Error: -286 Program runtime error`

HP-IB Error Messages

HP-IB Error Messages are associated with HP-IB operation. Refer to the HP 8920, HP 8921 Programmers Guide for information on HP-IB error messages.

HP-IB error messages take the form: `HP-IB Error: -XX <error message>` or `HP-IB Error <error message>`

For example:
`HP-IB Error: -410 Query INTERRUPTED.`
or
`HP-IB Error: Input value out of range.`

Text Only Error Messages

Text only error messages are generally associated with manual operation of the Test Set. Refer to the *HP 8920 or HP 8921 User's Guide* for information on text only error messages.

Text only error messages can also be displayed while running the Test Set's built-in diagnostic or calibration utility programs. Refer to the *HP 8920, HP 8921 Assembly Level Repair* manual for information on text only error messages displayed while running the Test Set's built-in diagnostic or calibration utility programs.

Text only error messages take the form: `This is an error message.`

For example:
`Input value out of range.`

The Message Display

During instrument operation, various messages may appear on the Test Set's display. Prompt-type messages generally appear on the first line of the Test Set's display. General operating and error messages usually appear on the second line of the display. Some messages are persistent; they remain displayed until the error condition no longer exists, or until another persistent message with greater priority occurs. Other messages are only displayed when the error first occurs; they are removed when a key is pressed or the knob is turned, or when an HP-IB command is received. Many of the messages are displayed on the MESSAGE screen until the instrument is turned off.

Messages that are about error conditions may tell you what to do to correct the error (turn something off, reduce a field's value, press a certain key, and so forth). Messages and prompts are sometimes accompanied by a beep or warble.

Note

Warbles and Beeps

A warble sound indicates that an instrument-damaging event is occurring. Beeps often occur only with the first occurrence of the message. Prompts are generally silent.

Non-Recoverable Firmware Error

The non-recoverable firmware error is very important. It appears when an unanticipated event occurs that the Test Set's firmware cannot handle. The message appears in the center of the Test Set's display and (except for the two lines in the second paragraph) has the form:

```
Non-recoverable firmware error.  Please record the 2 lines of
text below and contact Hewlett Packard through your local
service center or by calling (800) 827-3848 (USA, collect) and
asking to speak to the 8920A Service Engineer.

 'Address error exception'
  at line number 0

To continue operation, turn POWER off and back on.
```

Follow the instructions in the message.

Unfortunately, you will not be able to recover from this condition. You must switch the Test Set off and back on. When you rerun the test where the Error Message occurred, it may not occur again. If it does reappear, it would be helpful to HP to record exactly what the configuration of the instrument was when the error appeared and contact HP.

Text Only Error Messages

Operation errors generally occur when you try to do something the Test Set was not designed to do. Most messages tell you what to do to correct the problem, (turn something off, reduce a field's value, press a certain key, ... and so forth).

Some common messages are listed here:

All self tests passed.

The Test Set did not detect any hardware or firmware failures during its initial self-diagnostics. This message should always be displayed immediately after instrument turn on.

Input value out of range.

A number was entered that was too large or small for the selected field. Example: trying to set `AFG1 Freq` to 125 kHz.

Invalid keystroke.

You used a key that has no function relating to the selected field. Example: pressing the (ON/OFF) key while the **Filter 1** field is selected.

Option not installed.

You selected a function that requires optional hardware that is not present. Example: selecting `TDMA TEST` from the `To Screen` menu when you do not have an HP 83201A or HP 83201B Cellular Adapter connected to the Test Set.

Required Hardware for Additional Test Set Functions

Function	Required Hardware
AD CH PWR (Adjacent Channel Power)	Option 102 - Spectrum Analyzer[1]
SPEC ANL (Spectrum Analyzer)	Option 102 - Spectrum Analyzer[1]
LTV_MTR (signal strength meter) ROM Program	Option 102 - Spectrum Analyzer[1]
TDMA TEST	HP 83201A/B Cellular Adapter[2]
PDC TEST, PHP TEST	HP 83201B Cellular Adapter[2]
CDMA TEST	HP 83203A/B Cellular Adapters[2]
PRNT CNFG (Printer Configure)	Serial/HP-IB/Parallel Ports[3]
RADIO INT	Radio Interface Port[2]
Encoder, Decoder	Signaling[1]

1 Optional on HP 8920A and HP 8920B

2 Optional on all Test Sets

3 Optional on HP 8920A

Turn off either AM or FM settings.

You tried to create simultaneous AM and FM (using any combination of AFGen1, AFGen2, and the `Mod In To` field) . The Test Set does not provide simultaneous AM and FM.

Squelch interrupt overflow. Press MEAS RESET.

The Test Set temporarily interrupts audio measurements when squelch is first broken to prevent internal switching transients from influencing measurements (except when using the **SCOPE**, **SPECTRUM ANALYZER**, **DECODER**, or **SERVICE** screens). If squelch is repetitively broken in a period of a few seconds, the duration of measurement interruption becomes too great, and the Test Set stops interrupting the signal. Following measurements may be influenced by transient signals.

Pressing (MEAS RESET) clears the data buffer used to generate interrupts, re-setting the normal squelch operation to eliminate transients.

This condition may occur when monitoring low-level off-the-air signals.

Cal file checksum incorrect - initializing file

This error usually occurs after changing the Test Set's firmware ROM's. It is not a problem in that instance, but should not re-appear during subsequent operation of the Test Set.

Decoder buffer full. Decrease gate time

Too many decoder samples were sent to the decoder's buffer during a measurement gate time, causing a data overflow. Reducing the gate time decreases the amount of data sent during each measurement.

One or more self tests failed. Error code:XXXX

An instrument failure was detected when the Test Set was turned on. (For example, having a stuck front panel key during turn on.) The numbered error message corresponds to a binary-weighted group of errors listed in the *TST Common Command description in the Programmer's Guide.

Change Ref Level, Input Port or Attenuator (if using "Hold").

The RF signal level is either too great or too small for the current input port and/or attenuator setting. This error often occurs when trying to make a low level measurement using the RF IN/OUT port with the Spectrum Analyzer. Make the indicated change(s) until this message is no longer displayed.

Change RF Gen Amplitude, Output Port or Atten Hold (if on).

This message appears when the RF Generator `Amplitude` field is set too high when using the RF IN/OUT port, or when adjusting the amplitude with the `Atten Hold` field set to `On`.

The RF IN/OUT port has a lower maximum output level than the DUPLEX OUT port. Use the DUPLEX OUT port or reduce the RF Generator level.

If `Atten Hold` is `On`, you may be adjusting the amplitude outside of the allowed range. Change the amplitude

Direct latch write occurred. Cycle power when done servicing.

The **SERVICE** screen was accessed and one or more internal latch settings were changed. Turn the instrument off and back on to reset the latches. (This condition can occur during periodic calibration.)

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